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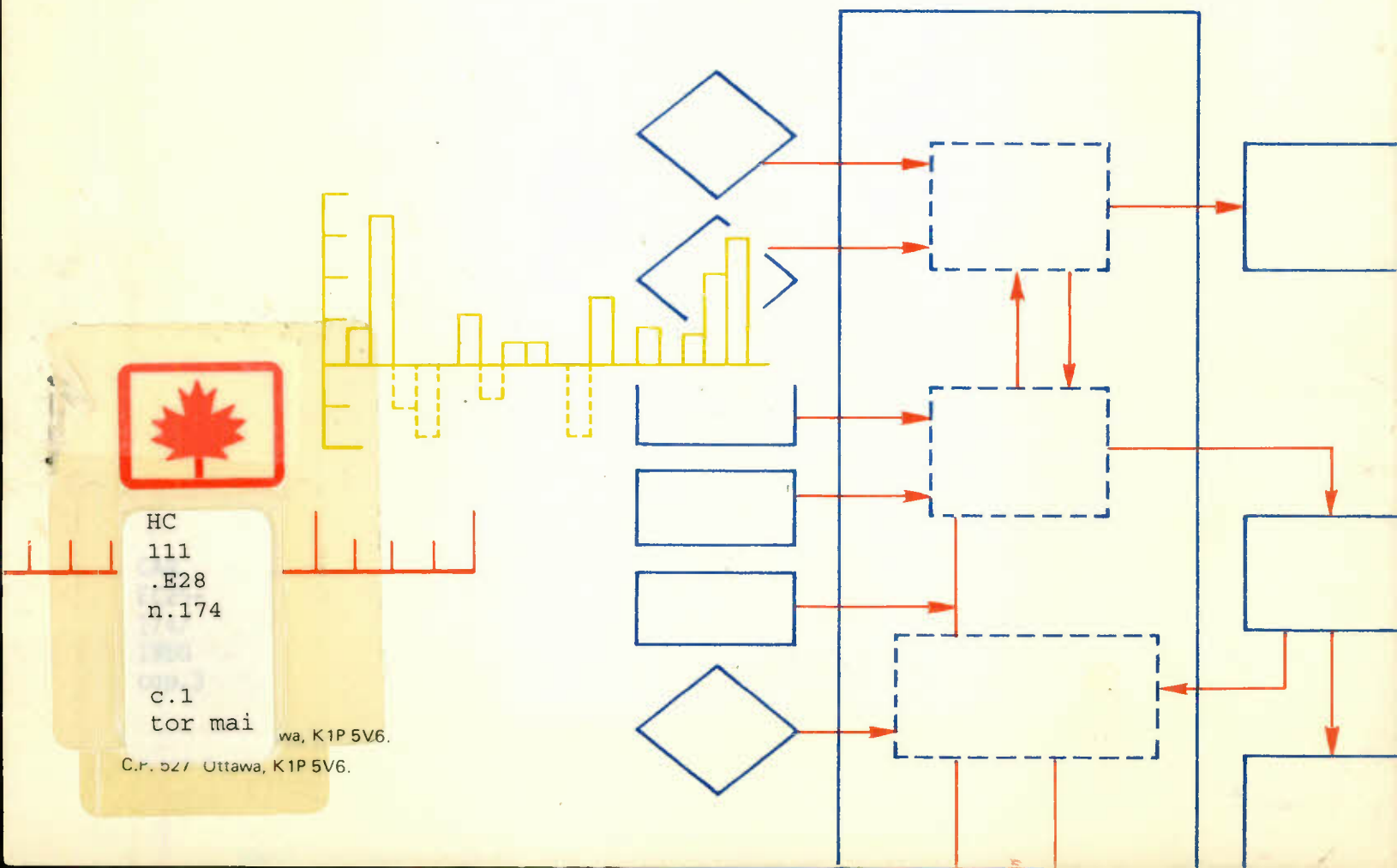

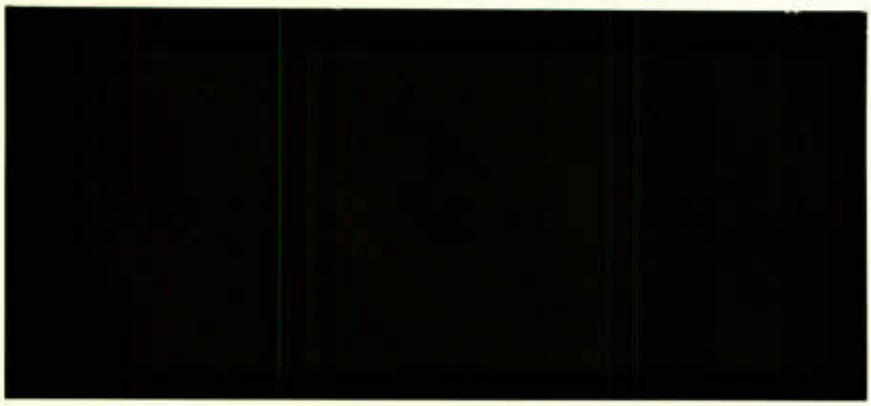

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DISCUSSION PAPER NO. 174

The Effects of the Growth of Private and Public Pension Plans on Saving and Investment in Canada

by Peter Wrage

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Résumé

La présente étude examine les effets des régimes de pension privés et publics sur le niveau et la composition de l'épargne personnelle. Elle tient donc compte également des modifications qui ont pu se produire dans les portefeuilles personnels sous l'influence des régimes de retraite actuels. En outre, l'auteur passe en revue les effets des régimes de pension sur la quantité de travail que fournissent les gens et, donc, de leur portée sur les décisions d'opter pour la retraite et sur l'épargne personnelle.

L'auteur établit un modèle des choix entre la consommation et les loisirs, portant sur un cycle de vie divisé en deux périodes, dont il se sert pour analyser l'épargne sous forme de pensions, ainsi que le comportement de l'offre de travail. En partant de l'hypothèse que la consommation et la demande de biens sont déterminées conjointement plutôt que d'une façon séquentielle, le modèle a été élargi pour inclure les choix de biens conditionnés par le rendement de ces biens et des risques qu'ils comportent.

Les équations d'estimation que donne le modèle ont été étendues pour tenir compte des changements démographiques passés, de l'inflation, du chômage, des risques afférents à un portefeuille, des taux d'intérêt et autres formes

de richesse des ménages. Cette optique plus vaste, ainsi que le cadre théorique plus rigoureux qui englobe la demande de biens, permettent une analyse plus complète que les études passées, qui étaient plus pragmatiques.

Les résultats empiriques obtenus portent à conclure que les Régimes de pensions du Canada et de rentes du Québec n'ont eu aucun effet direct sensible sur le comportement de l'épargne personnelle. Toutefois, il ne semble pas en être de même pour le programme de sécurité de la vieillesse et, fort probablement aussi, des régimes de pension offerts par les employeurs. En outre, les changements dans les attitudes envers la retraite, qui ont résulté de ces régimes de pension, ont également influé l'épargne personnelle. Les effets conjugués des régimes de pension et du vieillissement de la population ont, semble-t-il, contribué à réduire le taux de l'épargne personnelle de peut-être 0,5 point de pourcentage en 1975. Il s'est produit aussi, dans les portefeuilles des particuliers, une légère hausse de la participation à des régimes enregistrés d'épargne-retraite, aux dépenses des obligations d'épargne du Canada. De plus, les prestations de sécurité de la vieillesse, de même que celles du RPC et du RRQ ont entraîné une légère réduction de l'offre de travail par travailleur avant la retraite. Les régimes de pension offerts par l'employeur n'ont pas eu cet effet; avec les prestations de sécurité de la vieillesse et des autres formes d'accroissement de la fortune personnelle, ils ont influé sur le moment de quitter un emploi primaire pour la retraite. Voilà pourquoi certaines personnes ont choisi de prendre une retraite anticipée et ont réduit leur participation au marché du travail après l'âge de 65 ans.

ABSTRACT

This study examines the effects of private and public pension plans on both the level and composition of personal savings. It thus also considers personal portfolio changes which may have occurred as a result of existing pension plans. In addition, the study examines the effects of pension plans on the amount of labour supplied by individuals and, consequently, the implications for the retirement decision and personal savings.

A two-period life-cycle model of the consumption-leisure choice is used to analyse pension saving and labour supply behaviour. On the assumption that consumption and the demand for assets are determined jointly rather than sequentially, the model has also been extended to include asset choices which depend on the return and risk of the assets.

The resulting estimating equations have been extended to encompass the effects of past demographic changes, inflation, unemployment, portfolio risk, interest rates and other household wealth. This broader scope and the more rigorous theoretical framework which includes the demand for assets allow a more comprehensive analysis than past, more pragmatic studies.

The empirical results lead one to conclude that the CPP/QPP programs have not had any significant direct effect on personal saving behaviour. However, this does not appear to be the case with the OAS program and, quite possibly, the employer-sponsored pension programs. In addition, changes in retirement

behaviour, which have occurred as a result of these pension programs, have also affected personal saving. The combined effects from pension programs and an aging population appear to have reduced the personal saving rate by perhaps 0.5 percentage points in 1975. A small shift in the portfolio of individuals towards RRSP's from CSB's has also occurred. Furthermore, both OAS and CPP/QPP pension plan wealth have lead to a small reduction in the per worker labour supply prior to retirement. Employer-sponsored pension programs have had no such effect; they, along with OAS and other wealth, have affected the timing of retirement from the primary job. Thus, individuals have chosen earlier retirement and have reduced participation in the labour market after age 65.

Introduction

In recent years, concern about the adequacy of capital investment has again become a prominent issue in Canada. There is some apprehension that we may be saving too little to meet future investment needs which, it is assumed, would adversely affect economic growth and productivity in Canada. The preoccupation with such a potential shortage of saving has raised questions regarding the circumstances which would result in a more or less permanent gap between saving and investment and its implication for the economy. In general, such a capital shortage could come about for three reasons. First, financial markets could fail to clear, i.e. the demand for savings persistently exceed the supply of savings. Second, there may exist some standard regarding the desirable level of investment external to the economic system which exceeds the current and future expected supply of savings. Finally, capital formation may be adversely affected by government policies through their effects on the supply of saving.

This study is concerned with exploring the last issue, in particular, the effects of Canadian pension plan programs on the supply of saving. We shall explore the impact that both government- and privately-sponsored pension programs may have on saving behaviour. In the United States, both Feldstein [1974] and Munnell [1974] have argued vigorously that such programs have had an adverse effect on personal savings behaviour.

Feldstein's evidence, for example, shows that the U.S. social security system may have depressed personal saving by as much as 30 to 50 per cent. By halving personal saving, social security would have reduced total private saving by 38 per cent during the 1960s. Over the longer term, Feldstein estimates that this resulted in a decrease in the private capital stock of 38 per cent and a decrease in GNP of approximately 11 per cent.[1] If he is right, then the existence of similar programs in Canada could have enormous implications for future economic growth and productivity.

The Study

This study differs both in scope and methodology from other, currently available Canadian and U.S. studies. These studies take a narrow approach to the issue of pension plan effects on personal saving. They ignore the fact that individual saving decisions are made not only about the level of saving out of disposable income, but also how this saving is to be allocated among a variety of financial and real assets. These choices, in turn, are made against a background of decisions regarding consumption and the amount of labour to be supplied to the market. The presence of pension plan programs will affect all of these decisions.

This study examines the effects of private and public pension plans (including Old Age Security), on decisions about

the personal savings level and its composition, i.e. any personal portfolio changes which may have occurred as a result of the existence of pension plans. The study also examines the effects of pension plans on the amount of labour supplied by individuals and the implications for retirement and personal savings. By extending the study to encompass the effects of past demographic changes, inflation, unemployment, portfolio risk, interest rates and other household wealth, an attempt is made to focus on the ceteris paribus effects of pension plans. Finally, the study will examine whether changes in personal savings due to the pension programs are offset by other forms of saving, for example, corporate savings. This should establish whether the level of private domestic savings and its composition has been affected by pension programs.

Before developing a theoretical model of individual behaviour, we need to gain some insight into the institutional framework of Canada's pension programs as it has developed over the years and how previous researchers in this area have attempted to relate such pension programs to personal savings behaviour.

THE RETIREMENT INCOME SYSTEM AND PERSONAL SAVINGS BEHAVIOUR

Prior to the introduction of the Old Age Pension Act in 1927, saving for retirement had been primarily the responsibility of individuals. With the introduction of this act which

provided a basic pension to those aged 70 and over, the government took the first major step towards accepting responsibility for the financial well-being of its retiring citizens. Over the years, Canada's retirement income programs have evolved to the point where pension programs now provide both a minimum level of income and replace some portion of pre-retirement income. Those programs designed to provide a minimum income are all government financed. The most important of these programs is the Old Age Security (OAS) program non financed from general tax revenues. In 1977 it paid out $3,319 billion in benefits. It provides a demogrant to all residents of Canada over 65 years of age in the form of a flat- rate indexed pension without requiring a means test. In addition, a Guaranteed Income Supplement (GIS) is available to those individuals whose only retirement income consists of Canada Pension Plan (CPP) or Quebec Pension Plan (QPP) benefits and/or the OAS. However, while this program is also indexed, it does require a means-test and provides for a reduction of $1 in benefits for every $2 of income in excess of the OAS grant. In 1977, it paid out $1,017 billion in benefits to about 50 per cent of the population 65 years and older. A number of provinces (Nova Scotia, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia) have also introduced their own, additional program of income assistance. While not indexed, these programs do provide some additional guaranteed income for the retired.

The other major components of Canada's retirement income system are aimed at income replacement. The major government-sponsored programs in this area are the CPP/QPP programs. They cover 98 per cent of the labour force and are not income tested. Benefits are indexed, are tied to earnings up to a maximum earnings ceiling and are payable at age 65. Unlike OAS and GIS, which are financed from general revenue, these programs are financed from employer-employee contributions (1.8 per cent of the employee's pensionable earnings with a matching employer contribution). Currently, these contributions exceed benefits. While the excess funds will disappear as the CPP/QPP programs mature, i.e. when all individuals who have contributed over the full period begin to retire, the excess funds from CPP are currently made available to the provinces as loans in proportion to the contributions from each province, at the Government of Canada 20 year and over bond rate. With the exception of Quebec, these funds replace other borrowings and/or are used for provincial expenditures and investments. The Quebec Pension Plan invests its excess funds in province of Quebec securities and other financial market instruments.

The private sector provides the remaining elements of income replacement in the form of employer-sponsored pension plans, Registered Retirement Savings Plans (RRSPs) and other personal savings. Employer-sponsored plans are the most important both in terms of coverage and dollar volume. About 40 per cent of these plans are integrated with CPP/QPP, i.e. contributions and benefits of the two programs are integrated.

All such plans except plans operated by the federal government for its own employees are required by law to be fully funded. As of 1977, individuals who did not participate in such employer-sponsored pension plans, for example, the self-employed, could contribute as much as 20 per cent of their annual earned income, up to $5,500, to a RRSP and deduct these contributions from taxable income. In addition, individuals who are participating in an employer-sponsored pension plan, but contribute less than 20 per cent of their annual earned income, up to a $3,500 ceiling, may contribute the difference to a RRSP.

