Public Pensions and Elderly Mortality in Canada: Comparing Means tested and Universal Eligibility, 1921 – 1966

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ABSTRACT

We investigate the impact of three public pension programs on the mortality rates of recipient age groups in Canada. 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. Our data consist of age-specific mortality rates and pension information, by province, for the period 1921–1966. The three dimensional feature of this panel allows us to exploit variation in policy implementation dates across provinces, and changes in income and age group eligibility.

We find that the implementation of all three pension programs resulted in statistically significant reductions in recipient age group mortality rates and that the effect of the federal universal OAS of 1952 was twice as large as either of the means tested plans. However, the number of lives extended with the universal OAS was small and the estimated cost per life extended large.

We investigate the impact of three public pension programs on the mortality rates of recipient age groups in Canada. 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. Our data consist of age-specific mortality rates and pension information by province, over the period 1921–1966. Our focus on mortality follows that of a number of studies that estimate the impact of income transfer schemes on mortality to infer the impact of income on health and well-being of the recipient population.[2] We find that the implementation of all three pension programs resulted in statistically significant reductions in recipient age group mortality rates and that the effect of the federal universal OAS of 1952 was twice as large as either of the means tested plans. However, the number of lives extended with the universal OAS was small and the estimated cost per life extended large.

Empirical research has drawn conflicting conclusions regarding the impact of transferred income on the mortality of older populations.[3] Fishback and Stoian (2007) found 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) found 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 argued that the lack of effect of OAA before 1941 and a sizeable effect after, suggests that OAA benefits before 1941 were too small in value to have

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[2] According to Fishback, Haines and Kantor (2007, 1), 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. 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 and mortality are robust but the causal relationships remain uncertain. The lower mortality and better health status may arise because of higher income, or it could be that better health status causes higher income and lower mortality. See Orcutt Duleep (1986), Chapman and Hariharan (1994, 1996), Wilkens et al. (2002), Smith and Kington (1997), Cutler et al. (2006) and Balan Cohen (2008).

[3] Two studies examine income transfers and broader population mortality outcomes. Fishback, Haines and Kantor (2007) found 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 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.

resulted in a sizeable increase in income necessary to impact on mortality. Snyder and Evans (2006) found 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 concluded that the reduction in social isolation had a larger impact on mortality than did the reduced income transfer. Conversely, Hadley and Osei (1982) found a negative correlation between transfer income and mortality in older populations, but a positive correlation between earned income and mortality.

The existing literature has not demonstrated the relative effectiveness of means tested versus universal programs for improving the well-being elderly populations even though the high and rising costs of universal transfer schemes have emerged as a policy challenge.[4] With the exception of Fishback and Stoian (2007), empirical 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.[5] Theoretical considerations of means testing versus universalism highlight the issues of targeting transfers to the needy, and the administrative, incentive and deadweight costs of the two schemes. Besley (1989) showed that a means tested plan is likely to be more effective at alleviating poverty than a universal plan. Assuming a fixed program budget and no behavioral responses to the program, the gains from a universal plan arise from extending benefits to those individuals discouraged from applying for the means test, while the costs are the funds unnecessarily expended on individuals with no need for the income support. Feldstein (1987) demonstrated that a universal plan may be superior if the means test induces a large portion of the population to reduce their savings and to under-consume in their

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[4] Boadway (1998, 363) argues that universal social programs in Canada are unnecessarily expensive and do relatively little for those who need them most. Fishback and Stoian (2007) highlight that Social Security in the U.S., a universal, contributory pension scheme, is seen as one of the most successful anti-poverty programs in American history. At the same time it has become an expensive program with population aging in the US and social security reform is perennially a public debate.

[5] Fishback and Stoian (2007) limit their analysis to the pre-Social Security period to assess how successful continuation with the means tested (income targeted) OAA pension benefits over the introduction of old age social insurance (OASI) would have been for reducing health and welfare problems associated with poverty amongst the elderly. Their finding that OAA did not reduce senior mortality suggests that the high cost universal social security program was necessary to solve these problems.

retirement years. Further, the universal plan may be superior if the benefit paid by the means tested plan is set below the optimal level, to avoid this savings disincentive. Lindert (2004, 34-36) argued that universalism in tax transfer schemes resulted in lower deadweight costs per dollar taxed and transferred relative to means-tested plans. The lower administration costs and incentive costs of universal schemes fostered economic growth which raised incomes and increased the transfer of resources to needy individuals.

Canadian pension plans offer a "quasi-experimental" situation for identifying the effects of income transfers on mortality, and the relative effectiveness of means tested versus universal eligibility for alleviating poverty.[6] The means tested pensions, OAP and OAA and the subsequent universal pension OAS, were intended to address the living conditions of Canadian seniors, but they were also introduced 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 a means tested non-contributory pension plan in 1927 and for setting the age of eligibility at 70. While the timing of OAP introduction varied across provinces after 1927, all provinces participated with relatively uniform eligibility requirements and nominal benefit values. It is unclear whether considerations of program effectiveness for alleviating poverty guided the choice of the universal program in 1952. Historically, the change from means tested to universal benefits in Canada has been attributed to moral, political and administrative considerations. After World War II, means testing was argued to be "not nice" and was increasingly politically unpopular. As the responsibility for pension programs moved from the provinces to the federal government, means testing was not feasible or cost-effective for a centrally-administered plan. 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 expanding the extent of pension benefit coverage without a coincident increase in benefit sizes. Similarly, the means tested OAA extended

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[6] Meyer (1995) defined a natural or quasi-experiment induced by a policy change as 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 groups reflects correlation between assignment and outcomes.

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.

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 rates, by five-year age groups, by province, as well as by pension benefit eligibility and benefit generosity over the period 1921–1970. The three-dimensional feature of this panel allows us to exploit variation in implementation dates across provinces, the type of plan implemented, and changes in age group eligibility. We find that the implementation of means tested pensions resulted in a measurable, and statistically significant, impact on recipient age group mortality rates. We estimate that the 1927 OAP resulted in 8 lives extended per year for Canadians over age 70. Likewise, the estimated effect for the 1952 OAA was a reduction in the mortality rate for Canadians 65 to 69 year of age of 0.07 percent, or 9 deaths extended per year. We further find a statistically significant reduction in recipient mortality rates of 0.12 percent with introduction of the universal OAS plan. This estimate suggests that the universal pension resulted in 66 fewer deaths of Canadians aged 70 and over. Interpreted literally, our results imply that $2.6 million dollars ($18.6 million in 2005 purchasing power) were spent per life extended over what would have been spent had Canada continued with the means tested OAP in 1953.

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. Meyer (1995) defined a natural (or quasi-) experiment induced by a policy change as 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 groups reflects correlation between assignment and outcomes. In the context of

our study, 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.

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). With a strong ethos of self-reliance and market based initiatives, little progress was made on public pension development in Canada until the 1920s (Bryden 1974, 76). Over the first forty years of the twentieth century, attitudes towards government and the state were strongly *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, and 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. According to Bryden (1974, 76), by the 1920s Canadians were convinced that poverty among the aged was acute, widespread and chronic.[7] Upturns in the business cycle did little to alleviate these conditions.

