Should Income Transfers be Targeted or Universal? Insights from Public Pension Influences on Elderly Mortality in Canada, 1921–1966

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ABSTRACT

We investigate the impact of Canada’s means-tested and universal public pension programs on the mortality rates of recipient age groups for the period 1921–1966. We find that only the universal program significantly reduced recipient age group mortality rates. The implied social value of the mortality risk reduction from this program is one-tenth of the value per statistical life associated with contemporary government policy, meaning that Canadians did not need to place a high value on the life of a senior to justify the higher cost of the universal program.

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Public pensions for the aged in Canada represent the first, and one of the largest social policy initiatives of the Federal government. Struthers (2004, 350) describes how government policy towards the elderly after 1945 has “oscillated from means-testing to universality and back again towards selectivity” as the high and rising costs of universal transfer schemes emerged as a policy challenge. While we know much about the evolution of Canada’s pension programs and about the theoretical considerations of targeted versus universal transfers\(^2\), we know little about the relative effectiveness of targeted versus universal income transfers for improving the well-being of elderly populations in Canada. Researchers who have estimated the impact of public programs have looked at the presence of a program, or the generosity of benefits, without considering the means tested versus universal eligibility dimension of the program.

Canadian public pension plans offer a “quasi-experimental” situation for identifying the effects of income transfers on elderly well-being, and the relative effectiveness of targeted versus universal eligibility for alleviating poverty. The Old Age Pension (OAP), introduced in 1927 for Canadians over age 70, and Old Age Assistance (OAA), implemented in 1952 for Canadians aged 65–69, were means tested programs while Old Age Security (OAS), introduced in 1952 for Canadians over age 70, was a universal plan. The OAP, OAA and OAS were non-contributory programs intended to address the living conditions of Canadian seniors, to relieve municipal and provincial governments of the financial burden of supporting needy, aged Canadians and to encourage greater uniformity in income support arrangements across provinces. Program cost considerations were an important influence on the choice of non-contributory over

\(^2\) For example see Besley (1990), Feldstein (1987) and Lindert (2004, 34–36).
contributory finance, means tested versus universal eligibility, and for setting the age of eligibility for pensions.

How the pension programs were implemented allows for the identification of pension effects on elderly well-being. For the OAP, the timing of the program’s introduction varied across provinces after 1927 but all provinces participated with relatively uniform eligibility requirements and nominal benefit values. With the introduction of the universal OAS in 1952 nominal benefit levels were unchanged from the means tested OAP so we can identify the impact of extending pension benefit coverage without a coincident increase in benefit sizes. Similarly, the means tested OAA extended the same nominal benefit as the OAP under uniform terms of eligibility across all provinces to an age group that was ineligible for pension benefits prior to 1952. As the introduction of the Canadian Pension Plan and Guaranteed Income Supplement significantly complicate the identification of pension effects on mortality rates, we limit our sample period to 1921–1966.

Determining the effect of income transfers on the well-being of the elderly in Canada is hampered by the lack of information on incomes and living conditions of this population prior to the 1961 Census (Struthers 2004, 367). In the absence of an income measure, mortality can provide a proxy measure of economic welfare. Fishback, Haines and Kantor (2007, 1) highlight that mortality rates are associated with socioeconomic status and poverty, and are commonly used to measure aspects of economic welfare not fully captured by income measures.³ Fishback and Stoian (2010) argue that since means

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³ Income influences a person’s health by influencing his/her access to nutrition, housing and medical care (Fishback, Haines and Kantor 2007, Balan-Cohen 2008). Economic conditions also create social and psychological stresses which put people at greater risk of disease and death (Brenner 1979, Ruhm 2000, Laporte 2004, Fishback Kantor and Haines 2007). The empirical associations between income, health status
tested pensions were targeted at the elderly poor, and elderly with low incomes tend to have higher mortality rates (Chapman and Hariharan 1996), mortality rates can be used to assess the effectiveness of redistributive government programs. While significant advances in the understanding and the treatment of infectious diseases have played a major role in the decline of aggregate mortality rates over the twentieth century, deaths in the senior population have been dominated by degenerative conditions associated with the aging of the body that can be treated with rest and improved nutrition. It is plausible that senior mortality would have been influenced by income transfers, which allowed them access to necessities like food, shelter, basic medical care and drugs. Balan-Cohen (2008) argues that to the extent that pension income allowed the elderly to live independently instead of crowded almshouses, their exposure to infectious diseases would have been reduced. Pension incomes, in allowing for retirement from paid employment, may have reduced exposures to workplace risks or stresses associated with tenuous employment conditions.

Empirical research has drawn conflicting conclusions regarding the impact of transferred income on the mortality of older populations. Two studies examine income transfers and broader population mortality outcomes. Fishback, Haines and Kantor (2007) find a negative relation between per-capita means tested New Deal relief spending and several measures of mortality in the population, but not overall non-infant mortality. Winegarden and

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4 Cutler and Meara (2001). Armstrong, Conn, and Pinner (1999) have shown that, while seniors benefit from the improved treatment of infectious diseases over the twentieth century, infectious diseases constitute a small number of deaths relative to deaths in younger members of the population. Barker (1939, 720) reported that diseases of the circulatory system accounted for half of all deaths amongst the elderly in the U.S. in the 1930s. Pneumonia accounted for 12.5 percent of deaths; diseases of the kidneys, 8.5 percent, and diseases of the digestive system other than cancer counted for another 6.5 percent.

5 Boychuk (1998, 30) describes the threat of infectious diseases and other health dangers for poorhouse residents in Nova Scotia and New Brunswick.

6 On the other hand, Snyder and Evans (2006) speculate that if pension payments induced retirement, elderly mortality may have increased because of health problems associated with social isolation.

7 Two studies examine income transfers and broader population mortality outcomes. Fishback, Haines and Kantor (2007) find a negative relation between per-capita means tested New Deal relief spending and several measures of mortality in the population, but not overall non-infant mortality.
find that means tested pension Old Age Assistance (OAA) benefits had no significant impact on American urban mortality rates prior to 1940. They conclude that means tested benefits largely changed who paid for benefits of recipients with no meaningful increase in benefit coverage or generosity. Balan-Cohen (2008) finds that at the state level, OAA benefits were associated with a sizeable decrease in the mortality of males over age 64 after 1940. Balan-Cohen argues that the lack of effect of OAA before 1941 suggests that OAA benefits before 1941 were too small in value to have resulted in a sufficient increase in income necessary to impact on mortality. Snyder and Evans (2006) find that sharp reductions in social security pension benefits for Americans born after January 1, 1917, following US Legislation in the 1970s, reduced the mortality rate of the affected cohort. Showing that the cohort receiving lower pension incomes engaged in more post-retirement part-time employment, they conclude that the reduction in social isolation had a larger impact on mortality than did the reduced income transfer. Conversely, Hadley and Osei (1982) find a negative correlation between transfer income and mortality in older populations, but a positive correlation between earned income and mortality. Finally, Finkelstein and McKnight (2008) find no impact of the introduction of universal health insurance for the elderly in the United States through Medicare in 1965 on elderly mortality.

If public expenditure on these plans had a significant impact on the aggregate well-being of pension recipients, we expect to observe a decrease in the mortality rates of recipients over and above that observed for non-recipients. We apply a “differences-in-differences” approach to estimate the correlation between the annual change in mortality

Murray (1998) find that over a period from 1878–1913, expanding population coverage of government sponsored health-insurance programs contributed to the observed declines in mortality.
rates, by five-year age groups, by province, as well as by pension benefit eligibility and benefit generosity over the period 1921–1966. Variation in implementation dates across provinces, the type of plan implemented, and changes in age group eligibility allow us to identify the effects of pension benefits on recipient age group mortality. We find that the means tested pensions did not reduce recipient age group mortality rates, but the universal OAS pension benefits reduced recipient age group mortality rates by around 4 percent. This estimate suggests that the universal pension resulted in roughly 2,100 fewer deaths of Canadians aged 70 and over per year. We estimate that the value of a statistical life (VSL) implied by the OAS induced mortality risk reduction was around $0.5 million (2005 dollars) which is one-tenth of the VSL associated with contemporary government policy interventions. This means that Canadians did not need to place a high value on the life of a senior to justify the higher costs of the universal OAS program.

I. Public Pensions in Canada 1921–1970

The purpose of this study is to determine whether the payment of pension income, and the design of pension schemes, reduced the mortality of elderly Canadians. Our approach is to view the introduction and payment of pension benefits as a “natural” or “quasi” experiment. Pension recipients are the “treatment” group while non-recipients are the control group. As defined by Meyer (1995), a natural (or quasi-) experiment induced by a policy change is a situation where the researcher observes plausibly exogenous variation in the explanatory variables. This requires that the policy change is not induced by variation in the outcome measure of interest or sample selection, where assignment to treatment group reflects correlation between assignment and outcomes. In the context of our study, first we need to establish that the reasoning underlying pension introductions
and designs was not targeted at mortality outcomes. Second, we need to demonstrate that the assignment to the treatment group was not correlated with the outcome of interest. Finally, we need to establish that the programs were not anticipated to a degree that changes in the behavior of the recipient age groups confound our ability to identify the true effect of the pension income on mortality outcomes. For these reasons, it is informative to review the history of public pension plans in Canada.

The demands to introduce public pensions reflected the perceived extent of poverty amongst elderly Canadians, but not mortality explicitly. The economic condition of elderly Canadians had been a recurring policy issue in Canada since the late nineteenth century (Bryden 1974, 40–43). Over the first forty years of the twentieth century, Canadian attitudes towards government and the state were strongly \textit{laissez-faire} (Guest 1985, Struthers 1994). For the most part, older Canadians were expected to have saved and accumulated for their later years, to have continued working, to have relied on family for support and, where that failed, on outdoor relief provided by municipalities. There were some homes for the aged but they had a small capacity relative to the senior population.