By way of encouragement, Canada's Income Tax Act provides that contributions to employer-sponsored plans and RRSPs are, within certain prescribed limits, deductible from gross income in determining taxable income. The individual contributor therefore gains in two ways. First and foremost, by contributing to an RRSP, or indeed, an employer-sponsored plan, he defers his tax liability until retirement, at which time savings are received as income. In most cases, an individual's marginal rate of income tax will be lower during retirement than when contributions were paid in. This is largely due to the fact that such an individual's employment earnings, if any, are much lower. Furthermore, as a result of the Old Age Exemption and the Pension Income Deduction, any additional annuity income from RRSP, or other pension plans is also taxed at a rate much lower than that prior to retirement. Second, an individual earns the gross rate of interest on such retirement savings

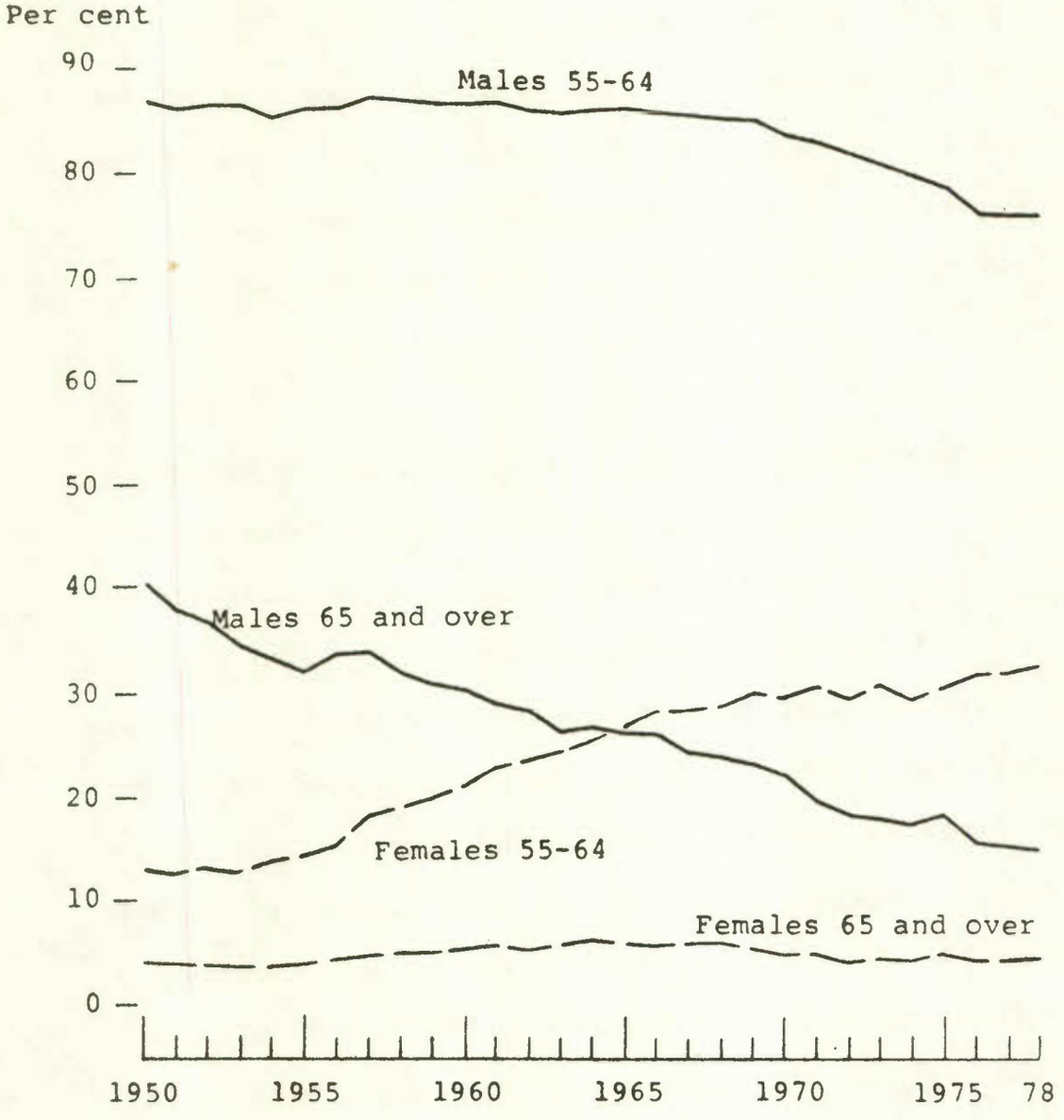
provided that interest earned is not received as income prior to retirement.

Finally, individuals also save for retirement by accumulating wealth in the form of financial and real assets. In the latter case, the major asset accumulated by Canadian households is equity in a home. The only major tax incentive to save via the accumulation of financial assets is the tax deductibility of the first $1,000 of interest income from such assets.

The development of such a retirement income system may have had an effect on attitudes towards working and saving for retirement. Not only would these programs tend to condition individuals to 65 years as a normal retirement age, but programs requiring an incomes test such as GIS, would actively discourage individuals to work past this age. The pension benefits from the various programs has also modified the sharp drop in income that individuals previously had to face on retirement. This income replacement effect also may have contributed to older workers retiring earlier. The decline in the labour force participation rates of the elderly (Chart 1) may therefore be partly due to this exogenous factor -- pension programs. Although the growth in personal income has no doubt been a major cause of earlier retirement, the drop in the participation rate of males after the introduction of CPP/QPP in 1966, along with the overall decline in the participation rate between 1950-78,

Chart 1

Participation Rates, Selected Age Groups, by Sex, 1950-78



Source These participation rates are based on annual averages of a monthly Labour Force Survey Division, Statistics Canada for the period 1953-78. Prior to 1953, the annual averages were derived from a quarterly survey. The monthly figures were revised in 1965, 1971 and 1976. These revisions covered 1956-65, 1966-74 and 1975-78, respectively. Figures prior to 1971 were taken from Special Table I, then published monthly and yearly. Latest figures are from Statistics Canada, Labour Force Annual Averages, Cat. No. 71-529, 1975-78.

has also been the result of the retirement provisions of the various pension programs. For example, the reduction in the age of eligibility in 1972 (70 to 65 years of age) for OAS benefits may have had a major impact on the retirement decision.

Anticipated pension benefits may lead individuals to choose more leisure either through earlier retirement and/or a reduced labour supply during the pre-retirement period.2 However, such expected earlier retirement would also induce individuals to increase their labour supply prior to retirement in order to increase their income and therefore maintain their personal savings goal for retirement. A reduced labour supply during pre-retirement, on the other hand, would require an individual to save more out of income, thus increasing the savings rate in order to maintain his personal savings objective for retirement.

Anticipated pension benefits may also affect personal savings behaviour directly, both in terms of the level of per capita saving and the composition of per capita saving. If individuals consider pension benefits as payments on an annuity commencing at age 65 to which they have contributed during their pre-retirement period, then pension programs can be considered as providing personal wealth. Such wealth will have the same effect on consumption as other, more tangible wealth -- it will increase consumption and therefore reduce personal savings.

Such a reduction in personal savings does not imply that all forms of personal savings are affected equally, i.e. all financial and real assets are reduced across the board. While it has been argued by Brainard and Tobin (1968) that saving should be viewed as a spending/no spending decision followed by a decision to allocate the saved funds among different assets (a problem in portfolio choice), it can also be argued that in the presence of imperfect capital markets there is a relationship between the motives to save and the form in which such saving take place. Thus one might expect individuals to cut back discretionary forms of savings for retirement due to the increased availability of contractual savings for retirement, i.e. pension programs. In addition, such contractual savings would change the risk and return characteristics of an individual's overall portfolio of assets. This in turn should lead to a change in the composition of assets in the discretionary savings component of his portfolio.

Table 1 presents the annual composition of the stocks of the major assets and liabilities held by individuals during the period 1957-75. The evidence suggests that equity held by individuals is the major component which has declined between 1957-75, about 16 percentage points. Furthermore, individuals also hold a larger proportion of their assets in savings deposits, private pensions, RRSP's and consumer durables. Corresponding to the latter, there has also been an increase in consumer credit. Both the net residential housing stock and

residential mortgage stock have also increased over the period. By no means does this imply that a causal relationship exists between such changes in portfolio composition and the existence of pension programs. Nevertheless, the fact that major changes in the composition of assets and liabilities followed the introduction of RRSP's, the rapid growth in private pensions during the 1960's and 1970's and the establishment of the CPP/QPP programs in 1966 is, at least, indicative of a possible link.

While this portfolio aspect of pension plan effects on personal savings has not been widely explored, this is not the case for the effects of pension plans on the level of personal savings. The literature in this area is quite extensive, we will therefore only outline the major controversies regarding pension plans and savings.

The Theory and Evidence of Pension Plan Effects on Personal Savings Behaviour

In the early 1960s, empirical studies by both Cagan [1962] and Katona [1962] indicated that pension programs had increased personal savings. By way of explanation, Cagan suggested that pension plans had had an educational effect on their members, making them more aware of the importance of saving for retirement. He called this phenomenon, the "Recognition Effect". A similar explanation was put forward by Katona. He argued that the very existence of a pension plan had led

Table 1

A Household Balance Sheet of Assets and Liabilities: 1957-75[1]
(PERCENTAGE COMPOSITION)

Period Covered	Money M1	Savings Deposits SDEP	Equity RCAP	Canada Savings Bonds CSB	RRSP's	Consumer Durables CD	Net Stock of Residential Housing	Private Pension Assets	Residential Mortgages	Consumer Credit	Total
1957-59	4.5	7.1	55.6	2.4	0.2	8.7	23.7	3.9	3.9	2.2	100.0
1960-62	4.4	7.0	55.7	2.9	0.6	9.3	22.4	4.9	4.6	2.6	100.0
1963-65	4.4	7.1	54.4	3.5	1.0	10.0	22.5	5.9	5.7	3.1	100.0
1966-68	4.4	7.8	52.7	3.3	1.4	11.2	22.5	6.4	6.2	3.5	100.0
1969-71	4.2	8.9	48.6	3.1	1.7	12.2	25.0	6.8	6.6	3.9	100.0
1972-74	4.6	11.4	44.0	3.6	2.0	13.7	25.8	7.6	8.3	4.4	100.0
1975	4.7	13.4	39.9	3.8	2.1	16.7	25.8	8.0	9.5	4.9	100.0

1 This balance sheet is not complete. It ignores net insurance assets, a major source of personal saving. Unfortunately, such data is incomplete. In addition, corporate bonds are excluded because households, in general, hold only minute amounts of such liabilities. In principle, human wealth i.e. human capital should also be included in this balance sheet in order to provide a link with the labour market. It was excluded because of the difficulty in estimating it.

2 The definition of the asset and liability categories is in Appendix D.

Source Based on data provided by the CANSIM data bank and own calculations.

individuals to intensify their saving efforts, which increased as individuals got closer to their retirement goal. Katona called this "the goal feasibility hypothesis".

Both the empirical work and the explanation of the results were considered controversial. The Cagan sample of households was quite unrepresentative of United States' households, because of the inclusion of self-employed households without an explicit control for differences in income variability of such households thus biasing any comparison of pension plan member and non-member behaviour in favour of the former (W. W. Waters [1976]). Furthermore Feldstein [1974] suggested that such findings could be more easily explained in the context of traditional economic theory without the contrivance of a recognition effect or a model which makes savings preferences endogenous.

An alternative hypothesis regarding the effects of pension plans on savings centered around the life-cycle theory of savings. According to this theory, wealth is accumulated during one's working life, in order to ensure an adequate income during retirement. Both private and public pension plans are a form of wealth because they provide benefits during retirement. It is assumed that such programs reduce the need to accumulate wealth for retirement from other sources.

Over the longer term, individuals could view such pension plans in either of two ways. On the one hand, they could think of the pension contributions as being equivalent to savings, earning a rate of return. Accordingly, they would reduce their own discretionary savings, which is equivalent to an asset substitution effect. If the pension program is a pay-go program in which no assets, i.e. funds, are generated, total savings might even be reduced. If the program is fully funded, then the implied additional savings could more than offset any reductions in personal saving.

On the other hand, contributions to public plans could also be viewed as an exchange of a current tax for an implied promise of future benefits. Consequently, individuals might focus on their expected benefits. This perspective implies that pension plan coverage is similar to owning an annuity, i.e. a claim on future annual payments starting at age 65. Such annuities would therefore be considered an important part of each family's wealth. This pension plan "wealth" is, of course, not tangible wealth rather it is an implicit promise that the next generation will tax itself to pay off on these annuities. Nevertheless, even though there are no tangible assets to correspond to this "wealth", it is perfectly rational for households to regard such future benefits as part of their personal wealth.[3] Such a "wealth" variable would play the same role in the aggregate saving function as is expected of ordinary wealth -- a higher level of wealth should increase

current consumption and decrease current saving.[4] More broadly, pension wealth "replaces" ordinary or tangible wealth by causing a replacement of discretionary saving by pension saving.

Using an extended version of the life-cycle savings model, both Feldstein [1974] and Munnell [1975] have shown that such a wealth substitution effect exists, but may be offset by increased saving due to an induced retirement effect. Accordingly, individuals covered by pensions have an incentive to either retire earlier than they would have in the absence of pensions or increase their leisure relative to labour during their working life. This would result in a shorter working period over the individual's life cycle. According to Feldstein, to obtain a desired level of retirement income, would therefore require greater savings out of income during those working years.[5] Initially, such an induced retirement effect could offset the wealth substitution effect. However, Feldstein argues that, as the retirement age stabilizes, this induced retirement effect would disappear. Consequently, in the long run, the wealth substitution effect would reduce personal savings. According to Feldstein, the net effect may have been a reduction of total private saving of 38 per cent in the United States.

Following Feldstein's methodology, Ilkiw [1978] and Boyle and Murray [1978], replicated this empirical work for

Canada in order to estimate the effects of CPP/QPP and OAS on the personal saving rate. Both the Canadian studies and some more recent work by Lapointe [1978] suffer some drawbacks. The Ilkiw paper essentially replicates Feldstein's work. Neither researcher distinguishes between permanent and transitory income effects. In addition, the instability of Ilkiw's proxy for the pension plan wealth variable both in sign and significance for the various estimated regression equations suggests that the variable is not a good proxy for perceived pension plan wealth. The Boyle/Murray study also follows Feldstein's methodology. It estimates and uses a CPP/QPP pension plan wealth variable and incorporates the concept of permanent and transitory income into the estimations. Its major drawback lies in the fact that like Feldstein, the empirical work ignores the direct effects of pension programs on the labour market. While the Ilkiw study suggests that CPP/QPP has reduced personal savings, the Boyle/Murray study remains agnostic.

The Lapointe [1978] paper also distinguishes permanent and transitory income effects on Canadian savings. The author uses the contribution variable as a pension plan wealth proxy which turns out not to be significant. This is not surprising, since it can be viewed as a tax, and Taylor [1967] has shown that as such, the effect on consumption is either small or insignificant. Furthermore, the model ignores the induced retirement effect. Consequently, the empirical results do not

constitute a test of the effect of pension plans on personal savings.

