An evaluation of the incidence of pension plans and public assistance to the elderly

AN EVALUATION OF THE INCIDENCE OF PENSION PLANS AND PUBLIC ASSISTANCE TO THE ELDERLY

Prepared by

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The Tax Measures Evaluation Division is a specialized analytic unit independent of line management within the Department of Finance that conducts follow-up studies of the effectiveness of specific tax measures. The studies undertaken by the Division are intended to stimulate public and parliamentary discussion and to promote improved understanding of tax measures in general.

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INCIDENCE OF PENSION PLANS AND PUBLIC ASSISTANCE TO THE ELDERLY: SUMMARY

The federal government devotes extensive resources to improving the economic security of Canadians in their retirement years. It does this through public pension programs -- the Canada Pension Plan (CPP), Old Age Security (OAS) and the Guaranteed Income Supplement (GIS) -- and by providing tax assistance to encourage individuals to build adequate private retirement incomes for themselves by saving in Registered Pension Plans (RPPs) and Registered Retirement Savings Plans (RRSPs).

The incidence effects of pension plans and assistance to the elderly are usually studied on the basis of annual income data; that is, who gets benefits this year by income level and -- if public assistance is involved -- who pays for these plans this year by income level.

It has long been recognized that it would be better to assess the effects of these programs over the lifetimes of individuals. After all, these are inherently lifetime measures: the average taxpayer incurs costs for these programs and subsequently receives their benefits over almost half a century. In some cases -- such as the Canada and Quebec Pension Plans -- pension payments are even based explicitly on the lifetime earnings histories of pensioners.

Annual income data are not good indicators of the lifetime earnings histories required for analysis of these programs. Some differences in the annual earnings of individuals arise from "transitory" or short-run fluctuations in income which are not typical of longer-run experience, such as from temporary spells of unemployment. Other differences in annual earnings data arise because the experiences of individuals are being recorded at different points in their life-cycles. In annual income data, for instance, high-income groups are disproportionately composed of individuals in the 40-55 age group while low-income groups are composed to a greater extent of younger and older individuals.

The result is that much of the variation evident in annual earnings data "washes out" in lifetime earnings data. For instance, it has been shown that half of the inequality in annual earnings data is attributable to transitory and age-related effects and disappears when one looks at lifetime earnings.

This is the first study to have used tax data for individuals over time to assess the effects of pension plans and public assistance to the elderly over the lifetimes of individuals.

The incidence calculations in the present study were performed for a sample of married couples. Couples were chosen as the unit of analysis principally because they share in

consumption and saving and because both public and private pension plans generally transfer some benefits to the surviving spouse when the principal beneficiary dies.

The analysis revealed substantial fluctuations in the income of average Canadian taxpayers over time. In the sample studied, 55 per cent of couples in a particular decile of the income distribution are not in the same decile a year later. This and similar results reinforce the case for estimating the incidence effects of pension programs on a lifetime basis because "transitory" changes in income are less important in calculations over long time periods.

The study finds that the tax treatment accorded to personal savings channelled through RPP/RRSPs, compared to the alternative of annual income taxation treatment, leads to benefits that increase more rapidly than lifetime income. The benefits/income ratio ranges from roughly half of 1 per cent of their lifetime income for couples in the lowest lifetime income decile to slightly above 3 per cent of their lifetime income for couples in the highest lifetime income decile.

The three public pension programs are progressive in incidence on a lifetime basis. Old Age Security is the most progressive of the three programs, followed by the CPP/QPP program. Somewhat surprisingly, the GIS program is the least progressive in incidence of the three public programs. A possible explanation is that the analysis was done only for taxfilers. Many of the elderly who may be the largest beneficiaries of the GIS program may not be taxfilers because their incomes are so low.

The benefits of OAS, GIS, and CPP/QPP taken together range from 17.1 per cent of lifetime income for couples in the lowest income decile to 4.4 per cent of lifetime income for couples in the top decile.

The total public/private pension package shows progressivity in its incidence. The after-tax benefits relative to lifetime income are roughly 2.3 times larger for couples in the lowest lifetime income decile than for couples in the highest decile.

Finally, when financing costs of the pension programs are taken into account, the overall progressivity of these programs is further increased.

It is important to note that this paper was completed in early 1989 and therefore does not explicitly simulate changes in RPPs or RRSPs which will come into effect in 1991 as a result of Bill C-52. The prospective liberalization of the new contribution limits to RPPs and RRSPs in 1991 as a result of Bill C-52 is reflected to some extent in the simulations, however, because of the method of calculation. Such

liberalization leads to benefits that increase more rapidly than lifetime income.

Nor does the paper simulate the effects of provisions to recover OAS payments to higher income Canadians introduced in the April 1989 budget. The effect of such recovery is, of course, to make the incidence of taxation more progressive in the short run. The effects in the long run also depend on indexation for inflation of the threshold in individual income above which benefits have to be repaid. With respect to such indexation, the 1989 Budget indicated that the government's intention is that "the level of the threshold will be reviewed periodically and adjusted as appropriate".

CONTENTS

I. INTRODUCTION

When the tax reform of 1987 was introduced, the Minister of Finance indicated that the government would continue to use the tax system to assist in meeting specific Canadian economic and social priorities, including building greater regional equality and encouraging domestic savings. At the same time, he said the Department would examine these incentives to ensure they are attaining their objectives. One of the largest incentives in terms of potential tax revenue forgone is the tax treatment accorded to retirement savings. The Tax Measures Evaluation Division has already commissioned a study on the distributional impact of Registered Pension Plans (RPPs) and Registered Retirement Savings Plans (RRSPs).[1] This paper is a complement to that study. Using the same general methodology, the incidence effects of RPP/RRSPs are put in the context of the incidence of overall government support for retirement income through public pension programs. The latter programs are Old Age Security (OAS), the Guaranteed Income Supplement (GIS), and the Canada and Quebec Pension Plans (CPP/QPP).

This paper is not concerned with the normative aspects of pension and old-age assistance programs where value judgements are involved in determining the extent of income distribution that <u>should</u> occur. Instead, it is concerned with the extent of income distribution that <u>is</u> occurring through the private and

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1. Davies, J. B., "The Incidence Effects of RPPs and RRSPs in a Lifetime Framework", Department of Finance, June 1989.

public pension programs. By providing a positive analysis of the incidence of these programs, it is hoped that this paper will supply useful information to those responsible for the design of pension policies.

For the average individual, the benefits and costs of pension programs are spread over half of a century. Despite this, incidence studies of pension programs usually present static calculations of the redistributive effects of the programs on an annual basis.[2] These types of calculations are misleading in two ways. They confuse redistribution among age groups with redistribution among income groups, and they focus only on the immediate incidence effects of what are inherently lifetime tax measures with lifetime incidence effects. In this paper, we will estimate the lifetime incidence of public and private pension programs for married couples in the same age cohort using data from a longitudinal file of Canadian taxpayers.

The paper is organized as follows. The next section describes the main features of the programs evaluated. The rationale for lifetime calculations is presented in Section III. Section IV details the construction of the data base. The methodology used to calculate the incidence of the pension programs is presented in Section V. The results are discussed in Section VI, and Section VII concludes the paper.

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2. Exceptions are Wolfson (1979) and Davies (1989).

II. MAIN FEATURES OF THE PUBLIC AND PRIVATE PENSION PROGRAMS

As noted above, the public pension system includes Old Age Security (OAS), the Guaranteed Income Supplement (GIS), and the Canada and Quebec Pension Plans (CPP/QPP). Benefits paid through these programs are fully indexed for inflation. With the exception of GIS, the benefits received are subject to income taxes. The programs are either financed out of general government revenues (OAS, GIS) or by special earmarked taxes (CPP/QPP).

The basic OAS pension is a flat rate benefit payable to all persons who qualify as to age and residence. As of January 1989, the maximum amount of the basic OAS pension was $323.28 per month.[3]

GIS is an income-tested supplement to the OAS payment to pensioners. The income supplement is based on a pensioner's or couple's annual income other than from OAS benefits: the maximum supplement is reduced by 50 per cent of this income. As of January 1989, the maximum amounts of monthly GIS were $384.19 for singles and $634.42 for couples.

Finally, CPP/QPP is a compulsory pension plan for almost all employed and self-employed persons in Canada. It is financed by a proportional payroll tax with a fixed exemption

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3. The federal budget of April 1989 introduced repayment of OAS benefits at a rate of 15 per cent of net income exceeding $50,000. This new measure is not included in the incidence calculations presented in this paper.

level and an upper limit. The combined (employer/employee) payroll tax rate in 1989 was 4.2 per cent and is scheduled to increase gradually over the next 23 years to 7.6 per cent. Annual contributions to CPP/QPP, which could not exceed $525 for employed persons and $1,050 for self-employed persons in 1989, qualify for a tax credit. The retirement benefits are determined through a complex formula that takes into account the earnings history of the pensioner. The maximum amount of the basic CPP/QPP pension was $556.25 per month in 1989. CPP/QPP also provides death benefits, survivor's benefits and disability benefits.

The private registered pension system consists of Registered Pension Plans and Registered Retirement Savings Plans. Through these vehicles, the government encourages individuals to build adequate retirement incomes for themselves in the years when income from employment has ceased. In order not to interfere with private accumulation of pension funds, contributions are fully deductible for tax purposes. Until Bill C-52 comes into effect in 1991, the maximum annual deduction for amounts contributed to RPP/RRSPs is 20 per cent of earned income up to $3,500 or $7,500 depending on whether or not individuals contribute to an employer-sponsored pension plan.[4] The retirement benefits paid out of the funds accumulated in RPP/RRSPs are taxable.

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4. The $3,500 contribution limit does not apply to required current service contributions (which are not voluntary contributions) to defined benefit plans.

III. ANNUAL VS. LIFETIME INCIDENCE

Incidence studies of tax and transfer programs are concerned with how the burden or benefit of these programs is shared among persons in various income groups. Results of such studies depend among other things on the concept of income used and on the period of time over which the effects of the programs are considered. While most incidence studies of the tax-transfer system are carried out using annual data, there is no reason, *a priori*, why our interest in income redistribution should be limited to a period corresponding to the earth's cycle around the sun.

Annual incidence studies in fact give a very poor idea of the distribution of the burden or benefit of tax and transfer programs for anything more than the very short run. In addition to genuine differences in the profiles of individual incomes, annual data also reflect transitory and age-related effects that are responsible for significant year-to-year fluctuations in individual incomes. For example, close to two-thirds of Canadian taxfilers experienced an increase in income from 1983 to 1984. Their average rate of increase in income was 25 per cent. The average rate of decline in income for the remaining third of taxfilers whose income declined or stayed the same was also 25 per cent.[5]

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5. Based on Historical Tables 3 and 4, *Taxation Statistics 1986 Edition*, Revenue Canada Taxation.