Little progress was made on public pension development in Canada until the 1920s. A special committee of the House of Commons established by the Prime Minister to investigate a pension plan for Canada reported its recommendations in 1924 (Bryden 1974). While the government accepted that the needs of a sizeable poor elderly

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8 Bryden (1974, 76). As the published Canadian Census volumes did not report earnings information by age until 1941 and income information until 1951, there is little evidence available on the economic status of seniors prior to the 1927 means tested OAP. In 1924, the House of Commons committee on old age pensions estimated the number of seniors (age 70 and older) in need of support at 98,841, or 37 percent of the senior population. See \textit{Labour Gazette}, August 1924 pp. 665-666. Actual coverage was 35 percent in 1937, when all provinces had implemented the OAP.
population justified a public transfer scheme, debate remained over whether Canada should move towards a non-contributory or contributory (social insurance) pension scheme, and if it was to be non-contributory, whether the pension should be means tested or universally provided. Bryden (1974, 77) argues that the deciding factor for these debates was the expected program costs. Means tested non-contributory pensions administered by the provinces, but supported by federal government cost sharing, were preferred over universal pensions by the government of the day as a strategy for limiting public costs and finessing the problem of legal jurisdiction over senior support that the federal government claimed it would face under a federally administered universal program (Bryden 1974, 106). An important function of the 1927 OAP was to provide financial relief for municipalities and provinces that were already supporting the indigent aged and this was best done with a non-contributory scheme.9 Contributory plans were assessed as too costly to set up and administer at that time.10 Similar cost considerations guided the choice of 70 as the minimum age of eligibility instead of 65.

In 1927, the federal government passed the Old Age Pension Act. Provincial participation was voluntary, with the federal government reimbursing provinces 50 percent of the OAP benefits paid. The four western provinces and Ontario had all adopted the OAP by November of 1929 but the remaining provinces only implemented the OAP after 1931 when the federal share of benefit costs increased to 75 percent.11 Bryden (1974, 84–85) indicates that while the Maritime provinces had the greatest need for

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9 *Labour Gazette*, March 1927, 269-270. A contributory (social insurance scheme) would not have addressed this situation since it would have done little for the existing senior population receiving municipal relief (Bryden 1974, 78).

10 Unlike the provinces that administered programs like Workers’ Compensation and mother's allowances, in 1927 the federal government had no administrative experience or infrastructure established for welfare administration.

11 The OAP was implemented in 1933 in Prince Edward Island, 1934 in Nova Scotia, and 1936 in New Brunswick and Quebec (Bryden 1974, 83).
public pensions due the high proportion of aged population with lower incomes than in the rest of the country, the more limited revenue capacity of these governments due to low incomes in the provinces delayed their adoption of the OAP.

At its introduction, the OAP paid a maximum annual benefit of $240. Under the OAP means test, the pensioner could earn or have other income to a maximum of $125 annually, after which the pension benefit was reduced on a dollar-for-dollar basis. Pensioners could own property, but an annual return on the asset was often assumed into the pensioner’s income. Pension eligibility was restricted to British subjects of at least 70 years of age who had lived the past twenty years in Canada and the past five years in the given province. Indians were ineligible for OAP benefits. While critics of the OAP emerged as early as the 1930s, calling for benefit increases and elimination of the means test, the Depression kept pension reform a low political priority. However, by the 1940s, rising cost of living with fixed pension benefits stressed pensioners. Pressure began to mount on the federal government to increase pension benefits, and in 1941 the federal finance minister argued that the federal government was constrained by the war effort and called on the provinces to make supplemental payments.

In 1951 the federal government enacted two new pension programs, the Old Age Assistance Act (OAA) and the Old Age Savings Act (OAS). Both programs were made effective January of 1952. The OAS was a federally-funded universal pension that

12 Bryden (1974, 92) suggests that in the 1930s old age pensioners were well off compared to Canadians collecting municipal relief as their benefits were paid regularly and in cash rather than in part and in kind.  
13 BC and Alberta raised monthly payments $5, and, by 1950, both offered supplements of $10 per month. Ontario offered a 15 percent supplement (amounting to a $3 maximum), which was replaced in 1947 by a formula paying a supplemental $10 monthly in exceptional circumstances. In 1943 Manitoba and Saskatchewan increased payments by $1.25, and Nova Scotia authorized a means tested increase of up to $10 per month. Other provinces did not offer supplemental payments. The benefit increase in 1944 caused Manitoba to cancel its $1.25 supplement payments; all other provinces kept theirs, with Saskatchewan increasing its supplemental payment to $3 per month (Bryden 1974, 93-97).
extended the maximum annual pension benefit in 1951 of $480 under OAP to all Canadians aged 70 and over. The OAA essentially made the 1951 means tested OAP pension benefits available to Canadians aged 65–69. The federal government covered 50 percent of the OAA pension expenditures and provinces agreed to implement and administer the program as of April 1952. Like the universal OAS, the OAA initially paid a maximum benefit of $480 annually, following the same benefit increases over the next decade (Figure 1). Along with benefit increases, the income allowances for OAA pension amounts were increased.

The move from provincial administered means tested programs to a federal administered universal pension for Canadians aged 70 and over addressed concerns that the means tested pension failed to meet the income needs of the poor elderly population and provided a strong disincentive to save for retirement. There was also a desire to see uniformity in pension provision across provinces, and to see the federal government assume the full cost of this expensive program. Critics of the means tested program alleged that many elderly who should have been eligible for the OAP pension were not in

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14 The pension was funded through a composite of three taxes; a manufacturer’s sales tax and income taxes on corporations and individuals. (Bryden 1974, 105).
15 Bryden (1974, 103–104, 107–108, 115). Marsh (1943) concluded that the OAP pension benefits of the time fell short of the minimum income needed for subsistence. Marsh recommended that pension benefits be increased in value, eligibility requirements be relaxed, and means testing be abolished. Struthers (2004, 352) argues that the move to universal eligibility addressed the means test but in not increasing the value of pensions from what was paid under OAP in 1951, the change did not address the perceived insufficiency of the benefits for addressing elderly poverty. Struthers (2004, 356) interprets this change to the universal OAS as the “incorporation of the middle class into the Canadian pension system” by providing an income floor upon which one could “build up their own provisions for an adequate and secure retirement.”
16 Under the OAP, means testing was applied unevenly even within provinces. Struthers (1994, 67-68; Boychuk 1998, 28, 37-38). Some of this reflected on the different capacities of municipalities to pay support, but in other cases, it reflected different views about who should be eligible for support and if eligible, how much support should be given. Snell (1996, 190-191, 207) highlights that pensions in rural areas were often reduced since it was thought that needs were not as great as in urban areas. Struthers (1994, 76) concludes that “Rural boards … cut down pension entitlement for married couples, often forced the able-bodied elderly over seventy to keep working, and vigorously upheld the responsibility of children to pay for parent care.”
receipt of the benefits. It was believed that in some provinces the means test was too stringently applied, and that the requirement for undergoing an annual investigation to ensure that the means test was met resulted in many seniors choosing to suffer the problems of poverty over the social stigma of the means test.\(^\text{17}\) Bryden (1974, 100) described how the provinces were losing interest in enforcing parents' maintenance legislation which legally obligated children to support elderly parents. Operationally this meant including expectations over contributions that children could reasonably make to their parents well-being when applying the means test, whether the children paid such contributions or not.\(^\text{18}\)

By 1950 political demand made it clear that means testing was to be eliminated. The choice of a non-contributory pension over a contributory pension, like OASI introduced in 1935 in the U.S., was a matter of debate. The costs and logistics of setting up and administering a contributory scheme threatened to delay the elimination of the means test resulting in the politically expedient choice of the non-contributory universal demogrant benefit under the OAS (Bryden 1974; Struthers 2004, 355). Similarly, the decision to extend means tested benefits to Canadians aged 65 to 69 was a compromise policy development, guided by concerns over program costs. This extension of public pension coverage was deemed manageable due to the relatively small expected size of the eligible 65 to 69 year old population with the means test (Bryden 1974, 105). Also, relative to the over 70 year old age group who typically were not found in the workforce,

\(^\text{17}\) Bryden (1974, 100-101). Marsh (1943) blamed means testing for the pension’s failure to eliminate poverty amongst seniors, stating that income from children and dividends on property ownership were often falsely assumed part of an applicant’s own income. In many provinces, Marsh (1943, 159) claimed, the test was applied too stringently, leading to the rejection of “... a large percentage of aged people in need of assistance to maintain them on a minimum level of subsistence.”

\(^\text{18}\) Gratton (1996) suggests that tensions around intra-familial transfers to support aged parents may explain the broad popular support for Social Security in the U.S. in the 1930s.
much of the 65 to 69 year old age group was capable of supporting themselves through paid work.\textsuperscript{19}

It seems unlikely that Canadians close to pensionable ages in the 1920s and 1940s could have anticipated these policy developments and altered their work and savings behaviors in ways that would confound the identification of an impact of a pension on their welfare. Bryden (1974, 68–69, 109–117) argues that the 1927 pension plan came about after a sudden and unexpected return of pensions to the policy agenda after 1925. Even though the 1927 legislation followed the 1924 recommendations, much of the policy debate leading up to the legislation focused on whether the pension plan should be contributory, and whether the plan should be entirely federal or shared between the federal and provincial governments. There was also uncertainty over basic parameters of the plan such as whether the age of eligibility would be 65 or 70. Except for Canadians already in economically dire circumstances, the existence of a means test that incorporated their children's income would make receipt of a pension an uncertain prospect even if the plan's implementation was anticipated.