Barro [1977] has suggested that in the long run the pension plan wealth effect depends on the extent of the offset of private intergenerational transfers, i.e. bequests. On the assumption that Social Security in the United States is a pure pay-as-you-go, government-imposed, intergenerational transfer, which substitutes for private transfers, no effect on capital accumulation (and on the supply of saving) should be observed. Any reduction in savings for retirement would be exactly offset by an increase in savings destined for bequests. However, the importance of the bequest motive in offsetting the effects of social security on savings is necessarily an empirical question. Barro's own work, using time series analysis of saving behaviour in the U.S. and an expanded Feldstein model does not support Feldstein's conclusions. Feldstein, of course, disputes both the theoretical and empirical conclusions reached by Barro. Firstly, on grounds that the case made for a large bequest motif is not borne out by survey evidence and secondly, on the grounds, that the empirical estimating equations are misspecified.[6]

Some Fundamental Theoretical Problems

The major deficiency of the basic model used by these researchers is that saving is treated as a residual and

specified as a function solely of one or more wealth variables constrained by current disposable income. What is lacking, is a structurally consistent model of household behaviour with the relationship between the household consumption (savings), leisure and investment decisions accurately specified. Only by taking into account the determinants of these decisions and their interrelationships will it be possible to make accurate estimates of the magnitude of any pension plan effects on savings.

A number of attempts have been made in that direction. In a recent paper Turner, [1978] has argued that the interrelationship between consumption and pre-retirement labour supply Smith, [1975] has been ignored, i.e. the "induced retirement" effect recognizes the impact of pension plans on the supply of older men, but overlooks the effect on workers in the prime labour force. As a result, these models do not recognize that pension plans may have caused an increase in income and therefore saving because of a positive induced retirement effect on the pre-retirement labour supply.

Another aspect of the extended life-cycle model used by Feldstein and Munnell, which has had some recent attention, is the treatment of uncertainty. Their model does incorporate uncertainty to the extent that permanent income or expected income is assumed to determine consumption, however, Martin [1978] correctly points out, that individual behaviour is

determined not only by income expectations but also by perceived risk. Given that most individuals are risk averse, savings will increase if the uncertainty of income (the variance of income) increases and decrease if uncertainty decreases. The riskless nature of pensions may be construed to reduce the uncertainty of income in the future, possibly decreasing savings.

Risk affects another aspect of household decision-making -- the household portfolio decision, i.e. the demand for real and financial assets. Friend and Crockett [1965] have argued that the consumer's investment decision is closely related to, if not identical to, his savings decision. Indeed, Tobin and Watts [1960] show that the desired structure of assets and liabilities will depend on: (i) attitude towards risk, (ii) the ability to borrow, (iii) the demand for consumer durables, (iv) household liquidity requirements, and (v) the nature of future demands on wealth for retirement and bequests. If the composition of assets is directly affected by pension plans, due to changes in income expectations and risk, then the level of assets in the portfolio near retirement is also affected. At the very least, due to differences in risk, each dollar of pension savings will not displace a full dollar of non-pension savings, thus increasing total private savings.

The problems and issues inherent in these studies suggest a model of behaviour regarding consumption, leisure and investment by the household under uncertainty. Such a model

must incorporate pension plans as part of the income constraint, as well as a constraint on the demand for assets. The model which follows tries to take into consideration these behavioural aspects. Nevertheless, it should be recognized that the model specification is at times somewhat pragmatic in order to incorporate the major institutional aspects of pension programs. While this reduces the economic rigour of the model, it still provides a useful framework for analyzing pension programs in Canada.

A Theoretical Model

As was pointed out earlier, saving is often viewed as a spending/no spending decision, with the allocation of saved funds among different assets an independent problem of portfolio choice. A basic statement of such a portfolio balance approach has been made by Brainard and Tobin [1968]. While they emphasize the role played by the wealth constraint in any system of asset demand equations, they also stress the fact that the total change in wealth (savings) is treated as exogenous and asset flow demands are conditional on the exogenously given change in wealth.

However, there may also be a relationship between the motive for saving and the form in which the saving is held. Friend and Crockett [1965] have argued that, "the consumer's investment decision is based on much the same consideration for

both real and financial assets, and is closely related to if not equivalent to his saving decision". Similarly, Tobin and Watts [1960] agree that there will be a relationship between portfolio composition and saving motives. "The composition of current savings and investment depends on the structure of the capital account ... and on the pattern as well as the magnitude of future consumption plans and aspirations". One would therefore expect that saving for retirement would in general take a different form than saving for other reasons, for example, the downpayment for a home.

If it is not legitimate to separate the flow - allocation and stock - allocation decisions, then there is no portfolio - balance problem in the sense of allocating a given level of wealth. On the contrary, there is a problem in determining consumption and asset demands jointly over time. The implication is that saving and portfolio decisions must be interdependent. Under these circumstances, one would expect a rational individual to make consumption and asset flow demand decisions dependent not only on income and his current stock of wealth, i.e. current holdings of individual assets and liabilities, but also dependent on the return and risk of these assets, i.e. expected future consumption relative to current consumption.

We will examine pension saving and labour supply behaviour in the context of the familiar analysis of the

consumption-leisure choice facing a representative individual. Two periods of the life-cycle will be distinguished; period 1 denotes an individual's normal working life and period 2 beginning on the individual's 65th birthday and ending on death. The individual is assumed to maximize his utility in terms of period 1 consumption C_1, future consumption C_2 in period 2, labour L_1 and risk. By assumption, an individual does not supply any labour, L_2 in period 2, i.e. during retirement. Furthermore, the return on assets is part of the individual's income used to make choices regarding consumption and saving. Thus only the asset risk variable σ need be considered as a decision variable in the utility function. Both L_1 and σ are assumed to provide disutility to the individual. We therefore postulate the following general utility function,

$$(1) \qquad U = U(C_1, C_2; L_1, \sigma)$$

and make the following behavioural assumptions;

(A1) The typical individual's behaviour can be represented by the above, well-defined utility function. The utility function is everywhere twice differentiable.

(A2) We define C_1, as the expected consumption of some defined composite commodity over the individual's working life, i.e. period 1, and C_2 as the expected consumption of the same composite commodity during the individual's retirement, i.e. period 2.

(A3) We define L_1 as the amount of labour the individual provides in period 1. It is assumed that the individual does not work during retirement, i.e. period 2.

(A4) It is assumed that the individual finds it possible to summarize asset choice opportunities in period 1 solely in terms of the expected return and risk associated with each asset, A_i. Thus,

$$A_i = A_i(\Gamma_i, \sigma_i)$$

In addition, we assume that,

$$\partial A_i/\partial \Gamma_i > 0 \qquad i=1 \ldots n \text{ assets}$$

and $$\partial A_i/\partial \sigma_i < 0$$

(A5) If individuals have a positive rate of savings and invest such savings in risky assets, then it is assumed that for a given level of risk, interest income will be generated. Thus,

$$\sum_{i=1}^{n} (A_{1i}-A_{0i})\,(1+\Gamma_i) \geq 0 \quad \text{where} \quad \sum_{i=1}^{n} A_{1i}=A_1 \quad \text{and} \quad \sum_{i=1}^{n} A_{0i}=A_0$$

and $\sum_{i=1}^{n} (A_{1i}-A_{0i})$ is the change in net assets held by individuals, $\sum_{i=1}^{n} \delta_i$ i.e. saving.

(A6) It is assumed that individual can dissave only if $A_o>0$, no net borrowing can take place if $A_o=0$.[7]

In period 1, an individual has an initial amount of wealth consisting of assets accumulated in the previous periods, interest income on such assets and labour income WL_1 where W is the nominal wage rate. We let A_{oi} be the amount of wealth

invested in asset i in the previous period, with a rate of return, Γ_{0i}. Total income, y, for period 1 can be written as,

$$(2) \qquad y = WL + \sum_{i=1}^{n} \Gamma_{0i} A_{0i} \qquad i=1 \ldots n \text{ assets}$$

During period 1, an individual will consume and invest this income. It follows that the budget constraint for period 1 can be written as,

$$(3) \qquad P\,C + \sum_{i=1}^{n} (A_{1i} - A_{0i}) = WL_1 + \sum_{i=1}^{n} \Gamma_{0i} A_{0i}$$

or alternatively, writing $(A_{1i} - A_{0i}) = \delta_i$, i.e. personal savings/dissavings in asset i.

$$(4) \qquad P_1 C_1 + \sum_{i=1}^{n} \delta_i = WL_1 + \sum_{i=1}^{n} \Gamma_{0i} A_{0i}$$

where $\sum_{i=1}^{n} \delta_i \gtrless 0$ since $\delta_i \gtrless 0$ for i=1...n which implies that asset substitution can take place.

We assume that in period 2, i.e. during an individual's retirement, all accumulated wealth is consumed, i.e. no bequests are made. The budget constraint for period 2 is,

$$(5) \qquad P\,C = \sum_{i=1}^{n} \delta_i (1+\Gamma_{1i}) + \sum_{i=1}^{n} A_{0i} (1+\Gamma_{1i})$$

where P_1 and P_2 are the prices of current and future consumption, δ_i is the change in the holdings of asset i and Γ_{1i} is the return on asset i for period 1. We also require that each asset i is some proportion of the total asset portfolio i.e.,

$$(6) \qquad A_{0i} = \alpha_{0i} A_0 \qquad \text{with} \sum_{i=1}^{n} \alpha_{0i} = 1$$

Using (6), we can rewrite equations (4) and (5) respectively as,

$$(7) \qquad P_1 C_1 = WL_1 + A_0 \sum_{i=1}^{n} \alpha_{0i} \Gamma_{0i} - \sum_{i=1}^{n} \delta_i$$

and

$$(8) \qquad P_2C_2 = \sum_{i=1}^{n} \delta_i (1+\Gamma_{1i}) + A_0(1+ \sum_{i=1}^{n} \alpha_{0i}\Gamma_{1i})$$

By solving equations (7) and (8) for C_1 and C_2 and substituting into equation (1), we derive the utility function,

$$(9) \qquad U = U[\frac{WL_1}{P_1} + \frac{A_0}{P_1} \sum_{i=1}^{n} \alpha_{0i}\Gamma_{0i} - \frac{1}{P_1} \sum_{i=1}^{n} \delta_i; \frac{1}{P_2} \sum_{i=1}^{n} \delta_i(1+\Gamma_{1i}) + \frac{A_0}{P_2}(1+ \sum_{i=1}^{n} \Gamma_{1i}\alpha_{0i}); L_1; \sigma]$$

We asume that for all positive prices a unique maximum is attained at which C_1, C_2, L_1, $A_i > 0$. The solution to the maximum problem gives each of the decision variables as a function of all prices, interest rates, initial stocks and risk.[8] In particular, we can define a labour supply function;

$$(10) \quad L_1 = L_1 (P_1, P_2, W, \Gamma'_{01} \cdots \Gamma'_{0n}, \Gamma'_{11} \cdots \Gamma'_{1n}, A_{01} \cdots A_{0n}, \delta_1 \cdots \delta_n, \sigma)$$

We can also define i asset flow demand functions;

$$(11) \quad \delta_i = \delta_i(P_1, P_2, W, \Gamma'_{01} \cdots \Gamma'_{0n}, \Gamma'_{11} \cdots \Gamma'_{1n}, A_{01} \cdots A_{0n}, L_1, \delta_1 \cdots \delta_n, \sigma$$

where $j \neq i$, $\Gamma'_{0i} = \delta_{0i}\Gamma_{0i}$ and $\Gamma'_{1i} = \delta_{0i}\Gamma_{1i}$ for i=1...n

In addition, from A5 we can define a personal savings function, since $S_1 \equiv \sum_{i=1}^{n} \delta_i = A_1 - A_0$, personal savings;

$$(12) \qquad S = S(P_1, P_2, W, \Gamma'_0, \Gamma'_1, A_0, L_1, \sigma) \text{ where } \Gamma'_0 = \sum_{i=1}^{n} \alpha_{0i}\Gamma_{0i}$$

$$\text{and } \Gamma'_1 = \sum_{i=1}^{n} \alpha_{0i}\Gamma_{1i}$$

The form of these equations is quite general. However, the variables are totally interdependent. To obtain a determinant solution therefore, requires some simplifications. Consequently, the terms L_1 and $\delta_1 \cdots \delta_n$ were dropped from the equations.

The latter were dropped on the grounds that investment in asset i is not correlated with investment in asset j, i.e. investment in asset i is a function of its own return and risk only. While it would be desirable to retain L_1 in equations (11) and (12) in order to maintain the direct link between savings and the labour supply, the resulting simultaneous equation system would not provide a determinant solution. Consequently L_1 was dropped and equations (10), (11) and (12 will be estimated independently.

For convenience, we shall assume that the equations are homogeneous of degree zero with respect to all arguments. Using P_1 as a deflator, we can then restate equations (10), (11) and (12) respectively as follows:

(13) $$\ell = \ell\left(P_2/P_1,\ W/P_1,\ \Gamma^*_{01}\ldots\Gamma^*_{0n},\ \Gamma^*_{11}\ldots\Gamma^*_{1n},\ \frac{A_{01}}{P_1}\ \ldots\ \frac{A_{0n}}{P_1},\ \sigma\right)$$

(14) $$\delta_i = \delta_i\left(P_2/P_1,\ W/P_1,\ \Gamma^*_{01}\ldots\Gamma^*_{0n},\ \Gamma^*_{11}\ldots\Gamma^*_{1n},\ \frac{A_{01}}{P_1}\ \ldots\ \frac{A_{0n}}{P_1},\ \sigma\right)$$

(15) $$S = S\left(P_2/P_1,\ W/P_1,\ \Gamma^*_0,\ \Gamma^*_1,\ A_0/P_1,\ \sigma\right)$$

where "*" indicates that the yields on the assets have been deflated by P_1.