Income fluctuations of the magnitude reported above can alter the income distribution picture over a relatively short period of time. Table I presents data on income mobility for a sample of married couples that is used for the incidence calculations in this study. In constructing this table, the

Table I

MOBILITY ACROSS ANNUAL INCOME DECILES

Percentage of couples in income decile y in 1978 who are in income decile x in 1979

Income decile in 1978 \ Income decile in 1979	1	2	3	4	5	6	7	8	9	10
1	66.7	15.4	0.0	15.4	0.0	0.0	0.0	2.6	0.0	0.0
2	25.6	38.5	25.6	7.7	2.6	0.0	0.0	0.0	0.0	0.0
3	5.3	31.6	36.8	21.1	5.3	0.0	0.0	0.0	0.0	0.0
4	0.0	7.7	20.5	30.8	28.2	10.3	0.0	0.0	0.0	2.6
5	0.0	0.0	5.1	12.8	41.0	20.5	12.8	5.1	2.6	0.0
6	0.0	5.1	2.6	7.7	5.1	51.3	20.5	2.6	5.1	0.0
7	0.0	2.6	5.1	0.0	12.8	7.7	38.5	10.3	20.5	2.6
8	0.0	0.0	2.6	5.3	0.0	7.9	15.8	39.5	21.1	7.9
9	0.0	0.0	0.0	0.0	5.1	2.6	10.3	28.2	38.5	15.4
10	2.6	0.0	0.0	0.0	0.0	0.0	2.6	10.3	12.8	71.8

Percentage of couples in income decile y in 1978 who are in income decile x in 1984

Income decile in 1978 \ Income decile in 1984	1	2	3	4	5	6	7	8	9	10
1	43.6	18.0	7.7	7.7	10.3	5.1	0.0	7.7	0.0	0.0
2	25.6	23.1	10.3	7.7	10.3	7.7	5.1	7.7	2.6	0.0
3	18.4	21.1	21.1	13.2	10.5	7.9	2.6	2.6	0.0	2.6
4	0.0	20.5	15.4	10.3	20.5	20.5	10.3	0.0	2.6	0.0
5	2.6	7.7	7.7	28.2	12.8	15.4	7.7	5.1	10.3	2.6
6	2.6	0.0	10.3	12.8	18.0	18.0	20.5	12.8	5.1	0.0
7	7.7	2.6	12.8	7.7	10.3	7.7	20.5	18.0	2.6	10.3
8	0.0	5.3	7.9	2.6	5.3	7.9	13.2	18.4	29.0	10.5
9	0.0	2.6	2.6	10.3	2.6	7.7	7.7	23.1	33.3	10.3
10	0.0	0.0	2.6	0.0	0.0	2.6	12.8	2.6	15.4	64.1

couples were allocated on the basis of their total income for the year 1978 to one of ten annual income deciles. The table shows the probability for couples in a given income decile in 1978 of staying in the same or moving to another income decile in a later year. The figures along the shaded diagonal refer to the probability that the couples concerned will remain in the same annual income decile.

The top part of the table presents results on income mobility over a one-year period. The data reveal that after only one year, 55 per cent of the couples in the sample are in a different income decile. If we abstract from couples in the first and the last income deciles, who have higher probabilities of remaining in the same income decile because they can only move in one direction, over 60 per cent of the couples are in a different income decile after one year. Data in the bottom part of Table I indicate that the probability of moving to another income decile increases when the observation period is extended. Close to 75 per cent of the couples in the sample belong to a different annual income decile in 1984 than the one they belonged to in 1978. Abstracting from data for the first and the last income deciles, the above figure increases to over 80 per cent. It should also be noted that income variability is greater in the longer run. While observations are concentrated around the shaded diagonal in the top part of the table, the bottom part shows a more scattered set of data with fewer zeros in the off-diagonal elements.

Other studies have also shown that about one-half of annual income inequality arises from transitory and age-related effects and that the distribution of income is much more uniform on a lifetime basis.[6] With lifetime data, transitory and age-related effects are completely removed; only permanent disparities among individuals remain. In light of the above, the use of annual income in assessing the incidence of pension programs is likely to produce a biased estimate of the redistributive effects of these programs across persons with different permanent abilities to pay.

There are other more evident reasons why the incidence of pension programs should be evaluated on a lifetime basis as opposed to an annual basis. A good deal of the annual redistribution involved in pension programs occurs first across age groups. Such is the case, for instance, with OAS -- which redistributes income at one point in time from young to old generations. To the extent that persons over 65 years of age are over-represented at the low end of the annual income scale compared to the rest of the population -- as they are -- an annual incidence calculation of OAS would over-estimate the progressivity of this program. A lifetime calculation would not incorporate the above bias since it would ignore the temporary effects of the age-income structure and concentrate only on redistribution that occurs throughout the lifetimes of individuals with different permanent incomes. When viewed in a

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6. The studies include Hanna (1948), Mincer (1974), Paglin (1975), Lillard (1977), and Blomquist (1981).

lifetime context, a program such as OAS does not redistribute income between age groups; everybody grows older and eventually is eligible for OAS payments.

Finally, perhaps the most obvious reason for evaluating the incidence of pension programs on a lifetime basis is that these programs entail tax measures that extend throughout the lifetimes of individuals. For example, an annual incidence analysis of RRSPs and RPPs would only report the tax benefits to individuals from deducting the contributions from taxable income in a given year. It would neglect to take into consideration the time profile of contributions, the non-taxation of the accruing interest income in the plans and the taxes that are paid when the funds are withdrawn at retirement. Similarly, in the case of CPP/QPP, an annual incidence analysis would disregard totally the fact that pension benefits are determined on the basis of the lifetime earnings history of the pensioner and that individuals participate in the financing of this pension program over a contribution period that can cover up to 47 years.

Having established our preference for an evaluation of the lifetime incidence of pension programs, we are confronted with the problem that there are no data-sets that contain information on incomes and taxes for the whole lifetime of individuals. The next section describes how this problem can be surmounted by constructing synthetic lifetime histories of incomes and taxes.

IV. CONSTRUCTION OF THE DATA BASE

It is important in an empirical study of the lifetime incidence of tax measures to control for sample homogeneity through time so that comparison of program benefits to individuals with different incomes remains meaningful. Family status, for instance, affects one's level of consumption, saving, and taxes. Since we cannot control for family formation and break-up through time in our sample, we restrict the analysis to a homogeneous sample of married couples. Since couples share in consumption and since both public and private pension plans generally transfer some benefits to the surviving spouse when the principal beneficiary dies, it also makes sense to calculate the tax incidence of pension programs for couples.

We use the personal income tax (PIT) 1 per cent Longitudinal File on individual taxpayers which covers the years 1978 to 1984. The file includes all taxpayers with a Social Insurance Number ending in the digits "15" who filed a T1 return in at least one of those seven years. This data-set allows us to create a subsample of married couples by matching up husbands and wives based on their Social Insurance Numbers. Only those couples with at least one individual filing a return in each of the seven years were selected.

"Synthetic" lifetime histories for the couples were created by chaining together the seven-year segments of data according to the age of the couples and their permanent income

rank.[7] In order to get projected data as meaningful as possible, a blow-up factor was used to reflect per capita economic growth.

Of course, seven years is only a small portion of a lifetime. Clearly, it would have been better to have used a longer period of time since it would have increased our ability to distinguish among couples according to their permanent incomes.[8] This time series may be long enough, however, to show the principal variations in the couples' incomes. This is illustrated by Table I, presented earlier, which shows that very large fluctuations in income can occur within seven years. Having used a cross-section in a single year to predict future data would not have allowed such fluctuations in time.

Figure 1 shows the lifetime earnings profile, obtained from the chaining procedure explained above, for the average couple in each lifetime income decile. There is nothing surprising in the patterns of earnings through time. The largest earnings disparities occur in the mid-40's, whereas average earnings across deciles are more similar earlier and later in life. This permits us to conclude that in annual income data, high-income groups are disproportionately composed of individuals in the 40-55 age group, while low-income groups are composed, to

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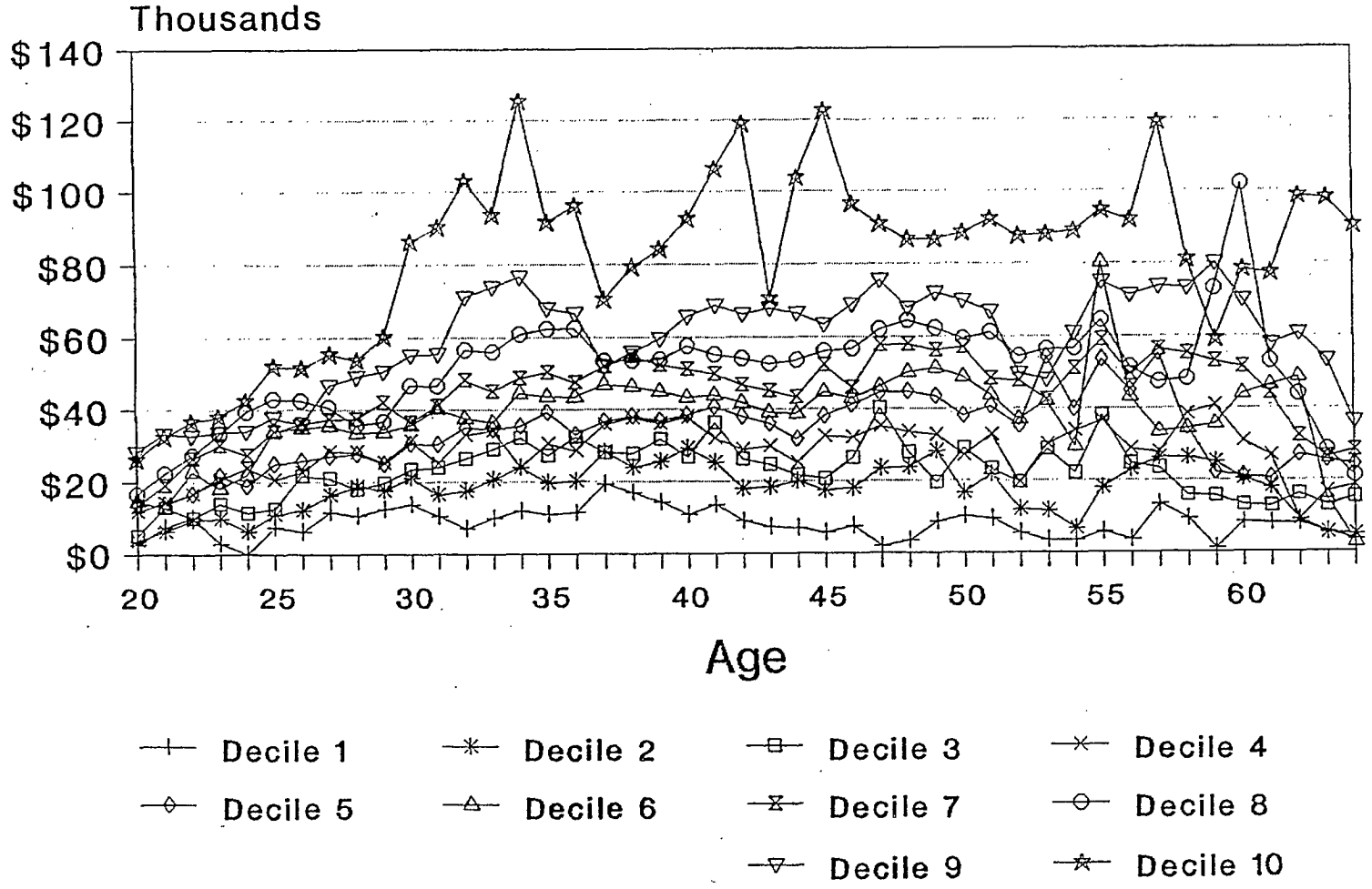
7. For more details on the linking procedure, the reader may refer to the Appendix at the end of the paper.

8. It is important to note that the procedure we used may impose too little income mobility over lifetimes. This is because we force the couples to have the same income rank over successive seven-year periods.

Figure 1

LIFETIME EARNINGS PROFILE FOR COUPLES BY LIFETIME INCOME DECILE



1984 dollars

a greater extent, of younger and older individuals. This emphasizes the need for a lifetime incidence study.

In addition to age-related effects, the annual data also reflect transitory effects, as we noted earlier, and this is shown by the year-to-year fluctuations in earnings in Figure 1. With lifetime data, these short-run transitory effects are removed, leaving only real permanent disparities.

Statistics Canada's life expectancy tables for married persons show that a married man aged 20 between 1980 and 1982 has a life expectancy of 54.08 years, while a married woman of the same age could expect to live, on average, another 60.28 years.[9] We therefore assume, for the 1978 cohort we are using, that the men and women in the sample will live until the age of 74 and 80 respectively.

In addition to lifetime earnings for the couples, the sample includes individual lifetime data on taxes, RRSP and RPP contributions, total income, and taxable income.[10] The latter allows us to calculate individual marginal tax rates. All the

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9. Statistics Canada, Marriage, Divorce and Mortality: A Life Table Analysis for Canada and Regions, 1980-1982, Catalogue 84-536, Tables XVI and XVII, pp. 37-38.

