

# SOCIAL SECURITY: REGRESSIVE OR PROGRESSIVE?\*

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## ABSTRACT

The evidence is growing that a positive correlation exists between income levels and longevity. In short, high-income earners live longer. That also means that high-income earners get larger retirement-income security benefits from social security.

This correlation raises the following questions:

- If social security contributions are a level percentage of earnings and high-income earners live longer and receive larger social security benefits, then is social security regressive?
- If higher income actually *causes* enhanced longevity, then would providing more social security benefits enhance population life expectancy?

This paper analyzes both the Old-Age, Survivors, and Disability Insurance (OASDI) system of the U.S. and the Canada/Quebec Pension Plans (C/QPP) in Canada to determine whether these systems are “a good deal” and whether they are regressive or progressive as defined above.

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## I. INTRODUCTION

That there is a correlation between income and life expectancy is becoming generally accepted; that is, those with high incomes live longer. Studies that provide evidence of this are many and include: Kitagawa and Hauser (1973), Rosen and Taubman (1979), Caldwell and Diamond (1979), Hadley and Osei (1982), Duleep (1986), Rogers (1992), Sorlie et al. (1992), Wilkinson (1992), Feinstein (1993), and Menchik (1993). Research using Canadian data include Wilkins et al. (1990), Wolfson et al. (1990), and Adam (1995).

Recent research has found evidence of a widening gap between the life expectancy of high- and low-income persons (Duleep 1989 and Pappas et al. 1993). The effect of income appears to be stronger than many other variables, such as race and education level, that can have an impact on mortality. Rogers (1992) and Menchik (1993) found that the effect of race on life expectancy was virtually eliminated when family income was accounted for. In addition,

Menchik (1993) found no separate effect of education on life expectancy once income was taken into account.

The fact that income and life expectancy are positively correlated is important in the study of the social progressiveness of social security. If social security systems required contributions that were a flat percentage of earnings and benefits were also a flat percentage of those earnings, then, given that high-income workers live longer, the resulting system would be regressive in that the ratio of lifetime contributions to lifetime benefits would be higher for low-income workers than for high-income workers (or equivalently, the ratio of lifetime benefits to lifetime contributions would be lower for low-income workers).

This paper examines the existing income security systems in Canada (in particular, the Canada/Quebec Pension Plans, or C/QPP) and the U.S. (Old-Age, Survivors, and Disability Insurance, or OASDI—OASI if Disability Insurance is ignored) to determine whether they are regressive as defined above. This is done in Section III, “Is Social Security Regressive?”

What if income has a causal effect on life expectancy (more income causes more life expectancy)? Would the provision of more retirement income from the social security system enhance the life expectancy of our retired population? If so, then perhaps it would be good public policy to expand our social security programs to achieve enhanced population life expectancy. This is explored and analyzed in Section IV, “Would more income *cause* enhanced life expectancy?”

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The paper starts with a short discussion of whether or not social security is a good deal.

The three sections of the paper, while all dealing in some way with the progressivity and regressivity of social security, are really independent papers; that is, the sections of the paper are not interdependent. The paper can be read and used as three distinct and disjoint subsections.

## II. SOCIAL SECURITY: DO YOU GET YOUR MONEY'S WORTH?

With the discussion of more personal responsibility for the provision of retirement-income security in both Canada and the U.S., some commentators suggest that workers could do better by placing their money into private pension plans or other tax-preferred savings vehicles such as Registered Retirement Savings Plans (RRSPs) in Canada or 401(k) plans in the U.S. Sometimes these comparisons are incomplete in many important details.

First and foremost, social security is *not* designed to provide every participant a profit. It is designed to be a compromise between social adequacy (that is, a floor of protection) and individual equity. Providing a floor of protection requires some cross subsidies within the system and is an important and intended part of the system. Those who appear to pay more, however, may also benefit. For example, by providing social security to all workers and by providing larger benefits per dollar of contribution to low-income workers versus high-income workers, the system helps those who appear to pay more by lessening the cost of social welfare and public assistance programs, which are paid for out of general tax revenues to which the wealthy generally pay more.

Second, a fair comparison between social security and a private pension plan must include the value of the ancillary benefits provided by social security. These include survivor benefits, orphans benefits, death benefits, and disability benefits. For example, in the CPP, only 64% of the payments are for retirement income (OSFI 1995, p. 8). This is often overlooked in comparing social security with a private pension scheme. In particular, defined-contribution plans do not have ancillary benefits.

Third, social security benefits are indexed to the cost of living. Most private plan benefits are not. In particular, defined-contribution plans cannot be. Thus, any comparison should be adjusted for the impact of inflation.

Fourth, the rates of return advertised for private savings plans are often gross of administrative and sales expenses. Administrative expenses for social security are low [0.8% of cash flow for OASDI (Chen and Goss 1997, p. 77) and 1.3%, for the CPP (OSFI 1995, p. 8)]. Any fair comparison should use rates of return net of expenses.

Fifth, the non-political risk associated with social security is low to nonexistent. No matter how long one lives and no matter what happens in the private marketplace, workers can expect to receive their social security benefits. The risk associated with social security is that the legislation granting the benefits will be amended. This can happen if voters find reason to support such amendments. For example, the normal retirement age for OASDI will rise from 65 to 67 over the next 25 years, which effectively is a reduction in benefits. Recent amendments to the C/QPP will reduce benefits on average by 9.3%. However, when comparing social security with a private savings or a defined-contribution pension plan, the worker must factor in the risk of market fluctuations and personal risks such as time-to-death before arriving at a fair comparison.

Finally, there may be some tax advantages to social security benefits in that some benefits are received tax free or they are tax advantaged [see also the Earned Income Credit (EITC) in OASDI].

Several difficult questions arise in the analysis of whether social security is a good individual investment. For example, in determining the value of a worker's contributions to social security, should the matching employer contributions, which are a feature of both OASDI and the C/QPP, be included? Myers and Schobel (1992) and Goss (1995) do not include the employer contribution in the cost of social security in their analysis. They contend that the employer contribution cannot be attributed to any particular worker and is there for everyone, just as general tax revenues are pooled for the general benefit. Feldstein (1974) and Aaron (1982), on the other hand, argue that the employer contribution ends up being paid by workers in its entirety either through resultant lower wages or higher prices for the employers' products and should be included. Outside of Myers and Schobel (1992) and Goss (1995), the studies referred to below include the employer contribution in the worker's "cost" of social security.

Also, a variety of mathematical techniques can be used to indicate whether or not social security is a good deal. The following methods have been used by more than one author:

- (1) Determine the rate of return such that the present value of contributions is equal to the present value of benefits (present expected value)
- (2) Determine the ratio of the present value of benefits to the present value of contributions (called the money's worth ratio)
- (3) Determine the inverse of (2), which is called the tax-benefit ratio
- (4) Determine the length of time benefits must be collected to get contributions back (with interest) (called the repayment time)
- (5) Determine the net subsidy equal to the present value of benefits less the present value of contributions; this will show the dollar size of the profit or loss to the individual.

All these techniques require the calculation of the actuarial value of contributions and benefits, which, in turn, requires choosing a rate of interest, except for method (1), and an estimate of the probability of receiving the benefits. This requires some assumptions that can lead to differing results, which can seem illogical at first glance.

For example, at a meeting of the Canadian Institute of Actuaries in November 1991 the QPP actuary (Menard 1991) indicated that for future Canadian workers (born after 1980), the present value of their benefits would be less than the present value of their contributions. At the same time, the CPP actuary (Dussault 1991) was claiming that no future Canadian workers would realize a rate of return less than 5.1% on their contributions. This equates to a net-of-inflation real rate of return of 1.6% since the calculation assumed an annual inflation rate of 3.5% (see also OSFI 1995, p. 101).

In effect, then, one actuary was predicting a net loss to future workers, while the other was projecting continued positive returns. How can this happen? The answer is quite simple. In calculating the present value of contributions and benefits, the QPP actuary was using an assumption of a real rate of return of 2%, which is higher than the rate of return promised in the projections of the CPP actuary (1.6%). Thus, taking all the risks and costs into consideration, if one is happy with an after-inflation rate of return of less than 1.6%, then the CPP is a good deal as argued by the CPP actuary. However, if an individual expects to be able to earn more than 2% plus the rate of inflation, then social security is not a good deal, as demonstrated by the QPP actuary.

Because of the resultant ambiguity in the various methods of analysis, whenever possible, the rest of this section uses the internal rate of return as the key

indicator of whether or not social security is a good deal.

Both *intragenerational* equity and *intergenerational* equity can also be measured. The former analysis attempts to compare the rates of return or ratios of benefits to costs of different subsets of today's participants. Thus, we might be interested in comparing men to women, or low-income workers to high-income workers, for example. In analyzing *intergenerational* equity, we are more interested in determining whether today's workers are doing as well as those of previous generations and future generations. Thus, we are looking for year-of-birth equity.

A large number of papers and analyses have been published providing indications of whether social security is a good deal or not. For the U.S., these include: Chen and Chu (1974), Burkhauser and Warlick (1981), Boskin et al. (1987), Myers and Schobel (1992), Duggan, Gillingham, and Greenlees (1995), Steuerle and Bakija (1994), Leimer (1995), Kollman (1995), Panis and Lillard (1996), and the OASDI Advisory Council (1996). For Canada, the main information available today comes from the C/QPP actuaries in their respective actuarial valuation reports (OSFI 1995, and Quebec 1995) and a recent C. D. Howe Institute report by Robson (1996).

The findings of these various reports have a great deal of similarity. With respect to intergenerational equity, all reports found that earlier cohorts (workers who retired in the early years of the system) realized higher average rates of return. This is because the early retiring cohorts required only a small number of years of contributions to earn full benefits and paid small pay-as-you-go contributions, while today's workers require 40 years of higher (mature plan) contributions for full benefits. Leimer (1995, p. 12) indicates the rates of return for OASI for various birth cohorts shown in Table 1.

Table 1  
Rates of Return (Net of Inflation)  
under OASI  
for Selected Birth Cohorts

Birth Year	Rate of Return
1876	36.5%
1900	11.9
1925	4.8
1950	2.2
1975	1.9
2000	1.7

Source: Leimer 1995, p. 12.

Similar analysis in Canada indicated the effective rates of return (gross of inflation) for the CPP shown in Table 2.

**Table 2**  
Rates of Return under the CPP  
for Selected Birth Cohorts

Birth Year	Rate of Return	
	(Gross of Inflation)	(Net of Inflation)
1911	31.1%	27.6%
1929	16.6	13.1
1948	9.0	5.5
1968	6.4	2.9
1988	5.2	1.7
2012	5.1	1.6

Source: OSFI 1995, p. 101.

As indicated earlier, the projected future rate of inflation in the CPP valuation is 3.5% per annum. Thus, the net rate of return for future birth cohorts is 1.6%, or almost exactly that indicated in the analysis of the OASI system.

Rates of return actually realized by future generations will depend on future birth rates, on future life expectancies, and on any amendments to Social Security.

Very little analysis has been done in Canada on *intragenerational* equity except for some work on the effect of income on mortality, which is reviewed in detail in the next section. However, much more has been published in the U.S. Leimer (1995, p. 17) provided the data shown in Table 3 based on work by Duggan, Gillingham and Greenless (1993). Many of these indications are not intuitively obvious and require explanation.

**Table 3**  
Rates of Return (Net of Inflation)  
under OASI  
for the 1895–1922 Birth Cohorts

Category	Rate of Return
Household type	
Individual	8.6%
Couple	9.8
Gender	
Female	10.9
Male	8.5
Race	
White	9.1
Black	9.6
Other	10.7
All	9.1

Source: Leimer 1995, p. 17.

Couples do better than individuals because of the significant survivor benefits available to the survivor of the worker after the worker's death. This also means that one-earner couples do better than two-earner couples. For the latter, the second wage earner contributes separately to the social security system, but gains only a marginal increase in benefits, namely, the difference between individual benefits earned and the survivor benefits that otherwise would have been paid.

Women do better than men because they collect benefits for their longer life expectancy for the same contributions and they tend to have lower earnings. According to Leimer, blacks and "others" do better than whites but purely because they tend to have lower incomes, and, as is shown in the next section, low-income workers do better than high-income workers in both Canada and the U.S.

Those with the lowest rates of return tend to be single male workers with average or high earnings and two-earner couples with high earnings (Chen and Goss 1997, p. 84).

### III. IS SOCIAL SECURITY REGRESSIVE?

Friedman (1972), Aaron (1977), and Wolfson et al. (1990), among others, have argued that because of the positive correlation between income and life expectancy, our social security systems are regressive. Clearly if social security contributions are a constant percentage of wages across a wide range of earnings and if high-income workers live longer, then the income distribution inherent in social security is perverse, because all participants in social security pay into the system at a level rate, but those with high incomes receive lifetime benefits that are worth relatively more. Thus the question is: Do high-income workers do better than low-income workers?

This matter is explored in this section in some detail, first for Canada and then for the U.S. In this discussion, regressiveness is defined as a system in which low-income workers pay more per dollar of actual benefit than high-income workers or low-income workers realize a lower effective rate of return than high-income workers.

#### A. In Canada

C/QPP records provide a great deal of information on this question. For every Canadian who has ever earned more than the Year's Basic Exemption (YBE, or \$3,500 in 1997), the C/QPP files contain a complete career earnings record for every year in which

earnings exceed the YBE. Also, because a worker's retirement income ceases upon death and because there is a C/QPP death benefit, the exact date of death of all C/QPP participants is available. The C/QPP annual retirement income is (approximately) equal to 25% of career earnings (indexed to the average industrial wage), up to the Year's Maximum Pensionable Earnings (the YMPE, which is close to the average industrial wage and equal to \$35,800 in 1997) over the best 40 years of work. Plan participants also are allowed to omit qualified years of disability and years at home raising children from the 40-year requirement. Using the C/QPP records, we can compare age-at-death with the level of the retirement income being paid to determine whether there is evidence of enhanced longevity with larger social security income.

The findings of one such study are shown in Figures 1 and 2. Mortality is presented, by gender, for retirement-income beneficiaries stratified into four groups: those receiving 0 to 25% of a full benefit, those receiving 25% to 50% of a full benefit, those receiving 50% to 75% of a full benefit, and those receiving 75% to 100% of a full benefit.