We are interested in studying the effects of pension programs on equations (13), (14) and (15). We will therefore assume that pension programs are similar to annuities i.e. individuals "save" (make contributions) until age 65, at which point, the annuities begin to pay off in the form of benefits. Terms of employment include a requirement for joining an employer-sponsored pension

program and making contributions. Similarly, being employed requires contributions to CPP/QPP. As mentioned earlier the OAS program is financed from general revenue and thus through the tax system. In all cases, however, individuals are required to contribute directly or indirectly to these programs. We will assume that the existence of these programs, by providing contractual earnings, will affect discretionary savings i.e. an individual's asset choices and given a riskless return on such pension savings, will alter the composition and level of his asset portfolio. To incorporate the effects of pension programs on labour supply, asset flow demand and personal savings, the equations were altered as follows;

$$(13') \quad \ell = \ell\left(P_2/P_1,\ W/P_1,\ \Gamma^*_{01}\ldots\Gamma^*_{0n},\ \Gamma^*_{11}\ldots\Gamma^*_{1n},\ \frac{A_{01}}{P_1}\ldots\ \frac{A_{0n-3}}{P_1},\ \frac{\overline{OASW}}{P_1},\ \frac{\overline{CPP/QPP}}{P_1},\ \frac{\overline{PP}}{P_1},\ \sigma\right)$$

$$(14') \quad \delta_i = \delta_i\left(P_2/P_1,\ W/P_1,\ \Gamma^*_{01}\ \ldots\ \Gamma^*_{0n},\ \Gamma^*_{11}\ \ldots\ \Gamma^*_{1n},\ \frac{A_{01}}{P_1}\ \ldots\ \frac{A_{0n-3}}{P_1},\ \frac{\overline{OASW}}{P_1},\ \frac{\overline{CPP/QPP}}{P_1},\ \frac{\overline{PP}}{P_1},\ \sigma\right) \qquad i=1\ldots n-3$$

$$(15') \quad S = S\left(P_2/P_1,\ W/P_1,\ \Gamma^*_0,\ \Gamma^*_1,\ \frac{A_0}{P_1},\ \frac{OASW}{P_1},\ \frac{CPP/QPP}{P_1},\ \frac{PP}{P_1},\ \sigma\right)$$

where $A_0 = \sum_{i=1}^{n-3} A_{0i} + OASW + CPP/QPP + PP$

where OASW, CPP/QPP and PP are respectively Old Age Security wealth, Canada and Quebec Pension Plan wealth and Private Pension Plan wealth.

Empirical Estimation Procedure

The theoretical equations derived in the last section relate to individual behaviour. To make the empirical work tractable, requires that the equations be transformed into estimable form. The use of aggregate time series data will also require some further modifications of the estimating equations. The equations to be estimated will consist of;

(i) a personal savings equation

(ii) a domestic private savings equation

(iii) a retirement equation

(iv) a labour supply equation

(v) asset flow demand equations for money, savings deposits, equity, RRSP's, CSB's consumer durables, net residential housing.

(vi) liability demand equations with respect to residential mortgages and consumer credit.

The equations will be estimated by both the 2SLS and OLS technique. In all cases, the empirical work will attempt to establish what, if any direct effects CPP/QPP, OAS and Employer-Sponsored Pension Plans have on personal and private domestic savings and portfolio selection behaviour. Furthermore, we will try to establish the approximate magnitude of these effects and how this relates to domestic saving and ultimately investment. The empirical equations that follow are based on the theoretical model. However, the specifications do at times deviate from the strict theoretical model because of the institutional framework and a considerable problem with multicollinearity inherent in

the estimating process of such a model. Furthermore, the reader should recognize that the model is incomplete because all determinants of savings, labour supply and asset demand are not included in order to focus primarily on pension plan effects.

We start with the development of a personal savings equation, based on equation (15'). We define the following empirical relationship;

$$(16) \qquad PS = \alpha_0 + \alpha_1 y_t + \alpha_2 y_{t-1} + \alpha_3 r_t^* + \alpha_4 P_t/P_{t-1} + \alpha_5 U_t + \alpha_6 RET_{t-1} + \alpha_7 h_{t-1} + \alpha_8 s_{t-1} + \epsilon_t$$

All variables are in real, per capita terms i.e. deflated by the consumer price index, C.P.I. and population. From equation (15'), the current real wage should reflect the fact that the personal saving decision depends on both a "transitory" and "permanent" wage component. If interest income from assets is included, the use of disposable income instead of wage income becomes a reasonable approximation. Then, both lagged disposable income, y_{t-1} and the unemployment rate, u_t correct for transitory income effects on personal savings and together with y_t, represent permanent income. One would expect per capita personal savings to increase with both current income and the unemployment rate.

Previous econometric work on saving behaviour consists largely of estimating Keynesian-type consumption functions. The inclusion of an interest rate variable in such analysis was the

exception rather than the rule. Several recent studies in the United States have included an interest rate as a determinant of saving behaviour, in particular, Boskin [1976], Wright [1969] and Weber [1970, 1975]. In the latter case, it was found that the nominal interest rate increased consumption, i.e. reduced personal savings. Since our theoretical model suggests that saving behaviour depends on the expected real rates of return from an individual's portfolio as well as the associated portfolio risk, proxies for both variables were initially included in the form of weighted averages of rates of return and their variances.[9] The theoretical model also suggests that personal savings depend on the anticipated and unanticipated inflation rate. Thus an increase in future prices will increase current consumption. We would therefore expect anticipated inflation to reduced current personal savings. In principle, we need to postulate a mechanism by which such price anticipations are formed. This requires the formulation in period t, of forecasts for periods t+1, t+2, ... and the construction of an index number based on these forecasts. Since there is no easy solution to this problem, we have approximated anticipated inflation by the actual inflation rate, P_t/P_{t-1}. This is not unreasonable if in the long term the anticipated inflation rate converges on the actual inflation rate.

Personal saving also depends on wealth, h. In our theoretical model (Equation (15')), wealth consists of two components; tangible wealth, defined as the net sum of all

assets and liabilites held by an individual, and net expected benefits from pension plans.[10] One would expect an increase in the beginning of period wealth to reduce personal saving on the assumption that individuals save toward some desired target retirement income. Furthermore, with the appearance of the CPP/QPP programs, many private plans were integrated with the public plans. It is therefore possible that a certain amount of substitutability will exist between CPP/QPP and Employer-sponsored pension plans. Consequently, the personal saving equation was estimated independently with wealth from CPP/QPP and Employer-sponsored Pension Plans and then with both variables together in the same equation, i.e. s_{t-1} and p_{t-1}.

In order to obtain a pure pension plan wealth effect and gage the effect of changes in retirement behaviour (due to the presence of pension programs) on personal savings, a retirement variable, RET was introduced into the equation. This variable consists of that proportion of individuals 65 years and older who are not in the labour force and is equal to one minus the participation rate of individuals 65 years and older. The retirement decision, to the extent that pension plan mandating retirement rules allow, is an endogenous decision variable. In principle, this would require that a retirement equation be derived directly from the model with the RET variable endogenously determined in the remaining equations. However, this presents considerable difficulties in the context of this model because it implies variable periods in the utility function. Consequently, following Munnell's example, the

retirement equation was developed independent of the model. Nevertheless, the endogeneity of RET implies that the equations should be estimated by 2SLS with respect to the retirement variable in the equations. According to Feldstein [1974], one would expect such a retirement effect to raise the personal saving rate. Thus, earlier retirement resulting from pension plans may cause individuals to save more during their working life, in order to maintain their desired level of real retirement income for a longer retirement period. However, it does not follow that per capita, real savings will rise as well. Such "induced" retirement also means that individuals who leave the labour force earlier, stop or considerably reduce their personal saving earlier. In aggregate, this may lead to a reduction in real, per capita personal saving even though the personal saving rate has increased. Consequently, the sign on the retirement variable could be either positive or negative.

Directly related to this issue, is another aggregation problem. The life-cycle hypothesis of savings assumes that the age-sex composition of the population does not change significantly over time. If the age-sex composition has changed in favour of an older population, than one would expect it to affect aggregate personal savings. In fact, Heien [1977] has found for the United States that an older population has been responsible for increased personal savings. An initial attempt was made to incorporate such effects in the equations, using the working population's median age for males and its dispersion as

variables, i.e. MAGE and VAGE, respectively. As it turns out, this effect is only important for the labour supply equation.

Following Munnell [1975], a retirement equation was developed independently of the model. Although alternative forms of this equation were tried, the basic estimating equation is as follows,

(17) $RET_t = \beta_0 + \beta_1 y_t + \beta_2 spa_{t-1} + \beta_3 d_t + \beta_4 (P_t/P_{t-1}) + \beta_5 h_{t-1} + \beta_6 m_t$

where y_t and P_t/P_{t-1} are defined as before and spa_{t-1} is the beginning of period total pension plan wealth $(s+p+a)_{t-1}$, d_t is the age dependency ratio, i.e. individuals aged 65 and over as a proportion of the remaining population and h_{t-1} is total tangible wealth.[11] We would expect an increase in real income and wealth to lead individuals to retire earlier ($\beta_1, \beta_2, \beta_5 > 0$). Inflation, however, erodes the real value of retirement income. With a lower than expected real retirement income, individuals will postpone their retirement ($\beta_4 < 0$). The more flexible the retirement rules of a specific pension plan program, i.e. CPP/QPP, OAS or employer-sponsored pensions, the stronger these effects should be. The age dependency ratio corrects for changes in the population's age-composition on retirement. Clearly, the larger the percentage of the population that is over 65, the greater will be the number of retirees ($\beta_3 > 0$). A reduction in the marginal tax rate m_t due to the tax deductibility of pension contributions should lead to earlier retirement since personal savings would be increased ($\beta_6 < 0$).

Domestic private savings is defined as personal saving plus corporate savings, i.e. retained earnings. While retained earnings can be treated as an endogenously determined variable, it is assumed to be exogenous with respect to the personal saving decision.[12] The domestic private saving equation was estimated on the same variables as those assumed to determine personal savings, as follows;

$$(18)\quad PDS_t = \gamma_0 + \gamma_1 Y_t + \gamma_2 Y_{t-1} + \gamma_3 \Gamma^*_t + \gamma_4 P_t/P_{t-1} + \gamma_5 U_t + \gamma_6 RET_{t-1} + \gamma_7 h_{t-1} + \gamma_8 s_{t-1} + \varepsilon_t$$

The signs on the coefficients are expected to be the same as those for the personal savings equation (16) for the same reasons.

We also derive a per worker labour supply function from the theoretical model, relating total man-hours supplied annually LS, deflated by the size of the labour force, to the empirical counterparts of the arguements of Equation (13). We can therefore postulate the following initial labour supply function;

$$(19)\quad LS = \theta_0 + \theta_1 (w_t/w_{t-1}) + \theta_2 \Gamma^*_t + \theta_3 (P_t/P_{t-1}) + \theta_4 h_{t-1} + \theta_5 s_{t-1} + \varepsilon_t$$

where w_t/w_{t-1} is the growth in real wages. This variable was used rather than w_t because the growth in wages significantly affected the per worker labour supply while the

wage level did not. One could expect the labour supply per worker to decrease with the growth in the wage rate ($\theta_1<0$) if a backward-bending labour supply curve is assumed. An increase in the interest rate, r_t, a weighted average of all asset returns, is expected to reduce the labour supply because it increases non-wage income (i.e. $\theta_2 <0$). There is no presumption on how the inflation rate will affect the per worker labour supply. On the other hand, if leisure is a normal good, one would expect any increase in wealth to reduce the per worker labour supply during all periods of the life cycle (i.e. $\theta_4, \theta_5 < 0$).

Before proceeding to the estimation of this equation, three additional problems require our attention. First, in the aggregate, the initial average, per capita labour supply equation is defined only over those individuals actually employed. However, we can define a 'normal' labour supply function, LS* which includes both the employed and unemployed workers. Such a labour supply function would more correctly reflect the market behaviour of individuals.

The two aggregate labour supply functions are related as follows:

(19) $LS^* - LS = U'$ where U' is an unemployment rate.

However, this is only an approximate unemployment rate, because it does not include any frictional unemployment. On the assumption that frictional unemployment is positively related to

measured unemployment U', the following relationship is postulated,

(20) $U_t = \lambda_0 + \lambda_1 U'_t$ where λ_0 is frictional unemployment.

We can then redefine the aggregate labour supply equation to include the actual unemployment rate, U_t.

Second, the life-cycle saving hypothesis assumes that the age-sex population cohorts do not substantially change over time. Consequently, any change in the age composition of the population, particularly the labour-force population, is bound to affect the average labour supply per worker. One can expect that an aging labour force implies, on average, a reduction in man-hours worked per worker. In order to capture the effect of a change in the age composition of the labour force on the labour supply, two variables were included in the labour supply equation -- the median age of the male labour force population, $MAGE_t$, and the age dispersion of the male labour force population, $VAGE_t$.

The third issue deals with the retirement decision and its relationship to the labour supply and the above aggregation problem. Given the assumption that leisure is a normal good, an increase in an individual's perceived wealth should lead to an increase in lifetime leisure. There are, however, a number of dimensions to any change in lifetime leisure and hence labour supply. Individuals might either reduce their pre-retirement labour or retire earlier. The labour supply variable, LS

captures only the pre-retirement labour supply dimension. The retirement equation, RET captures the other dimension. If individuals decide to retire earlier they would most likely increase their pre-retirement labour supply. The induced retirement effect of pension wealth on savings therefore has a similar counter-part in the labour supply equation.[13] Consequently, the labour supply equation was further modified by incorporating the retirement decision as the endogenously determined variable, $\hat{RET}$. The following equation was estimated,

$$(21) \quad LS = \theta_0 + \theta_1(w_t/w_{t-1}) + \theta_2\Gamma^*_t + \theta_3(P_t/P_{t-1}) + \theta_4 h_{t-1} + \theta_5 s_{t-1} + \theta_6 U_t + \theta_7 MAGE_t + \theta_8 VAGE_t + \theta_9 \hat{RET}_t + \varepsilon_t$$

Equation (14') yields the asset-flow demand equations consisting of 7 asset and 2 liability categories. The general form of the equations is as follows:

$$(22) \quad \Delta A_{it} = Q_{0i} + Q_{1i}\Gamma^*_{it} + Q_{2i}\Gamma^*_{0t} + Q_{3i}A_{it-1} + Q_{4i}A_{ot-1} + Q_{5i}P_t + Q_{6i}Y_t + Q_{7i}Y_{t-1} + Q_{8i}\sigma_{0t} + Q_{9i}S_{t-1}$$

where A is the asset-flow demand for asset i, Γ^*_{it} the own nominal, before tax rate of expected return, Γ^*_{0t} the average nominal, before-tax return on the remaining assets in the portfolio and A_{it-1} and A_{ot-1} are the stocks of the ith asset and total other assets (excluding pension wealth) respectively, at the beginning of period 1. From (A4), we would expect $Q_{1i} > 0$ for $A_{it} > 0$ and $A_{it} < 0$, i.e. a liability.

Furthermore, the higher the return on other assets, the smaller will be the asset flow demand for the ith asset (i.e. $Q_{2i} < 0$). While we cannot say, a priori, what the effect of the stock variables will be on the asset flow demand, one would expect a larger stock of other assets, i.e. wealth, to increase the demand for assets and decrease the demand for liabilities (i.e. $Q_{4i} > 0$ if $A_o > 0$ or $Q_{4i} < 0$ if $A_o < 0$). The effect of the own stock, A_i, on the asset flow demand (demand for liabilities) depends on the specific asset or liability in question. For example, the larger the stock of RRSP's, the greater one would expect the demand for RRSP's to be. The effect of the various forms of pension wealth on asset flow demand would depend on the extent to which they are asset substitutes. Furthermore, any overall increase in portfolio risk should reduce the asset flow demand for any asset i ($Q_{8i} < 0$). On the other hand, one would expect an increase in real income to increase the demand for assets (Q_{6i}, $Q_{7i} > 0$). Finally, the effect of inflation on asset (liability) choice would depend on the specific asset or liability.