When the pension debate re-awakened in the 1920s, the central issues were the design of the program and the definition of the eligible population. While the government accepted that the needs of a sizeable poor elderly population justified a public transfer scheme, debate remained over whether Canada should move towards a contributory (social insurance) pension scheme, which would do little for the existing population of poor seniors (Bryden 1974, 78) and was potentially constitutionally

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[7] 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 *Labour Gazette*, August 1924 pp. 665-666. Actual coverage was 35 percent in 1937, when all provinces had implemented the OAP.

inappropriate for the federal government (Bryden 1974, 106). There was also debate over whether a non-contributory pension should be means tested or universally provided.

Bryden (1974, 77) argued that the deciding factor for these debates was the expected program costs. An important function of the 1927 OAP was to provide financial relief for municipalities and provinces that were already supporting the indigent aged.[8] Contributory plans were assessed as too costly to set up and administer at that time, though Prime Minister McKenzie King believed that Canada should move towards such a scheme when the capacity of government to provide such a scheme improved; a means tested plan was a first step towards a comprehensive contributory program. 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. Similarly, means tested 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 for supporting seniors that the federal government claimed it would face under a federal, universal program. Similar cost consideration 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 benefits paid, a share that increased to 75 percent in 1931, encouraging participation from the poorer provinces. The four western provinces and Ontario had all adopted the OAP by November of 1929, followed by the Northwest Territories, Prince Edward Island and Nova Scotia in 1931, 1933 and 1934, New Brunswick and Quebec in 1936, and finally Yukon in 1950.[9] Bryden (1974, 84-85) indicated that while the maritime provinces had the greatest need for public pensions due the high proportion of aged population with lower incomes than in the rest of the country, the more limited

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[8] *Labour Gazette,* March 1927, 269-270.

[9] Several provinces held municipalities responsible for a portion of the costs. Initially Manitoba charged its full share of the program to municipal governments (excluding administration costs), taking responsibility for half of its share in 1930. In Alberta, 10 percent of pension payments were made by municipalities, until 1949 when the province relived municipalities if this expense. Ontario initially charged municipalities 25 percent of total pension payments, reducing this burden to 20 percent, 10 percent (following the federal funding increase), and finally to zero in 1937.

revenue capacity of these governments due to low incomes in the provinces delayed their adoption of the OAP.

The OAP paid a maximum annual benefit of $240. A means tested plan, the pensioner was permitted to earn supplementary income, to a maximum of $125 annually, after which the pension was reduced on a dollar-for-dollar basis. Pensioners were required to be British subjects, to be at least 70 years of age, and to have lived the past twenty years in Canada and the past five years in the given province. Indians were excluded from the program. Pensioners could own property, but an annual return on the asset was often assumed into the pensioner's income.

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. As the Canadian economy recovered, pressure began to mount on the federal government to increase pension benefits. 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.[10] Bryden (1974, 92) suggested 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. However, by the 1940s, rising cost of living with frozen pension benefits stressed pensioners. In 1943 the federal government increased pension benefits to $300 annually and in 1944 increased the total income allowance to $425.[11] Benefits were further increased to $360 in 1947 and to $480 in 1949. Under the new $480 pension, the corresponding income caps were increased to $600 for singles, and a separate $1080 cap was added for married pensioners. These increases did little more than offset inflation and OAP benefits were still seen as deficient.[12]

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[10] 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.

[11] Figure 1 shows these changes to benefits and income allowances over time. 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.

[12] See Figure 3. This opinion was exemplified in the 1943 Marsh Report, which argued that the Canadian government had a responsibility to ensure a minimal income for all its citizens. Leonard Marsh calculated a minimum income needed to subsist and concluded that pension benefits of the time fell short of this

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, replacing the OAP. The OAS was a federally-funded universal pension, paid to all Canadians aged 70 and over. Benefits, $480 annually, and residency requirements were the same as the OAP. The pension was funded through a composite of three taxes: a manufacturer's sales tax as well as taxes on corporate and individual incomes.[13] Over the next decade OAS recipients received several increases to their annual benefits,[14] until payments reached $900 annually in October of 1963, and were indexed for inflation. In 1965 the federal government began a process of annual decreases in the age of eligibility for the OAS benefits, lowering eligibility by one year, until in 1970 OAS benefits where available to all Canadians over the age of 65.

The OAA targeted low-income Canadians, aged 65–69. It was a means tested plan operating under the same principles as the 1927 OAP. The federal government covered 50 percent of the 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. Along with benefit augmentations, the income allowances for eligibility were increased, eventually reaching $1140 for singles and $1980 for married couples. Between 1965 and 1970, the government gradually switched recipients from the OAA to OAS plans, and in 1970 the OAA was eliminated.

The subsequent move from provincial means tested programs to a federal universal pension for Canadians aged 70 and over addressed concerns that the means tested pension failed to address the income needs of the poor elderly population and provided a strong disincentive to save to provide for one's retirement (Bryden 1974, 103–104, 107–108, 115). 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

minimum. This report recommended that pension benefits be increased, eligibility requirements be relaxed, and means testing be abolished.

[13] Each tax was initially set at a rate of 2 percent, with a $60 annual ceiling on the personal income tax. In 1958 large budget deficits lead to an increase to 3 percent on sales and corporate tax and 4 percent on income tax, increasing the annual ceiling to $120.

[14] The annual benefit increases were: $552 in July 1957; $660 in November 1957; $780 in February 1962; $900 in October 1963. See Figures 1 and 3.

been eligible for the OAP pension were not in 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.[15] 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.[16]

While it was 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. In the end, the costs and logistics of setting up and administering a contributory scheme threatened to delay, if not stall, the elimination of the means test. The political demand to address the means test resulted in the politically expedient choice of the non-contributory universal demogrant benefit. 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). It was also believed that, unlike the over 70 year old age group, most of the 65 to 69 year old age group were capable of supporting themselves through paid work (Bryden 1974, 116).

Census data indicate that the 1951 pension reforms had a significant impact on senior income. The proportion of male seniors 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

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[15] 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."*
[16] 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.

of age.[17] Reliance on the universal pension was notable by 1961, when 59 percent of seniors aged 70 and older reported an annual income below $1000. Within this group, 93 percent of all income came from government pension plans. Likewise, for senior age 65 to 69, 54 percent reported an annual income less than $1000. Over 50 percent of this group's income came from government pensions.

An important issue for our econometric investigation of the effects of pension benefits on senior mortality concerns whether Canadians close to pensionable ages in the 1920s and 1940s anticipated these policy developments and altered their work and savings behaviors in ways that would have offset the impact of a pension on their welfare. The 1927 OAP legislation followed the 1924 recommendations of a special committee of the House of Commons established by the Prime Minister to investigate a pension plan for Canada. However, as indicated by Bryden (1974, 68–69, 109–117), 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 were 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 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

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[17] Females on the other hand saw an increase in senior labour force participation, but this change is dwarfed by the dramatic increase in labour force participation for females in the next youngest age group. See Historical Statistics of Canada, Second Edition. D107-122 and D205-222.