Clearly, those with high incomes have lower mortality and thus enhanced life expectancies. That is, they receive benefits for a longer period and thus have benefits worth more than the benefits provided to low-income workers. As explained above, benefits in the C/QPP are simply 25% of career-average earnings regardless of the level of earnings (up to the YMPE). Thus, if contribution rates to the C/QPP were a level percentage of wages, then the C/QPP would be regressive.

However, there are three counterarguments to this statement.

First, the C/QPP pays more than just retirement-income benefits. In fact, only 64% of the dollars paid out of these plans goes to retirement income. The other one-third of cash flow is paid in disability benefits (19%), survivors' benefits (14%), orphans' benefits (1%), and death benefits (1%) (OSFI 1995, p. 8). These benefits dampen to a great extent the regressive nature of the pure retirement-income benefits. This is true for two reasons. Ancillary benefits are not purely wage related. For example, in 1997, a disabled CPP contributor was able to receive a pension that was equal to \$330.49 plus 75% of the contributor's retirement pension (calculated as if the contributor attained age 65 as of the date of disability) to a maximum of \$883.10 monthly. The flat-rate portion of the benefit formula means greater relative benefits to the worker with lower earnings. Also, because both death and disability are negatively correlated with income

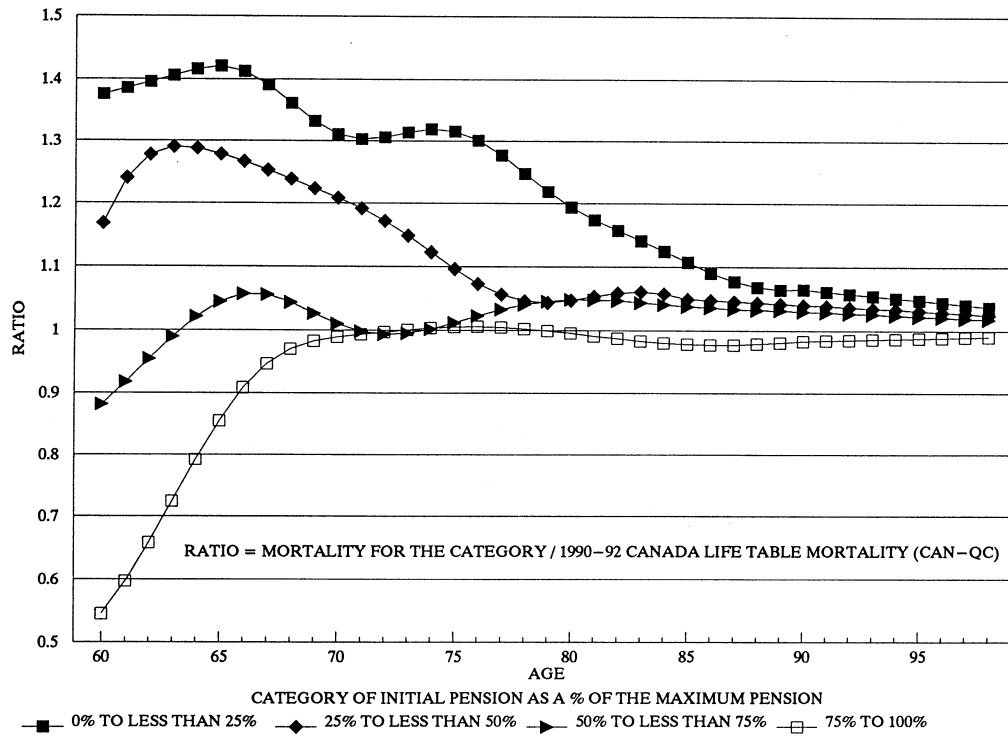
and socioeconomic status (Moore and Rosenberg 1997, p. 135), low-income workers get more ancillary benefits than high-income workers.

Second, although this paper focuses on the C/QPP plans, Canada's retirement income security system also pays benefits from Old Age Security (OAS), the Guaranteed Income Supplement (GIS), and the Spouse's Pension Allowance (SPA). None of these benefits are paid to high-income Canadians. In fact, the benefit schedule is highly progressive, because for every dollar of personal income beyond the OAS, GIS and/or SPA benefits are reduced by 50 cents. Add to that the fact that both OAS and C/QPP benefits are taxable income, while C/QPP contributions are not tax-deductible but receive only a tax credit at the tax rate for low-income earners (17% federal), and the result is a highly progressive system in total. Finally, OAS/GIS/SPA are financed out of general tax revenues, which, to the extent that they are from income taxes, are considered progressive.

Third, even if the impact of OAS and GIS is ignored, a part of the C/QPP funding formula that is often overlooked may mean that the retirement-income portion of the C/QPP on its own has a progressive element. Workers do not contribute on all their pensionable earnings. No worker contributes on the YBE, which in 1997 is \$3,500. Thus, if a worker earns \$3,600 in 1997, contributions are made on only \$100, but benefit credits are assigned to \$3,600 of earnings. Similarly, if a worker earns exactly half the YMPE, or \$17,900 in 1997, contributions are made on \$14,400, while benefit credits accrue on \$17,900. Finally, for the worker who earns the YMPE (\$35,800 in 1997), contributions are made on \$32,300 and benefits accrue on the full \$35,800. (This is also true for anyone earning more than the YMPE.)

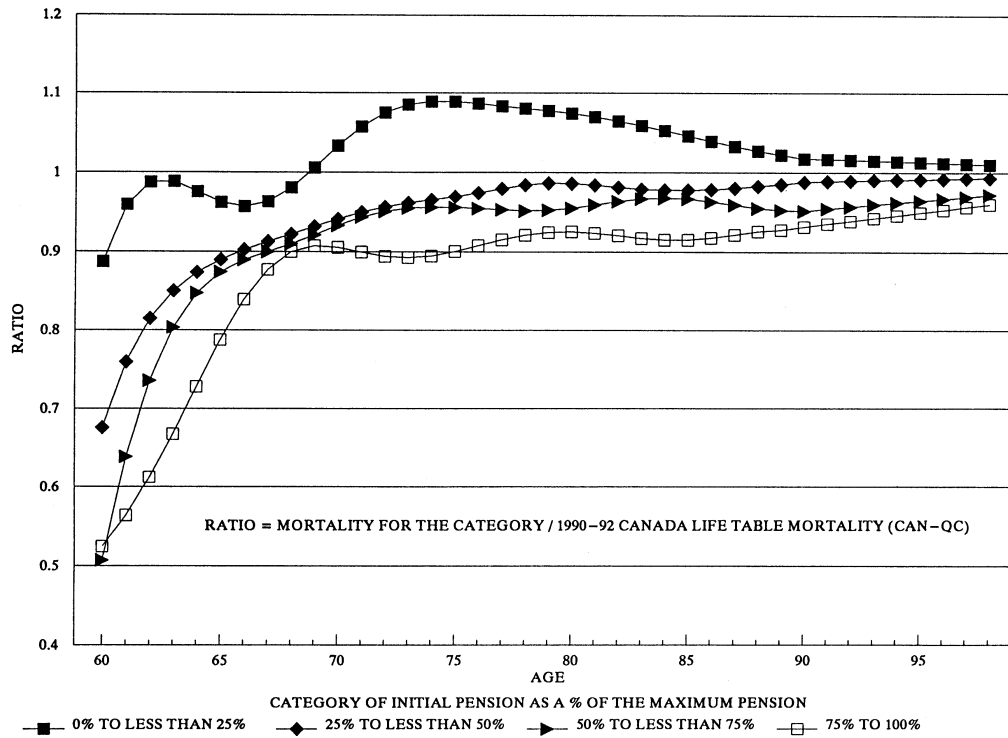
If we continue the CPP mortality analysis displayed in Figures 1 and 2, we find more than a 50% differential in mortality rates, for example, 0.027 for low income versus 0.018 for high income at the younger male ages, decreasing fairly regularly to nothing at the oldest ages (also found by Wolfson et al. 1990). However, a 50% differential in mortality rates does not result in a 50% differential in life expectancy. Life expectancy depends on survival. For example, if the mortality rates at a certain age are 0.018 and 0.027, that is a 50% mortality differential. However, the survival rates at that age are 0.982 and 0.973, respectively, or less than a 1% differential. Based on the CPP analysis, for men, there is a maximum 15% differential in life expectancy at age 60 for the highest incomes (75% to 100% of full benefits) versus the lowest incomes (0 to 25% of full benefits).

**Figure 1**  
 CPP Graduated Male Mortality by Level of Retirement Pension



Source: Personal memo to author from CPP Actuary.

**Figure 2**  
 CPP Graduated Female Mortality by Level of Retirement Pension



Source: Personal memo to author from CPP Actuary.

The differentials of life expectancy by income level are much smaller for women. However, for the period of study, 1988 to 1994, CPP retirement income for women would be less indicative of family income, and women's true standard of living, than CPP retirement income for men. Only when women achieve full lifetime earnings records will statistics like those contained in Figure 2 be more indicative of the true standard of living of the individual woman being studied. However, other studies have found smaller mortality differences by income levels for women than for men (Arber and Ginn 1993).

However, assume that there is a full 15% advantage in the retirement-income benefits paid by the C/QPP for anyone receiving a full benefit versus anyone receiving only a 25% benefit. Is the retirement-income portion of the C/QPP thus regressive?

Given the YBE, the high-income worker contributes on \$32,300 of earnings (indexed to wages), while the low-income worker contributes on \$5,450 (indexed to wages). Ignoring differences in life expectancy for the moment, the 100%-YMPE worker gets a benefit credit four times that of the 25%-YMPE worker, but pays a contribution that is  $32,300/5,450$  (or 5.93) as large. Thus there is a 48% advantage (1.4825) to the 25%-YMPE worker in the benefit/contribution formula. Because this 48% contribution formula advantage is greater than the 15% life expectancy advantage of the 100%-YMPE worker, we can argue that there is nothing regressive in the present C/QPP. That is, the C/QPP system as now structured (and with today's mortality by income class) is not regressive, even if we consider only the retirement-income benefits. Comparisons at other income levels are illustrated in Tables 4 and 5.

Table 4

Comparison of Benefit/Contribution Advantage to Life Expectancy Advantage at Several Income Levels at Age 60  
CPP, 1988-1994

Wage Band	Benefit-to-Contribution Advantage Versus 100% YMPE Earner	1988-1994 Average Age 60 Life Expectancy		Relative Life Expectancy Advantage of 100% YMPE Earner	
		Male	Female	Male	Female
0 to 25%	1.48	17.46	23.66	1.15	1.05
25 to 50%	1.12	18.42	24.37	1.09	1.02
50 to 75%	1.04	19.41	24.54	1.04	1.01
75 to 100%	1.00	20.13	24.80	1.00	1.00

Table 5

Comparison of Benefit/Contribution Advantage to Life Expectancy Advantage at Several Income Levels at Age 65  
CPP, 1988-1994

Wage Band	Benefit-to-Contribution Advantage Versus 100% YMPE Earner	1988-1994 Average Age 65 Life Expectancy		Relative Life Expectancy Advantage of 100% YMPE Earner	
		Male	Female	Male	Female
0 to 25%	1.48	14.12	19.56	1.13	1.04
25 to 50%	1.12	15.00	20.09	1.07	1.01
50 to 75%	1.04	15.65	20.17	1.02	1.01
75 to 100%	1.00	16.01	20.35	1.00	1.00

Tables 4 and 5 show that the CPP remains progressive for all cells except for age 60 male retirees whose earnings averaged between 50% and 75% of the YMPE. For them, the benefit-to-contribution advantage is exactly offset by the superior life expectancy of those at the 100% YMPE retirement benefit. Thus, we conclude that, in total, the CPP is progressive, even if only before-tax retirement income benefits is considered (which, it has been argued, is unfair).

One caveat needs to be stated, however. The C/QPP has recently been amended. One amendment froze the YBE at \$3,500. Thus, as earnings rise but the YBE remains frozen at \$3,500, the benefit-to-contribution advantage to low-income workers derived above will decrease and the C/QPP will become less progressive. Clearly, this subtle formula approach to some social subsidy within the C/QPP has a level of importance not appreciated by the public policy makers. Further monitoring of life expectancy differentials as the YBE decreases in importance seems appropriate.

## B. In the United States

Similar analysis can be done for the OASDI program in the U.S. In fact, the U.S. literature on this topic is far more extensive than the Canadian literature. See, for example, Friedman (1972), Freiden, Leimer and Hoffman (1976), Aaron (1977), Hurd and Shoven (1985), Meyer and Wolff (1987), Steuerle and Bakija (1993), Duggan, Gillingham, and Greenlees (1995), and Goss (1995).

Work was done by the Office of the Actuary in 1989 to determine whether a correlation existed between mortality rates and the OASDI benefit (expressed as the Primary Insurance Amount, or PIA). They analyzed a 1% sample from the Master Beneficiary

Record (MBR). Mortality rates from the 1979–81 U.S. Life Tables (adjusted to an age-last-birthday basis) were used to calculate the expected number of deaths. The actual number of deaths was obtained from the December 1988 MBR.

Table 6 displays the ratios of actual deaths to expected deaths for OAS beneficiaries. The analysis noted that:

Observation of this data reveals a trend toward lower ratios of actual deaths to expected deaths at higher PIA ranges. Mortality rates decrease as PIA levels increase for both male and female Old Age Beneficiaries. Thus the evidence obtained supports the hypothesis that mortality rates and PIA amounts are negatively correlated for Old Age Beneficiaries. (ibid.)

**Table 6**  
OASDI Mortality Ratios  
by Income Level

PIA	Mortality Ratio to 1979–81 U.S. Life Table	
	Men	Women
<\$400	0.90	0.86
\$400–599	0.89	0.79
\$600–799	0.77	0.71
\$800+	0.60	0.65
Average	0.81	0.82

Source: Barrick 1989.

Hence, we can see the same negative correlation between career earnings (on which the PIA is based) and mortality as seen in Canada. Similar to Canada, the mortality rate differentials by income level are about 1.5 to 1 at the extreme (male rates). Taking that differential at all ages and using the 1979–81 U.S. Life Tables as our base, we can show that the highest-income retiree analyzed has a life expectancy that is about 6.4% longer than the lowest-income worker studied. Does that mean that the OASDI system is regressive?

As stated above for the C/QPP, there are a number of counter-balancing features of the OASDI system. First, as in Canada, OASDI also pays disability benefits and survivor benefits, which offset the regressive nature of the retirement-income benefit to a great extent [see Aaron (1977) and Steuerle and Bakija (1993)]. Second, for the high-income earners, part of their OASI benefit postretirement is taxed in a highly progressive tax system. In determining progressivity, after-tax benefits should be compared, not before-tax.

