Canada's Aging Workforce: Participation, Productivity, and Living Standards

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INTRODUCTION

This paper looks at the consequences of Canada's aging population and workforce for labour-force participation, labour productivity, and the standard of living in Canada. It offers a broad overview of various arguments, rather than a focused research study. The paper is also written from a policy perspective with the intent of raising possible issues of concern for policy-makers. And the paper offers a number of predictions of particular relevance to public policy. The issues raised are not new, but are framed in a Canadian perspective based on available Canadian evidence. General discussion of aging and retirement in the United States, for example, can be found in Clark et al. (2004); Madrian, Mitchell, and Soldo (2007); and Wise (2004).

As Canada's baby boomers ease into retirement, there is a timeliness to concerns expressed in the popular media that, as many workers leave the workforce, Canada's elderly dependency ratio will rise, and more and more retirees will have to be supported by relatively fewer members of the workforce (*Globe and Mail* 2006; Guillemette 2003). This raises questions as to the economic well-being and average living standards of the population as relatively fewer workers are involved in producing output in Canada. It also poses concerns for the fiscal health and fiscal environment of government budgets as pension and health costs rise and as the traditional tax base of the working population declines in relative size (*Toronto Star* 2008). Obviously, these concerns are not unique to Canada, but are faced by most Organisation for Economic Co-operation and Development (OECD) countries, which have been experiencing declining fertility rates and longer lifespans. They also raise the question of whether Canada and other such countries are going to experience reduced living standards as a result of their aging populations. And, consequently, what is the possible role for public policy to improve economic well-being in light of this changing environment (OECD 2005)? But an aging population and slower labour force growth also provide an opportunity to review a number of labour market, social security, and tax policies with an eye to providing greater flexibility to life-course work patterns and reduced impediments to transitioning more flexibly into retirement, based on workers' range of choices (PRI 2003; SRI 2008; Halliwell 2008).

These concerns also relate to David Dodge's own labour market interests early in his ca-
reer, as his doctoral thesis at Princeton and his early work as a young faculty member at
Queen's University were in the area of human-capital labour markets (Dodge and Stager
1972; Dodge 1975). Even then, he exhibited an outlook that spread to both micro and
macro aspects of labour markets. This paper attempts to convey a similar overlap of both
micro and macro perspectives of living standards determination. Indeed, David Dodge has
recently pronounced on precisely the topic of this paper (Scoffield 2007). The paper is
also written as a plea for economic policy makers not to lose sight of important, ongoing
long-run concerns, although the current focus is on the financial sector crisis and its sub-
sequent spillover onto the macro economy.

This paper proceeds as follows. The first section looks at the basic evidence on aging and
changing labour force participation in Canada. The second section introduces a simple
analytical framework for examining the effects of aging on the average standard of living,
and then examines the effects of population aging on retirement and labour supply. The
third section reviews the effects of aging on labour productivity in the economy, both ana-
lytically and empirically. The final section offers some conclusions.

BASIC EVIDENCE ON AGING AND LABOUR FORCE PARTICIPATION

Consider first some basic evidence on population aging and labour force participation
among the older population in Canada. Table 1 provides the actual and predicted median
age of selected OECD countries. One sees immediately that the median age of the Cana-
dian population—38.9 years in 2005—is slightly younger than that in Europe, but three
years older than that in the United States (which has about the highest birth rate among
OECD countries). Among populations with the oldest (median age) are Germany (at
42.0 years), Italy (42.2 years), and Japan (42.8 years), where birth rates have been rather
low for quite some time. So Canada's population is generally younger than Europe's or
Japan's, but older than in the United States. Second, all of these populations are aging, but
Canada's is aging more slowly than in Europe or Japan, although more rapidly than in the
United States:

Median age increase, 2005–30	
United States	2.3 years
Canada	5.9 years
Europe	6.8 years
Japan	8.9 years

So the phenomenon of population aging is widespread across industrially developed
countries, with Canada's experience somewhat in the middle of the pack. The United
States is actually the outlier on this front, with its continuing relatively high fertility rate
and immigration.

The reasons for population aging as a widespread phenomenon are several. As already
mentioned, fertility rates have fallen dramatically over the past several decades among
developed countries—a major focus of inquiry among demographers around the world.
People as a whole are living longer, owing to improved health care, medical technology,
higher living standards, and healthier lifestyles. This is particularly true among those who

have already lived to middle age. Therefore, expected years in retirement beyond, say, age 65 have been rising quite markedly. Finally, the statistics are being driven by the aging of the post–World War II baby boomers—those born between 1946 and 1966 (with the peak year in 1960)—who amount to over 8 million persons in Canada. Indeed, in percentage terms, Canada's baby-boom segment was about the largest among developed countries. The baby boom was followed by a dramatic drop in fertility rates, so its effects on aging and rates of labour force participation are likely to be stronger in Canada than in just about any other developed country. And the leading edge of this 20-year cohort are now in their early sixties, thus entering or rapidly approaching retirement. By 2031, about 25 per cent of Canada's population is expected to be age 65 or older (Denton, Feaver, and Spencer 2005).

Table 1

Median age in selected OECD countries

	Canada	U.S.	Europe	U.K.	France	Germany	Italy	Japan
2005	38.9	35.9	39.3	38.8	38.9	42.0	42.2	42.8
2020	43.0	37.0	43.6	41.4	42.2	46.7	48.5	48.2
2030	44.8	38.2	46.1	42.5	43.6	47.1	51.7	51.7

Source: World Population Prospects, United Nations Secretariat

Table 2 provides statistics on three indicators of labour market activity for individuals age 55 and older in Canada over the past three decades. The first column represents labour force participation rates (or PRs), and the second column represents unemployment rates (or URs). Several well-known patterns are apparent, such as the general declines in male participation rates and the rise of female rates of participation among this older age group, so that the gap in participation rates between this group of men and women has narrowed from about 30 points to approximately 13 percentage points since 1976. One also notes the general rise in unemployment rates over the 1980s and early to mid-1990s, as Canada passed through two quite major recessions in the early 1980s and early 1990s. Since the mid-1990s, however, unemployment rates have declined markedly because of an unprecedented 16-year period of economic growth, but also because of the general aging of the population over this period.

For present purposes, however, I want to draw attention to a relatively recent reversal of the trend towards declining participation rates for older men. Since about 1997, participation rates among older men have reversed course and started rising. "Freedom 55" seems to be increasingly less attractive or less attainable. Participation rates for women have also continued to rise, so that for older workers as a whole, the participation rate by 2008 was three points higher than it was back in 1976. This is quite a remarkable turnaround. A similar turnaround also occurred at about the same time in several other countries, including the United Kingdom and the United States. Evidently, general factors are at work well beyond Canada.