Data and Methodology

The data for the empirical estimations comes from a variety of sources reporting on annual time series from 1946 to 1975. The majority of non-financial data series have been taken from the National Income and Expenditure Accounts, using the CANSIM data bank. Financial data on stocks and flows of the various assets and liabilities and their rates of return are

largely Bank of Canada statistics. Some of the data series have been developed from the CANDIDE 2.0 data bank, in particular, population data, capital stock and residential housing data which was made available for this work.

A number of the data series had to be constructed from raw data. In particular, we required the construction of a housing stock and a consumer durable stock series and their respective yields (See Appendix A). Furthermore, two demographic variables were constructed, a median age variable and an age dispersion variable for the working force population (See Appendix C). The construction of pension plan wealth data time series is discussed in Appendix B. Other wealth, h, was constructed from an approximate balance sheet for individuals. For the definition of h, see Appendix D.

The construction of a usable data base entailed some addition problems;

1) In order to have a common data base for the estimating sample period, 1953-75, some data series had to be extended to either end of the time series.

2) The majority of variables required construction from other data series. The list of the final variables used, and their definitions, is in Appendix D.

3) Some difficulties were encountered regarding the definition of a number of the variables.

A major concern has been about the definition of the personal savings variable. We have used the definition from the National Income Accounts, deflating it by the C.P.I. and population. By this definition, personal savings is the residual amount left over after deducting personal expenditures on consumer goods and services and direct personal tax payments and other current transfers from the total income. This implies that personal savings reflects the net effect of all measurement errors occurring in the component estimates of income, consumer spending and transfers to the government and other sectors. However, if one assumes that the net sum of such errors is approximately normally distributed and the errors are independent over time then for any OLS estimate with personal savings as the dependent variable, the estimated coefficients will not be biased.

A second issue relates to the definition of personal savings, disposable income and consequently the personal savings rate. Thus, it is argued that personal savings should include personal expenditures on durable goods and disposable income should include retained earnings and the rental flow from durable goods.[14] Because there are considerable difficulties in estimating the rental flow from durable goods,

it was decided to abandon this approach in the current study.

The empirical equations were estimated using the ordinary least squares (OLS) and the two-stage least squares (2SLS) methods. Applying 2SLS to the savings equations did not prove to be successful because of considerable multi-collinearity. By lagging the retirement variable thus making it exogenous, it was possible to estimate these equations by OLS. The asset/liability flow demand equations were also estimated by OLS. On the other hand, the labour supply equation was estimated jointly with the retirement equation by 2SLS method.

EMPIRICAL RESULTS

Personal Savings

Table 1 presents a number of real, per capita personal savings equations estimated by OLS.[15] The personal saving equations were estimated both with the joint effects of CPP/QPP wealth and private pension wealth, (Equations (16) and (16a)), and separately with OAS wealth (Equation (16c)) and private pension wealth (Equation (16b)). Initially, Equation (16) was estimated with the unemployment rate, in order to correct for the effects on income of the cyclical nature of the economy as suggested by the model. Since this variable appears to have no

Table 1

Estimated Personal Saving Equations (OLS); 1953-75

Equation	(16)	(16a)	(16b)	(16c)
Personal Disposable Income, Y_t	0.387 (3.39)	0.331 (4.55)	0.310 (4.43)	0.259 (3.94)
Lagged Personal Disposable Income, Y_{t-1}	0.186 (2.12)	0.181 (2.12)	0.068 (0.73)	0.190 (1.83)
Inflation Rate, Π_t	-431.909 (1.16)	-218.293 (1.42)	-452.658 (1.25)	175.292 (0.49)
Unemployment Rate, U_t	4.470 (0.64)			
Interest Rate, Γ_t	-11.726 (1.04)	-16.366 (1.95)	-18.984 (2.37)	-13.235 (1.73)
Retirement, RET_{t-1}	-7.760 (1.74)	-10.022 (3.26)	-8.921 (2.71)	-6.353 (2.18)
CPP/QPP Wealth, s_{t-1}	-0.005 (0.42)	-0.008 (0.85)		
Private Pension Wealth, P_{t-1}	0.024 (0.58)	0.356 (1.40)	0.054 (1.75)	
Old Age Security Wealth, a_{t-1}				-0.031 (1.79)
Other Wealth, h_{t-1}	-0.085 (2.42)	-0.065 (4.00)	-0.061 (4.12)	-0.063 (4.26)
Constant	544.520 (3.15)	540.880 (3.20)	85.365 (0.22)	101.644 (0.27)
$\bar{R}^2$	0.97	0.97	0.97	0.97
DW	2.44	2.31	2.22	2.29

significant effect on personal savings behaviour, it was dropped in the remaining personal saving equations.[16]

The results show CPP/QPP wealth, s_{t-1}, with the correct negative sign, however, it has had no significant effect on real, per capita personal savings.[17] This is consistent with the Canadian results by Boyle and Murray [1974]. Equation (16c) estimates the independent effect of the much older OAS program on personal savings. Results show that OAS wealth or expected benefits has resulted in a reduction in real, per capita personal saving. The effect is small -- a 10 per cent increase in expected benefits, i.e. real, per capita OAS wealth (about $204) would be required to reduce real, per capita savings by 5 per cent ($7).[18] In 1975, this would have reduced total nominal personal savings by $595 million or the personal savings rate by approximately 0.5 percentage point (from 10.7 per cent). Unlike the CPP/QPP programs which were introduced in 1966, the OAS program has been in existance since 1927, thus no substitutability should exist between it and these programs. It is, however, not unreasonable that individuals would include the expected benefits from this program in their decision calculus with respect to personal savings behaviour.[19]

Because employer-sponsored pension programs are fully funded, and substitution between such pensions and personal savings is assumed to be imperfect, one would expect employer-

sponsored pension programs to increase personal savings.[20] Along with Munnell [1975], we found that employer-sponsored pension wealth appears to have a small, but significant positive effect on real, per capita personal savings if estimated without CPP/QPP wealth in the equation. The variable is only marginally significant if CPP/QPP is included in the equation. In that case, a 10 per cent increase in real, per capita employer-sponsored pension wealth (about $47) would increase real, per capita personal savings by approximately 2 per cent (or $3). In 1975, this would have amounted to some $238 million in nominal terms. Furthermore, the low average elasticity of 0.2 implied by these results suggests that personal savings and employer-sponsored pensions are indeed poor asset substitutes. These pension plan wealth effects are however consistent with the effect of other "tangible" wealth, h_{t-1}. Thus, an increase of 1 per cent in real, per capita "tangible" wealth will reduce real, per capita personal savings by between 4.2 and 5.5 per cent (approximately $6 to $8 per person or nominally $590 to $786 million in 1975). As expected, personal disposable income, Y_t and y_{t-1} are both positively signed and significant.

Earlier retirement reduces real, per capita personal savings. While one would expect the "induced" retirement effect to increase the personal savings <u>rate</u>, in aggregate, earlier retirement will also reduce real, per capita personal saving since <u>fewer</u> individuals would be saving. Our evidence suggests that the latter effect predominates at the aggregate level. The

elasticity of personal savings with respect to retirement varies on average between -3.3 and -5.1. It suggests that a 1 percentage point reduction in the labour participation rate would reduce real, per capita personal savings by between 3.3 and 5.1 per cent (approximately $4 to $7 per person). In 1975, this would have amounted to some $393 to $607 million in nominal terms. A number of personal saving equations were also estimated with the working population age parameters, $MAGE_t$ and $VAGE_t$ included (not shown in Table 1). The evidence from these estimations suggests, although the results are not robust, that an increase in the median age of the working population may increase real, per capita personal savings.

Consistent with results by Weber [1975], the nominal interest rate has a significant and negative effect on real, per capita personal savings with an interest rate elasticity of between 0.5 and 0.7. This would appear to be on the high side and suggests that the coefficients are likely to be overstated. Anticipated inflation, π_t, likewise has the correct sign, but appears to have no significant effects on real, per capita personal savings.

Domestic Private Savings

The independent variables were also regressed against real, per capita domestic private savings which includes corporate retained earnings (Table 2). The results are similar

to those for personal savings. However, neither the retirement variable, RET_{t-1} nor the OAS wealth variable, at-1, have any significant effects on real, per capita domestic private savings. These effects wash out when personal and corporate savings are aggregated.[21] Employer-sponsored pension wealth continues to have a significant positive effect on domestic private savings although the wealth elasticity has been reduced to 0.17. While this cannot be considered conclusive, some additional evidence does suggest that personal saving has increased relative to corporate saving. Chart 2 shows that corporate saving has declined as a proportion of total domestic saving starting in 1960-62. Initially, government saving increased correspondingly, however, as of 1972-74, personal saving appears to have taken its place, crowding-out both corporate and government savings as a proportion of total domestic saving.

For these estimations, the unemployment rate was found to have a significant effect on domestic private savings in all equations. A 10 per cent increase in the unemployment rate (about 0.5 percentage point at the mean) will reduce domestic private savings by between 1.3 and 1.6 per cent (about $234 million in 1975). Since previous results indicate that the unemployment rate appears to have no effect on real, per capita personal savings, the impact must primarily be on corporate savings.[22] Since corporate profits tend to decline during periods of unemployment, it would not be unreasonable to assume

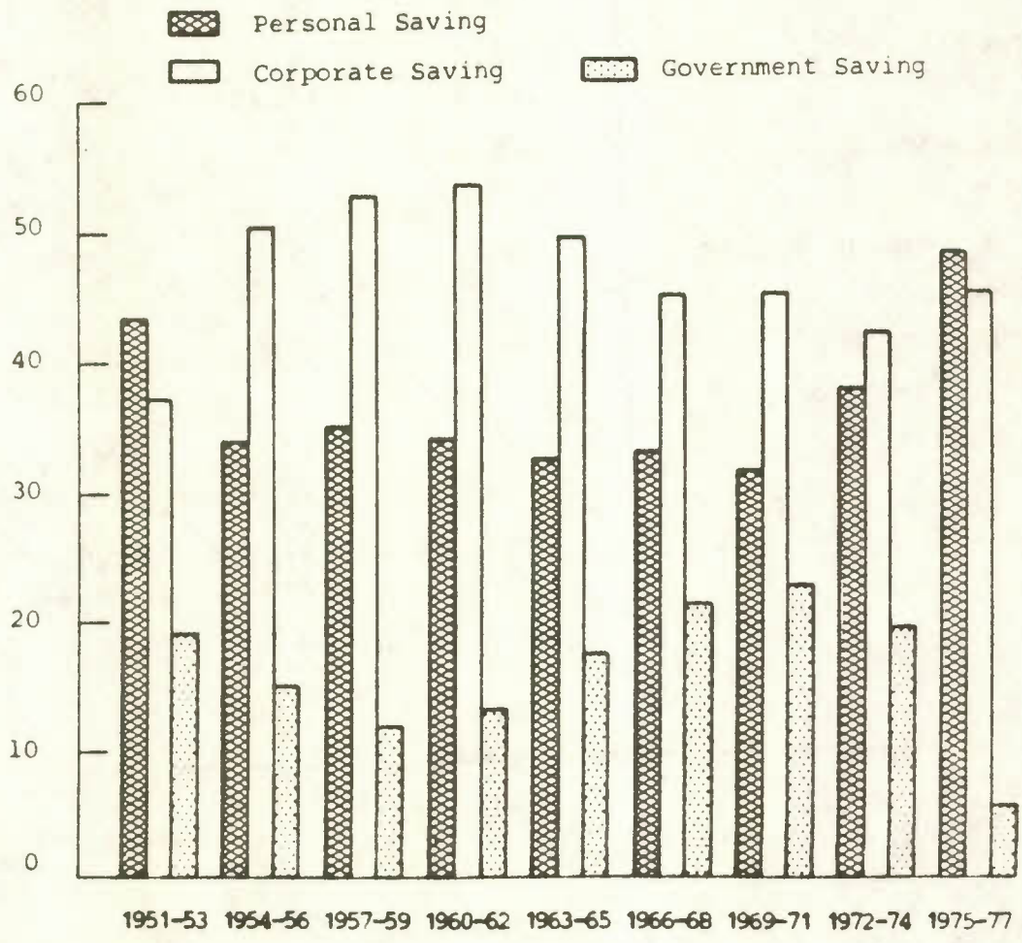
Table 2

Estimated Domestic Private Saving Equation (OLS); 1953-75

Equation	(18)	(18a)	(18b)
Personal Disposable Income, Y_t	0.267 (2.64)	0.295 (3.27)	0.236 (2.42)
Lagged Personal Disposable Income, Y_{t-1}	0.089 (0.56)	0.130 (0.99)	0.191 (1.19)
Inflation Rate, Π_t	578.384 (0.82)	266.890 (0.45)	430.886 (0.70)
Unemployment Rate, u_t	-6.734 (1.79)	-7.196 (2.12)	-8.242 (2.17)
Interest Rate, Γ_t	-23.061 (2.16)	-33.225 (3.02)	-20.973 (2.06)
Retirement, RET_t	-0.052 (0.01)	-6.665 (1.24)	0.247 (0.06)
CPP/QPP Wealth, s_{t-1}	-0.002 (0.18)		
Private Pension Wealth p_{t-1}		0.103 (1.89)	
Old Age Security Wealth a_{t-1}			-0.031 (1.32)
Other Wealth, h_{t-1}	-0.057 (2.87)	-0.060 (3.44)	-0.061 (3.33)
Constant	-457.886 (0.61)	-221.654 (0.31)	-390.691 (0.60)
$\bar{R}^2$	0.97	0.97	0.97
D.W.	1.95	1.99	2.16

CHART 2

The Composition of Domestic Saving



that retained earnings would do likewise. Finally, both other "tangible" wealth, h_{t-1} and the interest rate, r^*_{t-1} approximately retained their respective elasticities.

In summary, the collective evidence points to a small net reduction in real, per capita personal savings as a result of the various pension plan schemes. A 1 per cent change in all expected pension benefits and RET would have the net effect of reducing nominal personal saving by approximately $850 million in 1975. This would have amounted to a reduction of the personal savings rate from 10.7 to 10.0 per cent. There is some evidence, however, that changes in the age composition of the population may have offset this effect by as much as $240 million in nominal terms. At the more aggregated level of domestic private savings, evidence suggests that such savings has in fact increased as a result of employer-sponsored pension plans. The effects of CPP/QPP, OAS and retirement appear to wash out in aggregate. As a first approximation therefore, the evidence indicates that we need not be concerned about the direct effects of the pension programs on real, per capita personal saving and therefore the level of capital formation.[23]

Retirement Equations

Table 3 presents the estimated retirement equations. The equations were estimated to capture not only the

independent effects of CPP/QPP wealth (Equation (17a)), OAS wealth (Equation (17b)) and employer-sponsored pension wealth (Equation (17d)), but also the effects of both public plan wealth independently (Equation (17c)) and together with employer-sponsored pension wealth (Equation (17)).24

The evidence indicates that wealth, i.e. tangible wealth and expected future pension benefits induces individuals to retire earlier. However, the effect on the retirement decision appears to be small. A 10 per cent increase in the expected benefits of employer-sponsored pension programs, OAS and other non-human wealth reduces the labour force participation rate of the 65 years and older age group by 0.3, 0.7 and 1.2 per cent, respectively. In 1975, the total impact would have reduced the labour force of the 65 years and older by 3,200 males.25 Interestingly enough, CPP/QPP wealth has the opposite effect, causing individuals to postpone retirement (a 10 per cent increase in benefits increases the 65 years and older participation rate by 0.2 percent). This is not entirely unexpected since the CPP/QPP is earnings related, and during the period 1966-75, "blanketing-in" resulted in considerable intergenerational transfers of income to those persons becoming eligible for CPP/QPP benefits. The benefit formula was such that it was possible that some individuals, although entitled to it, postponed drawing the pension and continued to work past the age of 65 because the benefits foregone were more than offset by increased future entitlements.