Were Canadians able to anticipate the move from a means tested plan to a universal plan in 1952? Again, the sporadic and plodding nature of social policy development in Canada after World War II makes it unlikely that the precise timing would have been foreseen. Perhaps most relevant is the fact that most of the public debate discussed a contributory pension plan as the likely replacement for the means tested OAP. The seemingly abrupt development of a universal non-contributory plan in

\textsuperscript{19} Bryden (1974, 116). Snell (1996, 26-32) argues that most men in their 70s were out of paid employment by the 1930s and the usual age of retirement from paid work was also well below 70. Snell suggests that for those males 70 and over who were still in the workforce, OAP benefits likely expedited the retirement decision as the means test would have encouraged OAP eligible seniors to drop employment income towards zero.
1951 was a compromise approach for eliminating the means test when the administrative and constitutional logistics of introducing a contributory scheme seemed too difficult to surmount (Bryden 1974, 120–122). Similarly, rather than reduce the age of eligibility for OAS as a compromise solution for extending pension eligibility in the population, the government chose to introduce the means tested OAA for 65–69 year olds.

II. Framework for Quantifying the Impact of Public Pensions on Mortality

Our empirical focus is on the impact that the 1927 and 1952 Pension Acts may have had on recipient well-being as measured by mortality rates. Through raising incomes, altering work behavior and alleviating poverty, Canadian pensions could have influenced the mortality rates of recipient age groups. Following Blundell et al. (1987) and Besley (1990) we can determine which members of the eligible recipient population were most likely to have had their mortality risks influenced by income transfers.

Means tested, or targeted, schemes are designed to transfer the largest payments to people with the lowest incomes and positive transfers may only be made to recipients with income less than a predetermined maximum. The impact of these transfers on recipient well-being depends on the threshold income level under the means test. If means testing is too stringent, or the income threshold for full benefits is set too low, then individuals in need may not receive full transfers. If an individual considers the income test required to receive benefits costly, then he or she will apply for a transfer only if the private cost of the income test is offset by the private benefit of the transfer.\(^{20}\) If the policy maker does not factor the cost of the income test into the benefit payment, then

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\(^{20}\) Besley (1990) argues that there is a pecuniary or psychological cost associated with undergoing means testing. This is supported by the observations of Marsh (1943) and empirical work of Bundell et al. (1988).
some of the intended recipients will avoid the means test, and forgo receiving the income transfer.

When the design of the transfer is changed from means tested to universal eligibility without a corresponding change in benefit value, as with the change from OAP to OAS, the largest incremental income benefits go to members of the target population who did not receive the means tested transfer, as the incremental benefit of the universal pension is decreasing with the size of the means tested benefit paid.\textsuperscript{21} Therefore, any mortality effects estimated from the universal OAS will be attributed to those who received little or no benefit under the means tested pension, but had relatively low non-transfer income. This includes individuals who were targeted by the policy maker, but did not undergo the costly means test. Higher income members of the population will receive an equally large income transfer, but, assuming a diminishing marginal impact of income on health, will not experience the same reduction in mortality risk reduction.

Developments of, and changes to, Canada’s pension policies allow us to exploit transfer income variation across both the extensive and intensive margins within a recipient group. The extensive margin is represented by changes in the extent of pension coverage between 1921 and 1966. There were three periods of rapid coverage growth which we depict in Figure 2. The first took place between 1927 and 1939 as provinces implemented the OAP. The next period is after 1952 when OAS and OAA extended universal pension eligibility to the 70 and older population, and means tested pension eligibility to Canadians aged 65 to 69. The 1952 coverage increase is considerable,

\textsuperscript{21} Struthers (2004, 355-357) argues that the elimination of the means test under OAP without enriching pension benefits reveals that establishing an adequate social minimum for indigent elderly was not an important policy objective. Instead, universal eligibility for pensions under OAS was largely a benefit to middle class seniors.
amounting to 183 percent between 1951 and 1956, and can be primarily attributed to the universal pension plan. Between 1965 and 1970, the extent of pension coverage increased again as the means tested OAA was gradually replaced by the universal OAS for Canadians aged 65–69.\textsuperscript{22} Table 1 shows the variation in the percent of Canadians over age 70 receiving pension income across provinces under the OAP and the subsequent convergence in coverage across provinces with OAS. For OAA, the variation in the extent of pension receipt persisted, albeit for lower levels of coverage than under OAP.

Changes along the intensive margin, represented by increases in real benefits, are less dramatic. In Figure 3 we show the average pension benefit paid and the average personal incomes for all Canadians in 1992 constant purchasing power. Following an initial increase in the first five years of the OAP, there was little change in average (real) benefits prior to 1957. In 1951 approximately half of Canadians over the age 70 qualified for the means tested OAP, and the average pensioner received 91 percent of the maximum benefit. In the 1961 Census, 55 percent of Canadians aged 70 and older reported that all of their income came from government pension transfers.\textsuperscript{23} This indicates that the universal plan had little impact on the incomes of Canadians who had been OAP recipients. In the years following the Depression, there was also little change in the gap between average personal income and pension benefits; pension benefits averaged about 35 percent of average personal income in Canada. Government increases

\textsuperscript{22} In 1965 the federal government began a process of lowering the age of eligibility for the OAS benefits so that in 1970 OAS benefits were available to all Canadians over the age of 65.

\textsuperscript{23} Likewise, for seniors age 65 to 69, 54 percent reported an annual income less than $1000, and over 50 percent of this group’s income came from government pensions. The proportion of male seniors (65 and over) earning low incomes declined from 38 percent in 1941 to 16 percent in 1961. A similar shift occurred for the female senior labour force, with low-income earners decreasing from 69 percent to 38 percent. This improvement occurred as labour force participation trended down for males over 64 years of age. See Historical Statistics of Canada, Second Edition. D107-122 and D205-222. Snell (1996) argues that retirement from paid work was common for elderly men well before the rise of substantial public pension transfers.
to the OAS benefits from 1957 to 1968 decreased the income gap between pensioners and average Canadian earners to 40 percent, suggesting that the purchasing power of pensioners increased after 1957.

III. Mortality and Pensions: Data and Method

To examine the effectiveness of government initiated pension plans in reducing mortality among recipients, we use data from various Canadian government publications of vital statistics for nine provinces for the period 1921 to 1966.\textsuperscript{24} Mortality rates (deaths per thousand) for each year and province are reported by sex for five-year age groups.\textsuperscript{25} For each year in the study, we have 252 province/age combinations, for a maximum of 11,200 observations. We limit the sample period to 1921–1966 since our estimation strategy will identify pension effects on mortality off of local changes around dates of policy changes. In addition to the extension of OAS coverage to Canadians aged 65–69, the complexity of Canada’s social support systems for seniors increases substantially after 1966 with the introduction of the contributory Canada Pension Plan and the income tested Guaranteed Income Supplement that would make identification of pension effects on mortality rates more challenging.\textsuperscript{26}

The panel structure of our mortality data allows us to address any systematic differences across age groups and provinces. Our data set is suitable for the application of a “differences-in-differences” approach to identifying the effects of pension income on mortality. We identify a pension effect as changes in the level, and/or trend, of mortality.

\textsuperscript{24} We exclude Newfoundland which joined the Canadian Confederation in 1949.
\textsuperscript{25} The youngest age group is 20–25, and the oldest covers seniors 85 years of age and older.
\textsuperscript{26} Universal coverage for hospital services is introduced in Canada’s provinces after 1957 with the HIDS, and universal coverage for medical care is introduced in 1966 with the Medical Care Act.
rates of pension recipient age groups over and above that of non-recipient age groups after accounting for age group, year and province specific effects.

The dependent variable for all of our empirical specifications is the first-differenced logarithm of the mortality rate. We apply two approaches for incorporating pension plan measures as explanatory variables. First, we define dummy variables which equal 1 only in the year of introduction of a given pension plan in a given province, and 0 otherwise. We refer to this as an estimate of the level effect of a pension plan since it would represent a shift in the constant term for the level of the mortality rate for recipient age groups. Next, we introduce dummy variables that equal 1 if a defined pension plan is in place in a given province and year, and 0 otherwise, to determine if pension benefits influenced the trend decline in mortality rates for recipient age groups, relative to non-recipient age groups. We refer to this relationship as the gradient effect.

A general specification for our empirical model is:

$$\Delta \log(M_{ijt}) = \alpha + \beta_1 OAS_{ijt} + \beta_2 OAP_{ijt} + \beta_3 OAA_{ijt} + \gamma_1 OASG_{ijt} + \gamma_2 OAPG_{ijt} + \gamma_3 OAAG_{ijt} + \lambda' \delta + \lambda_{ijt} + e_{ijt}$$  \hspace{1cm} (1)$$

where $M_{ijt}$ is the mortality rate (deaths per thousand) of age group $i$, in province $j$ in year $t$. The dependent variable is the first difference of the logarithm of the mortality rate. The binary pension variables $OAS$, $OAP$, $OAA$, $OASG$, $OAPG$ and $OAAG$ model the three pension plans. For the level effect $OAS_{ijt}$, $OAP_{ijt}$ and $OAA_{ijt}$ equal one for pension eligible age groups in the year each plan was implemented, and zero otherwise. Explicitly, $OAP$ equals 1 for $i \geq 70$ and $t=$implementation year, where implementation year varies by province. $OAS$ equals 1 for $i \geq 70$ and $t = 1952$, and 0 otherwise. $OAA$ equals 1 for $64 < i < 70$ and $t = 1952$, and 0 otherwise. To estimate the gradient effect, the pension variables
equal 1 if age group \(i\) in province \(j\) was eligible for the respective plan in year \(t\), and zero otherwise. \(OAPG\) equals 1 for \(i \geq 70\) and \(\text{implementation year} \leq t < 1952\), where \(\text{implementation year}\) varies by province. \(OASG\) is 1 for \(i > 70\) and \(t \geq 1952\), and 0 otherwise. \(OAAG\) equals 1 for \(64 < \text{age} < 70\) and \(t \geq 1952\), and 0 otherwise.