The third column in Table 2 reports results for employment rates (ERs), which are the percentage of the population in this age group who are employed in the labour market. This is important for our purposes, because it captures the proportion of individuals in this

population who are earning a living and contributing to output production in the economy. A higher employment rate is associated with higher output, lower poverty rates, and a higher standard of living—this will be specified in more detail in the next section. A bit of manipulation can show that, if ER, UR, and PR are all expressed as proportions (between 0 and 1), then

$$ER = PR \cdot [1 - UR].\qquad\qquad(1)$$

That is, the employment rate—one of the principal determinants of living standards or economic well-being—can be expressed in terms of the underlying rates of participation and unemployment. It thus reflects both supply- and demand-side factors in the labour market, and it provides a convenient channel for understanding how various factors operating through the participation rate and the unemployment rate can affect living standards.

The figures in the last column of Table 2 reveal a similar reversal of trend for men and for workers as a whole. So the pattern of changing participation rates is essentially what is driving this quite remarkable rise in employment rates since the mid-1990s. Overall, employment rates declined from about 30 per cent in 1976 to 22 per cent in 1996 and by 2008 had risen to almost 33 per cent. This is one of the larger employment rate increases for older workers among OECD countries.

Similar patterns show up when one looks at separate age groups. Table 3 provides results for those aged 55 to 59, and Table 4 for ages 60 to 64. For both age groups, the declining pattern of participation rates and employment rates reversed in the mid-1990s and have since been rising for men and for workers overall. The increases have been stronger among those aged 60 to 64 than for those aged 55 to 59. For the former group, participation rates for all workers rose by 14 percentage points between 1996 and 2007, and employment rates went up by 14 percentage points, as well. So most of the adjustment is taking place within the 60- to 64-year-old age group. And this is precisely the age interval that Canada's baby noomers are now entering.

Why this reversal occurred and why at that specific time are as yet unclear (see, for example, Schirle 2008). A strong economic expansion and tightening of the labour market provided greater economic opportunities—for older workers, as well. More rapid employment growth in the service sector (rather than in the primary or manufacturing sectors) provides opportunities that are more accessible to older workers, particularly where cumulative experience and personal networks count more. While levels of real earnings for youth declined over the 1980s and 1990s, workers of prime age and older held up over this period as employers apparently wanted "work experience" in their workforce—why this would be the case in an era of rapid, ongoing technological change, though, is not clear. In Canada, the restructuring and displacements of the early 1990s that were associated with severe recession and adjustment to the Free Trade Agreement (FTA) and the North American Free Trade Agreement (NAFTA), as well as the government cutbacks in the mid-1990s, were pretty well completed by 1997, so there were now fewer layoffs and buyouts leading to early retirements. More generally, gradually improving health levels meant that more people want to keep active while facing the prospect of a longer retirement period. Also, the continuing shift away from private occupational pension coverage and away from defined benefit and towards defined contribution pension plans had the effect of shifting retirement income risk onto workers, and postponing retirement is a way of dealing with this increased risk. Finally, the rise in female labour force participation since the 1970s in Canada resulted in a big increase in older-worker, dual-earner house-

holds by the 1990s, and the spouses may wish to coordinate their retirement plans. Since women, on average, have shorter earning careers, they may wish to continue working longer in order to build up seniority benefits and higher earnings and pension entitlements, and their husbands may thus stay in the job a bit longer to dovetail their joint retirement plans.

Table 2

Rates of labour market activity by gender for workers aged 55 and over

	Participation rate %	Unemployment rate %	Employment rate %
All workers			
1976	31.4	3.9	30.2
1986	27.2	6.9	25.3
1996	23.7	7.3	22.0
2005	31.5	5.1	29.9
2006	32.2	5.1	30.5
2007	33.3	4.8	31.7
April 2008	34.3	4.8	32.7
September 2008	34.5	5.3	32.7
Men			
1976	47.2	3.8	45.4
1986	39.8	6.9	37.0
1996	32.2	7.3	29.8
2005	39.1	5.1	37.2
2006	39.1	5.2	37.1
2007	40.0	4.9	38.1
Women			
1976	17.7	4.3	16.9
1986	16.8	6.9	15.6
1996	16.6	7.2	15.4
2005	24.9	5.2	23.6
2006	26.1	5.0	24.8
2007	27.3	4.7	26.1

Source: CANSIM Table 282–0002. More specifically, the annual series come from v2461230, v2461251, v2461272, v2461440, v2461461, v2461482, v2461650, v2461671, and v2461692. The monthly series come from v2062978 and v2062977

Table 3

Rates of labour market activity by gender for workers aged 55 to 59

	Participation rate %	Unemployment rate %	Employment rate %
All workers			
1976	60.4	4.0	58.0
1986	59.7	7.5	55.2
1996	59.8	8.0	55.0
2005	68.2	5.2	64.7
2006	69.1	5.1	65.5
2007	70.6	5.0	67.1
Men			
1976	84.2	3.8	80.9
1986	78.2	7.5	72.3
1996	71.6	8.2	65.7
2005	76.2	5.2	72.3
2006	76.1	5.3	72.1
2007	77.6	5.2	73.5
Women			
1976	38.2	4.4	36.5
1986	41.7	7.5	38.6
1996	48.3	7.7	44.6
2005	60.4	5.2	57.2
2006	62.3	4.9	59.2
2007	63.9	4.8	60.8

Source: CANSIM Table 282–0002, analogous series numbers to Table 2

All in all, Canada's labour market profile for older workers is in reasonably good shape compared with other developed countries. Semi-hysterical media reports, such as "Boomers likely to trigger a Japan-type meltdown" (*Globe and Mail* 2006) would seem to be misplaced. There are several reasons why Canada will not follow the route of Japan. The first is demographics: the Canadian population is not aging as early or as fast as the Japanese. There are also higher female participation rates in Canada than in Japan, so that there are more earners per population member in Canada. The second is immigration:

Canada has a much higher immigration rate than Japan, and the average age of immigrants to Canada (about 32) is much lower than for the population as a whole. Such relatively high levels of immigration in Canada—and its increasing emphasis on economic or independent class immigrants who are, on average, younger still (about age 26)—will help soften the demographic slowdown. The third is geography: Canada happens to be situated next to the United States, with its population of 300 million that is aging more slowly than any other major developed country. Their continuing demand for Canadian exports and heavy investment in Canadian energy and resources will help keep incomes in Canada relatively high.