10. In projecting RRSP/RPP contributions in the future, the current limit of $3,500 is permitted to grow at a projected productivity growth rate of 1.5 per cent per annum. This adjustment reflects to some extent the likely effects of the prospective liberalization of the new contribution limits to RRSP/RPPs as a result of Bill C-52.

variables included in the sample are expressed in real 1984 dollars.

We may now proceed to calculate the incidence of pension programs on a lifetime basis. The following section explains the methodology used to do so for the different pension programs.

V. CALCULATING LIFETIME INCIDENCE OF PENSION PROGRAMS

In evaluating the lifetime incidence of pension programs, one could simply analyze how the benefits delivered through the programs are distributed among persons with different lifetime incomes. This approach, however, would overlook two important redistributive aspects of pension programs: the fact that some pension benefits are taxable and the financing by taxes of government outlays on pension programs. For some of the pension programs, much of the income redistribution comes from the tax side. In the case of OAS, the income redistribution effects come entirely from the tax side. OAS provides standard equal lump-sum monthly payments to individuals once they have attained 65 years of age. The redistributive effects of OAS arise from the fact that the payments are taxable and that the government outlays for OAS are financed out of general taxes that are raised in different amounts among individuals in different lifetime income groups.

The incidence calculations presented in this paper include the two tax effects mentioned above. To appreciate the contribution of each of these tax effects to the incidence of the pension programs, they are introduced sequentially in two sets of incidence calculations. One set of calculations includes the effect of current taxes collected from pension benefits. Another set of calculations incorporates the additional redistributive effects of taxes needed to finance the after-tax benefits of pension programs.

The calculation of lifetime incidence involves the comparison of program benefits and costs that occur over a period of several decades. In order to facilitate the interpretation of the incidence results, one can use an accounting method that sums up all the annual data in a single meaningful amount. This is what the concept of discounted lifetime value does. For example, lifetime income for individuals is the discounted value of annual flows of earnings throughout their lifetimes.[11] It is equal to the lump-sum amount of money individuals would accept at one point in time (say the start of their working life), given the interest rate at which it could be invested and taking into account the tax rates individuals will face in each year of their life, in exchange for all future earnings. Mathematically, lifetime income is expressed as:

$$(1) \qquad LI = E_{20} + \sum_{t=21}^{64} \left\{ \frac{E_t}{\prod_{j=21}^{t} \{[1+i(1-\tau_j)]/(1+\pi)\}} \right\}$$

11. More precisely, lifetime income is the discounted value of annual flows of earnings plus inheritances minus bequests. Unfortunately, we do not have information on inheritances and bequests for individuals in our sample. Our definition of lifetime income is simply the familiar Haig-Simons definition of income over a period of a lifetime and expressed in present value terms. It is equal to total consumption plus change in net worth summed over the lifetime. It represents consumption options over time and its size is independent of how one chooses to distribute consumption over a lifetime. See Aaron and Galper (1985).

where E_t is earnings[12] at age t, i is the constant nominal rate of interest, π is the inflation rate, and τ_t is the federal marginal tax rate the individual faces at age t given his taxable income at that time.

Similarly, lifetime benefits from any pension program for individuals represent the lump-sum amount of money they would accept (under the same conditions with respect to the interest rate and the income tax rates they face through time) to give up the program payments when retired. Expressing the costs and benefits associated with each program in this manner permits us to calculate ratios of net benefits to lifetime income. These ratios show the extent to which benefits from each program differ according to the lifetime income of individuals.

These net benefit ratios were calculated for each couple in the sample on the basis of available information for each of the spouses. The tax structure was that obtaining in 1984, the last year of the longitudinal tax file at the time the incidence calculations were made. Parameters of the pension programs are set, however, to the baseline date of January 1, 1989. Our calculations also assume partial indexation (over 3 per cent annual inflation) of the tax brackets and take account of the elimination of the deduction for dividend and interest income in the tax reform of 1987.

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12. In the calculation of lifetime income, earnings are defined to include employment income and only 80 per cent of net self-employed income. It is assumed that 20 per cent of net self-employed income represents capital income.

The following sub-sections describe for each program assumptions made in the calculation of their incidence.

Old Age Security

The standard benefit to individuals from the OAS program is simply the discounted real after-tax value of OAS payments to be received from age 65 until death:

$$(2) \qquad OASB = \sum_{t=65}^{D} \left\{ \frac{OAS_t\,(1-\bar{\tau}_t)}{\prod_{j=21}^{t} \{[1+i(1-\tau_j^*)]/(1+\pi)\}} \right\}$$

where D is equal to 74 for men and 80 for women. After-tax OAS benefits are computed using the average marginal tax rate $\bar{\tau}$ that applies to public pension benefits. The same average marginal tax rate is used in computing after-tax CPP/QPP benefits[13]. This procedure takes into account the fact that in any year infra-marginal units of the total pension benefits for an individual may be taxed at differential marginal rates owing to the progressive tax rate structure. The use of average marginal tax rates permits one to obtain the total incidence effects of the pension package by simply adding up the incidence effects for the

13. After-tax benefits from OAS and CPP/QPP are estimated using the trapezoidal method of approximation. $\bar{\tau}_t$ is equal to the average of the individual's marginal tax rate and the marginal tax rate that would apply to the individual's taxable income reduced by OAS and CPP/QPP payments.

various pension programs. It should also be noted that the marginal tax rate r^* used in the discounting of future benefits is equal to the individual marginal tax rate plus 50 percentage points in the years when the individual is receiving GIS payments. This adjustment is necessary to reflect the 50 per cent recapture rate on GIS payments.

Since the OAS program is financed out of the general revenues of the federal government, it is assumed that the total cost of the program for the cohort studied is allocated among individuals in proportion to their respective share of total lifetime taxes (personal income taxes, corporate income taxes, and sales taxes). In computing the shares of lifetime taxes, it is further assumed that the burden of corporate income taxes and sales taxes are proportional to lifetime income of individuals. Hence, the cost of financing the OAS program is allocated in proportion to individual shares of lifetime personal income taxes with a weight of .55 and in proportion to individual shares of lifetime income with a weight of .45.

Guaranteed Income Supplement

As of January 1989, the maximum annual amounts of GIS were $7,613.04 for couples and $4,610.28 for singles. These amounts translate to $6,474.84 and $3,921 respectively in 1984 dollars. The real amount of GIS for each couple is then determined in the following manner:

-from age 65 to 74, $GISC_t = \$6,474.84 - .5(YC_t - OASC_t)$;

-from age 75 on, $GISC_t = \$3,921 - .5(YC_t - OASC_t)$;

where YC_t and $OASC_t$ are respectively the total annual income and the total annual OAS payments received by the couple at age t.[14]

In order to perform the incidence calculations on an individual basis, GISC from age 65 to 74 is allocated between spouses as if each spouse were allowed a maximum real annual GIS payment of $3,237.42 reduced by half of individual income net of OAS payments. In the event that one of the spouses has a real income net of OAS in excess of $6,474.84, the full amount of GISC is allocated to the other spouse.

GIS payments not being taxable, the formula to determine the benefit to individuals from this program is:

$$GISB = \sum_{t=65}^{D} \left\{ \frac{GIS_t}{\prod_{j=21}^{t} \{[1+i(1-\tau_j^*)]/(1+\pi)\}} \right\} \tag{3}$$

with variables in the above expression as defined earlier.

The financing cost of the GIS program is allocated among individuals in the sample following the same assumptions as in the case of the OAS program.

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14. From age 75 on, only the wife's income net of OAS payments enter the calculation of GIS payments.

Canada and Quebec Pension Plans

Three types of CPP/QPP benefits are considered in this study: the basic retirement pension, the death benefit, and the surviving spouse's pension.

The basic retirement pension is calculated as 25 per cent of a person's average pensionable earnings, adjusted to reflect the final three-year maximum pensionable earnings. The detailed calculation is as follows. For each of the 45 years in the contributory period (from age 20 to 64 in our sample), a ratio of individual earnings to the year's maximum pensionable earnings (YMPE) is calculated:

$$R_t = E_t/YMPE_t \tag{4}$$

If earnings exceed the year's maximum pensionable earnings, the ratio is set equal to one. The individual average ratio for the contributory period is then calculated by averaging the ratios for all years. To protect the value of the retirement pension against the reduction that would result from periods when earnings were below the average pensionable earnings, the CPP/QPP allow the exclusion of some low-earnings periods when calculating the average ratio. These include low-earnings periods spent rearing children under age 7 and 15 per cent of the remaining contributory period when earnings were the lowest. We excluded 10 years for wives in our sample to take account of the provision

for rearing young children. Hence, after the exclusion of 15 per cent of the years with the lowest annual earnings ratios, the individual average ratio R was calculated over the highest 38 annual ratios for husbands and over the highest 30 annual ratios for wives.

In 1989, the YMPE was equal to $27,700. This translates to $23,558 in 1984 dollars. The YMPE is scheduled to increase in line with the Industrial Average Wage. The final three-year average maximum pensionable earnings for individuals in the age cohort we study is then calculated as follows:

$$(5) \qquad AMPE = \frac{\$23{,}558 * (1+g)^{44}}{3} \left[1 + \frac{1}{(1+\pi)(1+g)} + \frac{1}{(1+\pi)^2(1+g)^2} \right]$$

where g is the real rate of growth in wages and salaries.

The basic retirement pension in real terms is then:

$$(6) \qquad BCPP_t = .25 * R * AMPE \qquad \text{for } t = 65 \text{ to } 74 \text{ for husbands, } t = 65 \text{ to } 80 \text{ for wives.}$$

Based on our life expectancy assumptions, the basic retirement pension is the only benefit husbands in our sample receive. In addition to the basic pension, wives in our sample receive a death benefit and a surviving spouse's pension starting at age 75. The death benefit DBCPP is a lump-sum amount equal to one half of the annual retirement pension of the deceased contributor or 10 per cent of the YMPE for the year in which the

contributor died, whichever is less. The surviving spouse pension SBCPP is equal to 60 per cent of the amount of the deceased contributor's retirement pension. The total combined pension for a widow cannot exceed the maximum retirement pension payable to a 65-year-old.

The after-tax benefits from the CPP/QPP program are then given by the following expression:

$$(7) \qquad CPPB = \sum_{t=65}^{D} \left\{ \frac{BCPP_t\,(1-\bar{\tau}_t)}{\prod_{j=21}^{t} \{[1+i(1-\tau_j^*)]/(1+\pi)\}} \right\} + \sum_{t=75}^{D} \left\{ \frac{SBCPP_t\,(1-\bar{\tau}_t)}{\prod_{j=21}^{t} \{[1+i(1-\tau_j^*)]/(1+\pi)\}} \right\} + \frac{DBCPP\,(1-\bar{\tau}_{75})}{\prod_{j=21}^{75} \{[1+i(1-\tau_j^*)]/(1+\pi)\}}$$

where the last two terms on the right-hand side apply only to wives.

The CPP/QPP program is financed by a payroll tax with a fixed exemption level and an upper limit. The tax is paid in equal parts by the employee and the employer. Self-employed persons pay both shares. The combined (employer/employee) payroll tax rate in 1989 was 4.2 per cent and is scheduled to increase by .2 of a percentage point in each of the next two years and by .15 of a percentage point annually for the following 20-year period, after which it is assumed to remain at a level of 7.6 per cent. The exemption level is 10 per cent of the YMPE and

the contributions are determined by applying the tax rate to gross employment income and net self-employment income above the exemption level up to the YMPE. Under the assumption that employers' contributions are paid on behalf of employees, individual annual contributions $CCPP_t$ are given by:

$$CCPP_t = \theta_t \ (E_t - .1 \ YMPE_t), \text{ if } E_t < YMPE_t; \text{ or}$$

$$CCPP_t = \theta_t \ (.9 \ YMPE_t), \text{ if } E_t \geq YMPE_t;$$

where θ_t is the combined payroll tax rate individuals face at age t.