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 Well-being

Our empirical focus is on the impact which the 1927 and 1952 pension reforms may have had on recipient well-being as measured by mortality rates. In this section, we discuss mortality as a measure of health and well-being, and we present Besley's (1989) model to illustrate the income and poverty outcomes associated with a means tested pension plan and a universal pension plan.

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. Fishback and Stoian (2007, 10) argue that since means tested pensions were targeted at the elderly poor, and elderly with low incomes tend to have higher mortality rates (Chapman and Hariharan 1996), the aggregate 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. Most treatment for degenerative diseases is long-term and pre-emptive, such as improved nutrition.[18] It is plausible that senior mortality would be influenced by income transfers, which allow them to acquire necessities like food, shelter and access to basic medical care.

Canadian pension plans were introduced to address poverty amongst the elderly. Through their impact on raising incomes and alleviating poverty, the pensions would have influenced the mortality rates of recipient groups. To illustrate the different income

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[18] 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.

outcomes under means tested and universal pension schemes, we present a modified version of Besley's (1989) model. Besley (1989) examined whether means tested or universal income transfers are superior for poverty alleviation, holding total transfer expenditures constant.[19] In the Canadian case of the OAP and OAS pensions, the benefit paid to each recipient is held constant, but the number of recipients is increased (see Figures 2 and 3). As this leads to a large increase in expenditures, at this point we do not draw any conclusions about the superiority of either plan, but simply look at the income (welfare) outcomes across the target group.

Following Besley, we assume that there is a positive cost associated with undergoing a means test. This cost may be pecuniary (lost wages due to time spent being means tested) or psychological (due to the social stigma involved with means testing). Either way, we assume that it can be represented by a money cost. Let c denote the (unobservable) monetary cost associated with undergoing the means test. The policy maker's target for minimal income is given by y^m. Income in the population is distributed over the support $[0, \bar{y}]$ according to the cumulative density function $F(y)$. Total poverty P, as determined by the policy maker, is measured by:

$$P = \int_0^{y^m} \left(\frac{y^m - y}{y^m} \right)^\alpha dF(y)$$

where α is a measure of social poverty aversion.

For the means tested pension, the policy maker offers a pension benefit b to any senior who undergoes the means test and earns an income less than the minimum substance level y^m. So as not to discourage self-sufficiency, the government pays a maximum pension of z, where $c < z \leq y^m$. The difference between z and y^m is the income allowance, given by a. The benefit of undergoing the means test is given by:

$$b = \begin{cases} z & \text{if } y \leq a \\ z - (y - a) & \text{if } y - a \leq z \\ 0 & \text{if } y - a > z \end{cases}$$

A potential claimant will undergo means testing only if the benefit from doing so is greater than the cost, $z - (y - a) > c$. Therefore, only seniors earning an income less than $\tilde{y} = z + a - c$ undergo means testing. This is described in panel (a) of Figure 4, which shows the income benefit at each level of pre-pension income after the means tested pension is put in place. As this figure shows, the largest beneficiaries from the means tested plan are those with the lowest incomes. If an agent's income is less than a prior to the policy, they receive the full benefit. As income increases above a, the benefit size decreases, until at $\tilde{y}$ agents do not undergo the means test.

Poverty after the means tested pension policy is implemented is given by:

$$P^{MT} = \int_0^a \left(\frac{y^m + c - (y + z)}{y^m} \right)^\alpha dF(y) + \left(\frac{c - a}{y^m} \right)^\alpha \left[F(\tilde{y}) - F(a) \right] + \int_{\tilde{y}}^{y^m} \left(\frac{y^m - y}{y^m} \right)^\alpha dF(y)$$

The effectiveness of this policy at eliminating poverty depends negatively on the size of the means testing cost, and positively on the size of the income allowance. The influence of costly means testing enters in through two channels. First, those who undergo the means test are not reimbursed for this cost; second, the larger the cost, the larger the number of otherwise eligible agents who do not receive pension benefits. The income allowance works in the opposite direction -- increasing the allowance increases the number of pensioners who undergo means testing and allows some pensioners to offset more of the cost using alternative income sources. If the means tested plan offers a sufficient income benefit, and the density of very low income seniors is sufficiently high, we can expect a measurable increase in aggregate well-being from this policy.

The universal pension policy does not have a means test and is, therefore, free of the cost c. The remaining poverty in the population after the universal pension plan is:

$$P^U = \int_0^a \left(\frac{y^m - (y + z)}{y^m} \right)^\alpha dF(y)$$

We illustrate the income benefit of the universal plan, over and above that of the means tested plan, in panel (b) of Figure 4. Individuals with the lowest incomes (less than a) receive little additional income benefit from this policy. High income individuals receive a relatively large incremental income benefit, but have relatively low marginal value for

these gains. The individuals who gain the most from the universal pension over the means tested pension are low-income individuals who did not undergo means testing at cost c. Any measurable changes in the well-being which arise from the implementation of a universal pension policy can be primarily attributed to this group.

Developments of, and changes to, Canada's pension policies allow us to exploit 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 1970. There were three periods of rapid coverage growth. The first took place between 1927 and 1939 as provinces implemented the OAP. The next period is after 1952 when OAS and OAA were implemented. Coverage extended to all members of the 70 and older population, as well as some members of the 65 to 69 population. The 1952 coverage increase is considerable, amounting to 183 percent between 1951 and 1956, and can be primarily attributed to the universal pension plan (Figure 2). After 1965, the extent of pension coverage increased again as the means tested OAA was gradually replaced by the universal OAS for Canadians aged 65-69.[20] 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 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. This indicates that the universal plan had little impact on the incomes of Canadians who had been OAP recipients. There was also little change in the gap between average personal income and pension benefits; benefits averaged about 35 percent of average personal income. Government increases to the OAS benefits from

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[20] The contributory Canada Pension Plan was introduced in 1966.

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1957 to 1968 decreased the income gap between pensioners and average Canadians to 40 percent, suggesting that the purchasing power of pensioners increased post-1957.

As the economic climate differed across Canada, the purchasing power of uniform benefits differed by province. Pension benefits were more generous for recipients living in the eastern provinces, where personal income was below the national average from 1950 to 1970 (Table 1). In several years, in Prince Edward Island and Newfoundland the maximum OAS benefits were equivalent to 70 percent of average income. Conversely, British Columbia and Ontario report the highest levels of average personal income, with benefits consistently below 40 percent of the average-annual income. The switch from a means tested to a universal pension plan, and increases to benefit payments, could have had a larger impact on economic well-being in provinces which report low average personal incomes.