\(X_{ijt}\) is a matrix of provincial and age-group specific covariates. Data for the covariates we include are available beginning in 1926. We include both the level and first differences of average personal income by province, provincial enrollment in medical insurance plans (non-profit and public), and pension benefits per-recipient by province. The per-recipient pension benefits are set equal to zero for age-groups that were not eligible for them. Nominal variables are adjusted to 1952 Toronto purchasing power to account for cost of living differences over time and across Canada.\(^{27}\) Sources and summary statistics for this data can be found in the appendix. Finally, \(\lambda_{ijt}\) is a matrix of age-group, province, and year fixed effects, and \(e_{ijt}\) is the random error term.

Bertrand, Duflo and Mullainathan (2004) point out the potential for serial correlation to bias the differences-in-differences standard error estimates. Following Bertrand et al., we estimate specifications using a two stage procedure to correct for this potential bias. In the first stage Equation (1), less the pension dummies, is estimated:

\[
\Delta \log(M_{ijt}) = \beta_1 + X'_{ijt} \delta + \lambda_{ijt} + e_{ijt}
\]  

(2)

From this the vector of residuals, \(\hat{e}_{ijt}\), is calculated. In the second stage, residuals corresponding to the age-groups that are eligible for at least one of the pensions (65 and older) are regressed on the pension variables modeling the gradient and level effects. If

\(^{27}\) We also divide the variables by \$500 to scale the coefficient estimates.
policy implementation is independent of the fixed effects the full correlation will be found in the residuals.

The variation in constant purchasing power per recipient pension benefits across provinces shown in Table 1 reflects two influences. First, as shown in column (2) of each panel, while the nominal value of the maximum OAP benefit was the same across provinces, the purchasing power of that benefit was higher in the Maritime provinces than in Ontario and British Columbia. Second, differences in the stringency of means testing across provinces may have influenced how many pensioners received the maximum pension benefit. This influence would explain the variation in per recipient benefits in Column (3) of each panel. It is also important to recognize that our per recipient pension benefit does not include supplemental cash benefits provided by most provinces after 1940. These supplements carried over into the universal OAS period which means that they are not influencing the estimated pension effects that we present.

Finally, in all provinces but Quebec, New Brunswick and PEI, provincial governments took on the payment of hospital costs, some medical services and sometimes drugs for old age pensioners between 1942 and 1949 (Fitzner 1967, Gagan and Gagan 2002, Snell 1996, 210-212). The fact that OAP recipients had public health insurance coverage before the rest of the Canadian population other than non-elderly indigents influences how we would interpret the coefficient estimate for enrolment in medical insurance plans. To the extent that hospital and medical care insurance would have had a positive influence on mortality rates, the growth of medical insurance

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28 In the early 1940s all provinces except PEI, New Brunswick and Quebec, began supplementing OAP benefits in cash and in kind on a means tested basis (Bryden 1974, 93-94). The value of the supplements was highest in Saskatchewan, Alberta and British Columbia (Bryden 1974, 97; Struthers 2004, 358).
coverage would be expected to result in a reduced difference in mortality levels and trends of pension eligible and pension non-eligible age groups.

IV. Results

The estimated pension coefficients for level effects and gradient effects, over a number of specifications, are presented in Table 2. In each regression observations are weighted by their age-group/province specific population sizes in each year. Robust standard errors in the level effect estimates correct for age-group/province clustering in the data.29

The first three rows report the level effects for each of the pension plans. Under all specifications the level effect estimate for the universal OAS is larger than those estimated for the means tested plans. The statistically significant OAS level effect is robust across all of the model specifications in Table 2. Estimates suggest that recipient age group mortality rates decreased between 3.7 percent and 4.7 percent upon implementation of the OAS in 1952. The OAP level of effect is only apparent when controls are added for the levels of provincial incomes and pension payments per recipient. The specifications in columns (4), (6) and (7) show a statistically significant mortality reduction for age groups over 69 of 2.2 percent to 3.0 percent. The most optimistic estimate for the OAA is a reduction in recipient mortality of 0.9 percent, and this is not statistically significant.

Gradient effect estimates for the three pensions are sensitive to model specification. In columns (6) and (7) the combined negative level effects and positive

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29 Observations across groups are independent, but not necessarily within groups. Failure to account for the clustered observations leads to biased estimates of the standards errors for coefficient estimates. Adjustments are made using the `cluster` post-estimation command in STATA. This clustering strategy is not used for the gradient effect estimates as the number of groups in the second stage estimate is small.
gradient effects suggest that the level of mortality fell after the plan’s implementation but the trend decline slowed compared to non-pension recipient age groups. This means that incremental mortality reductions, relative to non-pension receiving age groups, diminish each year. In the specifications in (6) and (7), the OAS gradient effect is small in magnitude and statistically insignificant. In contrast, the OAP gradient effect is positive and significant. The magnitude of the OAP gradient effect suggests that the OAP level effect reduction on recipient age group mortality lasted less than two years. Comparing the standard errors reported in Column (6) to those in Column (7) suggests that serial correlation is not impairing our ability to infer significance. Therefore, we choose as our preferred specification the more computationally straightforward regression of Column (7).

In a first difference specification like we are using, adding controls for the first differences and levels of covariates is equivalent to having them included as a quadratic in a levels regression. Based on our preferred specification, in column (7), we find that increases in per recipient pension payments are associated with increased mortality rates while higher levels of per recipient pension payments are associated with larger decreases in recipient age group mortality. These estimated effects are not statistically significant or large in magnitude. Specifically, an increase of $100 in pension benefits per recipient (in 1952 Toronto dollars) which would have been a large increase, would have decreased mortality in the recipient age group by roughly 0.3 percent.

We performed a number of robustness checks on the level effect estimates. To determine if our OAS and OAA pension effect estimates may be spurious, we estimated

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30 We do not report these estimates here. A supplementary appendix to the paper, with full details, is available from the authors.
the specification in Column (7) of Table 2 with the OAS and OAA dummy variables
defined according to several incorrect implementation dates. For the range of years 1949
to 1955, only the correctly specified 1952 level effect OAS dummy returns a statistically
significant and negative coefficient estimate. We also estimated the models restricting the
sample period to 1940–1960 and restricting age groups to 50 and above. The magnitude
and statistical significance of the OAS level effect are robust to these data set restrictions.
In other specifications we replaced the pension dummy variables with levels of, and
changes in, the percentage of population over age 70 receiving pension benefits Likely
because these variables confound the differences between the means tested OAP and the
universal OAS, there are no significant effects of pension variables on recipient age
group mortality.

We also consider the impact that medical innovations over this period may have
on our estimates. Significant medical innovations over this period include the discovery
of insulin (1923), the introduction of sulfa drugs (1935), the introduction of tuberculosis
drugs (1944), and the medical use of penicillin (1945). Although we lack a formal test,
these innovations take place several years prior to the OAS and OAA and, with the
exception of insulin, after the OAP. Cutler and Meara (2001) find that, in the United
States, medical innovations in this period had a roughly equivalent impact on mortality
for the young and old. If this is also true in Canada than our differences-in-differences
strategy will be sufficient to control for any confounding effect. However, the market
availability of these drugs may offer a channel through which pensions and mortality are
related; increasing income will increase access to drugs. OAP benefits were
supplemented in kind with health care coverage in most provinces. In all provinces but
Quebec, New Brunswick and PEI, provincial governments took on the payment of hospital costs, some medical services and sometimes drugs for old age pensioners between 1942 and 1949, well after the OAP was introduced and well before the OAS replaced the OAP (Fitzner 1967, Gagan and Gagan 2002, Snell 1996, 210-212).

Finally, we look at the potential confounding effect of an influenza outbreak occurring in January and February of 1951 (Viboud et al. 2006; McDonald, 1967). This will compromise our estimation strategy if the impact on incremental deaths was large and disproportionately affected age groups 70 and over relative to age groups younger than 70. We do not have access to deaths by cause by age groups for provinces but we were able to obtain deaths due to influenza and pneumonia by age group for Canada. After removing deaths due to influenza and pneumonia from aggregate Canadian deaths\(^{31}\), we find a large decrease in mortality between 1951 and 1952 for recipient age groups over non-recipient age groups remains. In 1951, the influenza epidemic started, and was strongest, in the eastern provinces before moving west.\(^{32}\) We re-estimated the level effect parameters for the 1952 pensions, restricting the data to only age groups greater than 50 years, and removing the Maritime provinces from our data set. These restrictions have little impact on our results; the maximum difference is a reduction of one percent in the magnitude of our OAS level effect estimates (when Maritime provinces are omitted). We conclude that the 1951 influenza outbreak does not cause a significant bias in our estimated level effects.

\(^{31}\) As many pneumonia deaths result from an onset of influenza, and vice versa, we consider both causes of death as in Viboud et al (2006).

\(^{32}\) Viboud et al (2006, 663). McDonald (1967, 525) shows that for the period 1950-1964, the rate of excess mortality from respiratory disease during epidemic months was highest in the maritime provinces.
The findings of our analysis beg the question as to what kinds of deaths were avoided by the OAS pension transfers? Disaggregating data by cause of death presents a number of challenges, particularly due to changes in the reporting and categorization of diseases over the time period of interest. In addition, when looking at a subset of deaths by cause, it is possible that a decrease in one cause of death category is offset by an increase in another category. With these caveats in mind we interpret the cause of death results cautiously. For Canada for the period 1940–1960, we collected total deaths by cause for age groups 50 and older, and we calculated mortality rates by dividing by the age group’s population size.