Both wages and inflation play a much more important role in the retirement decision. A 10 per cent increase in real, per capita wages will have the same effect on the labour force as the sum of all wealth effects, i.e. reduce the labour supply of the 65 years and older by approximately 3,200 males in 1975. On the other hand, a 10 per cent increase in the inflation rate (about 1 percentage point in 1975) would result in a 5 per cent increase in the labour force participation rate of the 65 years and older males, i.e. an additional 7,400 males would postpone full retirement after age 65. The inflation rate, because of its negative effect on the real value of retirement income, plays a major role in the retirement decision.

To what extent can these results be generalized to the retirement decision of individuals 64 years and younger? While a majority of employer-sponsored pension plans have provisions for retirement prior to age 65, postponement of retirement past age 65 is often more difficult due to mandatory retirement age requirements. One should therefore expect the direction of the effects of the independent variables on the retirement decision of individuals aged 64 years or younger to remain the same. However, the magnitude of the effects on the retirement decision would be different because of the more extensive opportunities for retirement.

Table 3

Estimated Retirement Equations (OLS); 1953-75

	(17)	(17a)	(17b)	(17c)	(17d)
Real Per Capita Wage Rate, w_t	0.008 (2.78)	0.010 (3.52)	0.010 (2.40)	0.006 (1.48)	0.008 (3.06)
Interest Rate, Γ_t	-0.491 (0.66)	0.615 (0.95)	0.636 (0.87)	0.112 (0.16)	-0.564 (0.81)
Marginal Tax Rate, m_t	-0.362 (0.02)	-12.167 (0.44)	-13.203 (0.54)	-37.079 (1.17)	-2.696 (0.13)
Inflation, Π_t	-31.431 (3.17)	-32.169 (2.91)	-36.079 (3.14)	-26.717 (2.35)	-31.575 (3.26)
CPP/QPP Wealth, s_{t-1}		-0.002 (1.74)		-0.008 (2.23)	
Private Pension Wealth, p_{t-1}	0.008 (2.77)				0.008 (3.05)
Old Age Security Wealth, a_{t-1}			-0.0001 (0.04)	0.003 (1.57)	
Other Wealth, h_{t-1}	0.001 (3.57)	0.001 (2.87)	0.001 (2.97)	0.001 (2.82)	0.001 (3.73)
Total Public Pension Wealth, sa_{t-1}	-0.0002 (0.32)				
Constant	80.009 (2.98)	63.368 (1.86)	94.236 (3.27)	34.463 (0.91)	83.268 (3.41)
$\bar{R}^2$	0.97	0.96	0.96	0.96	0.97
D.W.	1.52	1.68	1.42	1.53	1.50

Labour Supply Equations

These equations were estimated by 2SLS method with $\widehat{RET}$ and $\hat{u}_t$ as endogenous variables.[26] The empirical evidence in Table 4 supports the hypothesis that expected pension plan benefits (other than private pension benefits) and other wealth reduce the pre-retirement supply of labour per worker. The results indicate that expected benefits from CPP/QPP and the OAS program would reduce the man-hours worked by each member of the labour force by 0.4 and 2.0 per cent per annum, respectively (a total of 45 man-hours per annum), if such benefits were doubled. By contrast, a 10 per cent increase in per capita real, tangible wealth would have almost the same effect on the workers' labour supply, reducing it by approximately 34 man-hours per annum. Equation (21a) which attempts to measure the effect of expected employer-sponsored pension benefits on the pre-retirement labour supply, suggests that they have no significant direct effect on the pre-retirement labour supply of each worker.

Earlier retirement induces individuals to increase their pre-retirement labour supply. This effect is more substantial than the direct wealth effect of any of the pension programs. A 10 per cent reduction in the average labour force participation rate of individuals 65 years and older (reducing it from 30 to 27 percent), increases the pre-retirement labour supply per worker by between 1.8 and 2.3 per cent. On balance,

Table 4

Estimated Labour Supply Equations (2SLS); 1953-75

Equation	(21)	(21a)	(21b)
Growth in Wage Rate, w_t/w_{t-1}	-335.945 (2.81)	-337.264 (2.55)	-254.339 (2.19)
Unemployment Rate, U_t	-40.010 (11.22)	-44.527 (8.08)	-37.733 (10.35)
Inflation Rate, Π_t	-418.111 (2.74)	-589.330 (2.54)	-148.318 (0.78)
Induced Retirement, RET_t	4.845 (2.45)	5.399 (2.54)	5.716 (3.05)
Median Age, $MAGE_t$	-6.503 (1.05)	-3.629 (0.50)	-3.218 (0.66)
Dispersion of Age Distribution, $VAGE_t$	-11.103 (9.28)	-13.465 (7.66)	-10.633 (8.53)
CPP/QPP Wealth, s_{t-1}	-0.012 (2.01)		
Private Pension Plan Wealth, p_{t-1}		-0.046 (1.11)	
Old Age Security Wealth, a_{t-1}			-0.017 (2.23)
Other Wealth, h_{t-1}	-0.033 (4.20)	-0.033 (3.85)	-0.041 (5.07)
Constant	5163.544 (13.86)	5687.416 (7.13)	4620.210 (12.594)
$\bar{R}^2$	0.98	0.98	0.98
D.W.	2.40	2.34	2.30

the induced retirement effect will marginally dominate the pension plan wealth effect on the pre-retirement labour supply. This is consistent with a positive induced retirement effect on the personal saving rate as postulated by Feldstein [1975].

From the empirical results based on the simultaneous estimation of the retirement and labour supply equations, it is apparent that the different pension programs affect different dimensions of the work-leisure choice. Expected benefits from employer-sponsored pension programs cause individuals to retire earlier, possibly because of their relative flexibility regarding retirement prior to age 65. However, such programs do not appear to have any effect on a worker's pre-retirement labour supply. On the other hand, both CPP/QPP and the OAS program affect the timing of full retirement as well as the pre-retirement labour supply per worker, albeit, the former to a much lesser degree.

The Portfolio Flow Demand Equations

Tables 5A and 5B present the portfolio equations. These equations were also estimated by the OLS method. In principle, Zellner's [1962] method of a "seemingly unrelated regression" estimator should be used. This method estimates all equations jointly subject to summation constraints, taking into account differences in error variances across equations as well as contemporaneous correlations among errors. Such estimates

Table 5A

Estimated Portfolio Asset/Liability Demand Equations (OLS) - CPP/QPP Effects; 1953-75[1]

Variables	M1	Savings Deposits	Equity	Canada Savings Bonds	Contributions to RRSPs	Consumer Durables	Net Residential Housing	Residential Mortgages	Consumer Credit
Asset Yield, Γ_{it}		25.228	-16.035	32.294	5.601	-5.965	-3.282	7.583[2]	4.438
		(2.00)	(2.07)	(1.93)	(0.41)	(2.67)	(0.80)	(4.85)	(1.38)
Average Yield - Other Assets, Γ_A	-17.102	-4.196		-73.859	17.701	-0.034	-7.118	-29.232	-6.074
	(3.62)	(0.78)		(4.51)	(2.03)	(3.55)	(0.22)	(5.39)	(2.04)
Asset Stock, X_{it-1}		-1.238	0.024	0.045		0.033	0.462	0.754	-0.008
		(4.54)	(0.60)	(0.14)		(0.40)	(3.96)	(10.03)	(0.06)
Other Asset Stock, A_{t-1}	0.012	0.221	0.068	0.022	0.095	-4.769	-0.266	0.020	-0.020
	(1.48)	(2.91)	(0.83)	(0.74)	(2.97)	(2.59)	(4.23)	(1.79)	(1.80)
Personal Disposable Income, Y_t	0.070	0.269	0.053	0.105	0.305	0.232	0.612	0.127	0.088
	(2.67)	(1.97)	(0.33)	(1.10)	(4.31)	(6.84)	(2.12)	(2.50)	(1.87)
Lagged, Personal Disposable Income, Y_{t-1}		0.077	-21.835[3]	-0.054	-1 439.110[4]	0.520	0.288	-0.012	0.093
		(0.47)	(1.72)	(0.64)	(2.50)	(1.05)	(0.84)	(0.18)	(1.49)
Inflation, Π_t	-377.161	1 161.104	1 882.086	168.164	-3 653.598	-369.498	-1 537.774	230.710	267.505
	(1.80)	(3.26)	(1.81)	(0.46)	(4.73)	(3.48)	(2.22)	(2.14)	(2.40)
Asset Risk, VX_{it-1}		-4.971				2.590		-6.992	
		(0.54)				(1.36)		(1.24)	
CPP/QPP Wealth, S_{t-1}	0.003[5]	-0.009	-0.027	-0.006	0.020	-0.001	0.015	-0.023	0.001
	(0.74)	(0.39)	(0.70)	(0.63)	(1.01)	(0.24)	(0.36)	(2.93)	(0.13)
Constant	227.600	-3 296.012	-1 969.685	348.544	3 807.296	365.063	730.588	-263.337	43.212
	(1.11)	(3.78)	(1.91)	(0.89)	(3.54)	(3.98)	(2.14)	(2.92)	(0.53)
$\bar{R}^2$	0.76	0.56	0.81	0.73	0.96	0.99	0.94	0.99	0.85
D.W.	2.71	2.47	1.97	2.50	1.33	2.16	2.14	2.44	1.92

1 All variables are defined in the Appendix C.

2 Coefficient for yield on net residential housing.

3 This coefficient is with respect to lagged unemployment rate,

4 Coefficient to tax rate variable.

5 Coefficient to Total Pension Plan Wealth.

Table 5B

Estimated Portfolio Asset/Liability Demand Equations (OLS) - Private Pension Plan Effects; 1953-75[1]

Variables	M1	Savings Deposits	Equity	Canada Savings Bonds	Contributions to RRSPs	Consumer Durables	Net Residential Housing	Residential Mortgages	Consumer Credit
Asset Yield, Γ_{it}		26.127 (2.07)	-17.264 (2.31)	31.743 (2.06)	1.888 (0.15)	-6.120 (2.95)	-1.397 (0.39)	6.735 (3.35)	4.498 (1.46)
Average Yield, Other Assets, Γ_A	-17.424 (3.65)	-4.616 (0.87)		-73.253 (4.86)	7.354 (0.79)	-4.651 (3.13)	6.865 (0.22)	-29.369 (4.07)	-5.313 (1.80)
Asset Stock, X_{it-1}		-1.198 (4.40)	0.114 (1.44)	0.078 (0.28)		0.009 (0.11)	0.570 (4.33)	0.872 (6.28)	-0.058 (0.42)
Other Asset Stock, A_{t-1}	0.006 (0.51)	0.209 (2.93)	0.024 (0.28)	0.015 (0.54)	0.004 (0.08)	-0.033 (3.66)	-0.432 (3.44)	-0.015 (0.99)	-0.022 (2.09)
Personal Disposable Income, Y_t	0.085 (3.67)	0.263 (1.83)	0.141 (0.80)	0.112 (1.28)	0.231 (3.21)	0.228 (6.84)	0.691 (2.59)	0.093 (1.31)	0.104 (2.13)
Lagged, Personal Disposable Income, Y_{t-1}		0.071 (0.43)		0.074 (0.98)		0.056 (1.17)	0.357 (1.09)	0.038 (0.45)	0.082 (1.23)
Inflation, Π_t	-353.518 (1.79)	1 533.926 (3.24)	2 206.965 (2.14)	196.941 (0.58)	-2 081.429 (2.15)	-346.042 (3.43)	-2 081.513 (2.70)	194.921 (1.30)	-271.542 (2.54)
Asset Risk, VX_{it-1}		-6.044 (0.66)	-10.391 (1.00)		-19.170 (0.03)	1.930 (1.19)		-13.822 (2.08)	
Private Pension Plan Wealth, p_{t-1}	0.022 (0.82)	-0.002 (0.02)	-0.236 (1.49)	-0.071 (1.81)	0.184 (2.30)	0.016 (0.87)	0.288 (1.63)	-0.004 (0.09)	0.018 (0.81)
Constant	227.073 (1.11)	-3096.223 (4.00)	-2 729.875 (2.44)	488.318 (1.32)	1 588.655 (1.23)	364.048 (4.41)	1 563.118 (2.43)	-102.576 (1.11)	61.220 (0.82)
$\bar{R}^2$	0.76	0.56	0.82	0.77	0.97	0.99	0.93	0.99	0.86
D.W.	2.75	2.56	1.66	2.20	1.10	2.38	2.08	1.84	1.95

1 All variables are defined in Appendix C.

2 Coefficient for yield on net residential housing.

3 Coefficient for lagged unemployment rate, U_{t-1}.

4 Coefficient for marginal tax rate variable.

would be more efficient than those obtained by the application of OLS to each equation in turn. Since summation constraints could not be applied in principle because of the exclusion of some assets and liabilities, the OLS method was used.

The interpretation of the results is complicated by the large number of coefficients and by the high degree of multicollinearity among independent variables. It was therefore decided to concentrate the discussion primarily on the pension plan effects, with some mention of other major results.

From Table 5A, it becomes evident that expected benefits from CPP/QPP and the OAS program have little effect on an individual's portfolio choices. At best, they appear to minutely reduce the demand for residential mortgages.[27] From Table 5B, we find that expected benefits from employer-sponsored pension plans have increased the outstanding net residential housing stock. A 10 per cent increase in real benefits, increases the real, per capita net residential housing stock by 2.0 per cent. Since employer-sponsored pension plans have tended to increase personal saving and residential housing is one form of personal savings, particularly for retirement, it may not seem unreasonable that this form of personal savings has increased. On the other hand, both CPP/QPP and OAS, by guaranteeing benefits at age 65, reduce future income uncertainty. One possible result may be that individuals

substitute increased investment in housing (via larger down payments, for example) for other forms of retirement savings.

The effect of the various pension programs on the housing market suggests greater liquidity on the part of households. Indeed, households appear to have made a number of corresponding portfolio changes resulting from the presence of the pension plan programs. In particular, employer-sponsored pension plans have reduced the demand for Canada Savings Bonds and Equity, at the same time increasing the demand for RRSP's. The OAS program has also had a similar effect on RRSP's. These results suggest that individuals have substituted RRSP's for Canada Savings Bonds and Equity as preferable forms of saving for retirement. In light of the tax deductibility of contributions to RRSP's and the tax status of interest and dividends, this result would not seem unreasonable.