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 on vital statistics covering nine of the ten provinces, spanning the period 1921–1966.[21] Mortality rates for each year and province are calculated by five-year age groups.[22] For each year in the study, we have 144 province/age combinations, totaling 6,397 observations. Figure 5 presents the Canadian overall mortality rate for 1921 to 2003, and Figure 6 presents mortality rates for selected age groups for Canada over the same period. Levels and variability of mortality rates increase with age and all age groups have shown a trend of declining mortality rates over the period of our study. The panel structure of our mortality data allows us to address these inherent and systematic differences across age groups. Our data set is suitable for the application of a "differences in differences" approach to identifying the effects of pension income on mortality. We will identify a pension effect as changes in the level, and/or trend, of mortality rates of pension recipient

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[21] We limit our study to 1921 to 1966 since the introduction of the contributory Canada Pension Plan, Medicare, and the elimination of OAA in favor of the extension of coverage under OAS introduces considerable complexity to the policy environment.

[22] Due to lack of data prior to 1949, Newfoundland is excluded. Infant mortality rates (ages 0–5) and rates for the oldest members of the population (greater than age 85) are not used due to changes in age group reporting in the published vital statistics data over the time period.

age groups over and above that of non-recipient age groups after accounting for age group and province specific effects.

The dependent variable for all of our empirical specifications is the first-differenced mortality rate. We apply three different approaches to incorporating pension plan measures as explanatory variables. In the first model 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 accelerated the trend decline in mortality rates for recipient age groups, relative non-recipient age groups. We refer to this relationship as the *gradient effect*. In the second approach we add the change in average pension benefits paid to a given age group in a given province in a given year to estimate whether the variation in benefits paid influenced the variation in mortality rates. Finally, the third approach includes 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 pension plans, since it would represent a shift in the constant term for the level of the mortality rate.

Gradient Effect

In this differences-in-differences specification, we estimate the model

$$\log(M_{ijt}) - \log(M_{ijt-1}) = \beta_1 + \beta_2 OAS + \beta_3 OAP + \beta_4 OAA + age_i + prov_j + year_t + e_{ijt}$$

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 variables *OAS*, *OAP* and *OAA* equal 1 if age group i in province j was eligible for the respective plan in year t, zero otherwise. *OAP* equals 1 for $i > 70$ and $t < 1952$, but the start date varies by province. *OAS* is 1 for $i > 70$ and $t \geq 1952$, and 0 otherwise. *OAA* equals 1 for $64 < age < 70$ and $t \geq 1952$, and 0 otherwise. age_i, $prov_j$ and $year_t$, control for age, province, and year fixed effects; e_{ijt} is the random error. The estimation for this specification is shown in Table 2.

Column (1) reports coefficient estimates for a specification with no adjustments made for the clustering of observations, while (2) reports the estimated coefficients with

standard errors corrected for age/province group clustering.[23] As shown, the correction for clustering reduced the estimated standard errors of our coefficient estimates. The coefficient for each pension policy indicator is interpreted as the change the growth of mortality rates for age groups eligible to be pension recipients under that policy. The coefficient estimate for OAS suggests that OAS recipients experienced a reduction in annual mortality rate growth of 0.026 percent. The coefficient estimate for OAP suggests that the early means tested pension plan had no estimable effect on recipient age group mortality. However, the estimated coefficient for OAA suggests a statistically significant 0.016 percent decrease in mortality rate growth was realized by the 65 to 69 age recipient group after the means tested plan was implemented.

Bertrand, Duflo and Mullainathan (2004) demonstrate that with differences-in-differences estimators, serial correlation may result in estimates of the standard errors for the coefficient estimates that are biased downward, leading to an inappropriate inference of statistical significance. They propose procedures to address the problem of serial correlation for the differences-in-differences approach. In the event that our first differencing of the mortality rate did not adequately address serial correlation in the mortality rates, we employ two of Bertrand et al.'s suggested procedures that sacrifice information in the time-series in favour of eliminating serial correlation. The results are reported in columns (3) and (4) of Table 2. If serial correlation is driving our results, these procedures should result in larger estimates of the standard errors and less likelihood of statistical significance than we report in columns (1) and (2).

Following Bertrand et al., we first exploit the different implementation years and eligibility changes for OAP, OAA and OAS plans, using a two stage procedure. In the first stage, we estimate:

$$\log(M_{ijt}) - \log(M_{ijt-1}) = \beta_1 + age_i + prov_j + year_t + e_{ijt}$$

From the first stage estimation, we calculate the vector of fitted residuals, $\hat{e}_{ijt}$. Limiting the panel of residuals to the age groups that were eligible for at least one of the pensions (65 and older), the residuals are regressed on the OAS, OAA and OAP indicators. If

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[23] 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 option in STATA.

policy implementation is independent of the fixed effects, the full correlation will be found in the residuals. The resulting coefficients reported in column (3) are consistent with those in column (1), and counter to what we would expect if serial correlation were a problem. The OAS and OAA coefficients remain statistically significant

In applying a second approach proposed by Bertrand et al. we only consider the impact of the universal OAS policy. Here we compare outcome averages before and after the OAS policy was implemented. To do this, mortality variables are indicated as being before or after 1952. By province/age groups, mortality variables are collapsed to their means, and the following regression is run

$$Avg[\log(M_{ijt}) - \log(M_{ijt-1})]_k = \beta_1 + \beta_2 OAS + age_i + prov_j + D1952_k + e_{ijt}$$

where $D1952_k = 1$ if the observation is for the post-1952 period and 0 otherwise. β_1 is the average change in the annual growth rate of the mortality rate before the OAS policy was implemented, and $D1952$ is the incremental change in the growth rate after common to recipients and non- recipients (controlling for age and province fixed-effects). β_2 can be interpreted as the average change in mortality rate growth correlated with the receipt of an OAS pension. The estimated coefficient in column (4) implies that mortality rates for eligible groups decreased 0.025 percent after OAS was implemented, consistent in magnitude with column (2). The results reported in columns (3) and (4) imply that it is unlikely serial correlation is biasing the estimates reported in column (2).

Continuous Benefits

The second model is specified using the first difference of average per-recipient benefits paid, for each of the three plans, as independent variables.

$$\log(M_{ijt}) - \log(M_{ijt-1}) = \beta_1 + \beta_2 BOAS + \beta_3 BOAP + \beta_4 BOAA + age_i + prov_j + year_t + e_{ijt}$$

where *BOAP*, *BOAS* and *BOAA* are the first differenced per-recipient benefits paid in constant purchasing power,[24] divided by 500, for province *j* in year *t*. Coefficients are

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[24] Purchasing power is in 1952 Toronto dollars, capturing changes in the real value of benefits across time and provinces. Nominal benefits are adjusted using cost of living indexes for major cities, as reported in Emery and Levitt (2002) and *Historical Statistics of Canada*, Table K23–32. The Emery and Levitt indexes

interpreted as the marginal effect of a $500 increase in benefits on mortality growth rates. The estimates for this specification are reported in columns (1) and (3) of Table 3, for unadjusted and cluster adjusted standard errors respectively. A second equation is estimated which includes indicator variables for the year of each policy's implementation along with the first differenced benefits variables. These estimates are reported in columns (2) and (4) of Table 3, for unadjusted and cluster adjusted standard errors respectively.