Table 4

Rates of labour market activity by gender for workers aged 60 to 64

	Participation rate %	Unemployment rate %	Employment rate %
All workers			
1976	44.7	4.5	42.7
1986	38.4	7.6	35.5
1996	33.1	7.5	30.7
2005	44.3	5.7	41.7
2006	45.1	5.6	42.6
2007	47.1	5.1	44.7
Men			
1976	66.5	4.4	63.7
1986	55.2	7.7	50.9
1996	43.6	7.5	40.3
2005	53.9	5.8	50.8
2006	53.3	5.4	50.5
2007	54.0	5.1	51.3
Women			
1976	24.4	4.9	23.2
1986	23.5	7.4	21.8
1996	23.1	7.4	21.4
2005	35.0	5.6	33.0
2006	37.1	5.4	35.1
2007	40.3	4.9	38.3

Source: CANSIM Table 282–0002, analogous series numbers to Table 2

EFFECTS OF THE AGING POPULATION ON
STANDARD OF LIVING, RETIREMENT, AND LABOUR SUPPLY

It is convenient for this section and the next to set out a simple analytical framework for examining the effects of population aging on general living standards. If Q indicates output or GDP of a country, P its population, and E its level of employment, then

$$\frac{Q}{P} = \frac{Q}{E} \times \frac{E}{P}.$$
(2)

If total output per capita is our indicator of standard of living or average economic well-being of a country, we can see that average living standards are the product of output per worker or average labour productivity in the economy and the number of workers per capita—what we have already identified as the employment rate. Consequently,

$$Std.\ of\ living = Prod_L \times ER, where\ ER = PR \cdot [1 - UR].^{1,2}$$
(3)

Average living standards thus depend on the overall employment rate and average labour productivity. In this section, we examine the effects of the aging population operating through the former channel. In the following section, we consider aging effects operating through the productivity route. The former can be viewed as a dimension of quantity of labour and the latter as a dimension of quality of labour or skill. Obviously, other important effects of aging are involved, as well—on the government's fiscal situation and on the composition of demand in the economy, for example. The focus of this paper, however, is on the effects of aging on overall living standards. Boothe and Roy (2008) estimate that, from 1981 to 2007, Canada's output per capita averaged growth of 2.2 per cent a year. They also find that 57 per cent of this growth arose from increases in labour productivity, while 21 per cent resulted from increases in employment.[3]

Obviously, one can also identify various refinements to the above decomposition formula. One could break down labour productivity into productivity per hour and average hours worked. One could also distinguish between GDP (output) and personal income, which is received by the household sector. Or one could go even farther and distinguish between disposable income and personal income. But for the purposes at hand, the simpler decomposition seems to be the most convenient. For simplification of focus, I also disregard the distribution of income among households and the role of net foreign income.

Two basic predictions emerge from the simple formulation above. First, to the extent that an aging population means an increasing proportion of retirees, population aging and a

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1. Actually, the participation rate, the unemployment rate, and the employment rate are defined only for the "eligible population," which is essentially the population aged 15 and over in Canada. So this equation should also include a further term $(1 - DR_c)$, where DR_c is the child-dependency ratio or proportion of the total population that is under 15 years of age. Obviously, a declining fertility rate will reduce DR_c and raise E/P as a direct effect. However, since this paper is concerned principally with the aging of the adult population and workforce, this term is disregarded in subsequent discussion.
2. One can also express the overall participation rate, PR, as
   $$PR = S(LT65) \cdot PR(LT65) + S(65 +) \cdot PR(65 +),$$
   where $S(LT65)$ is the share of the adult (or eligible) population under age 65, $S(65+)$ is the corresponding share aged 65 or over (what can be viewed as the elderly dependency ratio of DR_e), and $PR(LT65)$ and $PR(65+)$ are the corresponding age subgroup-specific participation rates. This can also be expressed as:
   $$PR = PR(LT65) - [PR(LT65) - PR(65 +)] \cdot S(65 +),$$
   where the term in square brackets is obviously positive.
3. The difference arose from improvements in Canada's terms of trade.

rising elderly dependency ratio will reduce participation rates and, hence, employment rates and reduce the rate of growth of the labour force. Indeed, the growth of Canada's labour force has already been declining from 3.5 per cent in the 1970s, to 2 per cent in the early 2000s, and is expected to decline to below 1 per cent after 2010 (Lapointe et al. 2006, 38). *Ceteris paribus*, these changes will be associated with reduced living standards. Second, to the extent that there is a reduced rate of growth of labour to the economy's aggregate production function, *ceteris paribus*, there will be a reduced rate of growth of output and thus of output per capita (i.e., living standards). These two effects thus reinforce each other. And these effects will be accentuated, for example, if (i) an increased rate of technological change and industry restructuring lead to greater workplace stress and hence earlier retirements; or (ii) increased international competition and job displacements from ongoing globalization of trade and a higher Canadian dollar lead to a similar increase in the number of discouraged workers. On the other hand, immigration can attenuate these two effects, although immigrants, on average, have lower employment rates than non-immigrants (OECD 2005, 46–48).

A number of further workplace effects would also be expected from an aging population and an increasing proportion of retirees.

(i)   There is likely to be a shortage of skilled workers in some industries, occupations (such as the health sector), and regions as many skilled workers retire (Mercenier, Mérette, and Fougère 2005). This is especially likely to be so in jobs that require experienced coordination and a network of contributing workers such as skilled construction contractors.

(ii)   As the large block of older workers move into retirement, there is likely to be an opening up of advancement opportunities for younger workers and a corresponding steepening of age-earnings profiles for younger workers. This is already beginning to be seen in 25- to 34-year-old workers (Beach and Finnie 2004).

(iii)   Regional economic disparities may intensify as high-growth areas, such as the West, experience high employment rates and attract relatively mobile younger workers, and slower-growth areas with older established industries and workforces, such as Quebec and the Maritimes, experience proportionally higher rates of retirement and, hence, lower living standards (Fougère et al. 2005).

(iv)   Workplaces are likely to become more accommodating of older workers as employers seek to provide continuity of workplace knowledge and to maintain their skilled human-capital stock. Accommodations could include more flexible hours and work arrangements, more ergonomic offices, computer screens that are easier to read, software that is easier to use, and more training on adoption of new technologies. This is already happening in Japan at major firms such as Toyota and Honda.