With contributions deductible for income tax purposes, the financing cost of the CPP/QPP program to individuals is:

$$(8) \qquad CPPC = CCPP_{20} + \sum_{t=21}^{64} \left\{ \frac{CCPP_t \ (1-\tau_t)}{\prod_{j=21}^{t} \{[1+i(1-\tau_j)]/(1+\pi)\}} \right\}$$

Registered Pension Plans and Registered Retirement Savings Plans

The tax treatment of retirement savings in RPP/RRSPs differs in two important respects from that for conventional savings. First, interest income accrues in RPP/RRSPs without being taxed. This feature provides a tax benefit to all contributors to the plans. The second difference is in the postponement of taxes achieved by contributing to the plans: income contributed to the plans is untaxed until it is withdrawn from the plans. This postponement effect may or may not benefit

contributors depending on whether or not the marginal tax rate they face at the time of the contribution exceeds their marginal tax rate at the time of withdrawal.[15] Our measure of the incidence of RPP/RRSPs will take two features into account.

One way of measuring the relative advantage of saving through RPP/RRSPs is to compare the after-tax present value of pension wealth in RPP/RRSPs at age 65 to the after-tax present value of wealth that would have accumulated had the same amount of annual RPP/RRSP contributions been invested throughout the individuals' working life in conventional saving accounts, with interest income subject to taxes. Under the RPP/RRSP scheme, the stock of disposable pension wealth accumulated by age 65 is equal to:

$$(9) \qquad A_R = \frac{(1-\tilde{\tau}) \sum_{t=20}^{64} S_t \left[(1+i)/(1+\pi)\right]^{65-t}}{\prod_{t=20}^{64} \left\{\left[1+i(1-\tau_t)\right]/(1+\pi)\right\}}$$

where S_t is the actual amount contributed to RPP/RRSPs at age t, and $\tilde{\tau}$ is an average of the annual marginal tax rates individuals

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15. While it is generally expected that individuals are in a lower tax bracket when they retire and that the tax-postponement effect acts as a tax-averaging device providing a tax benefit to the contributor, this is not always the case. For some wealthy contributors, their marginal tax rates in retirement will never be as low as the marginal tax rates they faced in their early working years. The tax-postponement effect may also be detrimental to individuals with lower incomes if tax brackets are less than fully indexed for inflation.

face in retirement. The average rate $\tilde{\tau}$ is used to approximate the taxation of the retirement income. If saved through conventional savings accounts, the same annual amounts of RPP/RRSP contributions would yield an after-tax stock of wealth at age 65 equal to:

$$(10) \qquad A_N = \frac{\sum_{t=20}^{64} \left\{ (1-\tau_t)\, S_t \prod_{j=t}^{64} \{[1+i(1-\tau_j)]/(1+\pi)\} \right\}}{\prod_{t=20}^{64} \{[1+i(1-\tau_t)]/(1+\pi)\}}$$

The relative benefit from saving through RPP/RRSPs is equal to the difference between A_R and A_N.[16]

In contrast to OAS, GIS, and CPP/QPP which are government expenditure/transfer programs that show up in the Public Accounts, RPPs and RRSPs do not involve any government direct expenditure. Hence, the incidence calculations gross and net of financing costs should give the same result. It could be argued, however, that RPPs and RRSPs are tax expenditures that lead to lower tax revenues for the government. To take account of this hypothesis, we also computed incidence calculations for RPP/RRSPs in which the value of forgone tax revenues to the government under an annual income tax system is allocated as a

16. The marginal tax rates in expression (10) are those that would apply if RPP/RRSP contributions and the annual amount of capital income in the RPP/RRSP accounts were part of taxable income.

financing cost of the program among individuals in proportion to their shares of total lifetime taxes.

It should be noted that in the case of employer-sponsored plans, data limitations constrain us to limit our incidence analysis of RPPs to the redistributive effects of employee contributions to the plans.

VI. RESULTS OF INCIDENCE CALCULATIONS

The benefit ratios for each program were calculated under the assumptions of a real annual growth rate in per capita earnings of 1.5 per cent, an inflation rate of 5 per cent per annum, and a nominal annual interest rate of 8.5 per cent. While the calculations were performed on an individual basis, for ease of presentation and interpretation the incidence results have been aggregated to present benefit ratios for the average couples across lifetime income deciles. The incidence results are presented in a series of Figures where the benefit ratios are plotted against the annualized value of the average lifetime income of the couples in each decile.[17]

Gross Benefits From Public Pension Programs

The incidence results for the three components of the public pension system are depicted in Figure 2.

The results show that OAS is the most progressive of the three programs. Benefits from OAS for the couples in the first decile are equivalent to an increase of 9 per cent in their lifetime income (or in their annual income for each and every year). OAS benefit ratios decline as lifetime income rises and

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17. The annualized value of lifetime income is equal to the constant amount of annual income over the working life that would have the same present value as lifetime income.

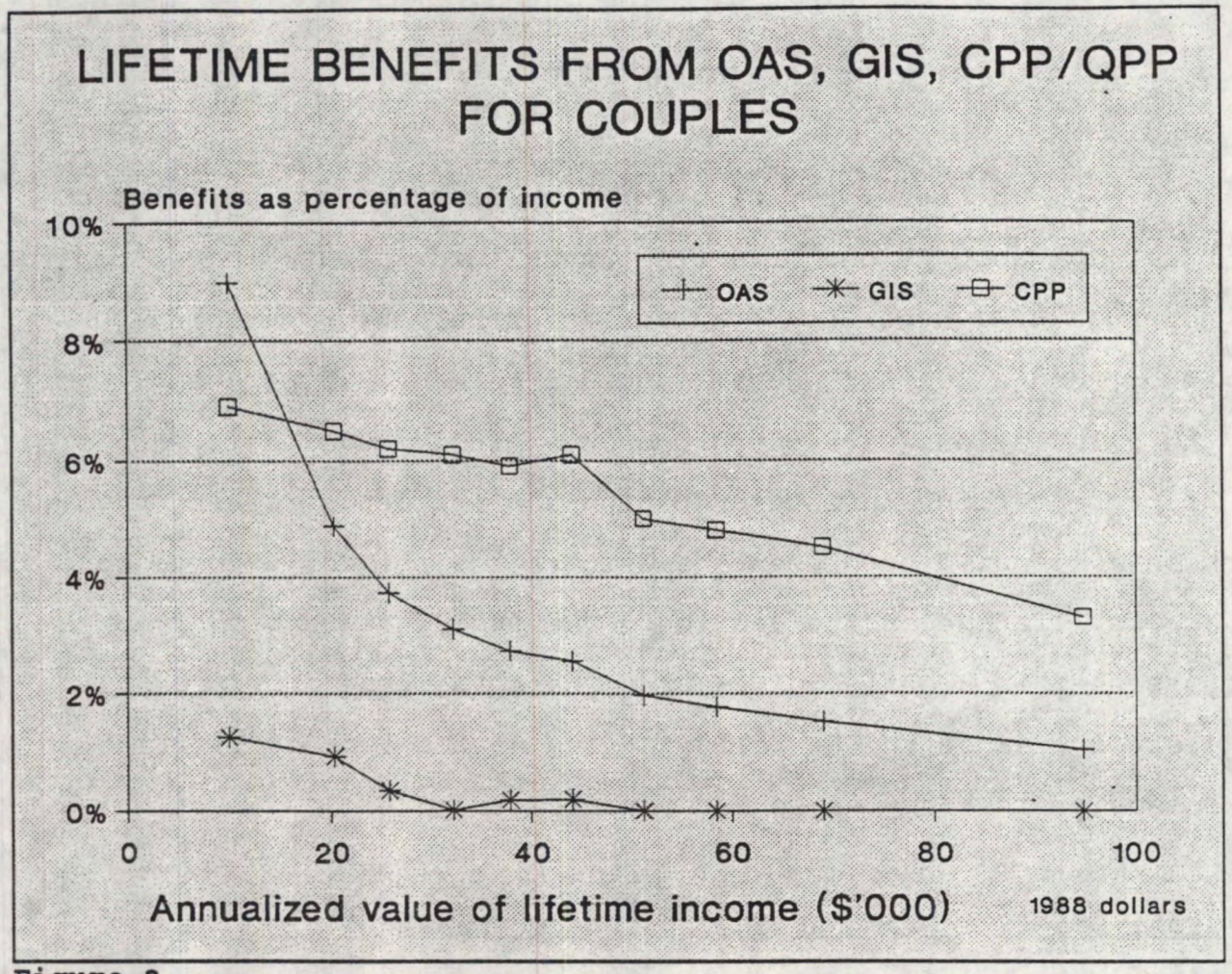

Figure 2

attain a minimum of just over 1 per cent of lifetime income for couples in the top income decile.

Whereas OAS pays equal amounts to everybody, CPP/QPP payments are partly related to lifetime income and hence are less progressive than OAS. CPP/QPP is still progressive, however, owing to the ceiling imposed on CPP/QPP pension payments. Benefits from CPP/QPP range from close to 7 per cent of lifetime income for couples in the first decile to 3.3 per cent of lifetime income for couples in the tenth decile.

Although it is often considered as the most progressive program on the basis of its contribution to annual incomes, GIS exhibits the least overall progressivity among the three public pension programs when evaluated on a lifetime basis for couples in our sample.[18] The reason for this result is that GIS payments to an individual or couple are determined each year during retirement according to the level of income of the individual or couple for that year. Because of variability in income through the years, annual income is not necessarily indicative of the purchasing power of an individual or couple over a lifetime. For instance, it could be that individuals receive GIS payments on the basis of low annual incomes in retirement although their lifetime incomes were high enough to prepare them better financially for retirement than other individuals who do not receive any GIS. The incidence results in Figure 2 show that the GIS program is progressive over the first four deciles, slightly regressive over the next two deciles, and proportional over the last four deciles. Couples in the four highest lifetime income deciles do not receive GIS at any time in their lives while couples in the fourth decile receive almost no GIS payments. The largest benefit ratio is 1.3 per cent of lifetime income for couples in the lowest income decile.

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18. GIS is less progressive than OAS for every income decile, and more progressive than CPP/QPP for couples in the second, third and fifth income deciles.

It should be noted that the results for the incidence of the GIS program presented in this paper apply to a sample of married taxfilers and that one should be extremely cautious in extrapolating these results to the entire population. In fact, Revenue Canada reports aggregate OAS payments for 1986 that are 37 per cent lower than the OAS outlays reported by the Department of Health and Welfare.[19] This would imply that there is a sizeable proportion of old persons who do not file an income tax return. It is more than likely that these persons have very low or nonexistent annual incomes and are the largest beneficiaries of the GIS program. By not capturing these individuals in our sample of taxfilers, our incidence calculations would underestimate the progressivity of the GIS program, at least for the lower lifetime income deciles.

Gross vs. Net Benefits From Public Pension Programs

Figures 3, 4, and 5 compare benefits for each of the three public pension programs gross and net of financing costs.

Figure 3 shows that the OAS program becomes more progressive when financing is taken into account owing to progressivity in lifetime taxes. For the system to be self-financed over the cohort's lifetime, couples in the four highest lifetime income deciles contribute more in financing OAS than

19. This ratio was calculated from data in Revenue Canada's Taxation Statistics and in Health and Welfare's Income Security Programs Red Book.

they will ever receive in gross benefits. The largest net loss is equivalent to a reduction of 1.4 per cent in the lifetime incomes of couples in the tenth decile.