The resulting coefficient estimates indicate that increased pension benefits reduced recipient age group mortality with each of the three pension schemes. The implied marginal effect of a $500 increase in pension benefits is a decrease in mortality rate growth of 0.053 for the OAS, but the estimated coefficients for the OAP and OAA benefits are statistically insignificant. However, when we control for the change in the extensive margin of coverage in the year of policy implementation, we see that the implied correlation can be largely accounted for in the initial year of each policy. This is consistent with the real value of benefits remaining relatively constant over the period examined. Implied mortality effects come from benefits paid on the extensive, rather than the intensive, margin of coverage. As such, we proceed to estimate the level-effects model, capturing the effect of policy implementation on mortality.

Level Effect

A level effect is a one-time shift in the mortality rate of pension recipients. To test for a level effect, we estimated the following equation:

$$\log(M_{ijt}) - \log(M_{ijt-1}) = \beta_1 + \beta_2 FOAS + \beta_3 FOAP + \beta_4 FOAA + age_i + prov_j + year_t + e_{ijt}$$

where *FOAS*, *FOAP* and *FOAA* are binary variables which equal one for pension eligible age groups in the year each plan was implemented, and zero otherwise. These results are

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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 to 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.

reported in Table 4, again with unadjusted standard errors reported in (1) and adjusted for clustered observations in (2). The coefficient estimates for *FOAS*, *FOAA* and *FOAP* are all negative and statistically significant (at size 5 percent). The means tested OAA and OAP pensions resulted in 0.07 and 0.028 percent reductions in mortality rates for recipients, in the year of implementation, while the universal OAS plan reduced the level of the mortality rate of Canadians 70 and older by 0.12 percent.[25]

We interpret these results as evidence that a level effect took place upon implementation of each of the pension plans. Figure 6 depicts average mortality rates for five selected age groups over the period 1921 to 2003. Pension eligible groups show a drop in their mortality rates after implementation of the universal OAS plan. This same decrease in mortality rates is not as apparent for non-eligible groups.

IV. Discussion of Results

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 was more successful in improving the well-being of pension recipients than was moving from no policy to a means tested plan. The permanent level-effect at the date of the universal plan's implementation seems consistent with Feldstein's (1987) model in which the means tested plan reduces savings incentives. Forward-looking younger people may undo the benefits of a means tested pension by saving less. If Feldstein's story is correct, then we would expect to see a larger impact on mortality throughout the course of the universal plan, as the public pension would augment private savings behavior.

A number of static explanations may be consistent with our empirical results. Specifically, Blundell et al. (1988) have shown that significant costs (psychic or pecuniary) may be associated with undergoing a means test, which leads to less than optimal uptake. Rather than undergo means testing, some seniors may have remained in hazardous forms of employment. Implementation of the universal plan would have provided such seniors with the incentive to leave dangerous employment without loss of income or dignity. Alternatively, as Fishback and Stoian (2007) have argued, rather than

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[25] Note that the serial correlation bias of differences-in-differences models does not arise in the level effects case. This is because the treatment is applied to, at most, one year for any given group. As a result, the probability of receiving the treatment in year *t* is not correlated with the receipt of the treatment in year *t*-1.

providing income to seniors, who would not have otherwise had their basic needs met, perhaps 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. The means tested OAP kept levels of income support the same but changed which level of government financed the pension. Or, as Gratton (1996) argues, public pensions substitute for support that individuals would have received from children. The reductions in mortality that did arise with the means tested pensions could reflect that pension benefits were more generous than local relief payments. [26]

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. In Table 5 we report the death reduction and cost per death avoided, for each of the pension plans, implied by the estimated level effects. The estimated level effect is a 0.12 percent reduction in the mortality rate of recipients for the universal OAS and a 0.07 and 0.029 percent reduction for the means tested OAA and OAP respectively. These translate to reductions in the numbers of senior deaths of roughly 66 per year for the universal OAS, 9 per year for the OAA and 8 per year for the OAP. Although the estimated level effect is lower for the OAP than the OAA, much higher mortality rates result in a similar effect in terms of deaths avoided.

Interpreted literally, our results imply that $2.5 million dollars ($18.7 million in 2005 dollars) were spent per life extended on universal pension coverage, over what would have been spent under means testing in 1953. While fewer deaths were avoided under the means tested plans, costs per-death avoided can only be estimated within a lower and upper bound of coverage, due to lack of information regarding sources of senior income maintenance prior to pension implementation. The lower bound on these estimates, zero dollars per death avoided, corresponds to the case in which all expenditures represent a shift in the source of senior income maintenance but not an increase in total pension expenditures. This is consistent with the original intention of the

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[26] Bryden (1974, 92) suggested 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. It could also reflect that the greater uniformity of pension arrangements relative to local relief that came with the means tested plan may have resulted in larger pension payments in the poorer provinces.

OAP, moving income maintenance from charitable and municipal organizations into the provincial and federal responsibility. The upper bounds, $53 and $46 million for the OAA and OAS plans respectively, correspond to the unlikely case that poor elderly Canadians had no income support through municipal outdoor relief. In this case, one treats the entire expenditure on means tested pensions as the increase in incomes of pensioners. It would be reasonable to entertain that the incremental costs per death avoided of the means tested pensions were positive, but less than that estimated for the universal OAS.

The literature on life-value estimate yields estimates between $1.03 million and $13.2 million (2005 Canadian dollars, see Viscusi, 1994a and Landefeld and Seskin, 1982), well below our estimated expenditures for the universal OAS of $18.7 million.[27] Given this, 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. As shown in Figure 1, the income cap was under-utilized as a policy tool.

Conclusion

We have examined the impact of early government pension plans on the welfare of recipients as measured by mortality rates. We found a significant negative impact from the implementation of all pension plans on mortality rates, but in terms of lives saved, the effect associated with the universal Old Age Security pension was much larger than the means tested Old Age Pension and Old Age Assistance. Specifically, a negative level

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[27] A full analysis of the cost-effectiveness of universal pension benefits is beyond the scope of this paper, but could be conducted using the method proposed by Viscusi (1994a, 1994b). 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. A more precise estimate will incorporate the endogenous decrease in health expenditure resulting from the universal policy. As shown in Viscusi (1994a), if the marginal propensity of seniors to spend on health related goods is large, the universal pension may be superior to the means tested pension, in terms of risk reduction.

effect in the rate of mortality for eligible groups is found to be correlated with the year in which each of the pension plans were introduced. The incremental number of lives extended by the universal pension plan was small and achieved at high cost relative to the alternative of continuing on with the means tested pension after 1951. While means testing was politically problematic for the Federal government after World War II, our results suggest that continuing with means testing but with a higher income ceiling for eligibility may have been a superior plan to the universal OAS introduced in 1952.