The coefficients on the other variables are generally acceptable. An increase in its own yield tends to increase the demand for an asset while relative increase in the yield of other assets tends to reduce its demand, (i.e. $\delta X_i/\delta \Gamma_i > 0$ and $\frac{\delta X_i}{\delta \Gamma_A} < 0$).[28] Similarly, the larger the own stock of a particular asset (liability), the less will be demanded. On the other hand, any increase in wealth (A_{t-1}) will tend to increase the demand for an asset (including residential mortgages). It does, however, reduce the demand for consumer credit, consumer durables and net housing equity. During

periods of inflation, as one would expect, the demand for liabilities (mortgages and consumer credit) rises. Individuals also demand more equity as a hedge against future inflation and tend to accumulate larger saving deposits as a hedge against future income uncertainty. Furthermore, inflation results in a reduction in the demand for money, consumer durables, residential equity and RRSP's.

Summary of Empirical Results

The empirical results lead one to conclude that the CPP/QPP programs have not had any significant direct effect on personal saving behaviour. This is not, however, the case with the Old Age Security (OAS) program, (possibly employer-sponsored pension programs) and changes in retirement behaviour which have occurred as a result of these pension programs.

Because of the full funding requirements of employer-sponsored pension programs, per capita personal saving may have increased by a small amount. However, this was more than offset by the effects of OAS and earlier retirement. In aggregate, public and private pension programs may have reduced personal saving (in nominal terms) by as much as $850 million in 1975, shaving 0.7 percentage points off the personal saving rate. At the same time, there is some evidence from earlier estimates (not shown) that the effect of an ageing population on real, per capita personal saving may have helped to mitigate this impact

on the personal savings rate. The combined effects from pension programs and an ageing population, appear to have reduced the personal saving rate by perhaps 0.5 percentage points ($600 million in nominal terms) in 1975.

Both OAS and CPP/QPP pension plan wealth have led to a small reduction in the per worker labour supply prior to retirement (about 45 manhours per annum). While employer-sponsored pension programs have had no such effect, they, along with OAS and other wealth, have affected the timing of retirement from the primary job. Thus, individuals have chosen earlier retirement and have reduced participation in the labour marker after age 65. This effect has been slightly reduced through the introduction of the CPP/QPP programs in 1966.

Although these pension plan wealth effects have reduced the labour supply, the earlier retirement, induced by pension programs, has in turn caused individuals to increase their pre-retirement labour supply ceteris paribus, in order to generate additional income which provides savings for a longer retirement period. The evidence indicates that this induced retirement effect has a far stronger impact on the pre-retirement labour supply, than the previously discussed pension plan wealth effect. As a result, there is a net increase in the pre-retirement labour supply of approximately 32.0 manhours for each worker 64 years and younger. This is, of course, consistent with a positive induced retirement effect on

the personal saving rate. Since the average annual direct loss in manhours from earlier retirement is no more than 3.0 million manhours, the net effect on the labour supply, as a result of the pension program is an increase in the number of manhours worked in the economy.[29] Finally, a fairly obvious, but nevertheless interesting conclusion regarding retirement behaviour, is the fact that individuals will postpone retirement during periods of inflation. Since inflation tends to reduce the real value of expected retirement income, one would expect individuals to work longer in order to compensate for such losses in retirement income.

The impact of the pension programs on the portfolio composition of individuals has been minor. Both CPP/QPP programs and employer-sponsored pension programs have had a small positive effect on the housing market. The pension system also appears to have led individuals to substitute RRSP's for both CSB's and equity holdings.

Conclusions and Policy Implications

With the exception of the CPP/QPP, we found the impact of the public and private pension programs on personal saving to be significant, but small in magnitude. The net effect of these programs, given an ageing population, may have resulted in a reduction of the personal saving rate of approximately 0.5 percentage points. Despite this small impact of the pension

programs, the wealth and retirement effects postulated by the theory had the expected impacts on the level of per capita personal saving. At the same time, the private programs have also altered the composition of personal saving, i.e., the portfolio of assets and liabilities held by individuals. Here, the major impact of the private pension programs has been on the proportions of RRSP's, Canada Savings Bonds and Equities held in the individual's portfolio. RRSP's have increased and CSB's and Equities have correspondingly decreased.

The effects on the level of per capita personal saving are the result of the OAS program, employer-sponsored pension programs and a generalized retirement effect. The adverse, albeit minor impact of the OAS program on personal savings implies that from an efficiency point of view, this redistributive program could be considered undesirable in its present form since it reduces economic growth. However, a program such as OAS is not designed with economic efficiency as its major characteristic, rather, it is designed to redistribute income from the working population to the population 65 years and older. The program must therefore be judged primarily on equity grounds.

For the period 1950 to 1967, the capital stock accounted for approximately 24 per cent of the average growth rate of National Income in Canada (4.95 per cent).[30] It may therefore be a desirable policy to increase the corresponding

domestic savings component via the pension system, if in so doing, no adverse effects on the economy become apparent. The results and theory show that it is essentially the full-funding requirement of employer-sponsored pension programs that is responsible for its "increased savings" effect. Currently, the OAS program is not funded and the CPP/QPP programs are only partially funded, for no other reason then that the programs have not reached maturity. At that time -- the 1980s, the latter will be on a pay/go basis. If we wish to increase private saving through the pension system, we face the choice of either fully or partially funding the CPP/QPP programs to create a large net positive effect on saving and/or expanding the private pension plan area relative to public plans, i.e., changing the public-private mix.

Funding the CPP/QPP programs would ultimately result in increased saving by the public sector. This method of increasing the level of national saving would be effective because it relies on compulsion. However, while it will increase saving, such a policy could also create some problems. Required increases in the contribution rate would have serious implications for the income distribution. Individuals with low incomes would be forced to increase their saving despite the fact that in the absence of such required increases in the contribution rate, they would most likely have saved little or nothing because of the large proportion of their income goes to needed consumption expenditures.

A more fundamental question is whether such a fund would be desirable. The types and volume of securities that such a fund would need to invest in, may in time, give the government control over large sectors of the private economy. The Caisse de Dépôt has already caused some alarm regarding such potential concentration of economic power in government hands. To avoid the possibility of large scale government intervention in the business sector such government control would have to be diffused. As an alternative, it has therefore been suggested by Feldstein that the investment policy of such a fund should be directed at outstanding government securities, thereby shifting private saving more toward industrial investment. However, such an investment policy would make the pursuit of monetary policy more difficult, because it would hinder the ability of the government to control the money supply through the buying and selling of government securities. It would therefore seem undesirable to increase national saving through the creation of a monolithic, government-run pension fund via the funding of the CPP/QPP programs. While these problems could, to some extent, be cicumvented by channelling these funds directly back into the private sector via existing financial intermediaries, i.e. commercial banks and trust companies, it would create similar problems of economic concentration in the private sector.

The other possibility is the expansion of the private pension plan sector. By legislating higher income replacement

rates for employer-sponsored pension plans than currently exist, the net positive impact of such plans on private saving would be increased. In addition, the private pension plan sector could be encouraged to expand its coverage of employees. Not only would this promote increased saving, it would also provide retirement income security to more Canadians. Currently, approximately 40 per cent of the labour force is covered by employer-sponsored pension plans. Coverage could be increased by making such pension plans a legal requirement for employers with a certain number of employees, especially in the service sector which has many small industry units, for example, restaurants. If, in addition, multi-employer pension funds were created, possibly along industry lines to create administrative economies of scale, the cost of such programs for both employer and employee would be greatly reduced.

Finally, we found that expected pension plan benefits have reduced the per capita, pre-retirement labour supply and has also lead to earlier retirement. Employer-sponsored pension plans are primarily responsible for the latter. In addition, the wealth generated by the pension plans has lead to a positive induced retirement effect on the pre-retirement labour supply. As a result, the net effect of the pension programs is to increase the pre-retirement labour supply per worker. These results imply that the removal of mandatory retirement regulations for employer-sponsored pension plans would have an adverse effect on the labour supply since the induced retirement

effect would disappear in the absence of mandatory retirement. Consequently, any policy designed to remove mandatory retirement regulations would have to consider the magnitude of its relative labour supply effect and may require compensating policies to stimulate personal savings, either directly through the pension system as previously discussed or through further tax incentive.

Appendix A

Derivation of a Consumer Durable Stock Series

1. Data: (a) Total durable goods expenditures = X

   (b) Expenditures on new and used automobiles + repairs and parts = E_a

   (c) Expenditures on durable goods excluding automobiles = $\underline{a-b} = E_{na}$

2. Following depreciation rates have been assumed.
   See AER, September 1976, F. S. Mishkin.

   (a) All consumer durables = 0.20

   (b) Autos and parts = 0.25

   (c) Non-auto consumer durables = 0.15

3. Independent calculation of estimating a constant annual average rate of depreciation.

   (a) Assume that at the end of a certain number of years, t=10, item has a scrap value, α of original value.

   (b) If $1-\lambda$ is annual depreciation factor, $\lambda^t = \alpha = 0.05$

(c) Given reasonable values of t and α, can calculate λ.

(d) Then the following identities define the durable goods stocks:

$$\text{(i)}\quad K_{at} = \sum_{i=0}^{n} \lambda^i E_{at-i} = E_{at} + \sum_{i=1}^{n} \lambda^i E_{at-i}$$

$$\text{(ii)}\quad K_{nat} = \sum_{i=0}^{m} \lambda^i E_{nat-i} = E_{nat} + \sum_{i=1}^{m} \lambda^i E_{nat-i}$$

where K_{at} and K_{nat} are durable stocks in period t and m and n are the periods over which scrap value is determined.

3A. E_a, E_{na} must be divided by population (Canada) and price index, CPI, to get real per capita durable stocks.

4. Data period 1926-1976 = 51 observations excludes 1943-1945 inclusive (war years). Total observations 48 (annual).

5. For automobiles, n = 10 years.

then

(1) $K_a(1936) = E_a(1935) + SUM[0.744 * E_a(1934)] + 0.744^2 * E_a(1933)$

$+0.744^3 * E_a(1932) + \ldots\ldots + 0.744^9 * E_a(1926)$.

(2) $K_a(1937) = E_a(1936) + SUM[0.744 * E_a(1935)] + 0.744^2 * E_a(1934)$

$+0.744^3 * E_a(1933) + \ldots\ldots + 0.744^9 * E_a(1927)$.

Exclude 1943 to 1945.

$K_a(1976) = E_a(1975) + SUM[0.744 * E_a(1974)] + 0.744^2 * E_a(1973)$

$+0.744^3 * E_a(1972) + \ldots\ldots + 0.744^9 * E_a(1966)$.

This establishes the series K_a (1926 to 1976) excluding years 1943-1945 inclusive.

6. For durables <u>other than</u> automobiles, K_{na}.

We use exactly the same calculation except that we use 0.85 instead of 0.744 and assume an 8-year instead of a 10-year period. This provides the series K_{na} (1926 to 1976) excluding the years 1943-1945 inclusive.

7. To calculate the flow of services from the durable stocks K_a and K_{na}; require a long-term interest rate defined as follows:

The user rental cost of consumer durable capital stock is

$$URCA = (R+\lambda_a)\ \left(\frac{PCD}{PCON}\right), \text{ similarly for } URCNA$$

Note:

Effect of inflation on expenditures is ignored, i.e., we are using nominal rates.

$\lambda_a = 0.744$ $\quad t = 10$ $\quad \alpha_a = 0.05$

$\lambda_{na} = 0.850$ $\quad t = 8$ $\quad \alpha_{na} = 0.25$

PCD = D 616480 Durable expenditure price index (annual)
$PCON$ = D 616101 CPI annual
R = Average bond yield 10 years > Government of Canada Bonds
= <u>B14013</u>

7A. $URCA * K_a = SKA$

7B. $URCNA * K_{na} = SKNA$ -- This calculates the service flow.

8. Generates:

(1) K_a = durable stock series automobiles

(2) K_{na} = durable stock series all but cars

(3) flow of services from K_a, SKA

(4) flow of services from K_{na}, $SKNA$

9. Add $K_a + K_{na}$ =
Add $SKA + SKNA$ = } Output

10. Run following regressions:

(a) $K_a = f(EXP_a)$

(b) $K_{na} = f(EXP_{ua})$

} Ordinary least squares

Appendix B

The Construction and Estimation of a Pension Plan Wealth Variable

Following Feldstein (1974) and Munnell (1975), one can define such a wealth variable as a measure of the perceived increase in permanent income. More precisely, it is an estimate of the present value of the expected future pension plan benefits taking into consideration coverage, life expectancy, age structure, benefit rates and the real, per capita growth of income.

Construction of the Variable[31]

The calculation of the present value of pension plan benefits accruing to working-age individuals for any given year consists of the sum of the expected benefits for;

a) working males, their wives and widows;

b) working females;

c) aged non-working men;

d) aged non-working women;

e) aged widows and widowers.

To calculate the expected benefits for individuals of a given age group, for example, 40-49 years, for a given year, 1970,

pension plan wealth for working males (a) would be calculated as follows:

$$(1) \quad W_{1970,40\text{-}49} = N_{40\text{-}49} * \sum_{i=65}^{100} (\bar{B}/PDI)_{Avge} * PDI_{1970} * (1+g)^{65-45}/(1+d)^{65-45} * (P_{\Gamma_i}/P_{\Gamma_{45}}) * (1+g)^{i-64}/(i+d)^{i-64}$$

Thus pension plan wealth, W, for males aged 40-49 in 1970 is equal to total expected benefits for this age group calculated at a constant average benefit-income ratio with real per capita disposable income at retirement projected to grow at 1, 2 or 3 percent per year. This figure is multiplied by the conditional probability of living to age 65 given the worker has reached age 45 plus the expected benefits at age 66 times the probability of living to age 66.

Definition of Component Variables

$\bar{B}$ = the trend value of Pension Plan benefits per recipient, the average over the life of the Pension Plan

PDI = per capita disposable income

$N_{40\text{-}49}$ = the number of men in covered employment aged 40-49

$\frac{P_{\Gamma_i}}{P_{\Gamma_{45}}}$ = the conditional probability that a man will live to age i(65, 66, 67, etc.) given he has lived to age 45

$\frac{(1+g)^{65-45}}{(1+d)^{65-45}}$ = g is the growth rate of real per capita income to age 65, d is the discount rate for benefits to calculate the present value now, i.e. 1950, from age 65.

$\frac{(1+g)^{i-65}}{(1+d)^{i-65}}$ = g is the growth rate that insures that per capita income continues to grow after retirement, i.e. i=65 ... 100 and d is the discount rate of benefits after retirement back to age 65.

Some Issues Regarding the Construction of the Variable

1) Feldstein found that only the determination of the real discount rate and per capita income growth rate, i.e. their difference really mattered in the determination of W.

2) Feldstein found that netting out the present value of the future pension plan contribution liability made no difference to the results.

3) This calculation assumes that the ratio of anticipated benefits per recipient to per capita disposable income has been fixed since the beginning of the program at its average value, $(\bar{B}/PDI)$. This implies that time series variation in the W variable is almost entirely due to changes in coverage.

4) The treatment of coverage and benefit rates is also asymmetric since anticipated future coverage is assumed to correspond to current coverage. This implies that while W is highly responsive to changes in actual coverage, anticipated benefit rates, and therefore W is invariant with respect to changes in actual benefit rates.