(v)   To the extent that direct health-coverage costs of older workers are borne more by employers in the United States and by taxpayers in Canada, employment opportunities for older workers are likely to be more readily available in Canada than in the United States. This could turn out to be fairly

important over the next 20 years as the baby-boom cohort transitions into their 60s and early 70s.

(vi)   The abandoning of compulsory retirement laws and an ongoing shift towards an increasing relative importance of general human capital in the workplace because of the widespread use of standardized software for accounting, filing, record-keeping, and basic statistical analysis of databases are likely to lead to an increased evaluation of the performance of older workers on the job and a resulting weakening of seniority rules and benefits. This is quite independent of a likely court challenge to seniority rules as a form of systemic discrimination against women and minorities in the Canadian workplace under the Canadian Charter of Rights and Freedoms, which will almost surely occur. The result could be the development of a broad menu of flexible work arrangements—including various forms of self-employment and contract work—for older workers.

(vii)   At least in the earlier stages of population aging where there is an increase in the proportion of older workers—not yet retired—in the workplace, age-earnings differentials are likely to narrow and age-earnings longitudinal trajectories are likely to flatten as the increased supply of older workers bid down their relative wages. The greater the degree to which older workers choose to postpone retirement—as we have seen is now occurring (Tables 2 to 4)—the stronger this effect will be.

(viii)   As the workforce ages, the Becker-Mincer human-capital model of on-the-job training predicts that there will be a fanning out of age-wage/earnings profiles and, hence, an increase in the degree of inequality in wage rates and earnings levels in the workforce (Mincer 1974; Becker 1974). This has already been happening and will likely continue as the baby boomers move towards the end of their working careers. Once they ease into full retirement, however, wage and earnings inequality in the workplace should reverse and start decreasing. If high-skilled individuals choose to continue working longer out of choice and low-skilled workers continue working out of need, earnings inequality among older workers could increase. Also, once the baby boomers have moved into retirement, income inequality as a whole is likely to decrease as the lowest-income individuals will have their income levels raised and stabilized by Canada's retirement social security system, while the highest-skilled individuals will generally have pensions that, while generous compared to the public pension system, are much lower than their pre-retirement earnings levels. So a larger fraction of the population who are retirees will likely reverse the trend of the past three decades towards higher income inequality in Canada.

This then leads into the question of why people retire and what are the major factors leading to a rising age of retirement in Canada (and elsewhere) over the past decade.[4] First is a matter of preference. Older people today are generally healthier and living longer than in previous generations, so the length of time they can expect to spend in retirement has increased considerably. Older people may thus wish to work at least part-time and keep

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4.   Formal models of the retirement decision can be found, for example, in Bloom, Canning, and Moore (2007) and in Bound, Stinebrickner, and Waidmann (2007).

active longer, perhaps because they find retirement boring and simply want to return to the labour force. Surveys find that a major factor is how much older people like the jobs they are doing.

Second is a matter of need. Many people simply haven't saved much for their retirement. Relatively low interest rates in the past decade or so and a longer expected retirement interval mean that a given wealth stock will support a lower annuity during retirement. So older workers may feel the need to continue working longer to supplement the shortfall of their retirement savings. Add to this the current crisis in world financial markets and dramatic declines in asset prices: what had previously appeared to be an adequate stock of wealth for a comfortable retirement may suddenly no longer be the case. There is also evidence that people nowadays desire a higher earnings replacement rate when they retire than a generation ago so that they can travel more and better enjoy urban cultural amenities during their retirement. These preferences, though, may have to be readjusted in light of current declines in asset prices.

Third, many workers are facing greater uncertainty in retirement funding quite apart from the current financial market turmoil. The past 20 years have seen a declining coverage of workers by occupational RPPs (registered pension plans). There has been a dramatic shift from defined benefit to defined contribution plans among RPPs, so that more risk has been transferred from employers to workers. Many defined benefit entitlements have been cut back, particularly with respect to health and drug benefits. The current decline in market values is leaving many RPPs notably underfunded. And the likely increase in firm bankruptcies in the approaching economic slowdown or possible recession will put pension commitments in greater jeopardy. All of these factors may contribute to workers having to postpone their retirements.

Fourth, women may want to work longer in order to build up their own pension entitlements, since their earning careers are typically shorter and less continuous than those of men, and the increased incidence of divorce forces them to be more self-reliant for their future sources of income. There is also the higher cost of educating the children in a household as more young people expect to go on to post-secondary education than a generation ago. There is a hysteresis effect of the current cohort of older women workers who are more used to working in the labour force than a previous generation and are more likely to wish to continue working. More educated workers also tend to maintain longer attachment to the labour market, and the current cohort of older workers—men and women—are significantly better educated than in previous decades. Their working career starts later, so they want more time to follow it through. The shift towards a white-collar economy where jobs are less physically demanding also provides greater opportunity for a longer working career. And, as already mentioned, when both spouses in an older household work, they may wish to coordinate their retirement plans so they can retire together. A man may thus choose to continue working a couple of years longer than otherwise until his wife is ready to retire, as well.

Fifth, if the Canadian economy is entering an era of labour shortages, particularly for selected skills, this will likely raise the demand for older workers to continue working and reduce a possible stigma against hiring older workers in the labour market. A shortage of skilled labour and a preference of older workers for more choice and flexibility in work scheduling and employment options mean that there is likely to be a marked growth of phased retirement and non-standard employment relationships (such as part-time and temporary work and contract or self-employment arrangements) aimed at older workers.

If judicial review ends up striking down job seniority rules as a source of systemic discrimination in the workplace, the demand for more flexible work arrangements for older workers will be further strengthened.

Sixth, on the other hand, the onset of a severe recession at the moment will likely reduce or temporarily reverse the currently rising average age of retirement. Shortages of labour will turn—at least temporarily—to surpluses, and job availability for older workers will be reduced. Cyclical layoffs and job displacements may also result in discouraged older workers simply withdrawing from the labour force, especially if a recession becomes a drawn-out affair.