We looked at mortality rates for deaths due to influenza (including bronchitis and pneumonia), tuberculosis, syphilis, digestive cancers, circulatory diseases, diabetes, cirrhosis of the liver, lung cancer, nephritis, senility and suicide. In 1951 these causes represented approximately 62 percent of all deaths for Canadians age 70 and older. The estimated level effects for the 1952 OAS and OAA pensions are reported in the top panel of Table 3. Recall that the estimated pension effect is the change in mortality for the recipient age groups in excess of that observed for non-recipient age groups. We find that there was a statistically significant reduction in the number of suicides for recipient age groups with the introduction of the universal OAS. Although suicides were not a large category for cause of death our estimated effect implies that 13 suicides were avoided, which constitutes a 1.5 standard deviation change in senior suicide rates (based on suicide rate for the period 1950–1970.) Other causes of death with significant mortality

33 See Emery (1993, Chapter 6 and page 121) for a discussion of cause of death classification. With revisions to cause of death classification that occurred in 1948, our model specifications would account for these changes in the estimated year effects hence this sort of change is not likely influencing our estimated pension effects on mortality.

34 This data was not available in published form for provinces for all years.
reductions associated with the OAS are digestive cancers, diabetes, cirrhosis of the liver and nephritis. Pension transfers may have contributed to these mortality reductions by improving living conditions and diet and improving access to medical care and drugs. In contrast, deaths due to syphilis, lung cancer, and tuberculosis were not influenced by pension transfers. Note that the statistically significant relative increase in deaths due to influenza and pneumonia for pension eligible age groups could reflect the reduction in other causes of death.

V. Results by Sex and Province

In Tables 4 and 5 we report coefficient estimates for males and females by province. It is readily apparent that the impact of the OAP and OAS differed by province and sex. As estimated by the level effect, the introduction of the means tested OAP is associated with sizeable mortality reductions for females in Ontario and Manitoba, and for males in Quebec, the Maritime Provinces and Manitoba (although not statistically significant.) In contrast, the universal OAS did not reduce female mortality outside of Manitoba. For males our estimates suggest the OAS had in the largest impact in Nova Scotia and provinces west of Manitoba.

One interpretation of these estimated pension effects is that if OAP eligibility reduced mortality, then the pension plan must have materially enriched needy elderly compared to what they had under the province’s social assistance regime. Similarly, if the move to universal eligibility under OAS reduced mortality, then the OAS must have enriched needy elderly who were ineligible under the OAP means test, or who received less than the full benefit due to the means test. Therefore, variation in provincial social

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35 It is worth noting that data by sex was collected over a separate time period, by a different person as the data used in prior analysis. That estimates are in agreement with one another provides a “human error” test on our results.
assistance, both prior to and during the implementation of the OAP, should explain the differences in Tables 4 and 5.

Explaining why the estimated effects of OAP and OAS pensions differ so much across provinces is challenging given the lack of scholarship concerning how the programs were administered in the provinces. Struthers (1994, 62) argues that “Although the launching of old age pensions, as with much else in Canadian social policy history, has received considerable analysis at the national level, almost nothing has been written about how this means-tested scheme was actually developed and administered by provinces and local governments in its formative years.”

Boychuk (1998) describes the important differences across provincial social assistance regimes. Prior to the OAP, needy elderly in Saskatchewan, PEI and Quebec relied on assistance from local governments. In the case of Saskatchewan, Boychuk (1998, 28) argues that support from municipalities was meager or non-existent. Nova Scotia and New Brunswick provided “indoor relief”, that is, relief to individuals in provincial workhouse institutions and did not pay outdoor relief except in cases where there was no space in the local almshouse. The remaining provinces, Ontario, Manitoba, Alberta and British Columbia had social assistance regimes that stratified the population in need between deserving and non-deserving. Non-deserving needy would likely have been males who were deemed capable of working or individuals whose families could have supported them. According to Boychuk, these provinces accepted responsibility for supporting deserving recipients, but were stringent in their willingness to support the non-deserving poor.

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36 Boychuk (1998, 34). Females were more likely to be seen as in need, and/or more likely to have family means of support (Struthers 2004, Snell 1996, 25). For example, males were more likely to have property and females were not under the same expectations to work as males.
As Balan-Cohen (2008) has argued for the U.S., if OAP benefits allowed males to live independently, which they could not do with the indoor relief social assistance regimes in Nova Scotia and New Brunswick, then they may have benefited from the reduced exposure to infectious disease. Females over age 70 were more likely to be urban residents while males over age 70 were more likely to be rural residents (Snell 1996, 25). To the extent that pension benefits were more generous in urban areas, it may be the case the mortality reduction for females in Ontario and Manitoba with the OAP reflects this sex difference in residence.

An OAS effect would be expected where means testing, or other eligibility restrictions, may have missed a sizeable portion of population in need. Bryden (1974, 101) suggests that means testing was more rigorously applied in some provinces than in others. The low percentage of elderly in Maritime provinces receiving the maximum OAP benefits and the low percentage of Ontario population aged 70 and over receiving full or partial OAP benefits has been interpreted as evidence of the strict application of means testing compared to the other provinces. In the case of Ontario, however, the low percentage of pension recipients in eligible age group population may have also reflected the relatively high non-pension income of Ontario’s aged population (Bryden 1974, 101; Struthers 1994, 68). Under the OAP, means testing was also applied unevenly within provinces (Struthers 1994, 67-68; Boychuk 1998, 28, 37-38). Some of this reflected on the different capacities of municipalities to pay support, but in other cases, it reflected different views about who should be eligible for support and if eligible, how much support should be given. Snell (1996, 190-191, 207) highlights that pensions in rural areas were often reduced since it was thought that needs were not as great as in urban
areas. Struthers (1994, 76) concludes that “Rural boards … cut down pension entitlement for married couples, often forced the able-bodied elderly over seventy to keep working, and vigorously upheld the responsibility of children to pay for parent care.” Limited resources for pension administration may have been a problem in some provinces.37

The lack of an OAS effect on mortality rates for Ontario casts doubt on Struthers and Bryden’s claim that Ontario was too stringent in its means testing. The relatively high non-pension incomes are the more likely reason for the lower eligibility and likely the reason for more zealous means testing. Abuse of eligibility is more likely among a more affluent group. Snell (1996, 18) highlights that a “significant majority of the elderly Nova Scotia poor had children residing in the same small province, and thus available for potential assistance and support”. Under OAP this might have reduced the percentage eligible for pension benefits relative to other provinces like New Brunswick if Nova Scotia was more aggressive about means testing on the basis of children’s capacity to support parents, or if Nova Scotia elderly were more likely to be living nearer to children.

The large reductions in mortality of males, but not females, in the three most western provinces associated with the introduction of the universal OAS in 1952 suggest other problems with the means tested OAP. Saskatchewan, Alberta and British Columbia had higher proportions of males over 70 living in rural areas and many of these elderly men were immigrants who had moved to Canada’s west earlier in the century.38

37 Christie (2000, 141-142) describes the challenges faced by Nova Scotia’s single investigator for mother’s allowances and old age pensions in 1938 of investigating “often reluctant applicants”. Christie identifies Ontario, Manitoba and Saskatchewan as having few investigators for the client demand for mother’s allowances.

the OAP, rural residence, expectations for males to work, and the challenges of immigrants meeting residency requirements or proving their age likely led to a substantial number of men in need not receiving full pension, or any pension, benefits under the OAP. 39 By 1952, more of the immigrant population would have met the 20 year residency requirement by age 70. Universal eligibility would have removed the penalty to rural residency under the means test and removed the potential stigma of being declared “non-deserving”. Finally, Indians who were ineligible for the OAP but were eligible for OAS benefits have greater representation amongst the western provinces’ populations.

Struthers (2004) argues that besides the means test, the problem with the OAP was the deficient benefits paid. Struthers argues that had Ontario supplemented its OAP benefits as the four western provinces had, the well-being of those in need would have been enhanced. Is it possible that our OAS effects in the western provinces are reflecting the supplemental means tested benefit in the west on top of the universal OAS benefit? While we include both the level, and annual change in, benefits per pension recipient in each province, our pension benefit variables do not include the supplemental payments to OAP benefits in some provinces so it is still possible that benefit supplements in the west could be what is being picked up in the OAS effect. We do not think that this is the case because the influence of benefit supplements on elderly mortality would have pre-dated

39 Snell (1996, 144-145) highlights the problem of proving one’s age for pension eligibility, the problem of proving one’s age. Most Canadians over age 70 in 1951 were born at a time when births were not necessarily registered. Emery (1993, 75, 82-84) discusses requirements for proving one’s age for delayed birth registration in Ontario. After 1945 documentary evidence of one’s birth. See Emery (1993, 83) for a list of acceptable documents for proving age. Programs like the OAP created a demand for delayed birth registrations in Ontario for the purposes of proving one’s age. Delayed registrations were for births not registered within twelve months of the birth date. Immigrants in particular had trouble proving age due to a lack of documents, or due to language barriers or a mistrust in government. Emery (1993, 97) finds that for Ontario, “birth registration was unusually complete for French Canadians but disproportionately incomplete for northern Ontario, females, and continental European ethnic groups.” p 97.
In the early 1940s all provinces except PEI, New Brunswick and Quebec, began supplementing OAP benefits on a means tested basis (Bryden 1974, 93-94). These supplements carried over to some degree into the universal OAS period. The value of the supplements was highest in Saskatchewan, Alberta and British Columbia (Bryden 1974, 97; Struthers 2004, 358). OAP benefits were also supplemented in kind with health care coverage in most provinces. In all provinces but Quebec, New Brunswick and PEI, provincial governments took on the payment of hospital costs, some medical services and sometimes drugs for old age pensioners between 1942 and 1949 (Fitzner 1967, Gagan and Gagan 2002, Snell 1996, 210-212).