However, far more powerful is the formula used to determine OASDI benefits. Consider a worker attaining age 62 at January 1, 1997 and retiring with 35 years of earnings at the nationwide average wage. The Average Indexed Monthly Earnings (AIME) for this worker would equal \$2,061. The PIA would equal 90% of the first \$455, plus 32% of the next \$2,286 and 15% of the AIME in excess of \$2,741. This would equal \$923.40. The OASDI retirement benefit payable would be 80% of the PIA, or \$738 per month.

For a similar worker who consistently earned exactly one-half of the nationwide average wage for 35 years, the AIME would be \$1,030; the PIA \$593.50; and the retirement benefit \$474.

The ratio of these benefits is not 2:1 (which would be the ratio of their contributions), but only 1.56:1. Thus, there is a 28.2% advantage to the low-income worker (2.00/1.56).

Similar calculations for workers retiring at age 65 in 1997 would result in a PIA of \$936 for the worker at the nationwide average wage and \$599 for the worker at one-half the nationwide average wage (this is also the monthly benefit prior to adjusting for the impact of Medicare premiums).

Interestingly, the benefit ratio is again 1.56, whereas the contribution ratio would be 2:1. Thus the low-income worker has gained a 28.2% advantage.

If a U.S. worker retiring at age 65 earning twice the average industrial wage is compared to a worker earning half the average industrial wage, the ratio of contributions would be 4:1, but the ratio of benefits is only 2.27. This creates a 76% advantage to the low-income worker.

Hence, no matter what wage stratum is considered, the benefit-to-contribution advantage to the low-income worker exceeds the life expectancy advantage to the high-income worker.

More sophisticated and more recent research supports this contention. In a 1995 paper, Duggan et al. used the Social Security Administration's 1988 Continuous Work History Sample (CWHS), which is an earnings history sample for 1% of all Social Security records. It contains more than 2.5 million records with actual earnings histories spanning the period 1951 to 1988. The file also contains month and year of death to allow the calculation of mortality rates. Further, it lists age, sex, and race.

The authors used a sample of 44,252 records from CWHS for persons born in the period 1895 to 1923 covering 205,549 male and 160,009 female person-years between ages 65 and 93 in the period 1960 to 1988.

They found that survivorship was significantly correlated with income. In fact, they determined that much of the difference in life expectancy between blacks and whites could be attributed to income differences, a result consistent with findings by Rogers (1992) and Menchik (1993). Further, much of the year-of-birth effect of improving life expectancy over time could be said to be due to increases in real income over time (Duggan et al. 1995, p. 9). Survivorship by income level is displayed in Figure 3 (male) and Figure 4 (female).

The authors then found the rate of interest such that the present value of expected benefits was equal to the present value of expected contributions. This included spousal survivor benefits. They did the calculation twice. First, they calculated the values assuming equal mortality across all income classes. They then recalculated the values using the actual mortality displayed for each income class (that is, lower mortality for the high-income classes and vice

versa). This is represented in Table 7 in the column headed "Adjusted for Mortality" and in Table 8 by the concept of "Income-Based Mortality." Rates of return are net of inflation. The results are shown in Table 7.

A more recent analysis was done by Goss (1995) using data from a study by Rogot and Johnson (1992). Goss's results are shown in Table 8.

Some explanation of Table 8 is required. Progressivity exists if low-income earners have higher ratios than high-income earners in each category. The rows titled "Standard Mortality" have a common mortality assumption across income levels. However, the rows titled "Income-Based Mortality" use the mortality rates specific to each income stratum in calculating the ratio of benefits to taxes paid in. Again, the system is progressive if low-income earners have higher ratios than high-income earners.

For single workers, both male and female, the lower mortality among the high-income single workers

**Table 7**  
Social Security Real Rates of Return  
by Income Class and Gender

Gender	Income Class	Rate of Return	
		Unadjusted for Mortality	Adjusted for Mortality
Men	Low	6.23%	6.17%
	Medium	5.59	5.58
	High	4.99	5.04
Women	Low	9.24	9.19
	Medium	7.66	7.70
	High	6.02	6.12

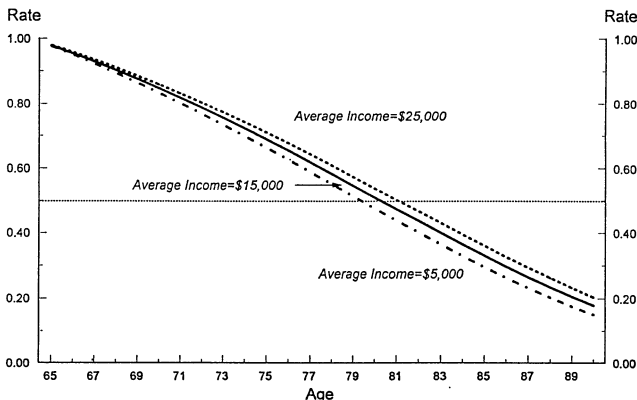
Source: Duggan et al. 1995, p. 14.

**Table 8**  
Ratio of Expected OASDI Benefits  
to Expected Employee Payroll Taxes  
(Present Value)

Class	Low-Income Earner	Average-Income Earner	High-Income Earner
Single Male			
Standard Mortality	2.08	1.55	1.03
Income-Based Mortality	1.84	1.56	1.11
Single Female			
Standard Mortality	2.42	1.80	1.19
Income-Based Mortality	2.35	1.79	1.22
Married, One-Earner Couple			
Standard Mortality	4.27	3.20	2.12
Income-Based Mortality	4.42	3.27	2.10

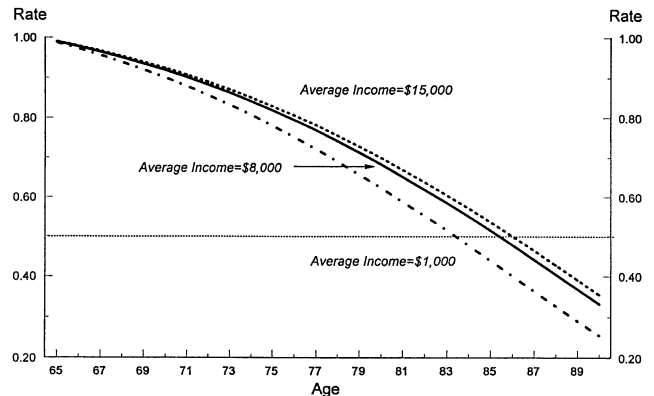
Source: Goss 1995, p. 4.

**Figure 3**  
Survivorship Rates for Males by Income Level



Source: Duggan et al. 1995, p. 20.

**Figure 4**  
Survivorship Rates for Females by Income Level



Source: Duggan et al. 1995, p. 21.

depresses the progressiveness of the OASDI system somewhat, but it still remains. For example, for single males, the ratio of 2.08 for low-income earners to 1.03 for high-income earners is more favorable than the ratio of 1.84 to 1.11, respectively, but the latter ratio still indicates progressivity. Clearly, even when we adjust for lower mortality (and higher life expectancy), low-income single workers achieve a superior benefit/cost ratio than high-income single workers (note that only employee taxes are included).

For the one-earner couple, the money's worth ratios actually show more progressivity when mortality variation by income is introduced. This initially surprising finding results from the fact that lower assumed mortality for the high-income earner produces (1) lower expected lifetime benefits for the spouse and children, which largely offset the increase in expected lifetime benefits to the worker, and (2) an increase in expected lifetime payroll taxes that is somewhat larger than the relative increase in total benefits (Goss 1995, p. 5).

Thus, even if we analyze only the retirement-income benefits of the OASDI system, there is still significant progressivity in the rate-of-return or benefit/contribution formula.

Hence, in total, we can conclude that both the C/QPP and OASDI systems, as now designed, are not regressive as some have suggested.

#### IV. WOULD MORE INCOME CAUSE ENHANCED LIFE EXPECTANCY?

To this point, we have studied the importance of the *correlation* between income and life expectancy and its impact on the progressiveness of the existing social security systems in Canada and the U.S. But what if more income *causes* enhanced life expectancy? This section examines the relationship between the provision of social security and population life expectancy. In particular, it attempts to determine whether the payment of larger social security benefits might lead to enhanced population life expectancy.

Section III shows a strong correlation between income and life expectancy. This relationship transcends gender, cause of disease, and geographic location (Canada 1994, p. 5). Wolfson et al. (1990) showed that this is not just because healthy people normally earn higher incomes (this is discussed in more detail later).

Using Canadian data, Wilkins and Adams (1978) state that men in the top 20% income bracket live an average six years longer than those in the bottom 20%

and can expect 14 more years of life free of activity restrictions. Women in the top 20% can expect three more years of life than those in the bottom 20% and 8 more years free of activity restrictions.

Wolfson et al. (1990) confirmed the positive correlation between income and longevity but also connected this correlation to the concept that providing citizens with more income might improve their life expectancy. This paper is very powerful for two reasons. First, it is based on a longitudinal study of male mortality by income level, which means that it is not subject to the problems associated with a cross-sectional study (that is, a snapshot at a single point in time). Second, the database is large. The data come from the CPP and include 55,101 male deaths from September 1, 1979 to September 30, 1988 and corresponding earnings records from 1966 to 1988.

The authors graphed mortality rates at ages 65 to 70 against pre-retirement income earned at ages 45 to 64 by the same people. The study showed that the mortality differentials by income levels are maintained through the study period, that the curves do not cross, and that the distances between them gradually become wider (see Figure 1, *ibid.* p. 5).

As the authors note:

It is difficult to imagine a clearer and more unequivocal result. These data cover over half a million individuals, and for each individual data from almost a quarter century of their lives have been drawn . . . . It should be emphasized that these are not cross-sectional results. (Wolfson et al. 1990, p. 5)

The authors also argued that an assumption that poor health causes low economic status cannot be used to explain the results. They tested this by looking at mortality rates for a subset of workers whose (real) earnings generally increased year after year prior to retirement. The authors stated that this is clearly not a group in which illness harms employment and advancement. For this subset, the mortality differentials between high-income earners and low-income earners are maintained. So even in a subset of healthy workers, the correlation between income and longevity is maintained.

Wolfson et al. (1990, p. 8) stated that if the entire population studied had experienced the mortality of the top 20% of earners from ages 65 to 75, the impact on life expectancy would have been the same as removing cancer as a cause of death from ages 65 to 75. Does this mean that money spent on trying to fight cancer might be just as effectively used to equalize

the income of the bottom 80% of the population with the top 20%?

The authors then prepared a sophisticated multi-variant analysis including a marital-status variable, an age-at-retirement variable, an earnings variable (and some others including a disability-status variable).

The results showed that married males have significantly higher survival probabilities at all retirement ages. Early retirees (who are not disabled) have higher mortality than late retirees (who are not disabled) and display a steeper gradient with earnings. There is a monotone increasing relationship between survival probability and age at retirement. Higher earnings always entail higher survival probabilities, but the magnitude of this earnings gradient tends to narrow for later retirement ages. The effect is similar but somewhat more variable among not-married men.

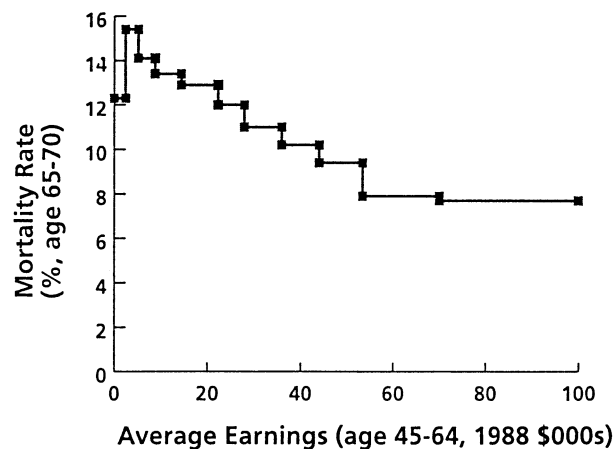
The authors concluded that an extra dollar of income offers a decreasing “protective effect” at higher income levels than at lower incomes (an intuitively plausible result). However, an extra dollar of income in any of the earning years has the same protective effect (that is, whether earned just prior to retirement or from earlier years). This may fit with the notion that permanent rather than transitory earnings is the key variable. In turn, it suggests that there are long-term effects of earnings on mortality, with lagged associations of as much as decades (which would be missed in a normal cross-sectional analysis).

While Wolfson’s work correlated post-retirement mortality with pre-retirement income (earnings between 43 and 64), these are exactly the earnings that determine post-retirement income. CPP retirement benefits are a direct function of pre-retirement earnings (up to the YMPE), as are retirement income benefits from private pension plans. The ability to save and earn investment income post-retirement is also a function of the level of pre-retirement income. Thus, it could be argued that Figure 5 could as easily indicate the relationship between post-retirement income and mortality.

In more recent studies, Adam (1995) and the CPP actuary show the relationship between post-retirement income and mortality (see Figures 1 and 2) and confirm the strong correlation between income (post-retirement) and longevity.

Mustard and Frank (1994) have also indicated that there is a correlation between income disparity in a country and the population life expectancy of that country [see also Wilkins and Adams (1978), Frank (1995), Hertzman (1996), and Canadian Public Health Association (1997)].

Figure 5  
Mortality Rates by Pre-retirement Income  
Ages 65–70



Source: Wolfson et al. 1990, p. 5.

In general there are correlations between a nation’s GNP per capita and health status measures such as life expectancy. But there are rather strong correlations between the degree to which national income is equitably distributed and health status. (Mustard and Frank 1994, p. 13)

Clearly, there is a correlation between income and longevity that cannot be explained away by confounding factors such as race or marital status. Thus, we might ask: “Is the income provision and income distribution present in social security a potential factor in actually creating enhanced life expectancy?”

The balance of this paper attempts to provide at least a partial answer to this important question by comparing and contrasting the provision of social security in Canada and the U.S. with the rate of improvement in mortality rates (and hence life expectancy) in the two countries.