Household wealth can also affect employment rates through its effects on labour supply and participation rates. Higher wealth and associated non-wage income are unambiguously expected to increase consumption, reduce labour supply, and reduce the age of retirement ("Freedom 55"). In the years before the current financial meltdown, wealth in Canada increased substantially more than mean incomes or earnings—see Table 5. This was partly due to the run-up of house prices over the past decade, but also due to rising equity markets. Now, wealth generally increases with age until the time of retirement, consistent with life-cycle theory. But as Table 6 shows, this positive age-wealth profile has become considerably more marked or concentrated as the wealth of the older population has increased disproportionately. This means that there is a greater degree of exposure of the older population's consumption and retirement patterns to asset-price fluctuations. Since wealth increases more strongly with age than do earnings or income, one would expect that for an aging population, the wealth-income ratios will continue to rise and, hence, that this exposure to asset-price fluctuations will continue to increase. This greater inequality of wealth for an aging population will thus temper the welfare implications of point (vii), i.e., workplace effects, earlier in this section. Therefore, the current financial meltdown—quite apart from corporate bankruptcies and private sector pension reductions—will likely lengthen working careers and continue raising the average age of retirement. In the longer run, however, historically large intergenerational inheritances of wealth by the baby boomers over the next 15 years or so are likely to attenuate the rising average retirement age.

Table 5

Average wealth-income ratios in Canada, 1984–2005
(thousands of 2005 dollars)

	Average wealth	Relative to average family income	Relative to average individual income	Relative to average men's earnings
1984	$148.5	2.313	5.646	4.035
1999	$202.9	2.791	6.609	5.022
2005	$251.7	3.210	7.627	6.007

Sources: Wealth figures from Morissette and Zhang (2007), Table 4; family income figures from CANSIM series v1544695; individual income figures from CANSIM series v25730800; men's earnings figures from CANSIM series v1540488

Canada's standard of living thus depends in part on maintaining a high employment rate. Policy efforts should be focused on furthering this undertaking. It is therefore worth pointing out the critical importance of maintaining good macroeconomic policy so that jobs are available, particularly for non-prime-age workers, and so that adjustment costs to employing older workers are lower. Policy responses should also open up a range of alternatives, encourage greater flexibility in adjustment to economic change, focus on fostering employment rather than protecting jobs, and not drive up costs of production and operation in Canada.

Table 6

Mean and median family wealth by age group, 1984–2005
(thousands of 2005 dollars)

Age	Median wealth				Average wealth			
	1984	1999	2005	% change 1984– 2005	1984	1999	2005	% change 1984– 2005
25–34	27.0	17.4	13.4	–50.4	80.5	77.5	71.0	–11.8
35–44	84.7	69.1	84.2	–0.6	158.5	175.0	238.3	50.3
45–54	142.8	132.7	146.0	2.2	233.2	285.4	355.9	52.6
55–64	148.7	177.5	203.5	36.9	242.3	348.9	409.0	68.8
65 and over	93.1	145.2	157.0	68.6	162.1	244.1	301.7	86.1

Source: Morissette and Zhang (2007), Table 4

To these ends, a number of specific policy measures could be considered.

(i)   Revise Canada Pension Plan/Quebec Pension Plan (CPP/QPP) and Registered Retirement Savings Plan (RRSP) rules so as to reduce incentives to retire before or at age 65, and open up opportunities for workers to both receive some retirement benefits and continue working with their current employer. Some initiatives along these lines were included in recent federal budgets, but more could be done to provide greater choice and flexibility of transition from full-time work to full-time retirement.

(ii)   Richard Shillington (2008) has pointed out that the income-tested Seniors Benefit and the GIS claw-back rate at age 65 do not provide an incentive for continuing to work beyond age 65. Milligan and Schirle (2008) examine other interactions, as well. Such work disincentives also blunt incentives to invest in registered savings accounts, since they reduce the rate of return on such savings. A lot of people are affected by eligibility for these programs, and Shillington shows that they can have a substantial effect.

(iii)   Revise employer payroll tax rules so as not to discriminate against employ-
          ment of short-hours (e.g., part-time) workers and to facilitate more part-time
          and flexible work-schedule arrangements, which are of special interest to
          older workers. For example, this could be done by putting the tax—at possibly
          a lower rate—on the total wage bill rather than having caps per worker.

(iv)   Provide incentives to employers to retain and attract older workers and to in-
          vest in accommodating them in the workplace.

 (v)   Encourage life-long learning, retraining, and skill upgrading for mid-career
          and older workers. Such incentives could be offered on both sides of the la-
          bour market.

(vi)   Provide incentives and advisory support for older workers to move into self-
          employment as a way of making better use of their accumulated experience
          and extending their working careers in a more flexible fashion. The United
          Kingdom has recently introduced such initiatives.

(vii)   Encourage employers with RPP programs to offer more flexible phase-in
          retirement options by allowing workers to receive partial RPP benefits while
          continuing to work, possibly part-time or on a contract basis, beyond age 65
          (or whatever is deemed the normal retirement age in the plans).

EFFECTS OF WORKER AGING ON LABOUR PRODUCTIVITY

Labour productivity is the other major determinant of living standards or the economic
well-being of a population. This involves both effort and skills, and thus both demand-side
and supply-side activity in workers' skill development, as well as efficient skill utilization in
the workplace. Unfortunately, direct measurement of worker productivity on the job is
typically very difficult, and there is much in this regard that we do not know. For example,
what are the relevant key dimensions of workers' skills? How do skills and productivity
depend on the education, training, health, and occupation of workers? Obviously, these
are major research questions. As Kuhn (2005) has pointed out, the *capacity* of acquiring
new skills seems indeed to decrease with age. But skills have many dimensions, and the
productivity of a group of workers appears to depend on skill mix in the workplace—for
example, the technical expertise and agility of younger workers operating under the ex-
perienced direction and judgment of older workers. Bringing in more skilled immigrants
will also enhance productivity after a period of adjustment, and immigrants are, on aver-
age, younger than the resident Canadian population.

Nonetheless, several things can be said about the expected effects of aging on worker
productivity. Concave age-earnings profiles are predicted from the conventional general
human-capital model, which assumes that wages reflect productivity over a worker's
career. Direct estimates of worker productivity by Hellerstein and Neumark (1995) and
Hellerstein, Neumark, and Troske (1999) are indeed consistent with the general human
model and find decreasing rates of productivity growth with age. The rate of skill growth
generally slows as one gets older. Hellerstein and Neumark (2004), using the 1990 De-
cennial Employer-Employee Dataset (or DEED) for the United States, estimate both wage
and productivity profiles from manufacturing establishments, and find that both profiles
are indeed positive and concave, but with the productivity profile slightly flatter than that

for wages, consistent with models of deferred compensation and career incentive schemes. A positive but concave profile across ages would thus imply, *ceteris paribus*, that as the baby boomers age, overall productivity will slow down.