This methodology was followed by P.P. Boyle and J. Murray in "Social Security Wealth and Private Saving in Canada," University of British Columbia, Working Paper No. 574, pp. 10-25. It was applied to Old Age Security (OAS) and CPP/QPP. The calculation was also adjusted net of future contributions and corrected for any changes in regulations, contributions or benefits. In addition, the value of net wealth was calculated with benefits taxed and tax relief on employee contributions (Table 6). This study makes use of the net wealth value, i.e. excluding future contributions for CPP/QPP and the gross values for OAS (Table 1).

Appendix C

A. The Creation of a Net Housing Stock Variable, $RESH_t$

Currently, no time series has been constructed to provide information about the net equity held by individuals in their own home. In order to construct such a data series, we require information about the existing net stock of residential housing at the end of each year, the average market value of such residential properties, the average mortgage held on such property and the year-to-year price changes.

Using the continuous inventory method, the stock at the end of each year of single detached dwelling units and multiple dwelling units was estimated for CANDIDE 2.0 and defined as RSST and RMSST, respectively. From information provided by Statistics Canada, the average net value of home ownership equity was calculated for 1970.[32] Thus, for 1970, the average market value of homes (home owners only) was $18,636. At the same time, the average outstanding mortgage on such homes amounted to $8,720. Consequently, the average net equity held in 1970 was $18,636 less $8,720 or $9,916. Using the Sector Deflator for Owner Occupied Dwellings developed for CANDIDE 2.0, it was possible to fix the nominal value of the total outstanding equity in residential housing for 1970 at

$57,411 billion. By multiplying each total housing stock figure by the average net value of home ownership equity for 1970 and inflating it by the Sector Deflator, we derive a time series for net residential equity held by home owners, i.e.

$$\text{Sector Deflator} * [(RSST_t + RMSST_t) * 9{,}916] = TRESH_t$$

The variable, $TRESH_t$ was deflated by the CPI, and put into per capita terms, resulting in the variable, $RESH_t$. As a proxy for the yield on equity, the conventional mortgage rate was used. One would expect the sign on its coefficient to be negative.

B. The Creation of Demographic Shift Variables; $MAGE_t$ and $VAGE_t$

The Life-Cycle Hypothesis of Savings assumes that no changes occur in the age composition of the population over time, i.e. the relative size of the age-sex cohorts remains the same over time. Consequently, any such compositional changes would, according to this hypothesis, affect aggregate savings and consumption. To incorporate the effects of such changes on aggregage savings requires the creation of variables that reflect movements in the age composition of the population. In particular, we have chosen the median age and the age dispersion around the mean as the variables to reflect such changes, i.e. $MAGE_t$ and $VAGE_t$. Using the standard

statistical formulae, the variables were created for both males and/or females for the working age populatin, i.e. ages 14 to 64 inclusive, using five year age-sex cohort groups over the period 1946-75.

C. The Unemployment Rate Equation

$$URATE = \underset{(3.69)^*}{23.216} - \underset{(3.87)}{19.895}\, w_t/w_{t-1} - \underset{(0.45)}{1.730} P_t/P_{t-1} + \underset{(8.33)}{0.864} u_{t-1}$$

$$\bar{R}^2 = 0.73 \qquad D.W. = 1.34$$

*t-values.

For a definition of the variables, see Appendix D.

Appendix D

Definitions and Sources of Variables Used

Symbol	Definitions
PS_t	Real, per capita personal savings defined as per the National Income Accounts, i.e. the residual amount left over after deducting personal expenditures on consumer goods and services, direct personal tax payments and other current transfers from total income.
PDS_t	Real, per capita domestic private savings defined as personal plus corporate savings, i.e. retained earnings.
LS_t	Total man-hours supplied annually by the labour force aged 15 to 64 years, deflated by the size of that labour force, i.e. man-hours supplied per unit of labour.

$(M1F)_t$ — Real, per capita annual money supply changes defined as the change in currency plus demand deposits; (D B2013), Bank of Canada Review, various issues.

SDF_t — Real, per capita annual personal savings deposits flow defined as the change in Chartered Banks Personal Savings plus Other Notice Deposits plus Deposits held by the public in Other Financial Institutions less gross RRSP contributions D(B654 + B655 + B3905 - RRSP).

I_t — Real, per capita annual gross capital formation by corporate and governemnt business enterprises, a proxy for equity formation (D30103).

$CSBF_t$ — Real, per capita annual change in outstanding Canada Savings Bonds; $(B2406_t - B2406_{t-1})$.

$RRSP_t$ — Real, per capita annual gross contributions to Registered Retirement Saving Plans; Taxation Statistics, various years.

CDF_t — Real, per capita annual consumer expenditure flow (D31350).

$RFSHF_t$ — Real, per capita annual Residential Housing Construction by Business (D40262).

$MORTF_t$ — Real, per capita annual Residential Mortgage Loan Approvals (D2649)

CCF_t — Real, per capita annual change in outstanding consumer credit balances of Selected Holders (D3420).

$(M1)_{t-1} = X_{1t-1}$ — Stock of Real, per capita money supply defined as currency plus demand deposits, lagged annual average (B2013).

$SD_{t-1} = S_{2t-1}$ Stock of real, per capita personal savings deposits defined as Chartered Banks Personal Savings plus Other Notice Deposits plus Deposits heldby the Public in Other Financial Institutions less gross RRSP contributions (B654+B655+B3905-RRSP).

$RCAP_{t-1} = X_{3t-1}$ Stock of real, per capita outstanding capital stock defined as plant plus equipment, lagged (CANDIDE 2.0: Series IKTME). A proxy for outstanding equity.

$CSB_{t-1} = X_{4t-1}$ Stock of real, per capita Canada Savings Bonds, lagged annual average.

$RRSPS_{t-1} = X_{5t-1}$ Stock of real, per capita Registered Retirement Saving Plans defined as the cumulative sum each year, of gross annual contributions, lagged.

$CD_{t-1} = X_{6t-1}$ Stock of real, per capita consumer durables, lagged. See Appendix A for construction.

$RESH_{t-1} = X_{7t-1}$ — Stock of real, per capita residential housing, lagged. See Appendix C for construction.

$MORT_{t-1} = X_{8t-1}$ — Stock of real, per capita residential mortgages outstanding, lagged and defined as Mortgage Assets held by Commercial Banks plus Loan and Trust Companies plus Trust and Mortgage companies. Source: CANDIDE 2.0 Data Bank (FMORTA. CB + FMORTA. LT + MORTA. TM).

$CC_{t-1} = X_{9t-1}$ — Stock of real, per capita consumer credit balances of selected holders (D3420), lagged.

s_{t-1} — Real, per capita expected benefits from the CPP/QPP programs defined as per Appendix B.

a_{t-1} — Real, per capita expected benefits from the OAS program defined as per Appendix B.

P_{t-1} Real, per capita private pension plan wealth defined as the book value of the stock of assets held by trust and insurance companies for employer-sponsored pension plans.

h_{t-1} Real, per capita non-human wealth defined as the net sum of real and financial assets and liabilities, i.e. Money (M1) + Savings Deposits (SDEP) + Equity (RCAP) + Canada Savings Bonds (CSB) + Registered Retirement Savings Plans (RRSP) + Consumer Durables (CD) + Net Stock of Residential Housing (RESH) - Residential Mortgages (MORT) - Consumer Credit (CC).

Y_t Real, per capita disposable personal income.

Y_{t-1} Real, per capita disposable personal income, lagged one period.

w_t Real, per capita annual wages, salaries and other non-wage related income.

w_t/w_{t-1} The growth in the annual wage bill.

Π_t A proxy for anticipated inflation defined as the growth of the Consumer Price Index (CPI), P_t/P_{t-1}.

m_t A proxy for the marginal tax rate defined as $1/(1-t_1)$ were t_1 is the ratio of all personal direct taxes over taxable income. With a progressive tax system, the average tax rate is (theoretically) equal to the marginal tax rate.

u_t The unemployment rate as defined by Statistics Canada, i.e. the number of individuals looking for work in the labour force.

RET_t A proxy for retirement behaviour defined as the number of individuals aged 65 years and older as a percent of the 65 years and older populations who are not in the labour force i.e. one minus the labour force participation rate of individuals 65 years and older.

r_t — The interest rate defined as the yield on Canada Savings Bonds.

sa_{t-1} — The sum of real, per capita expected benefits from the CPP/QPP program and the OAS program. (For a definition, see Appendix B).

$MAGE_t$ — The median age of the male populations aged 15 to 64. Using 5 year cohort groups, the median age was calculated. See Appendix C.

$VAGE_t$ — The variance around the mean age of the male population aged 15 to 64. See Appendix C.

VX_{it-1} — Asset Risk defined as the variance calculated on the weighted mean yield of all assets and liabilities for each period t.

$A_{1t-1} \cdots A_{9t-1}$ — The sum of stocks of assets and liabilities as set out in Tables 5A and 5B which proxies for Other Wealth in the asset flow equations. For each such equation the stock of that

particular asset was excluded from the sum and its effect on its endogenous asset flow determined separately.

$\Gamma^A_{1t} \ldots \Gamma^A_{9t}$ The weighted average yields on the asset-liability portfolio as defined above.

Γ^*_{2t} The yield on personal savings deposits, SDF_t, given by the 90 day Certificate of Deposit Rate (B14018).

Γ^*_{3t} The yield on equity defined as the inverse of the Price-Earnings ratio for the T.S.E. composite index (B4246).

Γ^*_{4t} The yield on Government of Canada Bonds 10 years and over (B14013).

Γ^*_{5t} The yield on Trust Company 5 year Guaranteed Investment Certificates (B14023).

Γ^*_{6t} The average rental rate on the outstanding stock of consumer durable goods. For estimation see Appendix A.

Γ^*_{7t} The conventional mortgage lending rate serves as a proxy for the opportunity cost of home ownership (B14204).

Γ^*_{8t} The conventional mortgage lending rate.

Γ^*_{9t} The Prime Business Loan Rate of Chartered Banks serves as a proxy for the consumer lending rate.

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Footnotes

1 M. Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation." Journal of Political Economy, Vol 82, No 5, Sept/Oct 1974.

2 Private pension programs provide reasonable flexibility for retirement prior to age 65. Old Age Security and CPP/QPP begin the payment of benefits at age 65 regardless of whether the individual has retired. One would therefore expect these latter programs to affect primarily the pre- and post-retirement work-leisure decision rather than the timing of retirement from full-time work which is more likely to be affected by private pension plans.

3 In an aggregate form, such "wealth" equals the total value of C(Q)PP annuities and reflects the number of workers at each age, their age-specific mortality rates, the rate at which per capita income can be expected to grow and an appropriate rate of interest at which to discount benefits.

4 Pension wealth has some additional characteristics that distinguishes it from other forms of wealth. In particular, the inherent absence of market risk of such wealth and its illiquidity prior to retirement also has an effect on the savings decision.

5 Feldstein thus ignores the possibility of increased saving from additional income due to pension plan affects on the labour market.

6 See M. Feldstein, "Social Security and Private Savings: Reply to Barro" NBER, mimeo 1978.

7 It should be noted that if , the individual holds a liability which has a negative price i.e. an interest cost.

8 There is no need to solve for since it is implied by .

9 The proxy for the risk variable proved to have the correct sign but was generally insignificant. It was therefore dropped from most of the equations.

10 Both tangible wealth and pension plan wealth are defined in Appendix B.

11 The retirement equation was also estimated with each pension plan wealth variable separately. In addition, slightly different specifications were tried.

12 Nevertheless, to the extent that shifts in business saving are correlated with shifts in personal saving, there would be a bias in the estimated coefficient.

13 If the induced retirement effect of an increase in pension wealth increases both pension and income (via the increase in pre-retirement labour supply) then Feldstein's conclusion that the savings ratio of non-retired individuals rises, is no longer obvious.

14 See L. Christensen and D. Jorgenson, "U.S. Income, Saving and Wealth 1929-69", Review of Income and Wealth, 1972.

15 Estimation by 2SLS method proved unsuccessful for the personal savings equations due to considerable multicollinearity. By lagging the retirement variable, RET, and therefore making it exogeneous, OLS estimations could be run. With this strategy, it is assumed that individuals have made their retirement decision and then decide to save towards retirement. This would not be inconsistent with the model.

16 From a comparison of equations (16) and (16c), the effect of the inclusion of the unemployment rate appears to result mainly in a reduction of the t-value of the wealth variables. However, unlike the evidence in the United States (Barro (1976) and Feldstein (1974), the effect is quite minor.

17 Other equations estimated with the CPP/QPP wealth variable only, yielded similar results.

18 The elasticity of personal savings with respect to OAS wealth was calculated at the mean values. All future calculations will be done in a similar fashion.

19 The estimation of the effect of OAS wealth on personal saving behaviour takes into consideration the change in the Age of Eligibility which was reduced from 70 years of age to 65 years of age for the tax year 1972. The wealth variable was correspondingly adjusted to reflect this change.

20 Private pension benefits are contingent on survival and death benefits are small. Furthermore, individuals cannot vary the level of contributions and the resulting pay-out stream except through retirement. Consequently, private pensions are an imperfect substitute for personal savings.

21 One possible explanation regarding the insignificant retirement variable, RET_{t-1} is related to its two dimensional effect on savings, i.e. induced retirement increases the personal savings rate, but earlier retirement reduces per capita personal savings. With respect to the latter, earlier retirement could also reduce corporate labour costs either by not replacing the employee or hiring younger employees at lower wages. In either case, corporate savings, ceteris paribus, would increase, at least partly offsetting any effects of RET_{t-1} on personal savings. It thus implies

that some substitution betwen corporate and personal saving does take place as a result of the pension programs, primarily through the retirement effect.

22 Boyle and Murray [1978] also found the effect of the unemployment rate on personal savings to be insignificant.

23 This does not imply however, that pension programs do not affect the components of personal saving ie contractual and discretionary saving and their composition. For evidence to this effect, see M. Daly and P. Wrage, "The Impact of the Old Age Security Program on Private Pension Saving and Labour Supply". Economic Council of Canada, Mimeo (1979).

24 The change in the Age of Eligibility for the OAS program is reflected in an adjustment in the OAS wealth variable.

25 In 1975, the male population 65 years and older was 845 thousand, with a participation rate of 17.4 per cent, this implies a male labour force component of 147 thousand. An aggregate impact of 2.2 per cent on the participation rate, reduces the labour force by 3,200 males.

26 The unemployment equation can be found in Appendix C.

27 The effect of expected benefits from OAS on asset flow demand equations was also estimated. The results are available on request.

28 The yield on residential mortgages is its opportunity cost, the rental rate on housing.

29 To calculate the loss in manhours from earlier retirement, the number of individuals leaving the labour force was multiplied by the average number of manhours worked by each worker.

30 E. Denison and W.K. Chung, "Economic Growth and Its Sources", in H. Patrick, H. Rosovsky, Asia's New Giant (Brookings Institution, 1976).

31 Based on Appendix B, A. Munnell, The Effect of Social Security on Personal Savings (1975).

32 Based on Statistics Canada, Catalogue No. 13-547, Table 77, Income, Assets and Indebtedness of Families in Canada, 1969.