VI. Valuing the Extension of Life with Pension Transfers

The results of our empirical work imply that, insofar as mortality rates provide us with a measure of well-being, moving from a means tested plan to a universal plan improved the well-being of aged Canadians. That said, our empirical results do not imply that the universal plan was superior to the means tested plan in any sense other than it resulted in a larger reduction of mortality. Nor, can we conclude that universal eligibility was necessary to achieve these mortality gains.

In Table 6 we report the death reduction, implied by the estimated level effects, for the OAP and OAS pension plans. The estimated level effect is a 4.2 percent reduction in the mortality rate of recipients for the universal OAS and a 3.0 percent reduction for the means tested OAP. These translate to reductions in the numbers of senior deaths of 2,152 per year for the universal OAS and 843 per year for the OAP. If we allow for a gradient effect as well, the number of lives extended by the OAP was closer to zero while
for the OAS, the average number of lives extended per year over 1952 to 1957 was around 1800\textsuperscript{40}.

Compared to having continued with the means tested OAP after 1951, the total incremental cost of having universal benefit eligibility under the OAS was $1.15 billion (2005 dollars) in 1951, or $1,805 (2005 dollars) per Canadian over age 69.\textsuperscript{41} To value the OAS induced reduction in mortality risk, we can calculate the Value per Statistical Life (VSL) associated with the number of lives “saved”.\textsuperscript{42} The VSL is interpreted as a measure of the marginal rate of substitution between wealth and mortality risk in a given time period (Hammit 2007, 229). In valuing the OAS reduction in mortality risk for recipient age groups, we do not observe an individual’s willingness to pay to reduce mortality risk. Instead, we observe what Canadian taxpayers were willing to pay to reduce mortality risk. Hence, we are looking at the social, rather than private, willingness to pay for mortality reduction. To calculate this social VSL, we compare the OAS incremental cost per person over age 69 in 1951 to the reduction in the recipient age group mortality rate. The VSL for the OAS induced mortality risk reduction was just over $535,000 (2005 dollars) \((dW/dMR=\$1805/0.003373)\). Allowing for a gradient effect, the VSL for the OAS rises to almost $900,000.

\textsuperscript{40} A detailed analysis is included in the supplementary appendix, available from the authors.
\textsuperscript{41} The incremental cost is calculated as \((\text{total population over age 69 in 1951})(1-\text{portion of population collecting OAP in 1951})\times\$480/\text{CPI}\). In 1951, 50 percent of the over 69 population of 638,200 received OAP benefits. With a CPI \((2005=100)\) of 0.133 the total incremental cost of the OAS was about \$1,151,639,097 (in 2005$) in 1951.
\textsuperscript{42} In time series studies like ours, we can only identify the number of lives saved in a one year period. We cannot infer anything about the number of life-years saved or the quality of life associated with extension of life. See Hammit (2007, 233). Viscusi (1994a, 1994b) points out that if expenditure on health is endogenous to the policy implemented, standard life-value estimates, as referred to above, underestimate policy benefits. In our context, if employment increases the risk of poor health for seniors, who therefore spend more on health related goods under the means tested plan than the universal plan, then the life-value does not reflect the full benefit of the universal policy.
Calculating the VSL for the means-tested plans is more difficult, as the pre-pension costs of senior support are not clear. Struthers (1994, 64) suggests that in 1928 prior to Ontario implementing the OAP, 10 percent of the population aged 70 and over were in receipt of public assistance. Following the implementation of OAP in 1929, one-third of Ontarians aged 70 and over were in receipt of public support. If we assume that the 23 percent of additional pension recipients under the OAP received full pension amounts and that the level effect of the OAP was not offset by the gradient effect, then the lower bound estimate for the OAP VSL is $228,000. While this is less than half of the OAS VSL, it is important to note that the OAP effects on elderly mortality were much shorter lived.

A VSL of $535,000 (2005 dollars) means that to economically justify the mortality risk reduction that was gained with the universal OAS, Canadians did not need to place a high value on the life of senior. The literature on value of life estimation yields estimates between $1.03 million and $13.2 million per VSL (2005 Canadian dollars, see Viscusi, 1994a and Landefeld and Seskin, 1982), with a common benchmark VSL being between $5 million and $7 million.43 This finding of a low value placed on saving the life of a Canadian over age 70 is consistent with the findings of Cropper et al. (1994) and Johannesson and Johannesson (1997). A comparison of the OAS VSL of $500,000 to a benchmark VSL of $5,000,000 suggests that saving the life of a Canadian aged 70 and over was one-tenth the value of saving a working age Canadian. Cropper et al. (1994) found from a survey of American households that saving one 20 year old was valued as

43While there is some debate as to whether the lives of the elderly should be valued at these benchmarks due to considerations like their shorter life expectancies, some suggest discount factors for VSL’s for older individuals of 25 to 30 percent. See Hammitt (2007, 229). According to Alberini et al. (2007), Health Canada uses a benchmark VSL of $5 million for Canadians under age 65 and 75 percent of that value for Canadians over age 65.
equivalent to saving seven 60 year olds, while Johannesson and Johannesson (1997) found in their survey of 1000 Swedes that saving one 30 year old’s life was valued as equivalent to saving the lives of 35 to 41 70 year olds.

IX. Conclusions

From these estimates we conclude that the primary benefit of public pensions on recipient age group mortality risk came from the level effect associated with extending pension coverage through the universal OAS program. The lack of impact of the means-tested plans, and a significant impact of the universal pension plan is consistent with the Blundell et al.’s (1987) finding that significant costs (psychic or pecuniary) associated with undergoing a means test can lead to less than optimal benefit uptake. The lack of an impact of the means tested plan is also consistent with Fishback and Stoian’s (2010) argument that rather than providing income to seniors who would not have otherwise had their basic needs met, the means tested plan shifted the burden of responsibility from one tax base to another. Prior to 1927, municipalities, charitable organizations and family would have provided relief to many in dire need (Struthers 1994, Snell 1996; Boychuk 1998). The means tested OAP kept levels of income support the same but changed which level of government financed the pension.

Our results weakly support Struther’s (2004) and Balan-Cohen’s (2008) arguments that the value of benefits provided under a means tested plan mattered for the well-being of the elderly. We find no correlation between pension benefit values and mortality rates of pension eligible age groups. However, the fact that the introduction of the means tested OAP is correlated with mortality reductions in provinces in the east of
Canada where incomes, and likely sources of income support, were lower can be interpreted as an enrichment effect.

The Canadian case demonstrates that the extension of universal coverage, rather than the enrichment of pension benefits, achieved the largest reduction in mortality. The OAP must have been administered in ways that missed a sizeable portion of the over age 70 population in need. The finding that mortality reductions following the introduction were greatest for males in the three most western provinces suggests that the problem was likely one of eligibility for full pensions under the OAP for males, immigrants and rural dwelling seniors. Counter to Struthers (2004) views of the problems with the means test for Ontario elderly, the lack of an OAS effect in that province suggests that the low percentage of elderly receiving OAP benefits, for those in receipt, full benefits, it must have been the case that high non-pension incomes are the explanation.

We have examined the impact of early government pension plans on the welfare of recipients as measured by mortality rates. We found a negative average treatment effect from the implementation of all pension plans on mortality rates, but only the effect associated with the universal Old Age Security pension was economically and statistically significant. The OAS reduced recipient age group mortality rates by 4.9 percent, roughly 2,100 fewer deaths of Canadians aged 70 and over per year. We estimate that the value of a statistical life (VSL) implied by the OAS induced mortality risk reduction was around $0.5 million (2005 dollars), which is one-tenth of value per statistical life (VSL) associated with contemporary government policy interventions. This means that Canadians did not need to place a high value on the life of a senior to justify the costs of the OAS program.
Even though the introduction of universal pension eligibility did not reflect that Canadians placed a particularly high value on the life of elderly Canadian, it is worth asking whether the same mortality reductions could have been achieved at a lower program cost. For example, following Boadway’s (1998) analysis and alternative pension reforms proposed prior to 1952, maintaining a means tested pension, but raising the eligible income threshold may have accomplished the same benefit as the universal OAS, but without the costly “overpayment” of benefits to relatively well-off Canadians over age 70.
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Table 1: Percent of ProvincialRecipient Age Populations Receiving Pension Benefits, and Maximum and Average Benefits Paid, Under OAP, OAS and OAA

<table>
<thead>
<tr>
<th>Province</th>
<th>OAP (1951)</th>
<th>OAS (1952)</th>
<th>OAA (1953)</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>PEI</td>
<td>49%</td>
<td>$526</td>
<td>$461</td>
</tr>
<tr>
<td>NS</td>
<td>59%</td>
<td>$526</td>
<td>$480</td>
</tr>
<tr>
<td>NB</td>
<td>67%</td>
<td>$535</td>
<td>$506</td>
</tr>
<tr>
<td>PQ</td>
<td>53%</td>
<td>$496</td>
<td>$449</td>
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<tr>
<td>ON</td>
<td>37%</td>
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<td>$452</td>
</tr>
<tr>
<td>MN</td>
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<tr>
<td>CN</td>
<td>46%</td>
<td>$505</td>
<td>$460</td>
</tr>
</tbody>
</table>


Notes:

Column 1 reports percent of the eligible age group population receiving pension benefits.

Column 2 reports the maximum benefit, in 1952 Toronto dollars*.

Column 3 reports the average benefit paid, in 1952 Toronto dollars*.