Furthermore, a lower share in the workforce of younger workers who are more educated, incorporate newer vintages of technology, are more technically agile, and can most easily adapt to new technologies in the workplace would suggest a lower overall rate of productivity growth. A lower share of young workers who often work harder to gain promotion, tenure, and higher wages in order to buy a house and start a family would also suggest a lower rate of productivity growth. An older workforce is generally less flexible to adjust to ongoing change, and adjustment costs are higher than for a younger workforce. On the other hand, older workers, on average, have better job-match qualities and greater tenure, require less supervising, and generally are more willing to choose non-standard work arrangements such as self-employment. The predominance of arguments, though, do suggest that an older workforce, *ceteris paribus*, will have a lower productivity growth rate.

However, *ceteris paribus* won't hold as the economy adjusts in various ways to the changing age structure of labour supply. Relative labour shortages lead to higher wages and, hence, more investment in capital (human and physical), upgraded average skill levels, improved utilization of labour skills, more rapid advancement opportunities for younger workers, and adoption of new production technologies (i.e., endogenous technological change) reflecting the relative availability of factors of production. Higher wages for skilled workers provide incentives for youth to invest more in education and training, thus raising average labour productivity in the long run (Fortin and Lemieux 2005; Fougère and Mérette 1999; and Fougère et al. 2006). Incentives to attract and retain skilled labour lead to improved working conditions, later retirement, more concern about health and safety issues, and greater investment in human capital (by both workers and employers). Health policy matters a lot. The access to and delivery of health care can have a big effect on longevity, healthiness, quality of life, and the ability to continue working without major breaks.

Shortages of labour and higher wages will make it cost-effective for firms to invest more in capital and innovation in order to raise worker productivity. Such capital deepening can go a long way to mitigating aging-induced slowdowns in productivity growth. Cutler et al. (1990) estimate that, in the absence of such capital deepening, U.S. per capita output would decline owing to population aging by 7 to 12 per cent over a 60-year period. But this could be offset by only a 0.15 per cent a year increase in productivity growth. A higher value of the Canadian dollar means that Canadian manufacturing will have to focus more on products involving higher-skilled labour, and Canadian producers can more readily afford imported capital equipment that embodies the newest (and most productive) technologies. So a higher Canadian dollar may foster a more rapid adoption of new technologies, although the evidence on this so far is mixed. All of these adjustment processes argue for a capital-deepening effect of increased worker productivity. Typically, such adjustment or secondary effects do not dominate the initial or primary effects of an aging workforce. Boersch-Supan (2001) argues that such capital deepening will not fully offset declines in productivity growth from an aging population. But to decide this more conclusively, one needs a formal model to evaluate the strengths of the different effects.

A recent evaluation of workforce aging on productivity in terms of alternative models of economic growth is found in Scarth (2008). Within the traditional neoclassical growth model of exogenous growth-rate analysis, Scarth points out four effects or channels

whereby population aging can have an effect on productivity growth and, hence, on living standards: (i) an increase in the elderly dependency ratio; (ii) an increase in workers' saving (and hence building up capital stock to make labour more productive); (iii) a decrease in the population growth rate; and (iv) an increase in taxes to finance the higher health and pension costs of an aging population. The first and fourth channels decrease living standards, while the second and third work to increase labour productivity and thus overall living standards. Best estimates from various calibration studies lead Scarth to find that "the resulting net effect is a one-time, but ongoing, reduction in living standards of about 7%" (p. 11), which he regards as quite significant.

Scarth (2008) then goes on to examine the "new growth theory" and three alternative forms of endogenous-growth-rate analyses. The first allows for endogenous investment in worker knowledge or human capital. The second allows for research and development investment in the economy and its resulting production externalities. The third model brings in environmental concerns and limited natural resources and their effects on output and living standards. Unfortunately, different results follow from the different ways of modelling such endogenous growth. Obviously, much additional research needs to be devoted to this set of questions before a clear-cut consensus can emerge. Nonetheless, his broad conclusion is that an aging population does represent a serious challenge, and we cannot avoid some pessimism regarding its effects on overall living standards, but that "the likely magnitude of the hit to living standards may just be manageable. . . . It is discouraging, however, that not all the approaches to growth provide analytical support for all the policy initiatives that are being discussed as responses to population aging" (Scarth 2008, 27).

Cutler et al. (1990) argue that slow labour force growth and labour scarcity induce more rapid technological change. From an empirical analysis of international data over 1960–85, they "find some evidence that nations with slower labor force growth do experience more rapid productivity growth. The estimates suggest that the reduction in labor force growth projected [for the United States] for the next 40 years may raise productivity growth enough to offset fully the consequences of increased [elderly dependency ratio]" (pp. 3–4). Mérette (2002, 7) also expresses an optimistic view of Canada's demographic change for its long-run growth prospects:

> It is the contention of this paper that population aging will enhance the role of human capital as an engine of economic growth because it creates strong incentives for young and future generations to invest in human capital formation. That investment, in turn, could more than compensate for the decrease in the proportion of the population of working age.

This will be driven by the rise in wages relative to interest rates, thus promoting a deepening of human capital among younger workers.

What, then, is the empirical evidence on the effect of population aging on productivity and, hence, on living standards? Again, unfortunately, there is no real consensus of empirical estimates, evidence from past experience may not be valid in the future, and evidence from some countries may not be appropriate for other countries because of institutional differences or differences in social norms. Warr (1994) reviews numerous studies from Europe that show no significant difference in job performance between older and younger workers. Kuhn (2005) reviews economics and psychology literature and concludes that both the level and the type of skills do indeed differ between younger and

older workers; but once education is taken account of, there is little evidence that productivity actually declines with age. Overall productivity depends on mixing of skills and the complementarity of different skill types by education and work experience. Older and younger workers often do quite different tasks in the workplace. Recent advances in the literature, as applied to immigration, suggest that how these different skill types work together can be quite important in the effect on productivity.