In general, between the early 1940s, when OASI was introduced, and the mid-1970s, the U.S. led Canada in the provision of social security benefits. However, because of the introduction of the GIS and the C/QPP in 1966/67, and universal health care gradually over the same decade, from the 1970s onward, Canada provided a more complete social security safety net than did the U.S. Thus, if the hypothesis is true—that the provision of more social security is a factor in enhancing life expectancy—then the data would have to show a more rapid improvement in mortality rates at advanced ages between the 1940s and the 1990s in Canada than in the U.S. If such improvement

is found, then we must analyze competing factors that might also explain such an improvement. The year 1940 is chosen as the start of the study to coincide with the introduction of benefits under OASI, and the lengthy time used for the study is required because of the lagged association between income and life expectancy (see Wolfson et al. 1990, p. 8).

We are not arguing here that having more social security would be the only cause of improved life expectancy or even the primary cause. Instead, the analysis attempts to investigate whether or not there is any evidence that larger social security benefits might be a factor in enhanced life expectancy. If mortality rates for those close to receiving, or receiving, social security payments in Canada improved more rapidly than those in the U.S. in a period of time when social security was expanded more rapidly in Canada than in the U.S., then we might conclude that enhanced social security benefits are one factor leading to enhanced life expectancy. Obviously, a large number of other factors might also have influenced life expectancy in this period, and they would have to be studied subsequently.

An understanding of the evolution of social security in these two countries is helpful at this stage. For those not familiar with this history, a lengthy summary is presented in Appendix A for Canada and Appendix B for the U.S. A very brief description follows.

Social Security in the U.S. really began with the passage of the Social Security Act in 1935. The original act provided for a compulsory federal program of old-age benefits for workers in industry and commerce, unemployment insurance, and grants to the states for old-age assistance, aid to the blind, and aid to dependent children.

The original act provided only retirement benefits at age 65 for most workers in industry and commerce. Since then, the program has been changed and liberalized several times. In 1939, survivor benefits were added. In the 1950s, coverage was broadened to include most workers in the U.S. In 1956 disability insurance was added, and in 1965 the Medicare program was enacted to provide hospital and medical insurance for the aged. In 1972, legislation was enacted that automatically increased benefits based on the Consumer Price Index and extended the Medicare program to disabled beneficiaries who had been on the roll for at least 24 months.

OASDI provides a replacement ratio of about 41% for a worker with lifetime earnings at the average national wage. Medicare pays only about 45% of all

personal health care costs incurred by the elderly. This low percentage can be explained by the numerous exclusions, deductibles, cost-sharing provisions, and limits on approved charges. Also, Medicare provides very limited coverage for long-term care, and custodial care is excluded altogether.

Starting in 1927, Canada had paid a means-tested pension of \$20 a month to persons over age 70 who were eligible. In 1952, the Old Age Security Act provided OAS benefits of \$40 a month payable at age 70 regardless of need. A means-tested pension (also \$40 a month) would be available to those aged 65 to 69. These benefits remained in force for the next 15 years, although benefits were increased several times.

In January 1966, Canada introduced the contributory, earnings-related C/QPP. Full benefits were not paid until 1976. The C/QPP provides a replacement ratio of 25% of earnings up to the average industrial wage. Also, in 1966, OAS became payable at age 65 (over a five-year transition) without a needs test. Also, the GIS was added to the OAS as a supplement to those who could pass an income test. Finally, in 1975, the Spouse's Allowance was added. It is payable to OAS pensioner's spouse, widow, or widower, aged 60 to 64 on an income-tested level. These households are thus guaranteed a minimum income equivalent to that of a GIS pensioner couple.

Without counting GIS, OAS plus C/QPP retirement income benefits provide an income replacement ratio of about 40% for a worker with lifetime earnings at the average industrial wage (25% from C/QPP and 15% from OAS).

Finally, in the period from 1958 to 1972, the government introduced extensive programs to cover hospital care and physician services. Coverage is universal and is meant to pay for all services that are "medically necessary." It has been estimated that the incomes of elderly Canadians would have to be as much as one-third higher if they had to pay for the various services covered under public health insurance (National Council of Welfare 1984, p. 62).

The provision of income security programs as outlined had a measurable impact on poverty among the elderly in Canada. Prior to the introduction of the OAS program in 1952, Canada's elderly had suffered relative economic hardship. But the position of the elderly steadily improved, especially since 1967, as shown in Table 9 from Myles and Street (1995, p. 343) (and confirmed in Burbidge 1996, p. 29), which compares median family income of different age groups to the overall median family income.

**Table 9**  
Median Family Income as a Percentage  
of Overall Median 1967–1991

Age of Family Head	Year			Change
	1967	1981	1991	
20–26	114	95	78	–32%
26–34	114	113	106	–7
35–44	106	117	115	+8
45–54	117	124	136	+16
55–64	114	110	109	–4
65–74	58	60	71	+22
75+	45	50	61	+35

Source: Myles and Street 1995, p. 343.

Measured poverty<sup>1</sup> among those 65 and over fell from 33.6% in 1980 to 16.9% in 1995 (National Council of Welfare 1997, p. 13). For couples 65 and older, the poverty rate fell from 22.2% in 1980 to 7.5% in 1995 (*ibid.*, p. 17). This compares to a poverty rate of 15.5% for those under age 65 (*ibid.*, p. 1). Many of the rates for seniors in 1995 were record lows or near-record lows (*ibid.*, p. 87). This significant improvement in poverty rates is mainly because of improved pensions (*ibid.*, p. 13).

As Fellegi (1988, p. 4.8) states, the most important contributing factors are:

- The maturing of the C/QPP
- Substantial increases in the GIS being granted and the Spouse's Allowance program being introduced
- A noticeable increase in private pension income because of more people being covered either by such plans or by RRSP
- An increase in "other income," primarily from investments.

Between 1971 and 1985, the proportion of the elderly receiving C/QPP increased from less than 15% to almost 60%; private pension recipients increased from one-fifth to one-third of the elderly; and the proportion receiving investment income grew from 44% to 57% (*ibid.*, p. 4.33). For those elderly who do live in poverty, the National Council of Welfare (1997, p. 51) showed that their income brings unattached men 65+ to within 82.3% of the poverty line, unattached women 65+ to within 83.8%, and elderly couples to 87% of the defined poverty line.

<sup>1</sup>Poverty is defined using Statistics Canada low-income cutoffs. Whereas the average Canadian family spends 36.2% of gross income on food, shelter, and clothing, it is assumed that any family spending 56.2% or more on these necessities is poor.

Also, Canada provides greater tax-financed health care protection than the U.S. In 1991, 36.3 million people, or 16.6% of the non-aged population of the U.S., were not covered by health insurance and did not receive publicly financed health assistance (Rejda 1994, p. 199). As stated earlier, despite "covering" Americans aged 65 and over, Medicare still leaves a heavy financial burden on the aged. Medicare pays only 45% of personal health costs for the elderly (*ibid.*, p. 276).

Based on U.S. Bureau of the Census criteria<sup>2</sup> for poverty (according to Rejda 1994, p. 392, a subsistence standard of living), in 1990, 12.2% of the American population aged 65 and over were living in poverty. The poverty rate for the aged is slightly less than that for the total population (12.2% versus 13.5%). However, the poverty rate is substantially higher for aged minority groups and for aged women who are divorced, separated, widowed, or never married (Rejda 1994, p. 81/82).

In the U.S., the elderly spend 8.3% of their incomes to pay for private health insurance versus the 4.9% of income that the non-elderly pay for private insurance (even though Medicare does not apply to those under 65, with some small exceptions). On top of that, elderly Americans spend another 8.3% of their incomes in out-of-pocket payments for health care (compared to 3.2% for the non-elderly) (Evans et al. 1995, p. 365).

This has no parallel in Canada. In Canada, young families spend 1.5% of their incomes on health care and private health insurance. This rises to 3.2% of incomes for Canadian elderly (versus about 17% in the U.S.) (*ibid.*, p. 366). In both countries, these costs are regressive in that they represent a larger percentage of income for the poor and a smaller percentage of income for the wealthier. Clearly, however, the impact in Canada is much less than that in the U.S.

The hypothesis being tested here is that the provision of additional social security benefits should enhance life expectancy. In that regard, economic security for the elderly in Canada fell short of that in the U.S. in the period between the 1940s (when OASI started paying benefits) and the 1970s. However, after

<sup>2</sup>Bureau of the Census computes several poverty thresholds for different-size families to determine the extent of absolute poverty in the U.S. Individuals and families whose cash incomes are below the poverty thresholds are counted as poor. The poverty threshold in 1992 was \$7362 for an unrelated individual under age 65 and \$14,463 for a four-member family.

the mid-1970s, with the advent of the C/QPP, GIS, and universal health care, economic security for Canadians improved rapidly and surpassed the level of economic security available in the U.S.

This opinion is held by a number of authors (see Banting 1985 and 1997, Wolfson and Murphy 1994, and Myles and Quadagno 1994 and 1997). For example, Myles and Street (1995, p. 339) state:

In the mid '70s, when the Great Pension Debate began, the economic status of the elderly had been in decline for almost three decades and Canadian seniors were decidedly worse off than their counterparts in the United States . . . Unlike the situation in the mid-'70s, by the end of the '80s the Canadian elderly were less likely to be poor or near-poor than the American elderly.

Thus, we conclude that from the 1940s to the mid-1970s (remember the first full C/QPP retirement benefits were paid in 1976 and Canadian publicly funded health care was not fully in effect until 1972), the U.S. led Canada in providing its elderly citizens with economic security. With all the improvements in Canada between 1966 and 1976, however, we also conclude that by the mid-1970s and ever since, Canada has provided its elderly with more economic security than is available in the U.S.

Can it be shown that this more rapid improvement in economic security for the elderly in Canada over this period resulted in more rapid improvement in mortality rates and life expectancy?

This question was answered by analyzing mortality data from the U.S. and Canada over the period 1940 to 1992. Because the U.S. takes its census on years ending in "0" (that is, 1940, 1950, etc.), vital statistics rates for those years were used for the U.S. In Canada, similar data become available in census years which end in "1" (that is, 1941, 1951, etc.). This one-year slippage should not affect the analysis, because we are not looking at absolute rates of mortality. Rather these base data were used to develop annual rates of mortality improvement (that is, given the census-year mortality rates by age and sex, what annual rate of mortality improvement occurred over the decade to the next census?).

Were the hypothesis to be found correct, we would observe more rapid rates of mortality improvement in Canada than in the U.S. over the period of observation, in line with the more rapid rate of improvement in economic security for the elderly over the same period. Data were plotted for males and females aged 55 to 64, 65 to 74, and 75 to 84. This was done both

for the Canadian population versus the entire U.S. population and for the Canadian population versus only the white U.S. population. The results are presented in Figures 6–17. The Percentage Rate of Improvement is the average per annum rate of improvement in mortality that produce the total decade improvements shown in the data.

Only Figures 9, 10, 15, and 16 present mortality improvement patterns consistent with the hypothesis; those correspond to females aged 55–64 (a relatively weak indication) and females aged 65–74 (a somewhat stronger indication). The other eight figures portray results that do not support the hypothesis, in that recent rates of mortality improvement (and hence improvement in life expectancy) have been superior in the U.S. versus Canada (in three of the age groups, remarkably so).

Thus, these data do not support the hypothesis that improved government-sponsored economic security programs result in improved population life expectancy.

## V. CONCLUSION

We have discussed three important questions. First: "Is social security a good deal?" We conclude that for past generations it was, and for future generations it will be, if all the attributes of social security, especially its inherent lack of non-political risk, are included in any comparison with private-sector alternatives.

Second, "is social security regressive?" We found that even if only the income security benefits of social security are analyzed separately, social security is not regressive. However, in the case of the C/QPP, this depends on the existence and size of the YBE, which has been frozen in recent legislated amendments.

Finally, we attempted to find a causal relationship between the provision of social security and population life expectancy. The data indicate that such a causal relationship does not exist. In fact, there is not even a positive correlation between the creation of enhanced social security and longevity in Canada versus the U.S.

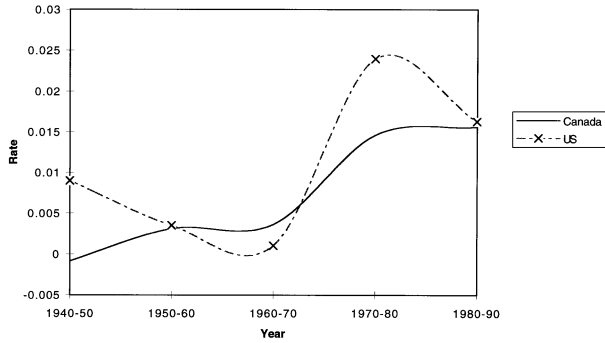
Why might this be the result?

Hertzman (1996, p. 2) provides one possible explanation.