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Table 1: Percent of Provincial Recipient Age Populations Receiving Pension Benefits, and Maximum and Average Benefits Paid, Under OAP, OAS and OAA, 1951 and 1956

	OAP (1951)			OAS (1956)		OAA (1956)		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(1)**	**(2)**	**(3)**
PEI	49%	$494	$414	98%	$494	18%	$475	$329
NS	59%	$494	$447	98%	$494	26%	$475	$407
NB	67%	$493	$433	99%	$493	38%	$477	$439
PQ	53%	$486	$449	100%	$486	31%	$477	$454
ON	37%	$488	$445	98%	$488	13%	$467	$442
MN	46%	$486	$460	96%	$486	16%	$476	$474
SK	46%	$485	$448	95%	$485	16%	$467	$455
AB	48%	$485	$440	95%	$485	17%	$476	$445
BC	44%	$493	$439	96%	$493	13%	$472	$472

Source: Population: *Census of Canada* 1951 and 1956; Coverage: *Historical Statistics of Canada* Tables C-287, C-66, C-313.

Notes:

Column 1 reports percent of the target population covered.

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

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

Table 2: Gradient Effect Specifications for Estimating Pension Effects on the Log-First Differenced Mortality Rate

	(1)	(2)	(3)	(4)
OAS (1952)	-0.026 (0.02)	-0.026 (0.005)*	-0.018 (0.002)*	-0.025 (0.003)*
OAA (1952)	-0.016 (0.02)	-0.016 (0.003)*	-0.011 (0.002)*	
OAP (1927)	0.000 (0.02)	0.000 (0.01)	0.002 (0.00)	
Observations	6400	6400	1600	288
Number of age/province groups	144	144	36	144

Standard errors in parentheses: * significant at size 5%. All regressions control for year, age group and province fixed effects. Columns (2), (3) and (4) report standard errors adjusted for clustered observations by age/province groups. (3) and (4) correct for serial correlation following Bertrand et al. (2004). Actual implementation dates for OAP differed by province. See text.

Table 3: Continuous Benefits Specification for Estimating Pension Effects on the Log-First Differenced Mortality Rate

|	(1)	(2)	(3)	(4)
OAS (1952)	-0.053	0.012	-0.053	0.012
	(0.05)	(0.07)	(0.026)*	(0.04)
OAA (1952)	-0.021	-0.012	-0.021	-0.012
	(0.05)	(0.06)	(0.02)	(0.02)
OAP (1927[1])	0.040	0.038	0.04	0.038
	(0.04)	(0.05)	(0.02)	(0.03)
FOAS		-0.096		-0.096
		(0.10)		(0.06)
FOAA		-0.068		-0.068
		(0.07)		(0.032)*
FOAP		-0.041		-0.041
		(0.04)		(0.014)*
Observations	6394	6394	6394	6394
Number of age/province groups	144	144	144	144

Standard errors in parentheses: * significant at size 5%. All regressions control for year, age group and province fixed effects. Columns (2) and (4) report standard errors adjusted for clustered observations by age/province groups. The explanatory variables are the first-differenced pension benefits paid per recipient by province (1952 Toronto dollars), divided by 500. Actual implementation dates for OAP differed by province. See text.

Table 4: Level Effect Specifications for Estimating Pension Effects on the Log-First Differenced Mortality Rate

	(1)	(2)
OAS (1952)	-0.120 (0.042)*	-0.120 (0.026)*
OAA (1952)	-0.070 (0.06)	-0.070 (0.031)*
OAP (1927)	-0.029 (0.04)	-0.029 (0.013)*
Observations	6397	6397
Number of age/province groups	144	144

Standard Errors in Parentheses: * significant at size 5%. All regressions control for year, age group and province fixed effects. Regression (2) reports standard errors adjusted for clustered observations. Actual implementation dates for OAP differed by province. See text.

Table 5: Reduction in Deaths and Cost of Lives Extended by Pension Plan as Implied by the Level Effect

|	Level Effect	Implied Change in Deaths per Thousand	Implied Deaths Avoided	Cost Per-Life (Nominal$)	Cost Per-Life (2005$)
OAS (1952)	-0.12	-0.096	66	$2,490,660	$18,726,767
OAA (1952)	-0.070	-0.020	9	$0–$7,129,679	$0–$53,606,608
OAP (1927)	-0.029	-0.028	8	$0–$3,916,023	$0–$46,070,860

Notes: Change in deaths per thousand is calculated by multiplying the estimated level effect (divided by 100) 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. Cost per life for OAS is the incremental expenditure on OAS, relative to the counterfactual continuation of the OAP in 1953, divided the implied deaths avoided.

Figure 1: Income Thresholds and Maximum Pension Benefits for Means Tested Pension Recipients
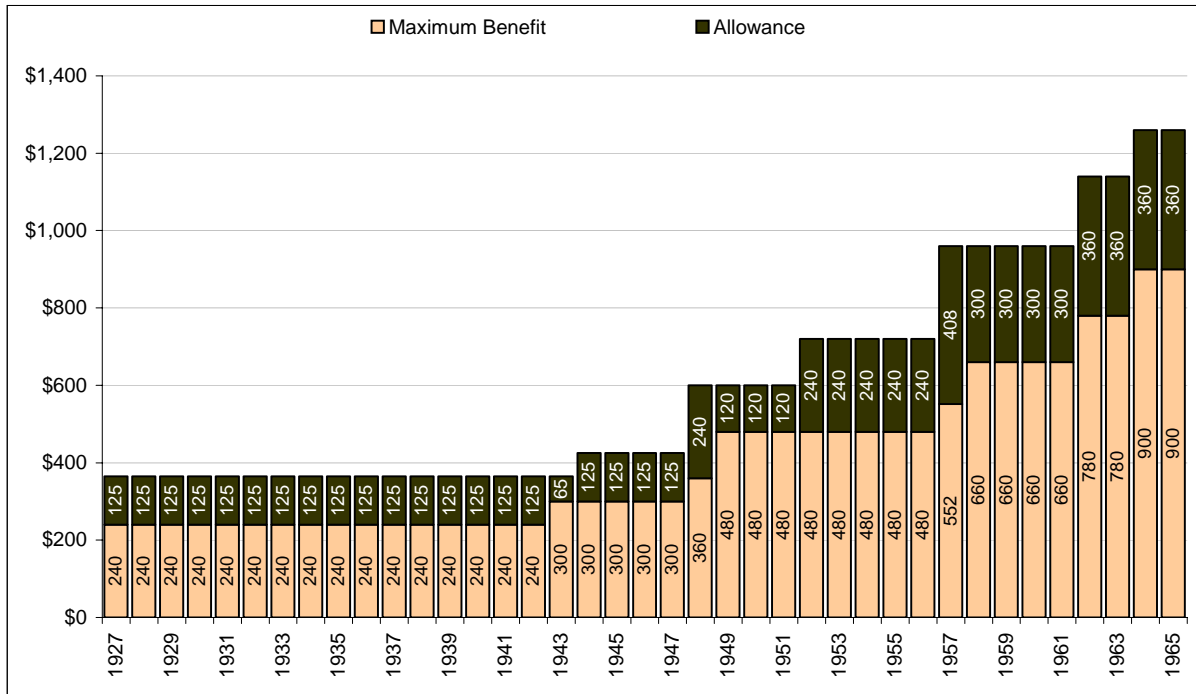

Notes: Source Canada Year Book 1921-1965. Current dollars.