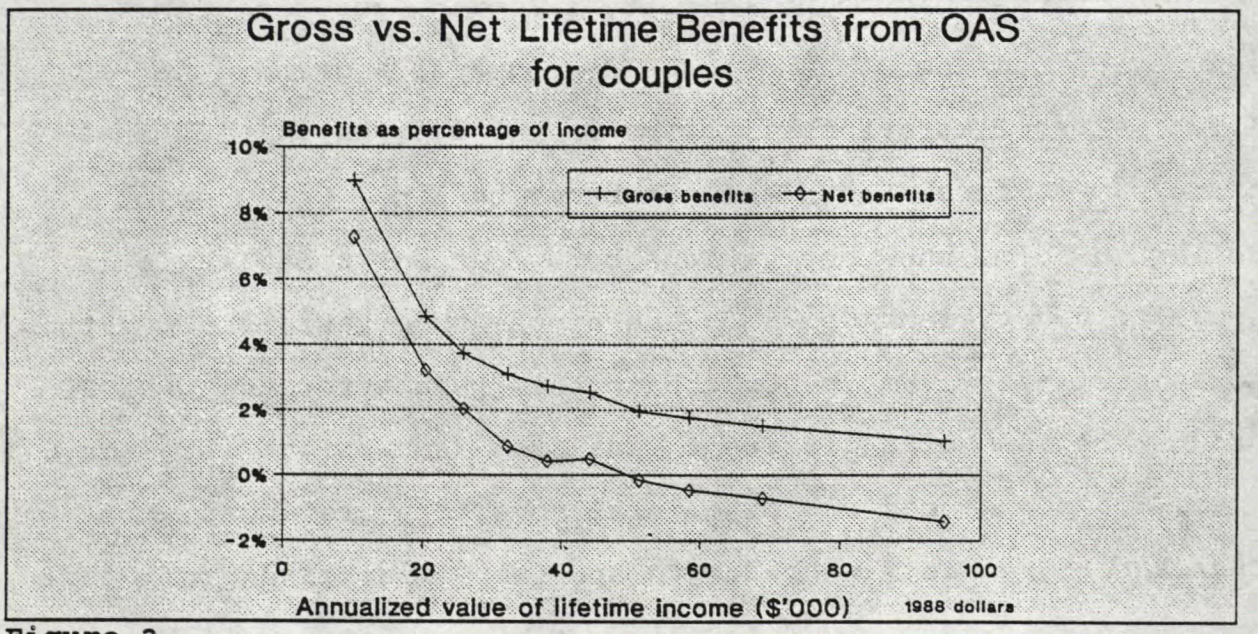


Figure 3

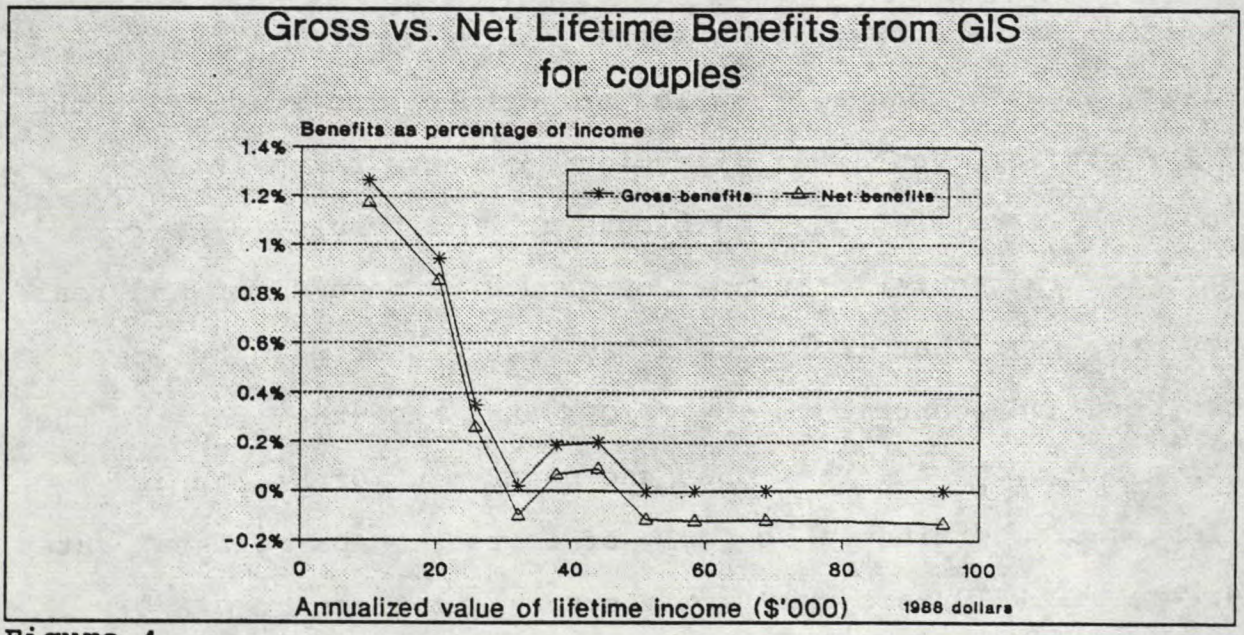


Figure 4

The results of incidence calculations for GIS in Figure 4 reveal that when financing is taken into account, couples in the four highest deciles and couples in the fourth decile incur net losses.

It should be noted that, following our financing assumption for the OAS and the GIS programs, aggregate net lifetime benefits across lifetime income deciles in Figures 3 and 4 sum to zero. From the net benefits line, the present dollar value of the observations below the horizontal axis is equal to the present dollar value of the observations above the horizontal axis. We do not obtain this result for the CPP/QPP program because of a different financing assumption. Whereas OAS and GIS are financed out of general government revenues, the CPP/QPP program is financed with special earmarked payroll taxes.

The effects of the payroll taxes on the lifetime benefits from CPP/QPP are illustrated in Figure 5. The net benefits line is above the horizontal axis for all income deciles, showing that all couples are net beneficiaries from the CPP/QPP program even after financing costs are taken into account. Several factors contribute to this result: inter-generational transfers financed by growth in population and real wages; the fact that individuals may face higher marginal tax rates when they contribute to CPP/QPP than when they receive the pension benefits; the fact that the department of Health and Welfare has determined a schedule of increasing payroll tax rates over the next 23 years only while our calculations of CPP/QPP

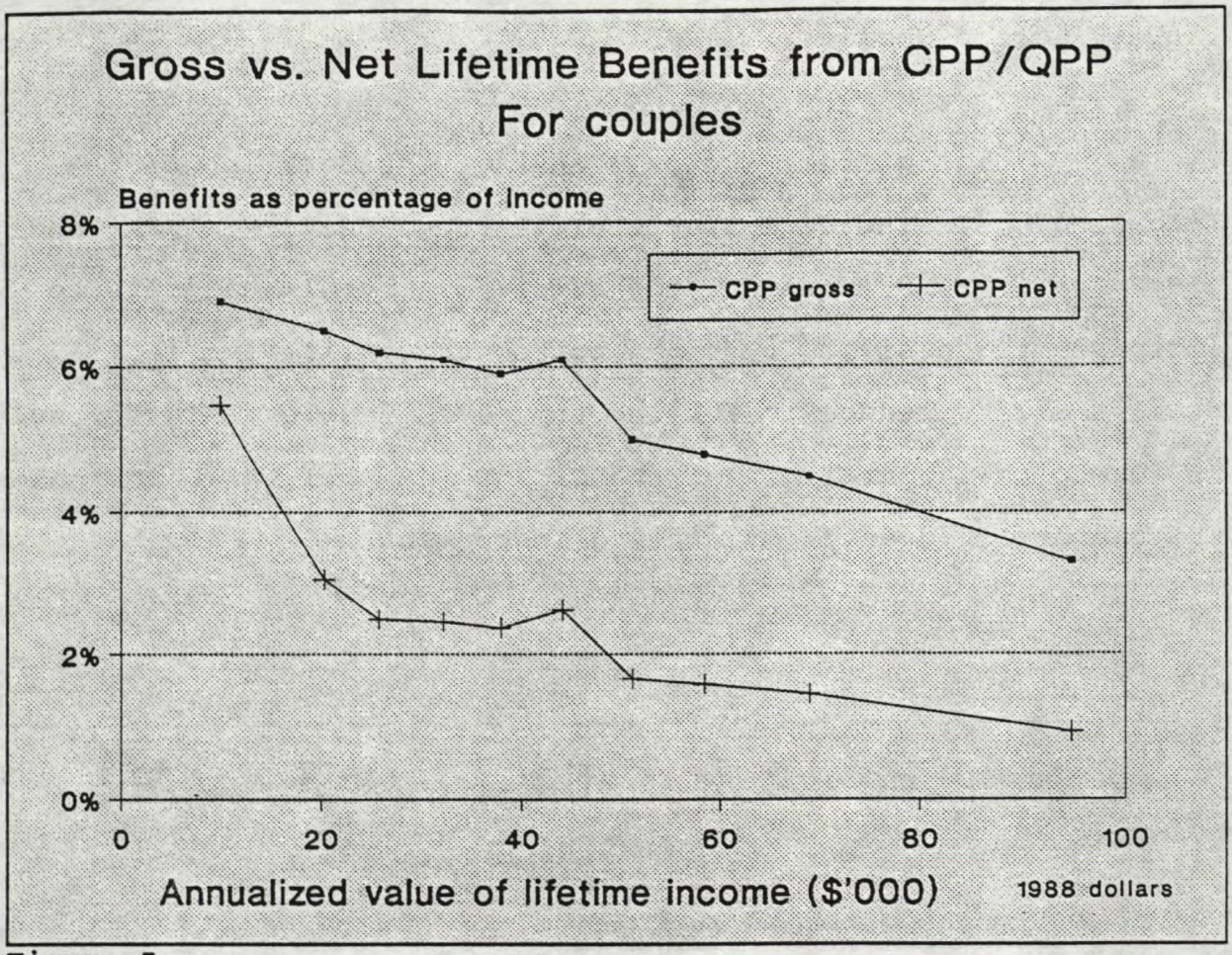


Figure 5

contributions extend over the next 45 years; and transfers to surviving spouses. Figure 6 provides an idea of the magnitude of the transfers to surviving spouses by showing benefits from CPP/QPP net of financing costs excluding the value of death and survivor's benefits. Death and survivor benefits account, on average, for one third of the net benefits from CPP/QPP for couples in our sample. Other factors mentioned above would be responsible for benefits net of financing costs that range from 4.7 per cent of lifetime income for couples in the lowest income

decile to 0.6 per cent of lifetime income for couples in the highest income decile.

Judging from Figures 3 and 4, consideration of financing costs increases the overall progressivity of OAS and GIS. For CPP/QPP, however, the effect of payroll taxes is to increase progressivity over the bottom three lifetime income deciles and to reduce it for the top seven deciles. This result is due to the upper limit on the CPP/QPP payroll tax which makes the latter a regressive financing instrument.