But in recent decades the relationship between health and wealth has become more complex as rich nations have grown richer. By 1970, the world's richest nations had reached unprecedented levels of national wealth and a distinct "flat of the curve" had begun to emerge, such that increasing increments of

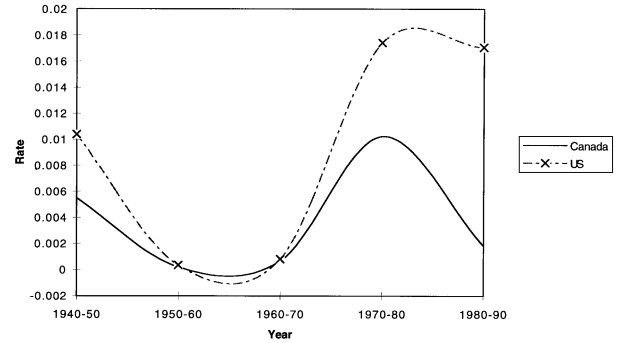
**Figure 6**

Canada Versus U.S. White Population  
Mortality Rates of Improvement for 1940-1990  
for Males Aged 55-64



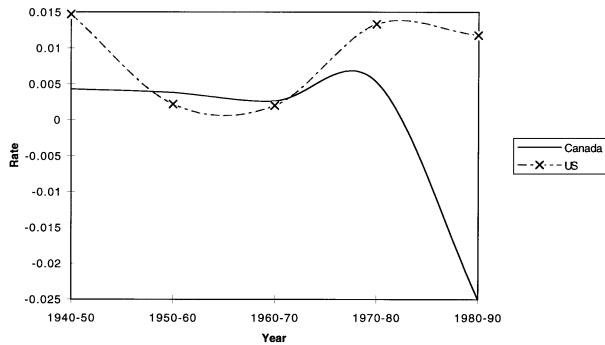
**Figure 7**

Canada Versus U.S. White Population  
Mortality Rates of Improvement for 1940-1990  
for Males Aged 65-74



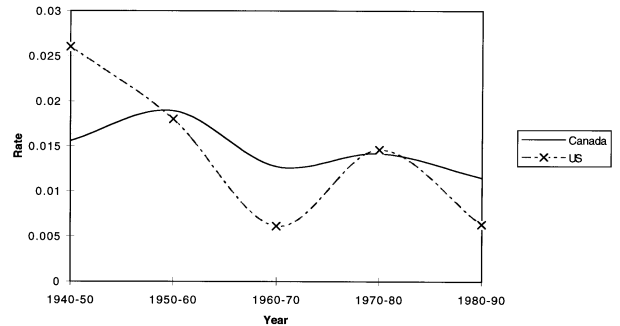
**Figure 8**

Canada Versus U.S. White Population  
Mortality Rates of Improvement for 1940-1990  
for Males Aged 75-84



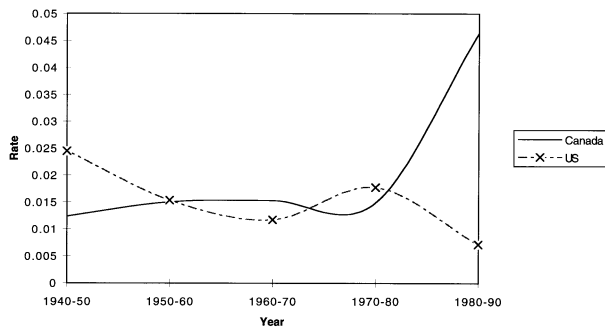
**Figure 9**

Canada Versus U.S. White Population  
Mortality Rates of Improvement for 1940-1990  
for Females Aged 55-64



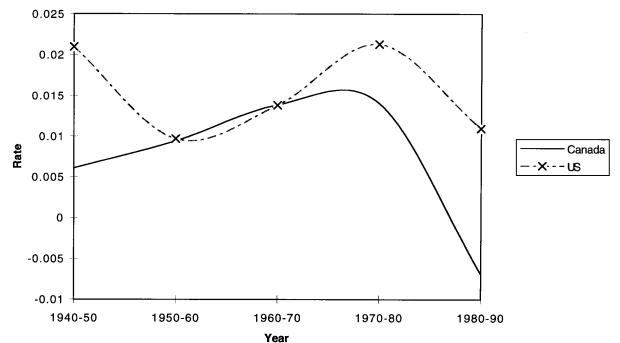
**Figure 10**

Canada Versus U.S. White Population  
Mortality Rates of Improvement for 1940-1990  
for Females Aged 65-74

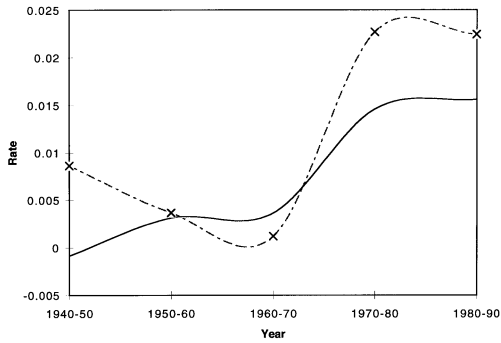


**Figure 11**

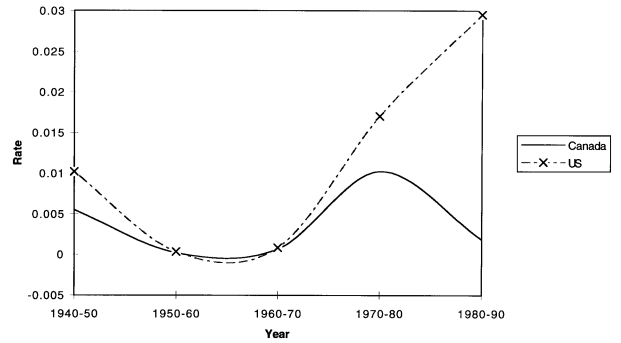
Canada Versus U.S. White Population  
Mortality Rates of Improvement for 1940-1990  
for Females Aged 75-84



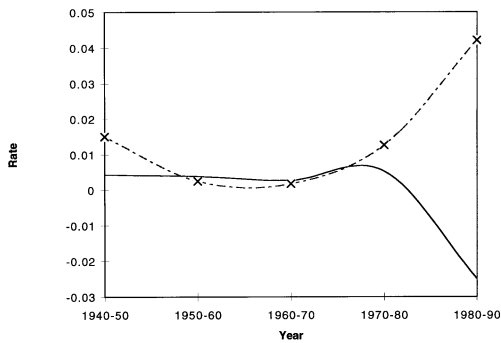
**Figure 12**  
Canada Versus Entire U.S. Population  
Mortality Rates of Improvement for 1940-1990  
for Males Aged 55-64



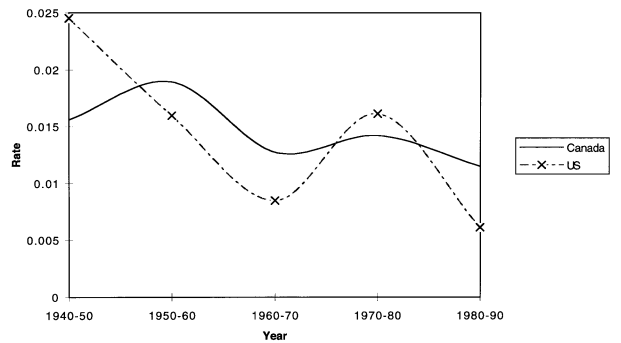
**Figure 13**  
Canada Versus Entire U.S. Population  
Mortality Rates of Improvement for 1940-1990  
for Males Aged 65-74



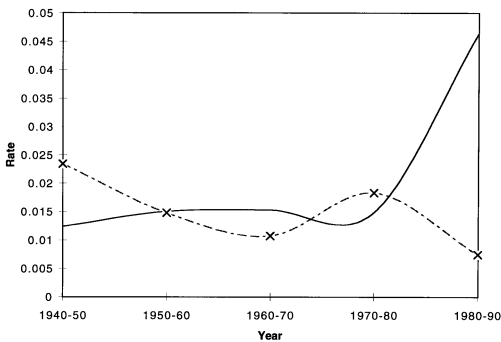
**Figure 14**  
Canada Versus Entire U.S. Population  
Mortality Rates of Improvement for 1940-1990  
for Males Aged 75-84



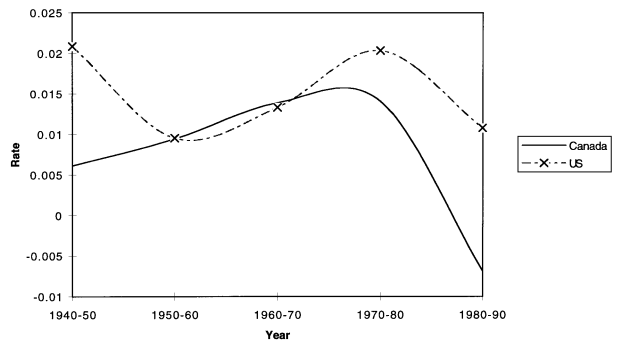
**Figure 15**  
Canada Versus Entire U.S. Population  
Mortality Rates of Improvement for 1940-1990  
for Females Aged 55-64



**Figure 16**  
Canada Versus Entire U.S. Population  
Mortality Rates of Improvement for 1940-1990  
for Females Aged 65-74



**Figure 17**  
Canada Versus Entire U.S. Population  
Mortality Rates of Improvement for 1940-1990  
for Females Aged 75-84



income among those countries with per capita incomes greater than \$10,000 U.S. (in 1991 dollars) were no longer associated with further increases in life expectancy. By 1990 all of the countries of the Organization of Economic Co-operation and Development, the world's wealthiest nations, found themselves on their "flat of the curve" (World Bank 1993: 34). At the same time, the traditional monotonic relationship between health and wealth persisted among the world's poorer countries; a pattern referred to here as the "steep incline," to distinguish it from the "flat of the curve."

Thus, it seems that given the level of income security now provided to our citizens plus their personal income, further enhancement of social security benefits in Canada and the U.S. cannot be expected to cause measurable improvements to population life expectancy.

Clearly, this topic is ripe for further research. Given that just providing more money to the elderly cannot be expected to cause their life expectancy to improve, what is the driving force that could be used to improve population life expectancy for those 65 and over? What would the results of the above analysis be if we analyzed mortality rates for low-income elderly only? What would a "cause-of-death" analysis reveal? Many questions remain unanswered. The bibliography provides a long reading list of historic literature on this topic. It is hoped that this introductory probe will create the impetus for further work.

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## APPENDIX A

### A SUMMARY OF THE EVOLUTION OF SOCIAL SECURITY IN CANADA

The first retirement income security offered in Canada came with the Old Age Pension Act of 1927. Under this act, the federal government offered to pay 50% (later raised to 75%) of the cost of means-tested pensions to be paid and administered by the provinces (in Canada, pensions are constitutionally a provincial power). The maximum pension would be \$20 a month to persons over age 70 who met certain citizenship and residence requirements and who could pass a needs test. Individuals were not required to contribute. By 1951, benefits had risen to \$40 a month (about 17% of the average industrial wage).

The Old Age Pensions Act was replaced by the Old Age Security (OAS) Act in 1952. OAS benefits of \$40 a month would be paid at age 70 regardless of need. A means-tested pension, also \$40 a month, would be available to those aged 65 to 69. This plan remained in force for the next 15 years, although benefits were increased several times. Because of several ad-hoc increases, the replacement ratio represented by the OAS went from 17% of the average industrial wage to a high of 20% in 1965.

With the introduction of the C/QPP in 1966, the age of eligibility for OAS was reduced from 70 to 65 over a five-year period. However, because wages were rising faster than inflation, the ratio of the OAS benefit fell to about 14% of the average industrial wage by 1983. OAS benefits are now indexed to inflation, and, recently, wages have not risen as fast as the cost of living. Thus, for the past five years, the OAS benefit has replaced about 15.7% of the average industrial wage.

The next major reform went into effect on January 1, 1966, when the contributory, earnings-related C/QPP was introduced, although the first full retirement-income benefits were not paid until 1976. The C/QPP pays retirement benefits at age 65 equal to 25% of credited earnings (up to the YMPE, approximately the average industrial wage and equal to \$35,800 in

1997). Equal contributions are paid by the worker and the employer on wages between the YBE (\$3,500 in 1997) and the YMPE.

There are also ancillary benefits similar to OASDI in the U.S. Virtually all the labor force earning more than 10% of the average industrial wage (that is, more than the YBE) participate in the C/QPP. Early and late retirement are allowed between ages 60 and 70, with benefit adjustments of 0.5% per month (6% a year) in either direction. C/QPP benefits are taxable income. Contributions are given a tax "credit," which is equivalent to a tax deduction for a worker earning average wages.

At the same time (1966), several other changes were also put into effect. The universal OAS system qualification age (without need) was lowered from age 70 to age 65 over a five-year period. This meant that OAS was available to any Canadian who satisfied a residency requirement. OAS was (and is) taxable income.

Effective January 1, 1967, the GIS was added to OAS as a temporary measure over the ten-year transitional period of C/QPP implementation, providing income-tested benefits for those with no or low C/QPP benefits. However, this temporary add-on is still with us and has remained an essential element of the government income security system. At the same time, several provinces also introduced supplements (for example, Ontario GAINS) for their residents. These were all needs or income tested (based on joint spousal income), and the benefits are non-taxable. The GIS supplement is reduced \$1 for every \$2 of monthly income the recipient has beyond the OAS. About 55% of OAS recipients receive at least a partial GIS.

When the GIS was introduced, it provided, in combination with the OAS pension, an income guarantee to single pensioners equal to about 25% of the average wage. A pensioner couple was guaranteed an income equal to about half the average wage.

In 1975, the SPA was added: It is payable to OAS pensioners' spouses, of either sex, aged 60–64 on an income-tested level. These households are thus guaranteed a minimum income equivalent to that of a GIS pensioner couple.

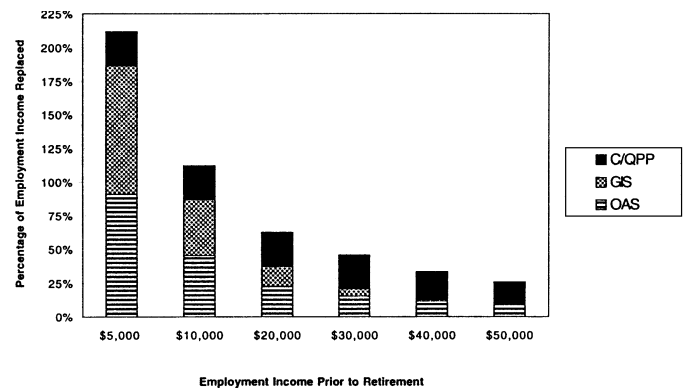
Since 1972, all these systems have had benefits fully indexed to the cost-of-living (except for two years in the mid-1980s during a period of wage and price controls). While the C/QPP have earmarked contributions, the other systems are paid for out of general tax revenues.

More recently, the government has decreased the value of some of these benefits, especially, for example,

the OAS benefit by introducing a clawback of benefits from wealthy Canadians (those whose incomes beyond OAS were in excess of \$50,000 a year, that limit only being partially indexed to the cost-of-living). Although these cuts are important, they do not affect the thesis of the analysis of this part of the paper since the effect is progressive and should not have a serious impact on the sense of security of the Canadian population.

For a worker earning the average industrial wage throughout his or her career, the government-funded retirement-income security schemes will provide a replacement ratio of approximately 40% (25% from C/QPP, close to 15% from OAS, and small amounts from other programs). Workers at lower wages realize a higher replacement ratio and workers with higher wages realize a lower replacement ratio as shown in Figure A-1.

Figure A-1  
Income Replacement Provided  
by Government Programs  
One-Earner Couple



The period between 1957 and 1972 was also important because it saw the introduction of a system of universal health care in Canada.

Because health care is also constitutionally a provincial matter, the first legislation to provide government-sponsored health care was at the provincial level (Saskatchewan, 1946, and British Columbia, 1949).