Nonetheless, a range of studies—using both microdata and macrodata approaches—have consistently found negative effects of population aging on labour productivity. After examining numerous surveys and commissioned studies with Canadian evidence, the Skills Research Initiative (2008) at Human Resources and Social Development Canada (HRSDC) and the Policy Research Directorate in Ottawa conclude that the rate of skill growth in the Canadian economy will indeed slow as a result of population aging:

> In a "base case" scenario, most of the economic impact of population aging occurs after 2021. Between 2021 and 2051, growth of living standards . . . would be 1% a year, about half the growth rate between 2001 and 2021. (Skills Research Initiative 2008, 1)

Hellerstein and Neumark (1995), using Israeli firm-level data, and Hellerstein, Neumark, and Troske (1999) and Hellerstein and Neumark (2004), using matched employer-employee data for the United States,[5] find age-productivity profiles that are tight, statistically significant, positive, and concave for workers in the manufacturing sector, so that an aging workforce would be shifting from steeper growth to flatter growth segments of the productivity profiles for workers in the manufacturing sector; consequently, an aging workforce would be shifting from steeper growth to flatter growth segments of the productivity profiles, *ceteris paribus*. Dostie (2006, 2007) applies the approach of Hellerstein, Neumark, and Troske (1999) to Canada. Using the Workplace and Employee Survey for 1999–2003 applied to *all* firms (not just manufacturing firms), he finds that both wage and worker productivity profiles are concave, with the highest levels for the 35 to 55 age group and diminishing thereafter, although only slightly. "While workers aged between 35 and 55 earn 13% more on average than younger workers [less than 35], we estimate their productivity to be 15% higher. Similarly, older workers [over age 55] earn on average 12% more [than younger workers] but are 13% more productive" (p. 15). Tang and MacLeod (2006), using Canadian macrodata, find a statistically significant negative, but quite modest, effect of workforce aging on labour productivity growth (of up to 0.13 to 0.23 percentage points per year). But the growth of Canada's labour productivity has been about 1.7 percentage points a year, so that the latter estimated effect of aging is indeed modest and likely quite manageable.

CONCLUSION

This paper has examined the arguments and evidence on the effects of population aging on labour force participation, labour productivity, and living standards in the Canadian context. We have seen that Canada's population is generally younger than Europe's or Japan's, but older than that of the United States, and it is aging more slowly than in Europe or Japan, but more rapidly than in the United States. The major sources of the aging

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5.   More general and more detailed discussion of the use of these data to estimate such questions as individual worker productivity can be found in Abowd and Kramarz (1999).

Canadian population are the aging of the post–World War II baby boomers followed by dramatic declines in fertility rates through the 1970s and 1980s.

The paper showed that the standard of living (or output per capita in the economy) can be expressed as the product of two major factors—labour productivity in the workplace and the employment rate (or those in the population contributing to production):

$$Std.\ of\ living = Prod_L \times ER, \tag{4}$$

where, in turn, the employment rate can be expressed in terms of the labour force participation rate (PR) and the unemployment rate (UR):

$$ER = PR \cdot [1 - UR]. \tag{5}$$

Consequently, the various factors affecting living standards can be seen as operating through these different channels. In the short run, say, less than 10 years, productivity in Canada hasn't changed all that much, whereas the rates of participation and unemployment have. A number of reasons why the participation rate of older workers and the average age of retirement in Canada have been rising over the past decade are examined. Excepting for the effects of a temporary slowdown or recession, I would expect these factors to continue operating and, hence, overall employment rates to continue rising.[6]

In the long run, say a decade or more, the ongoing changes in labour productivity cumulate upwards and come to dominate changes in average living standards. If growth rates are expressed in terms of percentage changes of variables, then the above decomposition implies that:

$$\%\Delta Std.\ of\ living = \%\Delta Prod_L + \%\Delta ER \tag{6}$$

and

$$\%\Delta ER = \%\Delta PR - \left(\frac{UR}{1-UR}\right) \cdot \%\Delta UR. \tag{7}$$

Over the long run, unemployment rates are not likely to follow a major trend from current levels and the unemployment ratio is a rather small number. The factor that will drive change in employment rates will be change in participation rates. In terms of participation rates, the aging of the population will manifest itself principally through the retirement patterns of older workers. But surely there is an upper limit of, say, around age 70 for the average age of retirement, given current economic expectations and social norms. So in the long run, the $\%\Delta Prod_L$ term would seem to dominate. The participation rate effect will also eventually turn negative as the baby boomers ease into full retirement. Even if the effects of an aging population on labour productivity are estimated to be rather modest in terms of per-year changes, over a decade or two, they can become fairly substantial. And if the analytical studies are accurate indicators of the long-run effects, Canada's aging population will likely have a noticeable direct negative effect on average living standards. But increased investment in skills and human capital on the supply side of the labour market, combined with capital deepening and an increased rate of technological change on

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6. However, to the extent that recent growth in output has been due to debt financing as well as to productivity growth per se, and the former is likely to decline sharply, output growth and, hence, increases in living standards, are likely to attenuate over the next while.

the demand side of the labour market, all as a result of labour shortages and rising real wages, are likely to substantially mitigate what may otherwise be a 7 to 10 per cent drop in living standards over the next 30 years. Such complex adjustments are not easy to model formally, but a range of studies suggest that these—and other possible economic adjustments—may well result in average living standards (or output per capita) declining rather minimally by, say, less than 3 per cent.

Economic well-being also depends on more than just current income. An older population will have lower crime rates. And, as we have seen, average household wealth has been rising relative to incomes, so long-run opportunities are increasing, as well.

REFERENCES

Abowd, J. M. and F. Kramarz. 1999. "The Analysis of Labor Markets Using Matched Employer-Employee Data." In *Handbook of Labor Economics*, edited by O. Ashenfelter and D. Card, Volume 3, Number 3: 2629–710. Amsterdam: Elsevier North-Holland.

Beach, C. M. and R. Finnie. 2004. "A Longitudinal Analysis of Earnings Change in Canada." *Canadian Journal of Economics* 37 (1): 219–40.

Becker, G. S. 1974. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. New York: National Bureau of Economic Research (distributed by Columbia University Press).

Bloom, D. E., D. Canning, and M. Moore. 2007. "A Theory of Retirement." National Bureau of Economic Research Working Paper No. 13630.

Boersch-Supan, A. 2001. "Labor Market Effects of Population Aging." National Bureau of Economic Research Working Paper No. 8640.

Boothe, P. and R. Roy. 2008. "Business Sector Productivity in Canada: What Do We Know?" *International Productivity Monitor* 16 (Spring): 3–13.

Bound, J., T. Stinebrickner, and T. Waidmann. 2007. "Health, Economic Resources and the Work Decisions of Older Men." National Bureau of Economic Research Working Paper No. 13657.

Clark, R. L., R. V. Burkhauser, M. Moon, J. F. Quinn, and T. M. Smeeding. 2004. *The Economics of an Aging Society*. Oxford, U.K.: Blackwell Publishing.