Figure 2: Percentage of Canadians Age 65 and Over Receiving Pension Benefits by Pension Plan
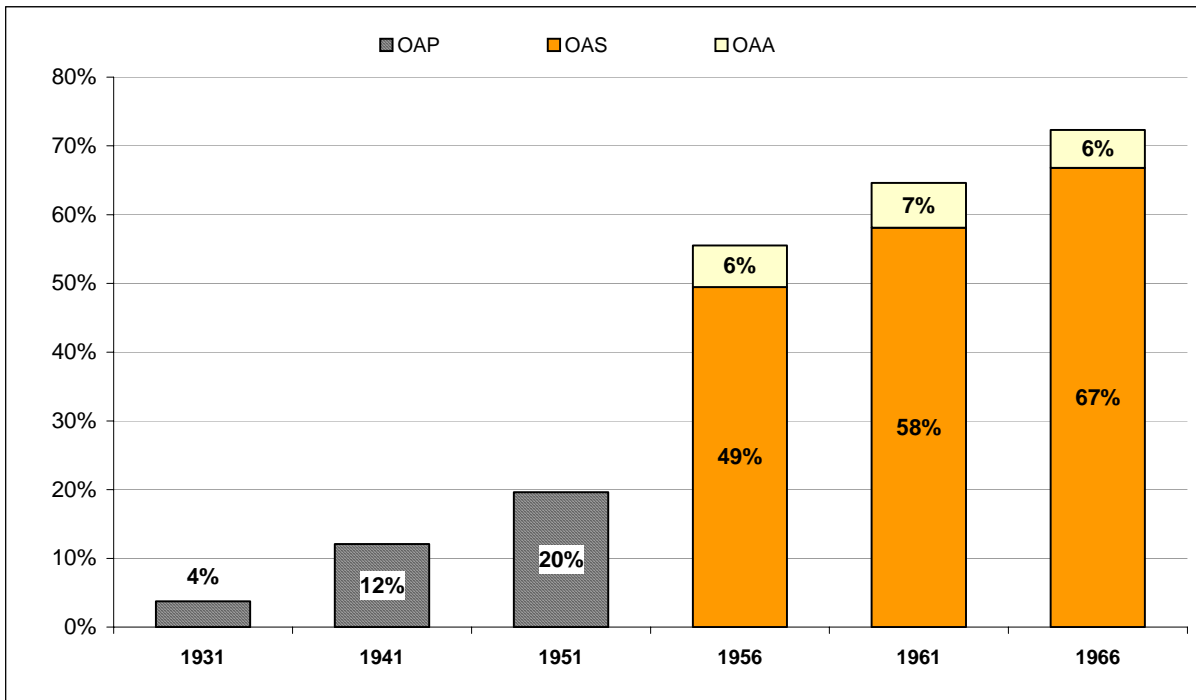
Source: Population: *Census of Canada* 1931–1966*;* Coverage: *Historical Statistics of Canada* Tables C-287, C-66, C-313.

Figure 3: Pension Benefits Paid Per Recipient and Average Personal Income of Canadians, 1927-1970 (Constant 1992 $)
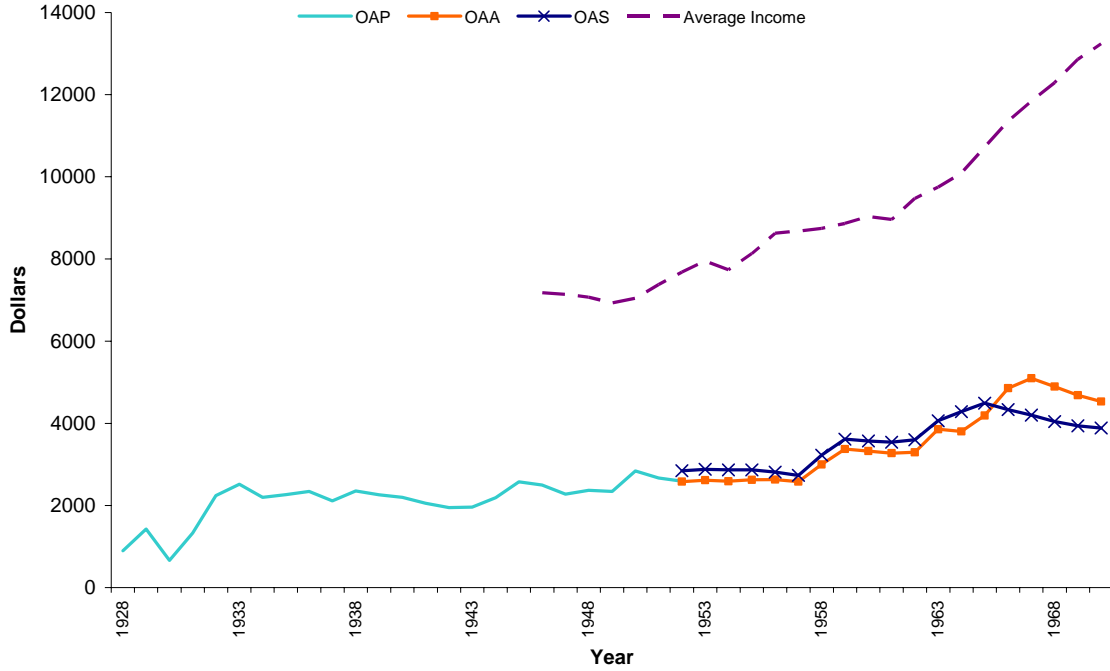
Source: Average Personal Income: *Economic Reference Tables* (1991), Published by Canadian Department of Finance (Table 16). Average Benefit Paid is determined by dividing Total Pension Payments by the number of recipients as reported in the *Historical Statistics of Canada, Second Edition*: OAS:recipients C66-78, payments C79-91. OAP: recipients C287-299, payments C300-312: OAA: recipients C313-325, payments C326-338.
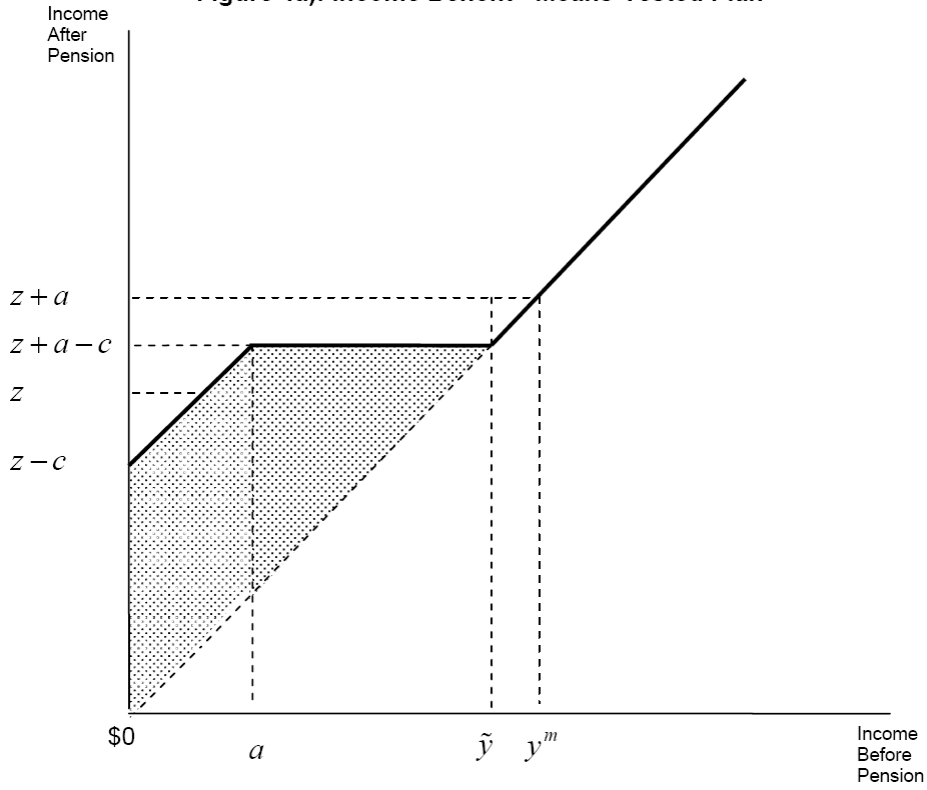
Figure 4a): Income Benefit - Means-Tested Plan