In 1957, the federal government introduced the Hospital Insurance and Diagnostic Services Act whereby the federal government would pay approximately 50% of the cost of provincial health care plans that qualified under defined criteria. By 1961, all provinces and territories had joined the national

program, which focused on pre-payment of hospital in-patient care and diagnostic services. This was followed by the Medical Care Act (1966–67), which added universal coverage of physician services from 1968. All provinces and territories joined the medical care arrangements by 1972.

In the early 1980s, the federal government became concerned that certain of the original basic standards, such as universal access, were being eroded. In particular, they objected to some provinces allowing hospitals to charge user fees and doctors to extra-bill. Their answer was the Canada Health Act, 1984, which imposed financial penalties on provinces that did not allow reasonable access to health services without financial or other barriers. By late 1980, all provinces had passed legislation eliminating extra-billing and user fees.

Elderly Canadians benefit from the Canadian health care delivery system. It has been estimated that incomes of elderly Canadians would have to be as much as one-third higher if they had to pay for the various services covered under public health insurance (National Council of Welfare 1984, p. 62).

## APPENDIX B

### A SUMMARY OF THE EVOLUTION OF SOCIAL SECURITY IN THE UNITED STATES

In 1935, what is now the OASDI system was legislated into existence. Initially, OASDI covered only some workers for monthly benefits after retirement and after age 65 (the status of “retired” was based on an earnings test). At first, federal, state, and local civil servants were not covered because they had superior plans of their own. Workers with extremely low incomes (for example, migrant farm workers and domestics) were (and are) not covered. However, over the years, OASDI has come to cover the vast majority of workers in the U.S.

After the 1935 act, a series of modifications (mainly expansionary) were made to OASDI. The following is a list of highlights, but should not be construed as a complete list of all amendments.

- 1939 Act.* Added benefits for family members and survivors (females and children).
- 1950 Act.* Broadened “survivors” to include equal coverage and benefits for males.
- 1952 Act.* Added a disability freeze so that retirements were not negatively affected

because of periods of qualified disability (similar to a waiver-of-premium benefit in a private insurance plan).

- 1956 Act.* Reduced the eligibility age for retirement benefits for women from 65 to 62 with an actuarial reduction in benefits (no benefit reduction for widows). The act also added disability benefits for workers aged 50 to 64 and children of retired and disabled workers aged 18 and over if disabled before 18 (increased to 22 in 1972). OASDI is generally second-payor to workers’ compensation. The act also changed the benefit calculation formula so that retirement benefits were ultimately to be based on the best 35 years of coverage.
- 1960 Act.* Dropped the age 50 requirement for disability benefits (see 1956 act). Thus, OASDI now provides insurance for qualified disabled contributors regardless of age.
- 1961 Act.* Allowed men to retire at age 62 but with a greater reduction in benefits than for women because of computational differences (full equality was achieved in 1972).
- 1965 Act.* Reduced the minimum age for the widows’ benefit from 62 to 60, but with an actuarial reduction in the benefit. For widows who remarry after age 60 (widowers, after age 62 until the 1972 act), benefits were not terminated. The definition of disability was liberalized from “permanent and total” to “expected to last at least 12 months prior to death.”
- 1967 Act.* Provided widows’ and dependent widows’ benefits beginning at age 50 if the beneficiary is disabled (with a large early-retirement reduction factor).
- 1972 Act.* Increased widows’ and dependent widowers’ benefit, with the same age requirements by sex. It introduced delayed retirement credits (1% per year of delay up to age 72 raised to 3% per year in 1977).
- 1977 Act.* Indexed the earnings record used to compute the PIA to national wages. Since such indexation, a worker consistently earning the national average wage realizes about a 42% replacement ratio from OASDI retirement benefits at the normal retirement age. From age 62 on, the PIA is indexed to the CPI.
- 1981 Act.* Legislated some small decreases to balance the short-term cash flow to the OASDI trust funds.

- 1983 Act.** Eliminated all remaining gender differences as were some other anomalies. Remarriage is no longer a cause of termination of widow(er)s' benefits for surviving divorced spouses and disabled widow(er)s, as was the case previously for widow(er)s aged 60 or over. The delayed retirement credit will rise to 8% per annum by 2009 and will take effect at the normal retirement age and stop at age 70. This is considered a full actuarial adjustment. The normal retirement age will rise to age 66 for those born in 1943 and to age 67 for those born in 1960 (in 2029 for widow(er)s). Also, 50% of OASDI benefits become taxable income for about 8% of today's (wealthiest) beneficiaries. The taxation formula is not indexed, so more recipients will pay tax over time.
- 1993 Act.** A second tier allowing for 85% of the benefit to become taxable income was introduced.

**Table B-1**

Replacement Ratios for Workers Retiring at Normal Retirement Age

Act	Earnings Level		
	Low	Average	Maximum
1935 (Minimum Coverage)	30.0%	20.0%	10.0%
(Maximum Coverage)	73.0	58.0	34.0
1939 (Minimum Coverage)	41.2	28.8	16.5
(Maximum Coverage)	57.2	40.0	22.9
1950	44.7	30.0	26.7
1952	45.2	30.3	28.2
1954	47.6	34.0	31.0
1958	46.7	34.2	31.8
1965	44.2	33.5	30.5
1967	46.9	36.3	33.5
1969	51.7	40.3	38.6
1971	53.5	43.0	39.4
1972	62.7	51.2	42.7
1975	70.2	55.9	42.6
1977 and on	55.5	41.1	27.4

Source: Myers 1993, p. 363.

The Social Security Act of 1935 authorized federal grants to states to pay part of the costs of aid in the form of cash to aged persons, blind people, and needy children. In 1950, a fourth program was added for the permanently and totally disabled. However, in 1974, the character of the three programs for adults was considerably changed when they were brought under the SSI program. SSI can be viewed as a guaranteed annual income for certain categories of the population. SSI is paid based on the individual's means, being reduced generally for other income. It is a federal program.

Since 1974, SSI payments amounts are automatically adjusted for inflation. The basic SSI monthly payment (in 1993, \$434 single and \$652 couple) represented about 74% of the poverty standard for a single recipient and 88% for a couple. When "other income" and food stamps are also considered, these proportions rise to 85% single and 100% couple (Myers 1993, p. 801). SSI payments are reduced one-third if the recipient is living in the household of another person and not paying room and board.

A state may supplement the federal SSI. The state is permitted to require a residence period for these supplementary payments. In 1992, 44% of those receiving SSI (federal) received state supplements (Rejda 1994, p. 437). The receipt of food stamps has no effect on the amount of the SSI payment. At the end of 1990, a total of 4.8 million persons were receiving federal SSI payments (1.5 million aged, 3.3 million disabled, and 84,000 blind). About 70% of the aged recipients were also receiving OASDI benefits.

With respect to medical care, despite many early attempts to introduce universal medical care to the U.S., the first substantive government legislation took effect in 1965. The 1965 amendments to the Social Security Act established a basic compulsory hospital insurance plan for the aged (HI) and a related voluntary supplementary medical insurance plan (SMI). These are often referred to as Medicare Part A and Part B, respectively.

HI, or Medicare Part A, covers people aged 65 and over if eligible for OASDI or RR (Railroad Retirement) retirement benefits, disabled beneficiaries of OASDI under 65 if entitled to OASDI disability benefits for at least 24 months, and qualified persons who need maintenance dialysis or a kidney transplant. Persons not insured for HI can voluntarily enroll and pay a monthly premium.

HI benefits include inpatient hospital care, skilled nursing facility care, home health care, and hospice care. There are deductibles, coinsurance, and limits to these benefits (both in terms of duration (days) and dollars). Custodial care is not covered.

SMI, or Medicare Part B, is a voluntary program that pays for physician services and other services and supplies not covered by HI. Most people join at age 65 or disability. You are automatically enrolled if you are entitled to HI benefits, but you can refuse coverage. SMI benefits include doctors' services, outpatient hospital services, home health visits, and other medical and health services. SMI pays 80% of the approved charges for covered medical services after the patient

pays a \$100 calendar-year deductible (there are several exceptions to this general rule).

There are several exclusions to Medicare coverage: most chiropractic services, custodial care, dentures and routine dental care, eyeglasses and routine eye examinations, the first three pints of a blood transfusion, hearing aids, most immunizations and vaccinations, prescription drugs and medicines taken at home, private-duty nursing, private room, and routine physical checkups.

HI is financed largely by a payroll tax plus a relatively small amount of general revenues. SMI is financed by monthly premiums (which cover 25% of the cost) paid by covered individuals and by general tax revenues.

Medicare pays about 45% of the health care costs of those 65 and over (Rejda 1994, p. 276).

Medicaid was also enacted in 1965. It is a joint federal-state program that provides medical assistance to low-income persons who are aged, blind, disabled, or members of families with dependent children including custodial nursing home care. Benefits vary from state to state, although there are federal minimum guidelines.

Medicaid applicants must meet a needs test to receive benefits similar to other public assistance programs (for example, Aid to Families with Dependent Children and Supplemental Security Income). According to Rejda (1994, p. 430), qualifying is not easy.

Medicaid is financed by general revenues, jointly by the federal and state government (federal grants are higher for poorer states).

## DISCUSSIONS

### JOHN A. BEEKMAN\*

The author is to be congratulated for writing an excellent paper, with comprehensive analyses of several very important social questions. He has provided readers with a thorough study of the topics and complete analyses, tables, figures, references, and appendixes.

As I studied his paper, I found myself paraphrasing his questions by substituting "active life expectancy" for "life expectancy." The concept of active life expectancy was developed by Katz et al. (1983). This

discussant and William B. Frye (1991) have developed projections of such expectancies. It is easy to infer the conclusions from such modifications. But have any studies been made of such changed questions? The third paragraph of Section IV has a reference by Wilkins and Adams (1978) that seems very appropriate.

The author concludes his excellent paper with a paragraph calling for further research in this area. It seems that a further study of active life expectancy would come under that purview.

In summary, this paper is a substantial contribution to our understanding of the OASDI system (U.S.) and the C/QPP (Canada), and the author deserves our thanks for his excellent work.

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### BERNARD DUSSAULT\*

My discussion of Dr. Brown's paper follows its three-section structure. Although as stated in the paper these three sections are independent, I deem it important to draw the reader's attention to the first two sections' heavy reliance on internal rates of return (IRR) calculations. This satisfies me that the author is thereby giving the IRR notion the proper attention it deserves, in that it appears to be a very powerful, unique, relevant, scientific, and objective tool for measuring several critical financial aspects of social security such as those covered in the first two sections of the paper.

Social Security: Do You Get Your Money's Worth?

Notwithstanding the above-mentioned proper attention given by the author to the IRR approach, he

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seems to somewhat contradict himself in this connection on page 3. Indeed, he discusses, with some lack of thoroughness, the respective merits of the IRR and the money's worth ratio (MWR) approaches as appropriate tools for addressing the money's worth issue. He first suggests that either method is appropriate and that one should be selected in favor of the other on the basis of whether an individual is "happy" or not that a given social security system is a good deal. But then he recognizes the ambiguity in the various methods of analysis and adopts the IRR as a key indicator of whether or not social security is a good deal. I support very much his conclusion that the IRR is a key indicator, but not his happiness-based rationale.

Three weaknesses of the MWR are as follows: The first is the ambiguity it creates by involving two assumptions:

- The implicit assumed rate (whether known or not) of increase in employment earnings (corresponding to the assumed IRR for an earnings-related plan financed on a pure pay-as-you-go basis) used in projecting both arrays of contributions and expenditures
- The current market rate used for discounting both arrays of contributions and expenditures.

The second weakness is the arbitrary implicit interpretation that the market rate of interest corresponds to the money's worth rate of interest.

The third weakness is the incorrect (and therefore misleading) frequent interpretation by many of its users that the MWR corresponds to the dollar amount of benefits the contributor is expected to get for each dollar of contributions put in the plan. Such a benefit-dollars to contribution-dollars ratio is obtained uniquely by dividing the *undiscounted* value of the sum of projected benefits by the *undiscounted* value of the sum of projected contributions. Such ratio is shown for some birth cohorts of contributors on page 101 of the fifteenth CPP actuarial report. When a layman (and even an expert) makes an investment, he looks first (if not exclusively) at the expected annual effective rate of return, for example, 10%. Obviously, the investor also has to be concerned with the income taxes on investment earnings and by the eroding effect of inflation on investment earnings. The MWR does not provide any support to either of these two concerns because it merely indicates whether the expected return (before taxes but not necessarily before price increases) on a contemplated investment (for example, a government bond, a stock, contributions to a social security program) is better or worse than that of another specific investment (whatever it may be).

Therefore, the best way to assess various investments is to compare their respective IRR (before and after the effect of taxes and price increases) rather than using the MWR, an indicator blending somewhat arbitrarily the respective IRRs of two investment transactions. Considering all the above, Dr. Brown accordingly made the right choice by selecting, notwithstanding his reasons, the IRR as the proper indicator for addressing the money's worth issue underlying social insurance programs. The money's worth question should then be examined in respect of the following two basic perspectives.

Is the IRR Net of Inflation and Taxes Positive?

In general, once an IRR net of inflation and taxes is negative, investors do not get their money's worth. IRRs net of inflation are shown for some cohorts of contributors in the sixteenth actuarial report on the CPP. The income taxes applying to CPP pension income are not discussed in the CPP report. However, J. Bruce MacDonald produced in July 1995 an Actuarial Monograph on the CPP that devotes a full chapter to this matter. With a marginal tax rate of 50%, investors would be fully assured of obtaining a positive IRR net of inflation and taxes provided the effective IRR is on average at least twice the average weighted inflation rate. This means that with an average inflation rate of 3%, investors would be fully assured of a positive IRR net of inflation and taxes provided the effective IRR is at least 6%. With an IRR below 6%, the IRR could still be positive for individuals with a marginal tax rate below 50%.

At What Level Does a (Positive) IRR Net of Taxes and Inflation Become a Money's Worth Deal?

The answer to this question would normally depend heavily (as so well exhibited by the author) on the degree of risk individuals are prepared to accept in investing money. For someone not ready to accept any risk at all, a nil IRR could be acceptable. For someone ready to absorb an optimal/reasonable degree of risk, a money's worth IRR could be arbitrarily expected to be at least 15%. For someone willing to absorb any degree of risk, the IRR ranges from a combination of a total loss of capital to an unlimited high positive IRR value. In any case, therefore, the money's worth question is subjective to a certain extent.