* Nominal benefits are adjusted using cost of living indexes for major cities, as reported in Emery and Levitt (2002) and *Historical Statistics of Canada*, Tables K23–32. The Emery and Levitt indexes are spatially adjusted to Toronto 1913 purchasing power for 13 cities over the period 1900–1950. The Historical Statistics of Canada indexes for cities are not spatially adjusted but cover 1940–1975. To splice these indexes together, we calculate, by city, the implied inflation rate over the period 1940–1950, which was common to the two sets of indexes. The Emery and Levitt indexes are extended by applying the Historical Statistics inflation rate by city and multiplying by the ratio of the two sources’ indexes for 1940–1950. This method assumes that the only driver of differences in indexes between provinces after 1950 is price changes within each province rather than changes in relative prices across locations.
Table 2: Gradient and Level Effect Specifications for Estimating Pension Effects on the First Differenced Logarithm of the Mortality Rate

<table>
<thead>
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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
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<td>-0.049</td>
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<td>-0.042</td>
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<tr>
<td></td>
<td>(0.016)*</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.017)</td>
<td>(0.019)</td>
<td>(0.016)</td>
<td>(0.022)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAP Level Effect</td>
<td>-0.009</td>
<td>-0.019</td>
<td>-0.022</td>
<td>-0.029</td>
<td>-0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.008)*</td>
<td>(0.010)*</td>
<td>(0.008)*</td>
<td>(0.012)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAS Gradient Effect</td>
<td>-0.015</td>
<td>-0.013</td>
<td>-0.001</td>
<td>0.000</td>
<td>0.005</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.004)*</td>
<td>(0.004)*</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.010)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAA Gradient Effect</td>
<td>-0.008</td>
<td>-0.008</td>
<td>0.001</td>
<td>0.001</td>
<td>-0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.009)</td>
<td></td>
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</tr>
<tr>
<td>OAP Gradient Effect</td>
<td>0.005</td>
<td>0.006</td>
<td>0.015</td>
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<td>0.023</td>
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<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.004)*</td>
<td>(0.004)*</td>
<td>(0.008)*</td>
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<td></td>
</tr>
<tr>
<td>Real Pension Payment (First Difference)</td>
<td>0.024</td>
<td>0.022</td>
<td>0.022</td>
<td>0.022</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Pension Payment (Levels)</td>
<td>-0.014</td>
<td>-0.013</td>
<td>-0.013</td>
<td>-0.011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)*</td>
<td>(0.003)*</td>
<td>(0.003)*</td>
<td>(0.008)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Insurance Coverage (First Difference)</td>
<td>0.036</td>
<td>0.036</td>
<td>0.036</td>
<td>0.036</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.084)</td>
<td>(0.084)</td>
<td>(0.084)</td>
<td>(0.084)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Medical Insurance Coverage (Levels)</td>
<td>-0.014</td>
<td>-0.014</td>
<td>-0.014</td>
<td>-0.013</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.017)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Prov. Personal Income (First Difference)</td>
<td>-0.016</td>
<td>-0.016</td>
<td>-0.016</td>
<td>-0.016</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Prov. Personal Income (Levels)</td>
<td>0.014</td>
<td>0.014</td>
<td>0.014</td>
<td>0.015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.006)*</td>
<td>(0.006)*</td>
<td>(0.006)*</td>
<td>(0.006)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations (1st Stage)</td>
<td>11200</td>
<td>11200</td>
<td>11200</td>
<td>10080</td>
<td>10080</td>
<td>10080</td>
<td>10080</td>
</tr>
<tr>
<td>Observations (2nd Stage)</td>
<td>4000</td>
<td>4000</td>
<td>3600</td>
<td>3600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>3.16%</td>
<td>1.14%</td>
<td>1.49%</td>
<td>3.02%</td>
<td>0.73%</td>
<td>1.23%</td>
<td>3.01%</td>
</tr>
</tbody>
</table>

Notes: Standard errors in parentheses clustered by age/province/sex groups: * significant at size 5%. All regressions are weighted by population size and control for year, age group and province fixed effects. Columns (2), (3), (5) and (6) apply 2-step procedure to correct for serial correlation (see text for details.) Adjusted R-squared for two step procedure corresponds to the second stage regression.
Table 3: Level Effect Estimates and Implied Deaths Avoided by Specific Causes of Death

<table>
<thead>
<tr>
<th>Level Effect</th>
<th>Influenza</th>
<th>Tuberculosis</th>
<th>Syphilis</th>
<th>Digestive Cancers</th>
<th>Circulatory Diseases</th>
<th>Diabetes</th>
<th>Cirrhosis of the Liver</th>
<th>Lung Cancer</th>
<th>Nephritis</th>
<th>Senility</th>
<th>Suicides</th>
</tr>
</thead>
<tbody>
<tr>
<td>oas</td>
<td>0.163</td>
<td>-0.014</td>
<td>0.014</td>
<td>-0.072</td>
<td>-0.029</td>
<td>-0.098</td>
<td>-0.078</td>
<td>0.001</td>
<td>-0.127</td>
<td>0.820</td>
<td>-0.115</td>
</tr>
<tr>
<td></td>
<td>(0.060)*</td>
<td>(0.059)</td>
<td>(0.077)</td>
<td>(0.017)*</td>
<td>(0.016)</td>
<td>(0.030)*</td>
<td>(0.059)*</td>
<td>(0.026)</td>
<td>(0.031)*</td>
<td>(1.492)</td>
<td>(0.053)*</td>
</tr>
<tr>
<td>oaa</td>
<td>0.006</td>
<td>-0.080</td>
<td>0.261</td>
<td>-0.052</td>
<td>-0.024</td>
<td>0.032</td>
<td>-0.237</td>
<td>-0.049</td>
<td>-0.064</td>
<td>1.154</td>
<td>0.224</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.059)*</td>
<td>(0.073)*</td>
<td>(0.020)*</td>
<td>(0.017)</td>
<td>(0.040)*</td>
<td>(0.047)*</td>
<td>(0.030)</td>
<td>(0.036)*</td>
<td>(1.413)</td>
<td>(0.064)*</td>
</tr>
</tbody>
</table>

Implied Deaths Avoided

<table>
<thead>
<tr>
<th></th>
<th>Influenza</th>
<th>Tuberculosis</th>
<th>Syphilis</th>
<th>Digestive Cancers</th>
<th>Circulatory Diseases</th>
<th>Diabetes</th>
<th>Cirrhosis of the Liver</th>
<th>Lung Cancer</th>
<th>Nephritis</th>
<th>Senility</th>
<th>Suicides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ages 70+</td>
<td>-365.12</td>
<td>5.21</td>
<td>-0.74</td>
<td>208.08</td>
<td>376.97</td>
<td>68.70</td>
<td>12.95</td>
<td>-0.34</td>
<td>200.91</td>
<td>-740.46</td>
<td>13.22</td>
</tr>
<tr>
<td></td>
<td>(134.40)</td>
<td>(21.95)</td>
<td>(4.08)</td>
<td>(49.13)</td>
<td>(207.98)</td>
<td>(21.03)</td>
<td>(9.79)</td>
<td>(8.97)</td>
<td>(49.04)</td>
<td>(1.347)</td>
<td>(6.09)</td>
</tr>
<tr>
<td></td>
<td>(19.76)</td>
<td>(13.57)</td>
<td>(3.65)</td>
<td>(18.98)</td>
<td>(63.21)</td>
<td>(10.64)</td>
<td>(4.32)</td>
<td>(8.25)</td>
<td>(12.28)</td>
<td>(5.65)</td>
<td>(4.93)</td>
</tr>
<tr>
<td>Observations</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
</tr>
</tbody>
</table>

Notes: Dependent variable is the first-difference log mortality rate for the respective cause of death for Canada, for age groups 50–65, 65–69 and 70+ for the years 1940 to 1960. All regressions are weighted by population and include year and age-group fixed effects and gradient dummies for the respective pensions. Robust standard errors reported in parentheses: * significant at size 5%.
Table 4: Level Effect and Gradient Effect by Province for Females

| Females            | CN     | CN2    | PEI    | NS     | NB     | PQ     | ON     | MB     | SK     | AB     | BC     |
|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| OAS Level Effect   | -0.020 | -0.021 | -1.884 | -0.054 | -0.031 | -0.002 | 0.007  | -0.203 | -0.061 | 0.044  | -0.050 |
|                    | (0.027) | (0.027) | (1.289) | (0.070) | (0.124) | (0.035) | (0.040) | (0.090)* | (0.105) | (0.079) | (0.084) |
| OAA Level Effect   | -0.011 | -0.015 | -1.52  | -0.047 | 0.002  | 0.013  | -0.005 | -0.22  | 0.055  | -0.066 | -0.01  |
|                    | (0.038) | (0.037) | (1.430) | (0.114) | (0.133) | (0.043) | (0.040) | (0.123) | (0.140) | (0.105) | (0.091) |
| OAP Level Effect   | -0.021 | -0.022 | -0.208 | -0.098 | 0.057  | 0.002  | -0.09  | -0.221 | 0.223  | -0.06  | 0.008  |
|                    | (0.017) | (0.017) | (0.460) | (0.094) | (0.107) | (0.035) | (0.029)* | (0.080)* | (0.204) | (0.086) | (0.118) |
| OAS Gradient Effect| -0.003 | -0.005 | -0.049 | 0.046  | 0.022  | -0.009 | 0.007  | 0.008  | -0.119 | 0.033  | -0.033 |
|                    | (0.015) | (0.014) | (0.820) | (0.106) | (0.085) | (0.038) | (0.030) | (0.062) | (0.098) | (0.071) | (0.061) |
| OAA Gradient Effect| -0.009 | -0.005 | -0.221 | 0.026  | 0.02   | -0.028 | -0.001 | 0.071  | -0.035 | 0.023  | 0.028  |
|                    | (0.014) | (0.012) | (0.689) | (0.100) | (0.079) | (0.038) | (0.032) | (0.095) | (0.106) | (0.093) | (0.072) |
| OAP Gradient Effect| 0.025  | 0.021  | 0.056  | 0.062  | 0.025  | 0.026  | 0.034  | 0.019  | -0.084 | 0.045  | -0.01  |
|                    | (0.012)* | (0.011) | (0.408) | (0.065) | (0.050) | (0.028) | (0.024) | (0.058) | (0.069) | (0.056) | (0.056) |
| Real Pension Payment (First Difference) | 0.019  | 0.020  | 2.508  | -0.051 | 0.026  | 0.107  | -0.034 | 0.045  | 0.18   | 0.25   | 0.09   |
|                    | (0.028) | (0.027) | (1.649) | (0.115) | (0.132) | (0.059) | (0.045) | (0.045) | (0.112) | (0.113)* | (0.065) |
| Real Pension Payment (Levels) | -0.009 | -0.012 | -0.077 | -0.039 | -0.014 | 0.009  | -0.022 | -0.068 | 0.008  | -0.051 | -0.039 |
|                    | (0.012) | (0.011) | (0.689) | (0.084) | (0.066) | (0.032) | (0.029) | (0.056) | (0.083) | (0.068) | (0.059) |
| Observations       | 5040   | 5600   | 630    | 630    | 630    | 630    | 630    | 630    | 630    | 630    | 630    |
| Adjusted R-squared | 2.41%  | 2.53%  | 3.84%  | 8.63%  | 5.45%  | 16.93% | 10.52% | 8.04%  | 12.94% | 6.43%  | 3.89%  |