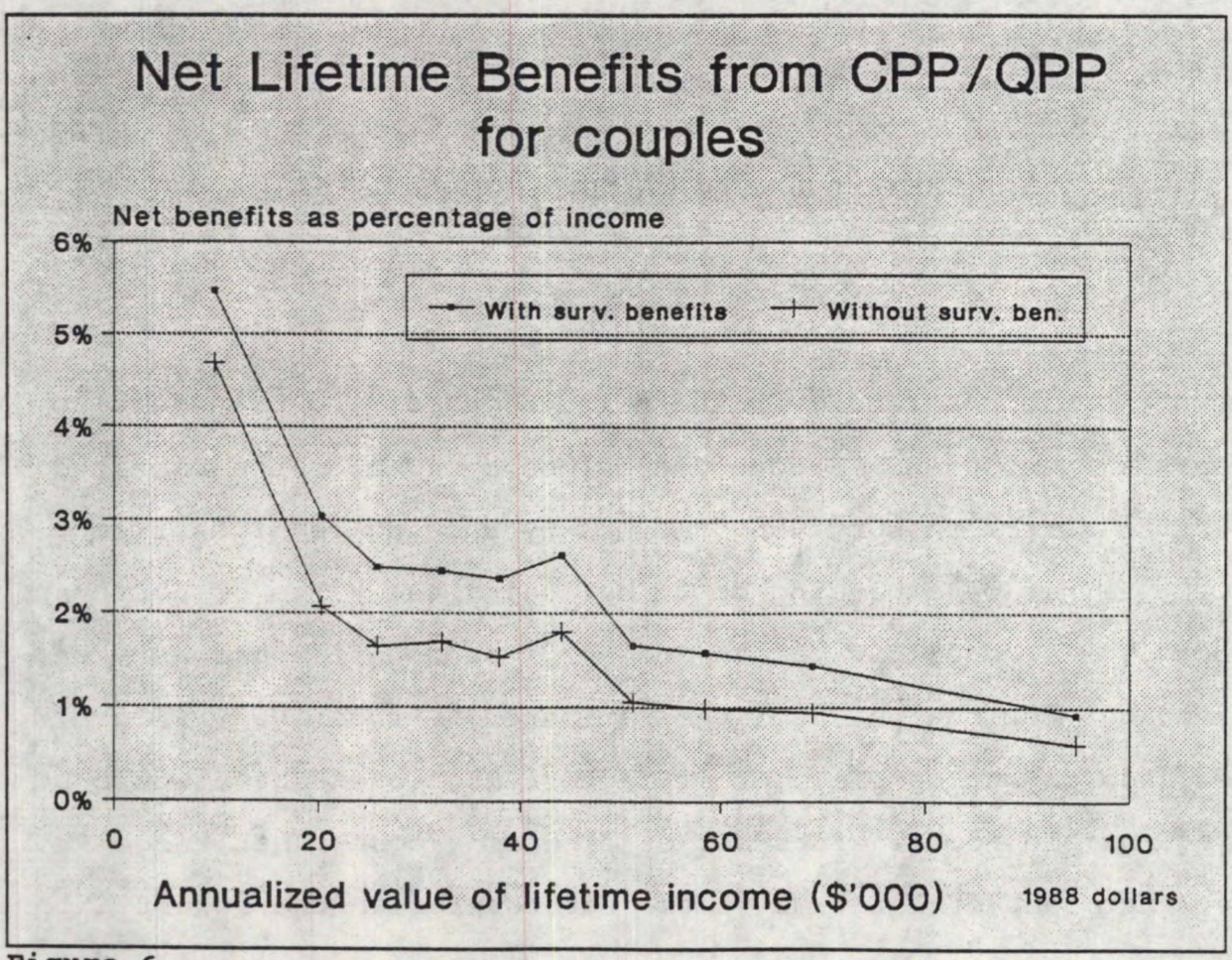


Figure 6

The lifetime benefits for each of the three programs net of financing costs are presented together in Figure 7.

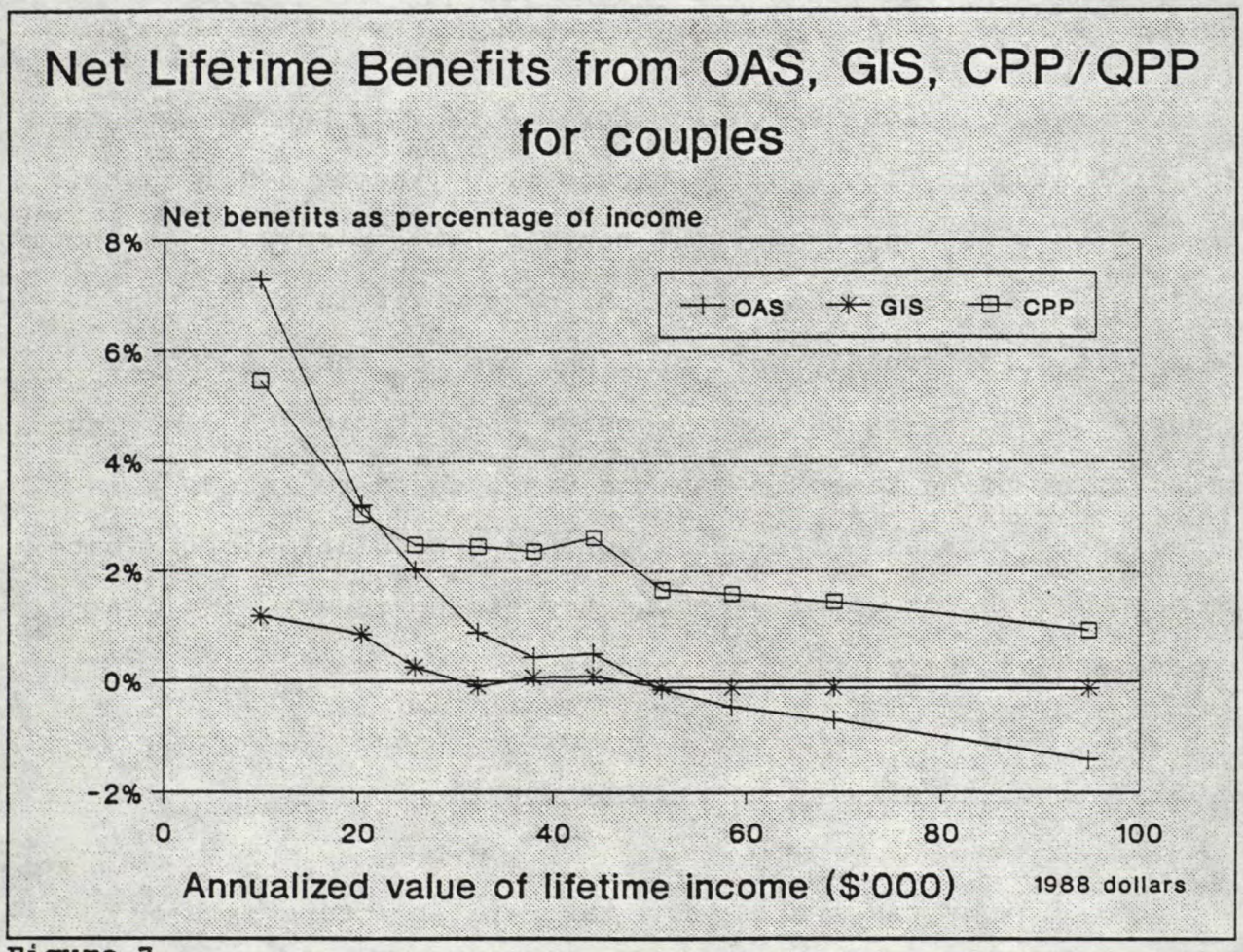


Figure 7

Compared to Figure 2, it can be observed in Figure 7 that apart from reducing effective benefits for everyone, and the marginal effects on progressivity mentioned above, inclusion of our assumed individual financing costs in the incidence calculations does not alter the ranking of the public pension programs in terms of their overall progressivity: OAS is still the most progressive pension program, followed in order by CPP/QPP and by GIS. Again, one should keep in mind that the incidence results

net of financing costs for the GIS program apply only to our sample of taxfilers and that the program could turn out to be more progressive if evaluated for non-taxfilers as well.

Gross Benefits From Private Pension Programs

The incidence results for the private pension programs are presented in Figure 8. Although every income decile benefits from the RPP/RRSP programs, the benefit ratios increase as income increases. Private pension wealth for couples in the first decile is worth roughly half of 1 per cent of their lifetime incomes more than if the same pension contributions had accumulated after being taxed in savings vehicles where interest is taxed as it accrues. The corresponding appreciation of private pension wealth for couples in the top decile is slightly over 3 per cent of their lifetime incomes.

Gross vs. Net Benefits From Private Pension Programs

In any tax system, the tax rate structure is not independent of the choice of the tax base. In a system that has evolved with RPPs and RRSPs excluded from the tax base, it may well be that in the absence of such programs tax rates applying to a larger tax base would have been consistently lower. In these circumstances, it becomes difficult to attach a financing cost to RPPs and RRSPs. On the other hand, if one regards RPPs and RRSPs as tax expenditures, such as would be the case under a comprehensive annual income tax system, then the forgone tax

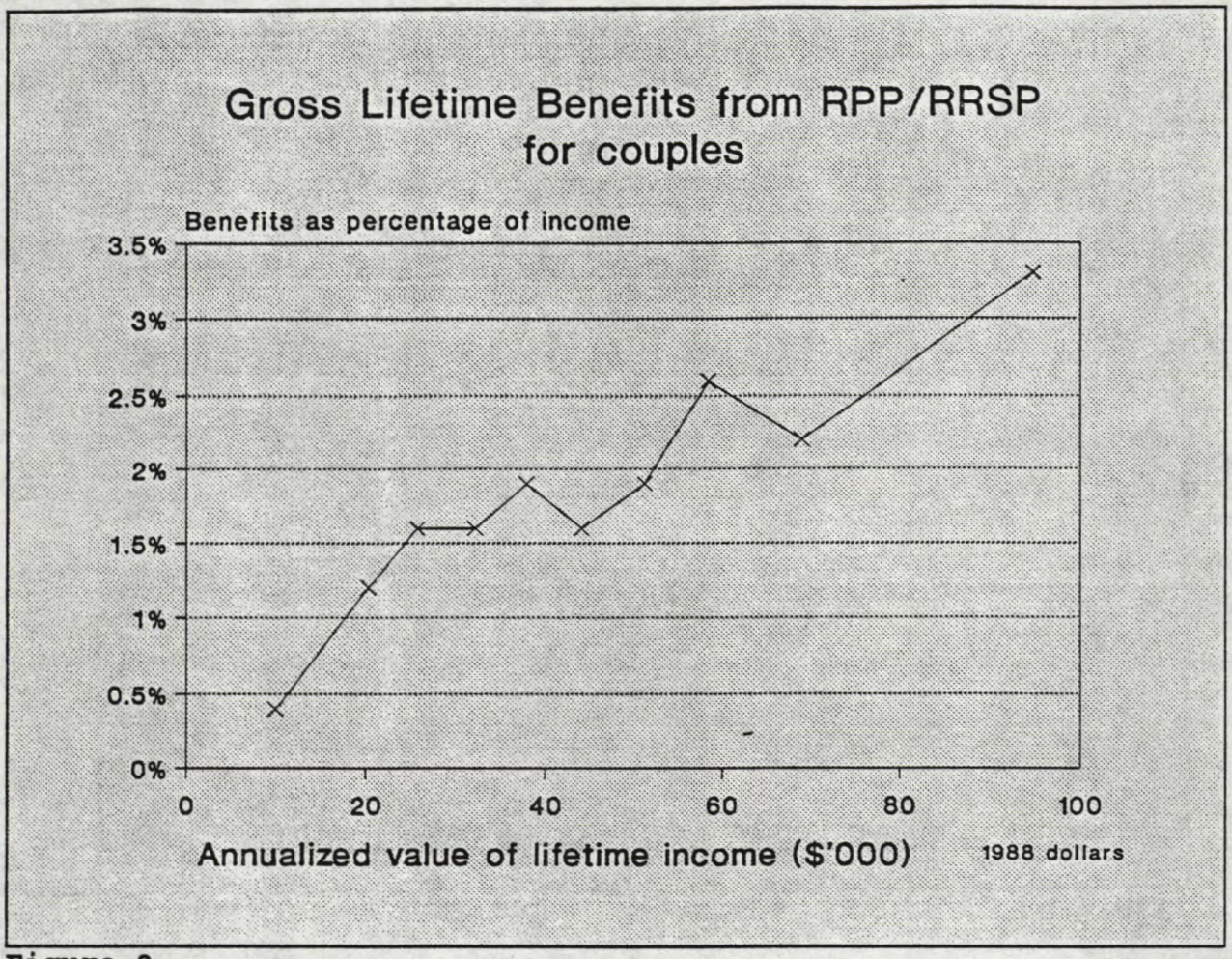


Figure 8

revenues to the government from the use by individuals of RPPs and RRSPs can be considered as the financing cost of the programs to individuals. This approach presumes that the RPP/RRSP programs lower the revenue-raising capacity of the government and contribute to either an increase in its deficit or a reduction in some expenditure programs.