With a social security plan, the IRR for a given cohort is an average for all members of the cohort. This

*per se* makes it obviously impossible to give to the “Do you get your money’s worth” question a single yes or no answer that would suit each and all members of the cohort. In this connection, we could hold the view that the 1.8% projected ultimate real IRR projected for the CPP, as shown on page 14 of the sixteenth actuarial report, is hardly a bad return for the large proportion of the more than 10 millions of CPP contributors not having the investment expertise to achieve by themselves such safe return from age 18 to death. However, this is a group-average answer that cannot apply to all members of the group.

With Bill C-2, the CPP fund/benefit ratio is projected to increase eventually from 2 to at least 4. Such fuller funding is projected to increase the ultimate CPP real IRR by about 0.3% (from 1.5% to 1.8%) for two reasons:

- Assumed interest rates are higher than assumed increases in employment earnings
- The investment policy is changed from exclusive long-term government bonds to a diversified portfolio that is expected to exhibit an improved rate of return.

This illustrates that the CPP IRR could be further increased by an even greater extent of fuller funding. But, as indicated by Dr. Brown, this option brings in many other still not fully addressed questions (for example, publicly or privately managed plan?).

Although it is the measure of choice, the IRR concept so easily leads to misinterpretations and fallacies that I deem it important to clarify the following point, which does not appear that obvious from the paper. The rate of return under an earnings-related social insurance program, whether fully, partly, or not at all funded, depends exclusively on the return on investments (if fully funded) and/or the increase in total employment earnings (if pay-as-you-go). Factors like cost-of-living indexation and longevity have no bearing on return because they correspond to plan provisions that affect the pricing of the plan but not its IRR.

### Is Social Security Regressive?

Dr. Brown’s analysis of whether social security is regressive is very interesting and elaborate. I fully agree with his approach, his reasoning, and his conclusion that the CPP is not regressive. He provides proper and relevant thoughts about the new CPP provision, whereby the YBE is frozen at its current value of \$3,500 after 1997, which could eventually reverse the present CPP progressive nature. In that connection, Table 1 provides measurements, using the CPP

actuarial valuation model on the basis of the CPP sixteenth actuarial report (page 14), of the variation of the CPP IRR by level of employment earnings. Those measurements are for hypothetical constant (for example, 50% of the YMPE) earnings throughout the contributory period. Such a model escapes the effect of the CPP dropout provisions, but it was selected because of its simplicity for properly assessing the effect of earnings level on the aggregate IRR of the cohort. As for the sixteenth report, calculations were made for total employees’ and employer’s contributions (versus employees only). However, they rely not only on a new algorithm accounting for the effect of earnings level on mortality, but also on some mortality experience update, which explains the slight difference between the aggregate values in Table 1 and those shown on page 14 of the sixteenth report.

Table 1

Constant Earnings as a Percentage of the YMPE	Effective IRR (Employees and Employers) for the Cohort Born in	
	1988	2012
33- <sup>1</sup> / <sub>3</sub> %	5.86	5.52
50%	5.62	5.40
66- <sup>2</sup> / <sub>3</sub> %	5.51	5.36
100%	5.42	5.31
Aggregate	5.48*	5.41*

\*Comparing to 5.44% and 5.38%, respectively, in the sixteenth actuarial report to the CPP, which does not explicitly account for the effect of the level of earnings on mortality.

The results for the cohort of contributors born in 1988 support Dr. Brown’s conclusion, that is, the CPP is currently not regressive, in that the IRR increases inversely with the level of employment earnings. As an insight into the eventual ultimate effect of the frozen YBE, the table also shows similar IRR values (for the same constant earnings levels) for the cohort of contributors projected to be born in 2012. This cohort will start contributing to the CPP only in 2030, at which time the relative impact of the YBE (\$3,500) would have practically disappeared, because the YMPE is projected to then amount to about \$150,000. The YBE would then represent only 2% to 3% of the YMPE. That stands for the first year (2030) of the contributory period of that cohort born in 2010. For the last year, that is, 2076, when all members of the cohort reach age 64, the YBE would then represent only 0.3% of the YMPE, projected at about \$1,140,000.

These results indicate that the now-frozen YBE does not materially affect the current progressive

status of the CPP, because the IRR for the cohort starting to contribute in 2030 still decreases, though more moderately, with the level of pre-retirement employment earnings. Interestingly enough, also, the results implicitly indicate, as normally expected, that average earnings tend to decrease as a percentage of the YMPE with the effect over time of the frozen YBE. Indeed, the average IRR for the 1988 cohort lies between those for constant earnings at  $66\frac{2}{3}\%$  and 100% of the YMPE, while that for the 2012 cohort lies between those for constant earnings at 50% and  $66\frac{2}{3}\%$  of the YMPE.

Whether IRRs should be measured regardless of employers' contributions appears to be a matter of personal choice. Obviously, for self-employed persons, the employers' contributions have to be included. For CPP actuarial purposes (as in Table 1), employers' contributions are taken into account. For interested readers, Table 2 indicates how the above values are affected if the employers' contributions are disregarded in computing IRRs.

Table 2

Constant Earnings as a Percentage of the YMPE	Effective IRR (Employees Only) for the Cohort Born in	
	1988	2012
$33\frac{1}{3}\%$	8.27	7.79
50%	7.92	7.60
$66\frac{2}{3}\%$	7.77	7.52
100%	7.62	7.44
Aggregate	7.83	7.69

### Would More Income Cause Enhanced Life Expectancy?

Mortality levels nowadays are well-known to vary inversely with the level of income (for which employment earnings are a good proxy). This theory has so far been supported by numerous scientific studies, one of which was conducted recently (yet to be published) by the CPP statutory Actuarial Valuation Unit on the CPP retirement pension beneficiaries over the 13-year period 1983 to 1995. Such earnings-related mortality discrepancies gradually vanish through the end of the life span.

Regardless of the source of income—whether business, salary, investments, or social security—more income should therefore entail declines in mortality rates for the cohort of people subject to such financial gains. Although the implementation of social security programs could have played a role in the mortality declines experienced in the 20th century, Dr. Brown's conclusion that social security has not yet proven to

enhance life expectancy in old age makes some sense for the following three reasons:

- The tax-progressive nature of the CPP produces in a sense transfers of earnings within each cohort of contributors from high-income earners to low-income earners. If the CPP could thereby enhance the life expectancy of low-income earners, it should logically at the same time reduce the longevity of high-income earners. The aggregate longevity of the cohort could thus remain essentially unaffected.
- The 13-year study of CPP retirement beneficiaries' mortality shows a clear relationship between the level of *pre*-retirement earnings and *post*-retirement mortality. *Post*-retirement earnings should also normally affect *post*-retirement mortality. The reason that the CPP has not materially enhanced the longevity of current cohorts of people over age 65 might well be that the additional earnings they get through CPP, which previous cohorts did not get, still leave them in an earnings-level category not differing widely from that of previous cohorts. For example, beneficiaries of a CPP retirement pension corresponding to less than 25% of a maximum pension receive relatively larger earnings than their predecessors, but these earnings still remain at low absolute levels.
- According to a proposition that I presented October 30, 1997 in Washington, D.C., at the one-day seminar on the effect of mortality improvements on social security long-term financial projections, productivity (excess, if any, of annual increase in employment earnings over inflation) acts as a catalyst and is a driving factor, without which mortality declines cannot take place.

In support of the above-mentioned theory, productivity has averaged about 1.5% a year in Canada over the last 75 years, while aggregate mortality for all ages and both genders combined has declined by about 1% a year on average during the 20th century. While productivity was practically nil over the last 15 to 20 years, the above-mentioned CPP mortality study for ages over 60 reveals sharp drops in mortality declines (especially for females) over the 13-year study (1983–1995) period and even longevity deterioration (that is, mortality increases) at some ages over 80 for both males and females.

Consistent with that theory, CPP actuarial valuations assume, for the 21st century, an annual productivity rate of 1% and an aggregate annual rate of decline in mortality of about 0.45%. Indeed, like the 20th century's actual set (1.5% annual productivity and 1% annual mortality decline) of economic-demographic assumptions, the 21st century's set (1% and

0.45%, respectively) tends to have a neutral effect on long CPP projections.

To conclude, I suggest that without sustained productivity, a social insurance program such as the CPP should not be expected to play an active role in enhancing longevity.

## KENNETH G. MANTON\* AND KENNETH C. LAND†

Dr. Brown's paper addresses three major questions: (1) Is social security a "good" deal? (2) Is Social Security regressive? and (3) Does more income "cause" enhanced life expectancy? This is an important paper; it is based on a careful and thoughtful analysis and review of much relevant research literature.

Succinctly, Dr. Brown suggests that social security is a good deal if we take into account its near certainty of payment. That is, it is one option with relatively negligible risks. For risk-averse persons, the stability of the program is worth a significantly lower return. In addition, the author, by examining all components of the social security system, and the effects of taxes, suggests that the program is highly progressive—though, in some cases, due to not-well-understood aspects of the temporal structure.

We focus on the third question (Does more income reduce mortality?) because it produces the most anomalous results; that is, though social security-type income has increased more rapidly, in recent years, in Canada than the U.S., there is little evidence, based on the evidence presented in this paper, that this produced significant life expectancy advantages in Canada. There are several reasons why life expectancy advantages may not have been noted in Canada over the period (1940–1990) examined.

First, prior studies (for example, Manton and Vaupel 1995) also have shown that in recent years, the U.S. has had significant life expectancy advantages above age 80 over all other major developed countries (including Japan and France). What is not reviewed in the current paper is the differences in the health care systems in different countries, especially in the

specific sectors of the health care system that focus on providing services to the elderly population. In Japan, for instance, specialized geriatric health care is rare; for example, elderly stroke victims often do not receive physical therapy and remain for extended stays (6+ months) in acute care hospitals (Okamoto 1992, Ikegami and Campbell 1995).

A number of other developed countries have strict limits on the amount of GDP spent on health services (for example, Denmark is capped at 6% of GDP). It is arguable that any specific capped amount is arbitrary and ends up limiting access to care to some demographic groups, for example, the very elderly population. Thus, the potential advantages of higher income at later ages in Canada may not have become manifest in higher Canadian life expectancies because of restrictions on the new types of health care technology that could be accessed through that system.

Dr. Brown alludes to this problem by quoting Hertzman to the effect that the returns of improved health to income reach a plateau in many countries at about \$10,000 annual per capita income. We suggest that this roughly reflects a "threshold" in the per-capita income needed to purchase effective health care; that is, the average benefit gained by each dollar of income above \$10,000 per capita declines. This is, however, a function of the level of medical technology available that could increase both the per-dollar rate of health improvement and the total amount of improved health that can be purchased; for example, each dollar may purchase more, but more dollars of income (pay, \$15,000) could allow the purchase of innovative care.

In addition, it is important to be aware of a number of sociobehavioral factors that could restrict improvements in health at late ages in different countries. For example, from 1954 to 1968 (and earlier in Britain), there were increases (about 0.2% per year) in U.S. male mortality—largely because of increased cardiovascular disease risks due to changes in occupational activities and in food consumption [that is, increased levels of fat and animal protein consumption, changes in food hygiene (Kaplan and Keil 1993)]. These all represent potential within-country trends that could serve to "hide" increases in life expectancy due to rising income in specific countries. The U.S. male situation illustrated a period over which two consequences of higher income on health ran in opposite directions.

Another issue that is unclear in Dr. Brown's discussion is the relative activity of recent biomedical research in the two countries (U.S. and Canada) as well as the rate of growth of new biotechnology industries.

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There are clear differences in the drug regulatory process in Canada and the U.S.—with different drugs often approved in the two countries. This could again influence the types of health care facilities and care available to elderly populations, with there being a possible advantage in the U.S.

A relatively unresearched question is how minority and native groups with low income fare with respect to health care access. In the U.S., differentials in access to health care between high- and low-income groups can be relatively low because many of the high-quality teaching hospitals are located in the low-income sections of major U.S. metropolitan areas. This improved “geographic” access may blunt some of the differences in health care access due to income differentials in the U.S. In Canada, in contrast, there may be strong provincial differences (for example, Quebec versus Ontario) and effects of geographic remoteness.

Also, education may be a more persistent and stable measure of socioeconomic status than income— income is especially difficult to define in elderly populations where it may be strongly confounded with “wealth” and assets. Studies of education’s relation to life expectancy generally have found that a larger number of years of school completed has a much larger effect on female (that is, 4 to 7 years) than male (about 2 years) life expectancy (Land, Guralnik, and Blazer 1994, Manton et al. 1997, Kitagawa and Hauser 1973). These results are consistent with the weak finding of a Canadian advantage for some females in Dr. Brown’s analyses.

Also consistent with some of the temporal trends in the findings are that the potential effects of Medicare and Medicaid’s introduction in 1965 (legislation in 1965, programs started in 1967) became manifest in the early 1970s and dominated income differentials—even though U.S. Medicare participants may pay more out-of-pocket for supplementary medical services. Not presented, but of potential importance for this analysis, were the changes in death rates for persons aged 85+. This is the population group in which mortality has declined most rapidly and for whom mortality rates start relatively high. This group is also important because it has the highest rate of institutionalization, especially for females, and U.S. institutionalization rates have been declining rapidly.

Finally, one feature not represented in the plots was an effort to control for an explicit lagged impact of income change on mortality reductions. We do not know how long it may take for increased incomes to reduce mortality by (a) improving risk factor levels,

(b) slowing or curing specific chronic diseases, and (c) reducing chronic disability. For some diseases (for example, cancer) the lag can be 30+ years, for others much less.

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#### ROBERT J. MYERS\*

Dr. Brown has once again enriched the actuarial literature on social insurance programs in Canada and the U.S. As he well puts it, he has presented essentially three independent papers. All deal with several aspects of the C/QPP and the U.S. program (OASDI) for their progressivity and regressivity.

The first “paper” considers whether people get their money’s worth from what they “pay.” Such measurement can be done in several different ways, but if these are properly done, they all lead to the same conclusions. Key to this question, as Dr. Brown clearly brings out, is that the two programs considered as a whole are *not* intended to satisfy individual-equity conditions (that is, be an investment). Rather, they are intended to be income-replacement programs—a combination of social adequacy and individual equity.