Robust standard errors in parentheses: * significant at size 5%. All regressions control for year, age-group and province fixed effects.

Observations are weighted by age group/province population and standard errors are corrected for clustered observations by age group/province. Column CN includes provincial income and medical insurance coverage, Column CN2 does not.
Table 5: Level Effect and Gradient Effect by Province for Males

<table>
<thead>
<tr>
<th>Province</th>
<th>CN</th>
<th>CN2</th>
<th>PEI</th>
<th>NS</th>
<th>NB</th>
<th>PQ</th>
<th>ON</th>
<th>MB</th>
<th>SK</th>
<th>AB</th>
<th>BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAS Level Effect</td>
<td>-0.064</td>
<td>-0.065</td>
<td>-0.206</td>
<td>-0.245</td>
<td>0.055</td>
<td>-0.031</td>
<td>-0.034</td>
<td>-0.029</td>
<td>-0.164</td>
<td>-0.171</td>
<td>-0.128</td>
</tr>
<tr>
<td></td>
<td>(0.015)*</td>
<td>(0.015)*</td>
<td>(0.251)</td>
<td>(0.080)*</td>
<td>(0.087)</td>
<td>(0.027)</td>
<td>(0.023)</td>
<td>(0.069)</td>
<td>(0.062)*</td>
<td>(0.055)*</td>
<td>(0.039)*</td>
</tr>
<tr>
<td>OAA Level Effect</td>
<td>-0.008</td>
<td>-0.012</td>
<td>-0.063</td>
<td>-0.244</td>
<td>0.15</td>
<td>-0.014</td>
<td>0.009</td>
<td>-0.037</td>
<td>0.027</td>
<td>-0.021</td>
<td>-0.156</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.238)</td>
<td>(0.096)*</td>
<td>(0.084)</td>
<td>(0.034)</td>
<td>(0.029)</td>
<td>(0.096)</td>
<td>(0.095)</td>
<td>(0.072)</td>
<td>(0.083)</td>
</tr>
<tr>
<td>OAP Level Effect</td>
<td>-0.037</td>
<td>-0.038</td>
<td>0.052</td>
<td>-0.163</td>
<td>-0.078</td>
<td>-0.070</td>
<td>-0.027</td>
<td>-0.095</td>
<td>-0.026</td>
<td>0.079</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>(0.017)*</td>
<td>(0.018)*</td>
<td>(0.217)</td>
<td>(0.088)</td>
<td>(0.087)</td>
<td>(0.041)</td>
<td>(0.031)</td>
<td>(0.078)</td>
<td>(0.086)</td>
<td>(0.056)</td>
<td>(0.073)</td>
</tr>
<tr>
<td>OAS Gradient Effect</td>
<td>0.012</td>
<td>0.007</td>
<td>-0.024</td>
<td>-0.046</td>
<td>-0.014</td>
<td>0.015</td>
<td>0.013</td>
<td>0.006</td>
<td>0.072</td>
<td>0.016</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.013)</td>
<td>(0.223)</td>
<td>(0.071)</td>
<td>(0.069)</td>
<td>(0.031)</td>
<td>(0.023)</td>
<td>(0.056)</td>
<td>(0.089)</td>
<td>(0.050)</td>
<td>(0.074)</td>
</tr>
<tr>
<td>OAA Gradient Effect</td>
<td>0.002</td>
<td>0.005</td>
<td>-0.131</td>
<td>-0.023</td>
<td>-0.017</td>
<td>0.006</td>
<td>-0.005</td>
<td>0.027</td>
<td>0.023</td>
<td>0.046</td>
<td>0.094</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.010)</td>
<td>(0.184)</td>
<td>(0.064)</td>
<td>(0.055)</td>
<td>(0.032)</td>
<td>(0.024)</td>
<td>(0.077)</td>
<td>(0.082)</td>
<td>(0.059)</td>
<td>(0.082)</td>
</tr>
<tr>
<td>OAP Gradient Effect</td>
<td>0.021</td>
<td>0.014</td>
<td>-0.018</td>
<td>-0.011</td>
<td>0.011</td>
<td>0.029</td>
<td>0.018</td>
<td>0.022</td>
<td>0.071</td>
<td>0.008</td>
<td>-0.039</td>
</tr>
<tr>
<td></td>
<td>(0.010)*</td>
<td>(0.009)</td>
<td>(0.154)</td>
<td>(0.051)</td>
<td>(0.047)</td>
<td>(0.024)</td>
<td>(0.019)</td>
<td>(0.050)</td>
<td>(0.068)</td>
<td>(0.044)</td>
<td>(0.059)</td>
</tr>
<tr>
<td>Real Pension Payment (First Difference)</td>
<td>0.024</td>
<td>0.025</td>
<td>1.486</td>
<td>0.075</td>
<td>0.127</td>
<td>0.076</td>
<td>0.055</td>
<td>-0.005</td>
<td>-0.038</td>
<td>-0.194</td>
<td>-0.059</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.020)</td>
<td>(0.983)</td>
<td>(0.094)</td>
<td>(0.081)</td>
<td>(0.044)</td>
<td>(0.052)</td>
<td>(0.049)</td>
<td>(0.112)</td>
<td>(0.073)*</td>
<td>(0.116)</td>
</tr>
<tr>
<td>Real Pension Payment (Levels)</td>
<td>-0.012</td>
<td>-0.015</td>
<td>-0.057</td>
<td>0.013</td>
<td>-0.008</td>
<td>-0.023</td>
<td>-0.009</td>
<td>-0.033</td>
<td>-0.032</td>
<td>-0.021</td>
<td>-0.078</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.199)</td>
<td>(0.058)</td>
<td>(0.053)</td>
<td>(0.027)</td>
<td>(0.020)</td>
<td>(0.050)</td>
<td>(0.066)</td>
<td>(0.040)</td>
<td>(0.066)</td>
</tr>
</tbody>
</table>

Observations: 5040 5600 630 630 630 560 630 630 630 630 630
Adjusted R-squared: 5.11% 5.21% 1.04% 12.78% 6.05% 21.13% 26.39% 6.50% 8.67% 17.63% 15.25%

Robust standard errors in parentheses: * significant at size 5%. All regressions control for year, age-group and province fixed effects. Observations are weighted by age group/province population and standard errors are corrected for clustered observations by age group/province. Column CN includes provincial income and medical insurance coverage, Column CN2 does not.
Table 6: Reduction in Deaths and Value per Statistical Life as Implied by the Level Effect

<table>
<thead>
<tr>
<th>Plan</th>
<th>Level Effect</th>
<th>Implied Change in Deaths per Thousand</th>
<th>Implied Deaths Avoided</th>
<th>Implied Value of Statistical Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAS (1952)</td>
<td>-0.042</td>
<td>-3.373</td>
<td>2,152</td>
<td>$535,050</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(1.285)</td>
<td>(820)</td>
<td>($306,327, $2,112,041)</td>
</tr>
<tr>
<td>OAP (1927)</td>
<td>-0.03</td>
<td>-2.853</td>
<td>843</td>
<td>$227,624</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(1.141)</td>
<td>(337)</td>
<td>($127,592, $1,053,816)</td>
</tr>
</tbody>
</table>

Notes: Standard errors and 95 percent confidence interval for VSL, in parenthesis, calculated using the Delta method. Change in deaths per thousand is calculated by multiplying the estimated level effect by Canadian mortality rates in the year prior to implementation. For the OAS and OAP plans, mortality rates are the average mortality rates for age groups 70–74, 75–79, 80–84 and 85–89, weighted by age group population. Implied deaths avoided are the product of the change in deaths per thousand and the population of the recipient, for the year prior to implementation. Value per Statistical Life is calculated as outlined in Hammit (2007): dividing the incremental expenditure per recipient by the reduction in mortality risk. VSL for OAP assumes that pension recipients went from 10 percent of the population over age of 69 to one third as Struthers (1994, 64) reported for Ontario for 1928 and 1929.
Figure 1: Income Thresholds and Maximum Pension Benefits for Means Tested Pension Recipients

Figure 2: Percentage of Pension Coverage for Canadian Population Age 65 and Over

Figure 3: Pension Benefits Paid Per Recipient and Average Personal Income of Canadians, 1928–1970 (Constant 1992 Dollars)