The incidence results net of financing costs for the private pension programs when RPPs and RRSPs are considered as tax expenditures are presented in Figure 9. The inclusion of

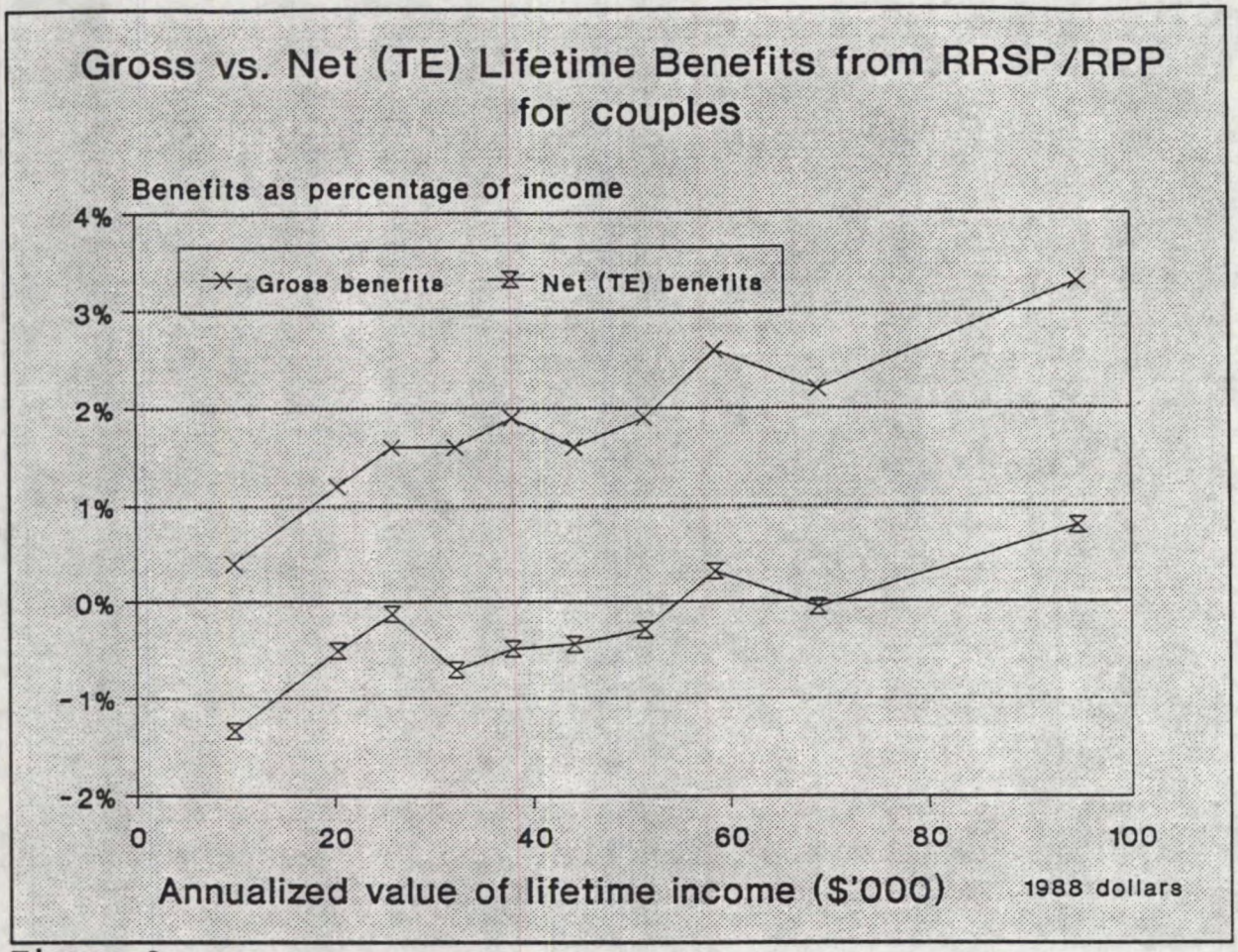


Figure 9

financing costs in the incidence calculation makes the RPP/RRSP programs appear less regressive. Figure 9 also shows that when RPPs and RRSPs are considered as tax expenditures, only couples in the eighth and tenth lifetime income deciles are net beneficiaries of the RPP/RRSP programs.

Gross Benefits of the Pension Package

The incidence of the pension package is portrayed in Figure 10. The figure shows that the incidence of the package of public pension programs is progressive. The incidence effects of

OAS, GIS, and CPP/QPP taken together range from benefits of 17.1 per cent of lifetime income for couples in the lowest income decile to 4.4 per cent of lifetime income for couples in the top decile. When added together, the incidence effects of the public and private pension programs make up a comprehensive pension program that is progressive in incidence except for the interval between the seventh and eighth lifetime income deciles. The benefits of the pension package go from 17.5 per cent of lifetime income for couples in the first income decile to 7.7 per cent of lifetime income for couples in the tenth decile.

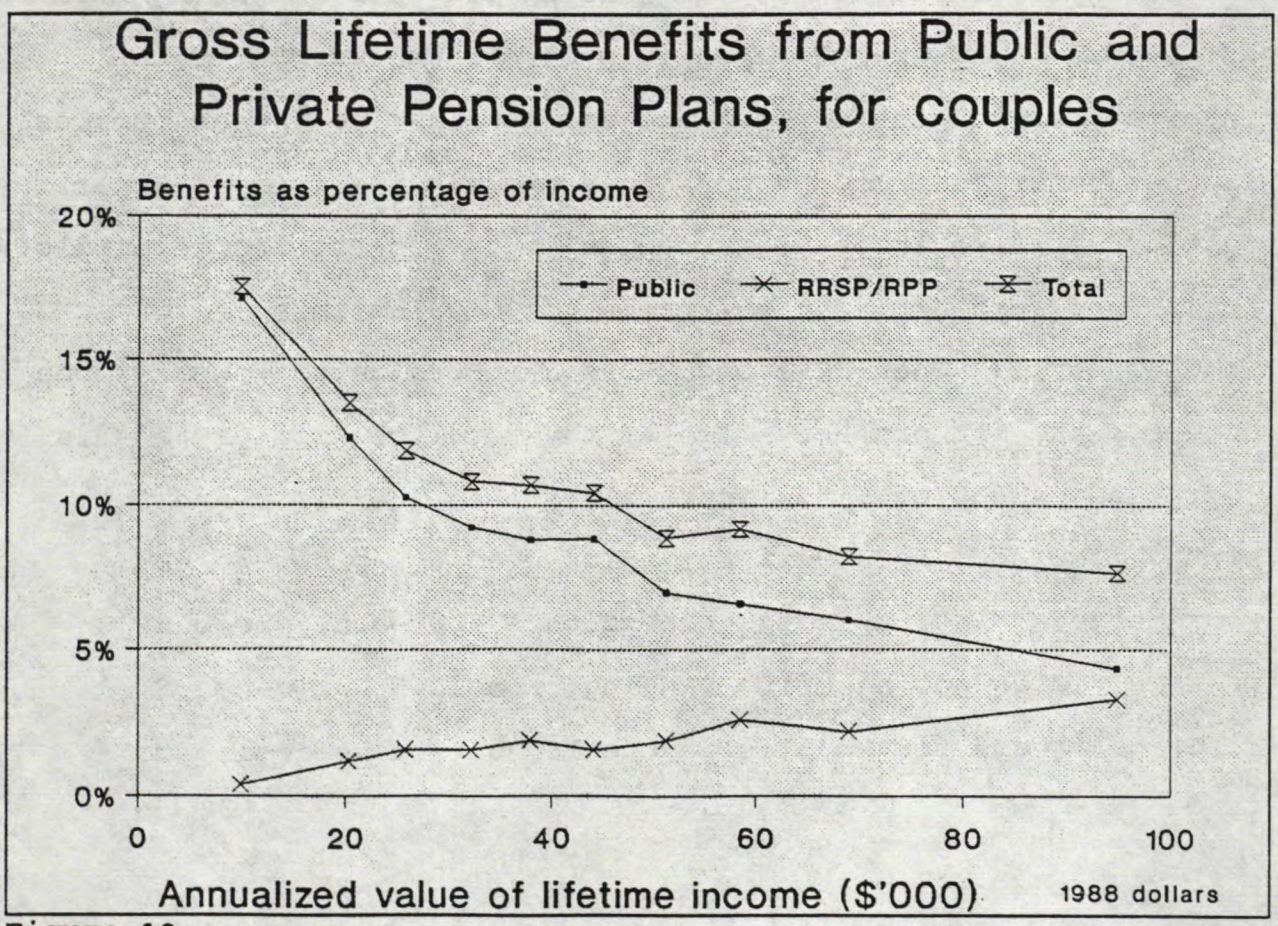
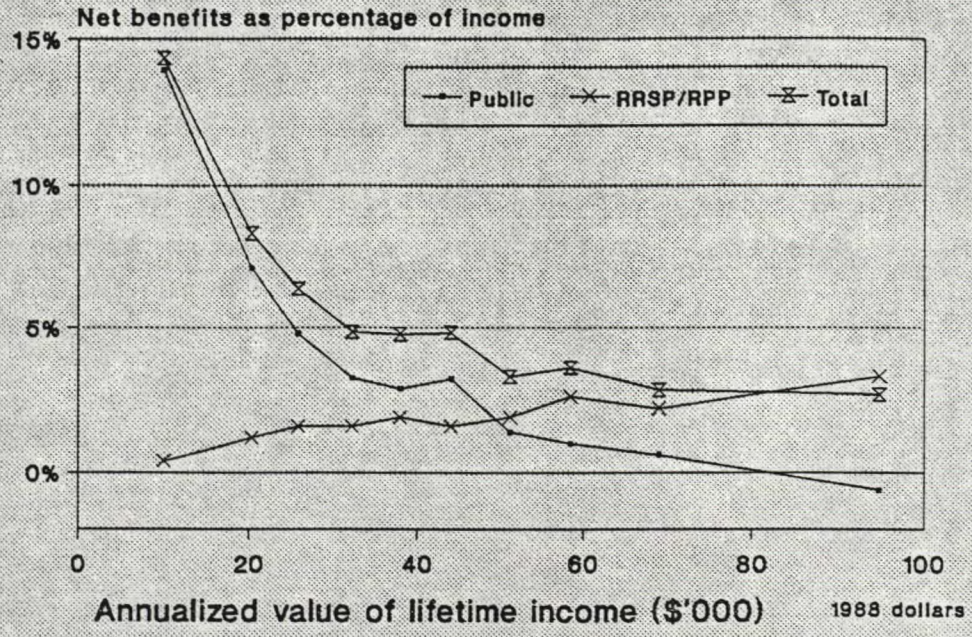


Figure 10

Net Benefits of the Pension Package

The incidence of the pension package net of financing costs is presented in Figure 11. The two graphs in Figure 11 reflect different financing assumptions for the RPP/RRSP programs. RPPs and RRSPs are considered as tax-exempt items in the graph on the top and as tax expenditures in the graph on the bottom. The public pension package as a whole is progressive on a net-of-financing-costs basis except for the interval between the fifth and the sixth lifetime income decile. Couples in the first nine income deciles are net beneficiaries from the public pension package whereas couples in the top income decile incur a net loss equivalent to 0.6 per cent of their lifetime incomes. The net total incidence of the pension programs including RPPs and RRSPs as tax-exempt items is progressive except for the interval between the seventh and eighth lifetime income deciles. The net benefits from the pension package range from 14.3 per cent of lifetime income for couples in the lowest income decile to 2.7 per cent of lifetime income for couples in the highest income decile. When RPPs and RRSPs are considered as tax expenditures, the net progressivity of the total pension package is increased except over the interval between the fifth and the sixth lifetime income deciles, which even turns out to be regressive. Under this tax-expenditure approach, the pension package yields net benefits ranging from 12.6 per cent of lifetime income for couples in the lowest income decile to

NET LIFETIME BENEFITS FROM PUBLIC AND PRIVATE PENSION PLANS, FOR COUPLES



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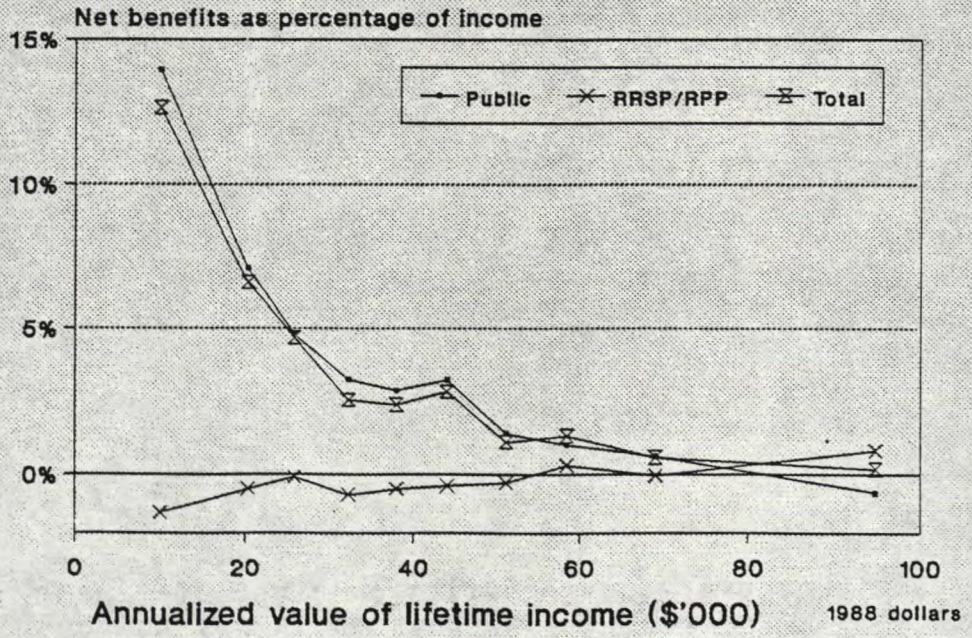

Figure 11

0.2 per cent of lifetime income for couples in the highest income decile.[20]

Not only are the net lifetime benefits from the pension package progressive, i.e., net benefits/income ratios decrease as lifetime income rises, but the dollar amount of net benefits also decrease globally with lifetime income: the present value of the net lifetime benefits from the pension package is $28,618 for couples in the first income decile while it is only $4,859 for couples in the tenth income decile.