Cutler, D. M., J. M. Poterba, L. M. Sheiner, and L. H. Summers. 1990. "An Aging Society: Opportunity or Challenge?" *Brookings Papers on Economic Activity* 1: 1–73.

Denton, F. T., C. H. Feaver, and B. G. Spencer. 2005. "Population Aging in Canada: Software for Exploring the Implications for the Labour Force and Productive Capacity of the Economy." McMaster University, Quantitative Studies in Economics and Population Research Reports.

Dodge, D. A. 1975. "Impact of Tax, Transfer and Expenditure Policies of Government on the Distribution of Personal Income in Canada." *Review of Income and Wealth* 21 (1): 1–52.

Dodge, D. A. and D. A. A. Stager. 1972. "Economic Returns to Graduate Study in Science, Engineering and Business." *Canadian Journal of Economics* 5 (2): 182–98.

Dostie, B. 2006. "Salaires, productivité et vieillissement de la population active." Skills Research Initiative Working Paper No. 2006 A–09.

———. 2007. "Wages, Productivity and Aging." Centre interuniversitaire de recherche en analyse des organisations (CIRAN0), Scientific Series Working Paper No. 2007s–02.

Fortin, N. and T. Lemieux. 2005. "Population Aging and Human Capital Investment by Youth." Skills Research Initiative. Draft paper (June).

Fougère, M., S. Harvey, J. Mercenier, and M. Mérette. 2005. "Population Ageing and the Effective Age of Retirement in Canada." Skills Research Initiative Working Paper No. 2005 A–03.

———. 2006. "Population Ageing, Time Allocation and Human Capital: A General Equilibrium Analysis for Canada." Skills Research Initiative Working Paper No. 2006 A–10.

Fougère, M. and M. Mérette. 1999. "Population Ageing and Economic Growth in Seven OECD Countries." *Economic Modelling* 16 (3): 411–27.

Globe and Mail. 2006. "Boomers Likely to Trigger a Japan-Type Meltdown." 17 March.

Guillemette, Y. 2003. "Slowing Down with Age: The Ominous Implications of Workforce Aging for Canadian Living Standards." C. D. Howe Institute, Commentary No. 182 (May).

Halliwell, C. 2008. "Retirement in Canada: Some Trends, Some Issues." In *Retirement Policy Issues in Canada*, edited by M. G. Abbott, C. M. Beach, R. W. Boadway, and J. G. MacKinnon, McGill-Queen's University Press. Forthcoming.

Hellerstein, J. K. and D. Neumark. 1995. "Production Function and Wage Equation Estimation with Heterogeneous Labor: Evidence from a New Matched Employer-Employee Data Set." National Bureau of Economic Research Working Paper No. 10325.

———. 2004. "Are Earnings Profiles Steeper Than Productivity Profiles? Evidence from Israeli Firm-Level Data." *Journal of Human Resources* 30 (1): 89–112.

Hellerstein, J. K., D. Neumark, and K. R. Troske. 1999. "Wages, Productivity, and Worker Characteristics: Evidence from Plant-Level Production Functions and Wage Equations." *Journal of Labor Economics* 17 (3): 409–46.

Kuhn, P. 2005. "Skills, Human Capital and the Life Cycle." Skills Research Initiative Working Paper No. 2005 A–04.

Lapointe, M., K. Dunn, N. Tremblay-Côté, L.-P. Bergeron, and L. Ignaczak. 2006. "Looking Ahead: A 10-Year Outlook for the Canadian Labour Market (2006–2015)." Labour Market and Skills Forecasting and Analysis Unit, Strategic Policy Research Directorship, Human Resources and Social Development Canada, SP–615–10–06E.

Madrian, B., O. S. Mitchell, and B. J. Soldo, eds. 2007. *Redefining Retirement: How Will Boomers Fare?* Oxford, U.K.: Oxford University Press.

Mercenier, J., M. Mérette, and M. Fougère. 2005. "Population Ageing in Canada: A Sectoral and Occupational Analysis." Skills Research Initiative Working Paper No. 2005 A–06.

Mérette, M. 2002. "The Bright Side: A Positive View on the Economics of Aging." *Choices*. Institute for Research on Public Policy (IRPP) 8 (1): 1–28.

Milligan, K. and T. Schirle. 2008. "Improving the Labour Market Incentives of Canada's Public Pensions." *Canadian Public Policy/Analyse de politiques* 34 (3): 281–303.

Mincer, J. 1974. *Schooling, Experience, and Earnings*. New York: National Bureau of Economic Research (distributed by Columbia University Press).

Morissette, R. and X. Zhang. 2007. "Revisiting Wealth Inequality." *Perspectives on Labour and Income* 19 (1): 6–17.

Organisation for Economic Co-operation and Development (OECD). 2005. *Ageing and Employment Polices: Canada*. Paris: OECD.

Policy Research Initiative (PRI). 2003. *Horizons* 6 (2).

Scarth, W. 2008. "Some Macroeconomic Effects of Population Aging on Productivity Growth and Living Standards." In *Retirement Policy Issues in Canada*, edited by M. G. Abbott, C. M. Beach, R. W. Boadway, and J. G. MacKinnon. McGill-Queen's University Press. Forthcoming.

Schirle, T. 2008. "Why Have the Labor Force Participation Rates of Older Men Increased since the Mid-1990s?" *Journal of Labor Economics* 26 (4): 549–94.

Scoffield, H. 2007. "Aging: A Recipe for Slower Growth and Rising Rates." *The Globe and Mail*, 14 June.

Shillington, R. 2008. "Comments." In *Retirement Policy Issues in Canada*, edited by M. G. Abbott, C. M. Beach, R. W. Boadway, and J. G. MacKinnon. McGill-Queen's University Press. Forthcoming.

Skills Research Initiative (SRI). 2008. "The Labour Market and Skills Implications of Population Aging in Canada: A Synthesis of Key Findings and Policy Implications." Ottawa: Human Resources and Social Development Canada.

Tang, J. and C. MacLeod. 2006. "Labour Force Ageing and Productivity Performance in Canada." *Canadian Journal of Economics* 39 (2): 582–603.

Toronto Star. 2008. "Ontario Braces for a Grey Wave." 8 November.

Warr, P. 1994. "Age and Job Performance." In *Work and Ageing: A European Perspective*, edited by J. Snel and R. Creamer. London: Taylor & Francis.

Wise, D. A., ed. 2004. *Perspectives on the Economics of Aging*. National Bureau of Economic Research. Chicago: University of Chicago Press.