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Proper analysis of course takes into account all elements involved, such as the presence of ancillary benefits and of investment and sales expenses. An element that is much more difficult to deal with is who “pays.” The employee contribution is easy to deal with, but the employer contribution is less clear. In the aggregate, the latter is certainly part of employee remuneration, but should it be considered individually assignable? The same question arises in employer-sponsored benefit plans; for example, in a plan providing maternity benefits for employees only, should it be considered that the average employer cost expressed as a percentage of payroll is really paid by each employee (in which case, male employees do not come anywhere near getting their money’s worth)? Also, if general revenues are involved in the financing of the program (or a proposed substitute plan), how can it be recognized that high-income persons actually, although very indirectly, are paying more of these costs than low-income persons?

In balance, I believe that money’s-worth analyses are, at best, interesting. They, however, are not really controlling as to the consideration of whether a social insurance program is well designed and functioning properly. The same thing—although to a much greater extent—is the case insofar as school taxes (on real estate) are concerned; people with the same family composition pay greatly different amounts of taxes and yet receive exactly the same “benefits” (let alone the differences between people who do not have children and those who do).

The second “paper” deals with the title of the basic paper—the matter of whether C/QPP and OASDI are regressive. In my opinion, this is the most important of the three “papers,” because there is much public misperception of this matter. For example, a paper by Holtz\* argues that, solely because the mortality of African-American is significantly higher than that of whites, the former are unfairly discriminated against by OASDI and therefore it should be drastically altered (for example, by having different full-benefit retirement ages by race) or eliminated.

As Dr. Brown so well points out, when measuring regressivity and progressivity, all elements combined should be considered, not merely one (such as relative mortality). Among such other elements are (1) all other benefits besides retirement benefits, (2)

weighted benefit formulas (favoring low-income earners), and (3) effective net contribution rates relative to the earnings from which benefits are determined. I strongly agree with him that, when all elements are properly accounted for, both C/QPP and OASDI are clearly progressive when analyzed by race or income level.

A subsidiary important feature of Dr. Brown’s paper is the reference to several studies that conclude that the higher mortality of African-Americans relative to whites is not due to race but rather to income levels. Over time, this mortality differential may vanish as the long-term effects of efforts to achieve racial equality in educational and employment opportunities take hold. Certainly analysis of the various U.S. decennial life tables of this century shows a significant narrowing of the differential mortality between African-Americans and whites as the years went by.

The third “paper” deals with the intriguing question of whether more income through social insurance programs might lead to increased life expectancy. He attacks the problem by comparing the adequacy over time of Canadian economic-security protection (cash and health benefits) with that of the U.S.

Dr. Brown states that, from 1940 to the mid-1970s, the U.S. led Canada relatively in the provision of economic security, but that thereafter this situation was reversed (largely due to more health care protection, with the cash benefits protection being at about the same level). I agree, in general, with his conclusion, but I believe that the health care differential is not as large as he infers from the figure in his statement that “Medicare pays only about 45% of all personal health care costs incurred by the elderly.” This widely quoted figure is, at best, misleading. In my view, it incorrectly considers in the denominator the sizable costs of custodial nursing home care, which is largely for room and meals (which cost everybody has, in one form or another) and is not covered by Medicare. Actually, the costs for such care are largely met by Medicaid (a public assistance federal-state program), which is used for such purpose by a high proportion of middle- and low-income persons and even by many high-income persons (through well-planned legal procedures of transferring their assets to their children). I believe that the correct figure for the proportion of health care costs met by Medicare is about 70% (and much of the remainder is paid by private insurance and Medicaid).

Dr. Brown then goes on to examine whether the increasing relative adequacy of economic-security measures in Canada since the mid-1970s, compared

\*HOLTZ, GEOFFREY T. 1996. “Social Security Discrimination Against African-Americans: An Equal Protection Argument,” *Hastings Law Journal* 48 (November): 105–27.

with the U.S. situation, was associated with more rapid rates of mortality improvement in Canada. After extensive analysis of the official decennial life tables of both countries, he found that indeed this was not clearly the case. In only 4 out of 12 comparisons of mortality rates of improvement for 6 age-sex groups in Canada and the U.S. (both total persons and whites only) did the hypothesis hold true; in the other 8 instances, the reverse was the case.

From this analysis, we can conclude that increased government-sponsored economic security programs will not necessarily result in increased life expectancy of the population. In my view, however, it would seem that, up to a point (which perhaps both Canada and the U.S. have already reached), the level of government-provided economic security, plus people's personal income, is positively correlated with life-expectancy increases.

#### KRZYSZTOF OSTASZEWSKI\*

The key ideas of Dr. Brown's paper are tied into his proposition that higher income causes enhanced longevity. This proposition can be supported only through statistical correlation, as Dr. Brown has done, and then possibly upheld by an evaluation of the underlying causation, which the work of Dr. Brown lacks.

As we all learn in elementary statistics classes, correlation is not causation. Let us assume we analyze two random variables,  $X$  and  $Y$ , and our analysis proves their high correlation. Why can't we necessarily conclude that  $X$  causes  $Y$ ? This high correlation can be achieved through the following alternatives to the statement " $X$  causes  $Y$ ":

- (1)  $Y$  may be causing  $X$ .
- (2)  $X$  and  $Y$  may be caused by a factor  $Z$  external to both of them.
- (3)  $Y$  may in fact be caused by a combination of factors, and we may have inadvertently mixed  $X$  with another factor causing  $Y$ .

Most analysis of variance and related statistical methods is devoted to the issue of distinguishing among factors contributing to observed variables. Statistics almost never stops at establishing correlation.

How can longevity and income be related? Let us analyze the three possibilities suggested above.

- (1) Can enhanced longevity be causing higher income? This is entirely possible. Enhanced longevity can indeed mean better health throughout life, better attention to that health, and better understanding of the processes governing health, and all those enhance ability to earn income.
- (2) Can enhanced longevity be caused by an external factor that also causes higher income? Obviously so. We can immediately point towards better education as the first such factor, and overall rationality of a person being the underlying philosophical background providing both longer life and higher income. If you can think for yourself, you are more likely to earn and more likely to live longer.
- (3) But this observation is indeed the key. Dr. Brown has conveniently ignored the entire field of public choice theory of modern economics to arrive at a predetermined conclusion. Dr. Brown makes no distinction between ways of arriving at a higher income. Higher income is better, regardless of source. Given the gravity of the issue, the analysis would naturally control for a form of income. Do poor people receiving welfare have the same longevity as the working poor?

Even though this issue already exists in the classical work of Adam Smith, modern public choice theory has created a concrete framework of analysis of crucial differences between free market societies and command economies with respect to the issue of source of income. Public choice theory points out that the political process is used by political agents to achieve economic rents without earning them in the marketplace. At the time of Adam Smith, such rents were received by the aristocracy; today they flow to those better skilled at political games. Employing government coercion in order to produce income for oneself is the key to rent-seeking activity.

Social security systems, and social insurance in general, have been powerful forces in inducing citizens of previously free societies to learn rent-seeking behavior. The key question, which indeed is central here, is: Is enhanced longevity correlated with successful political rent-seeking or with earned income?

One can obtain the first approximation to the answer to this question by comparing two statistics in countries worldwide: portion of GDP consumed by the government-provided income versus life expectancy. This is, of course, an imperfect first approximation, because low government expenditures can coexist with vast corruption (indeed resulting in high government expenditures) or higher government expenditures can

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coexist with honest government (resulting in relative overstatement of government expenditures). We would naturally expect this question to be carefully addressed in this research. Given the experience of socialism in the 20th century, we must at least wonder whether rent-seeking enhances longevity.

One more crucial issue here is ignored in Dr. Brown's work. If poverty contributes to mortality, how exactly does this happen? This question is of interest given recently revealed figures on mortality in Eastern Europe and Russia. After decades of government providing income to its citizens (and thus, according to Dr. Brown's proposition, enhancing their longevity), it has become clear in the post-communist era, when the true mortality statistics became available, that there is a vast mortality gap between Western and Eastern Europe. Recent studies did not attribute it to income directly, but rather to a common feeling of hopelessness and lack of control over one's life so prevalent in Eastern Europe. This in turn induces people there to adopt unhealthy lifestyles; then they die.

It is rarely remembered that the 20th-century progressive taxation has its origins in the 19th-century flat income tax rate introduced by Prime Minister William Gladstone of Great Britain, which excluded incomes below a certain level. In effect, poor people did not pay taxes in 19th-century Britain. This was not intended to "punish the rich," but rather to create a feeling of hope and opportunity among the poor. Ironically, the 20th-century social insurance systems, ostensibly created to help the poor, put the heaviest burden of payroll taxes on the same poor people they proclaim to help. A notable exception has been Canada, granting exemption to the first 10% of YMPE in the C/QPP until recently. The earned income credit program in the U.S. was created with the same intention, although with imperfect execution.

If indeed higher income is to enhance longevity, could it be then that taking one's income away by the government causes one to have a shorter life? Or, as my libertarian friends would put it: "Do taxes kill?"

Given that the poor in America pay basically only payroll taxes, we should not hasten to ignore that question. Inner-city residents plagued by crime and social insecurity pay the payroll taxes nevertheless, if they are brave enough to work. They rarely live to see their social security benefit check.

### AUTHOR'S REPLY

It is a great compliment to have authors of such high quality review one's work. In each case, the

reviewer adds to the knowledge base targeted in the original paper. I respond to the reviews in order.

John Beekman

Dr. Beekman introduces the extremely important concept of "Active Life Expectancy." It does society little good if, in the pursuit of enhanced life expectancy, the added years are all spent in gradations of disability. In fact, if that were the case, the added costs to Medicare and Medicaid would bankrupt those systems (and they need little help).

There is a multitude of literature on this topic. One of the most common authors is Kenneth Manton of Duke University, who is also one of the discussants to this paper (see later). Interested readers would do well to read almost anything of an appropriate title written by Manton, Manton and Land, or Manton and Corder. I list one such paper in the bibliography to this reply.

My own reading of the literature (and it can be argued that the literature does not arrive at a common conclusion on whether enhanced life expectancy has brought more or fewer years of disability) is that both pure actuarial life expectancy and active life expectancy have been improving at about the same rate (multiplicative). That means that the proportion of life spent in some state of disablement has held more or less constant as a percentage of lifetime. Thus, while there may be some small increase in the need for chronic care and chronic care institutions as the population ages, it will not be a catastrophic increase. This also means that the mathematical assumptions underlying my presentation are defensible.

Bernard Dussault

For a new reader in this area, Bernard Dussault is the Actuary of the Canada Pension Plan. He is also responsible for all actuarial valuations of Old Age Security, the Guaranteed Income Supplement, and the New Seniors Benefit in Canada. He is a wonderful ally and the source of many excellent research reports on Social Security (not just relevant to Canada). I thank Mr. Dussault for his continued assistance.

Mr. Dussault notes the superiority of the internal rate of return as an objective measure of determining whether social security is "a good deal" (if that question ever really should be answered). By implication, Mr. Dussault suggests that other methods may be open to bias and manipulation depending on the "goals" of the analyst. I agree.

I disagree, however, with Mr. Dussault, that increasing the funding ratio of the CPP and investing the new assets in the private sector will necessarily increase the IRR from a paygo rate. In the long run, it is not possible for low-risk investments to “outperform” real wage increases. Both are a direct function of economic growth. Second, these assets have no value unless they continue to be backed by a growing, productive economy. That is to say, they are not demographically immune (see Brown 1997).

I would also disagree with Mr. Dussault that life expectancy has no effect on IRR. The apparent mathematical proof that it does not assumes a stable population in which life expectancy is constant. Mr. Dussault may wish to try this proof in a quasi-stable population and allow for improving life expectancy.

In regard to the correlation between the provision of social security benefits and population life expectancy, Mr. Dussault postulates that the reason we cannot find evidence of such a link may be that social security is only a wealth transfer scheme and, whatever has been gained by the poor, has (equally) been lost by the wealthy.

I would refer Mr. Dussault to papers by Mustard and Frank (1994), Hertzman (1996), and the Canadian Public Health Association (1997), all of which indicate that there is also a correlation between income equality (disparity) in a nation and the population life expectancy in that nation. Thus, a progressive social security system (which both Canada and the U.S. have) should enhance population life expectancy.

Finally, Mr. Dussault introduces an interesting hypothesis that proposes that population longevity is correlated with economic productivity. Mr. Dussault then provides some statistical evidence in support of the hypothesis. I believe we are still some distance from actual acceptance of this theory, however, and keenly await further developments.

Kenneth Manton and Kenneth Land

It is indeed an honor to have this discussion from these two prominent demographers. The discussants clearly state the difficulty one has in identifying “causal” factors of population health. I would hope that Dr. Manton and Dr. Land would expand on this theme in a future *NAAJ* paper. I believe it would provide an excellent forum for further discussion.

Without further analysis, I would presume to propose one hypothesis presented by the authors. They imply that the spending of more GDP on health care and access to new technology necessarily improves

population health. Based on papers by Mustard and Frank (1994), Evans (1993), Evans and Stoddard (1994), Barer et al. (1996), and the National Forum on Health (1997), I could not come to the same conclusion. In fact, I agree with the listed authors that if, by spending more money on traditional health care delivery to the detriment of other activities (for example, free education) then we may actually harm population health. Clearly, this is a marvelous area for further discussion.

Robert Myers

It is always satisfying to have someone of Robert Myers' stature say kind things about your work. I agree with Mr. Myers that the time and effort spent on analyzing the money's-worth argument for social security is misguided. However, it is necessary so long as so many people do the calculations incorrectly or inappropriately but then gain the glare of media attention with their erroneous conclusions. We must always have the truth ready to present.

I appreciate greatly the extra information provided by Mr. Myers, especially his expansion on the U.S. particulars, where I am clearly not in his league.

Krzysztof Ostaszewski

I truly and sincerely appreciate the added input of Dr. Ostaszewski. I do think he weakens his presentation with unfounded accusations that I conveniently ignored an entire field of literature, however. Dr. Ostaszewski's theories are neither commonplace nor universally accepted. When one does a literature review in this area, one is not led to Dr. Ostaszewski's preferred bibliography.

I thank Dr. Ostaszewski for allowing us these insights, but I feel no need to apologize for not having indicated them originally.

Finally, I leave readers to decide on their merits.

In closing, I would like to thank the discussants for their thoughtful comments, for their additional input, and for the questions that they leave us requiring further research.

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*Additional discussions on this paper can be submitted until October 1, 1998. The author reserves the right to reply to any discussion. See the "Submission Guidelines for Authors" for detailed instructions on the submission of discussions.*