20. The fact that everybody benefits on a net-of-financing-costs basis from the pension package is due to the financing assumptions of the CPP/QPP program that yield aggregate net benefits.

VII. CONCLUSION

This paper has shown that there are large fluctuations in the income of couples over time. These fluctuations are sizeable even over a one-year interval. Given short-run variability in incomes, the calculation of benefit ratios using annual income in the denominator and the ranking of individuals across income groups defined on the basis of annual income would have produced biased estimates of the incidence of pension programs. We thus opted for the use of lifetime incomes in calculating the incidence of pension programs, which in fact incorporate lifetime tax measures.

The incidence calculations show that the three public pension programs are progressive on a lifetime basis. Old Age Security is the most progressive of the public pension programs. It is followed by the CPP/QPP program, which provides pension benefits that are related positively to income up to a certain level. The GIS program comes in last in terms of progressivity despite the fact that it is income-tested. The GIS program is even regressive over certain income ranges. This most interesting result is due to the fact that we calculated the lifetime incidence of an annual income-tested program. The incidence result for GIS confirms that retired individuals with low annual incomes did not all share similar income profiles in the past. With more realistic assumptions concerning income variability (i.e., with more variability), this imprecise relationship between the levels of GIS benefits and lifetime

income would become even more indeterminate. The incidence results for the GIS program were obtained, however, for a sample of taxfilers and probably underestimate the progressivity of the program for the lower lifetime income deciles.

The tax treatment accorded to personal savings channelled through RPP/RRSPs, compared to the alternative of annual income taxation treatment, leads to benefit/income ratios that increase with lifetime income. Due to a lack of detailed information, employers' contributions to RPPs were not considered in obtaining the above result. The employers' contributions to RPPs are substantial (close to twice the size of employees' contributions) and do not necessarily follow the same distribution as the employees' contributions (over 30 per cent of members in RPPs are in a non-contributory plans).[21] Their inclusion in our calculations could alter the incidence of the RPP/RRSP programs. Despite the fact that benefit-income ratios for the RPP/RRSP programs increase with lifetime income, the public/private pension package is progressive -- yielding after-tax benefits relative to lifetime income that are roughly 2.3 times larger for couples in the lowest income decile than for couples in the highest income decile.

Consideration of the financing costs of the pension programs increases the overall progressivity of OAS and GIS. For the CPP/QPP programs, the financing of the program with a payroll

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21. Statistics Canada, Pension Plans in Canada, 1986, Catalogue 74-401, Ottawa, 1988.

tax increases the progressivity of CPP/QPP over the bottom three lifetime income deciles and reduces it over the top seven lifetime income deciles. When RPP/RRSPs are regarded as tax expenditures, their incidence net of financing costs becomes less regressive, but with only two income deciles showing positive benefits. However, the impact of the financing costs on the incidence calculations does not alter the ranking of the public and private pension programs in terms of their relative progressivity. When financing costs are taken into account, the overall progressivity of the pension package is increased: the benefits/income ratio for couples in the lowest income decile is more than 60 times larger than the ratio for couples in the highest income decile.

Finally, the fact that benefit/income ratios for the RPP/RRSP programs increase with lifetime income should not be alarming. One of the objectives of the RPP/RRSP program is to encourage individuals to build adequate retirement incomes. If more individuals are able to provide for their own retirement needs, financial pressure on social programs will be eased and Canadian society will be better able to meet the challenge of caring for a rapidly aging population. Hence, the success of the RPP/RRSP program can be assessed by its effects on savings. The fact that benefit/income ratios for the RPP/RRSP programs increase with lifetime income constitutes a cost that should be applied against the social benefits from higher aggregate retirement savings. The empirical determination of the effects of RPP/RRSPs on personal savings would also permit the

achievement of more precise estimates of the incidence of the RPP/RRSP program. In fact, if RPP/RRSPs are successful in increasing savings, the incidence calculations presented in this paper, under the assumption of no behavioural response, overestimate the relative benefits to higher income people of the programs.

APPENDIX

We study the behaviour of married couples where the husbands were aged between 18 and 67 in 1978.[22]

The sample we are using contains 388 married couples (or 776 individuals) for which we have seven years of information for at least one of the spouses. Therefore, it represents 2,716 observations (388x7), which is not negligible.

This data-set permits us to construct a set of "synthetic" lifetime histories for the couples by chaining together the seven-year segments of information according to the age of the couples and their permanent income rank. This matching procedure proceeds as follows.

The observations are grouped into five-year age ranges in order to get ten separate age groups: 18-22, 23-27, 28-32, ..., 58-62, 63-67. Each couple of these age groups is then treated as if its members were at the same age in 1978, this one being the median age of the group. Therefore, the couples with husbands aged between 17 and 22 in 1978 are treated as if they were 20, all those with husbands aged between 23 and 27 as if they were 25, and so on.

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22. Of course, when we had information for the wife only, we used her age.

Our goal is to link couples from successive age groups. Since the average number of couples within each age group is 38.8, this means getting about 38 lifetime histories, which is not a lot. Also, since the age groups do not contain the same number of couples, we are constrained to get rid of some observations or to duplicate a few ones out of about 38. In both cases, the marginal effect of choosing one observation instead of another one is quite strong since there is only 38 observations and this may lead to very different results.

To avoid these problems, we standardized the age groups by duplicating observations within each of them, at random, in order to get 10,000 observations in total or 1,000 by age group. In this way, we don't loose any information and the linking procedure between age groups becomes easier.

The data allow us to compute a discounted lifetime income for the period 1978-1984, L_{78}^{84}, which provides a good indication of permanent income:

$$(A1) \qquad L_{78}^{84} = \sum_{t=1978}^{1984} \frac{E_t+P_t+G_t}{(1+r)^{t-1978}}$$

where E=earnings, P=pension income, G=government transfers, and r, a common discount rate equal to 3 per cent. This permits us to rank the observations within each age group according to L_{78}^{84}.

The next step consists in matching up the couples from successive five year age ranges according to their relative L_{78}^{84} within the age group. In doing so, we suppose that the characteristics of those aged 25 in 1978 will apply to a period starting five years later, that the ones of those aged 30 in 1978 will apply to a period starting ten years later, and so on. The underlying assumption is that the economic conditions that prevailed in 1978-1984 will continue to exist during the whole lifetime of the cohort studied. In order to make projected data as meaningful as possible, a blow-up factor is used to reflect per capita economic growth.

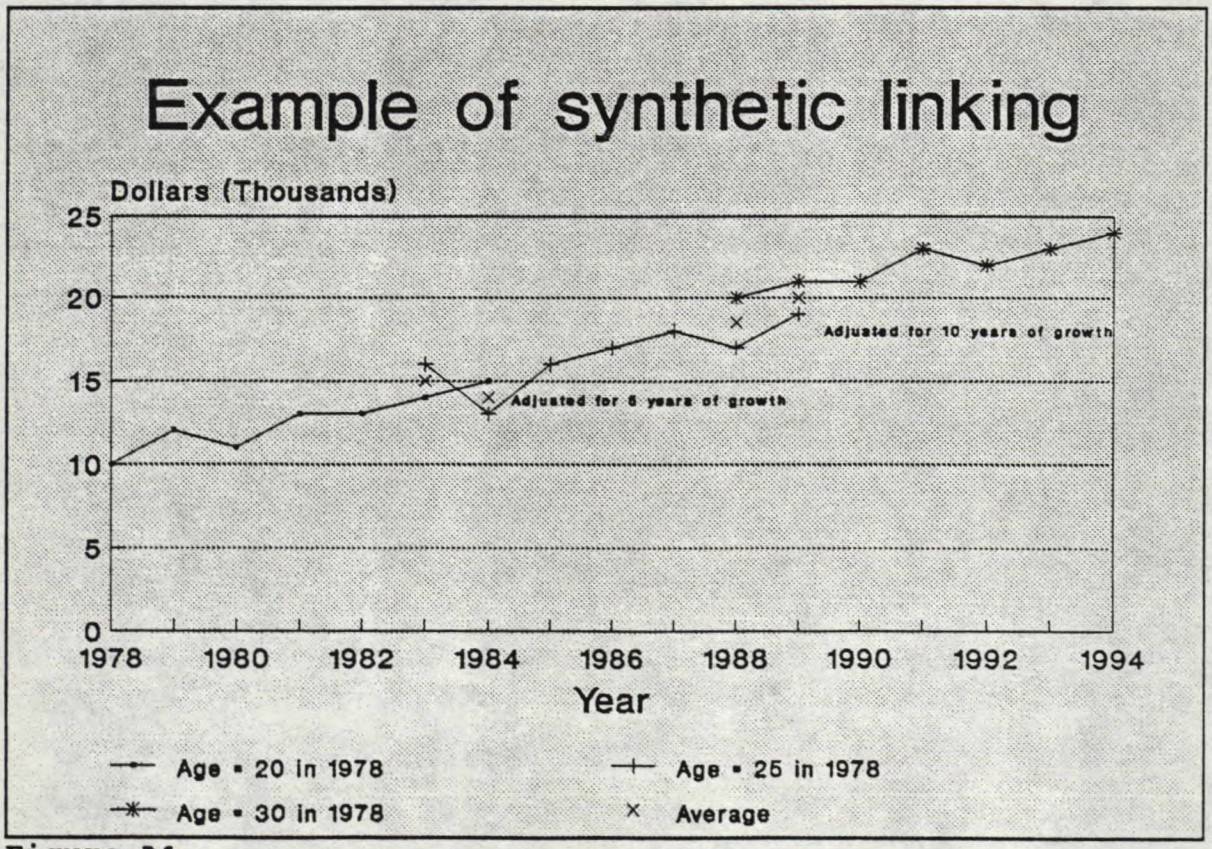

Figure A1

If we had five years of data, this would all work very neatly. In fact, we have data for seven years. Therefore, we allowed the seven-year age segments to overlap during two years at the extremities of the segments. This approach is illustrated in Figure A1, using the earnings variable.

The "·" observations are taken directly in the sample since they show earnings for the period 1978-1984 of a couple aged 20 in 1978. The "+" observations come from observations on earnings of a couple aged 25 in 1978 that were adjusted for five years of growth. Thus, they give projected earnings of a couple with the same characteristics but aged 25 in 1983. Similarly, we project earnings for the remaining lifetime. The overlapping "·" and "+" observations that are averaged together help to smooth up the links. All other variables are projected in the same way.

This procedure allows us to obtain lifetime histories on 10,000 couples, based on the characteristics of 388 couples, that cover 61 years of economic life.

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