Income
After
Pension

$z+a$

$z+a-c$

z

$z-c$

$0   a   \tilde{y}\ \ y^m$ Income
Before
Pension

Figure 4b): Income Benefit - Universal Plan

Income
After
Pension

$z+a$

$z+a-c$

z

$z-c$

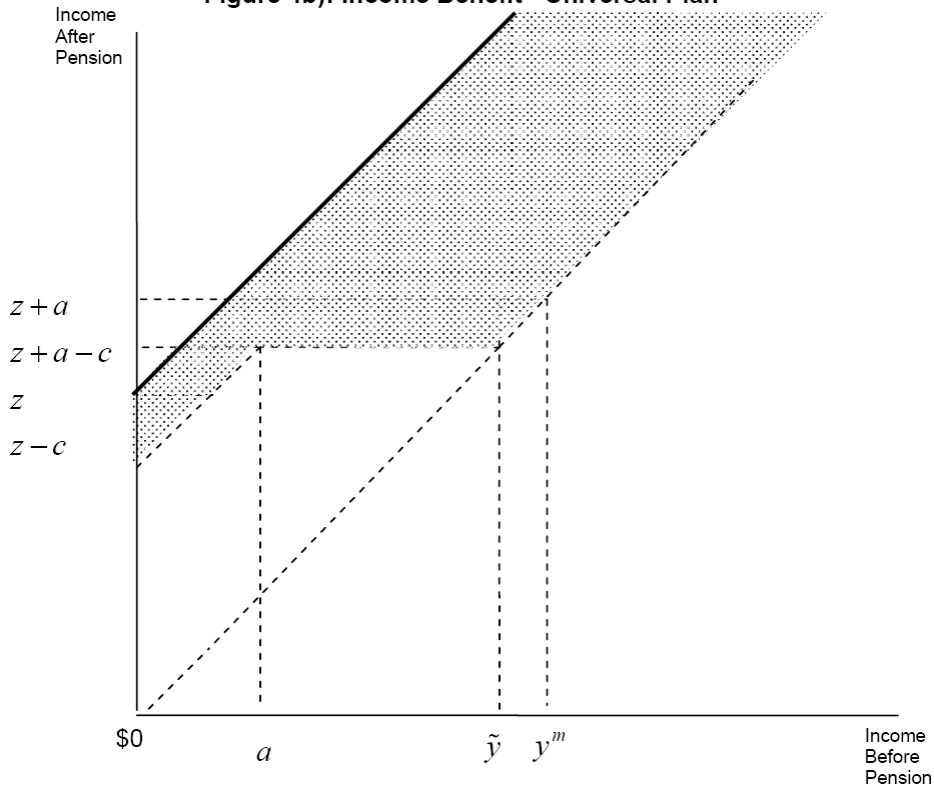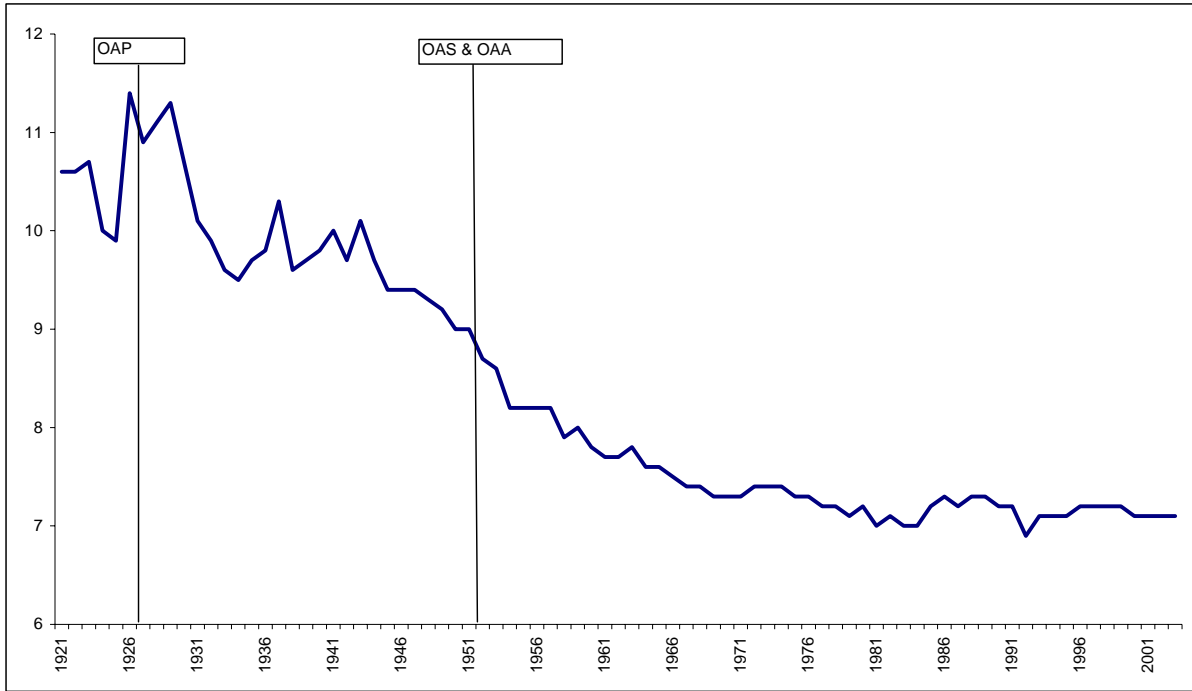$0   a   \tilde{y}\ \ y^m$ Income
Before
Pension

Figure 5: Overall Mortality Rate for Canada, 1921 to 2003 (deaths per 1000)

Source: See data appendix.

Figure 6: Elderly Mortality Rates by Five Year Age Groups, Canada 1921-2003