Desirable Funding Level of Defined Benefit Pension Plans[1]

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(note: The quotations appearing in this monograph are exact, except where capitalization and punctuation were changed in keeping with modern style and grammar guidelines.)

[1] Assertions and results presented in this study are those of the authors and do not engage the RRQ at all.

Abstract

The objective of this study is to measure, for the first time, the amount of surplus which would be needed to account for, among others, the risk of insufficient return on assets. The surplus is measured according to the application to defined benefit (DB) pension plans of the guideline for life insurers regarding capital adequacy requirements issued by the Inspecteur général des institutions financières (IGIF) in Quebec (IGIF 2002a). Applying this guideline would allow the computation of the required surplus which DB pension plans should keep in addition to the actuarial liability determined on the going concern basis before authorizing any assignment of the surplus to employer contribution holidays. Keeping such surpluses would reassure plan participants regarding the future payment of their pension benefits. Surpluses thus determined are compared with current plan surpluses in order to measure the impact of modifying funding requirements as proposed in this study. Another purpose of the study is to determine if the application of the IGIF guideline to DB pension plans would require a revision of the maximum funding limits imposed by the Income Tax Act of Canada (CDOJ 202a) if the required surplus could not be financed within these limits.

1. Introduction

During the last decade, numerous defined benefit (DB) pension plans accumulated asset surplus in Quebec and Canada, and several plans granted contribution holidays to their members and/or to the employer further to the accumulation of surpluses, such as Mouvement Desjardins (Bérubé 1997), Télé-Métropole and Hydro-Québec (Bérubé 1998). Between 1992 and 1996, 524 of 1,235 DB plans (42 percent) under provincial authority of Régie des rentes du Québec (RRQ) took contribution holidays. Furthermore, among these, 131 employers granted themselves contribution holidays during five years (Le Cours 1998). On the other hand, in some cases, employees agreed to share their DB plan's asset surplus with their employer to avoid its bankruptcy. In 1997, some employees of Eaton did so (Presse Canadienne 1997).

In the fall of 2000, the Quebec National Assembly modified the Supplemental Pension Plans Act (SPPA) (ANQ 2002). The constituent text of new DB pension plans must indicate the employer's right to appropriate all or part of the asset surplus for payment of the employer's contributions (ANQ 2002, art. 14 par. 17). An amendment to the pension plan confirming the employer's right to appropriate the asset surplus for payment of the employer's contributions is also allowed by the SSPA for plans existing on Dec. 31, 2000, if the members consent (ANQ 2002, art. 146.4 and 146.5). Before amendment of the SPPA, contribution holidays were neither allowed nor forbidden by the law (ANQ 2002, art. 43.1). Now, since 2001, the asset surplus may be allocated to the employer's contributions if, at the last actuarial valuation date, no amount remains to be paid in connection with an unfunded actuarial liability and if the plan is solvent (ANQ 2002, art. 146.1). The maximum amount of asset surplus that may be appropriated for payment of the employer's contributions must be the lesser of asset surplus determined on a going-concern basis and asset surplus determined on a solvency basis.

The employer is legally responsible for the unfunded actuarial liability when DB pension plan assets are insufficient to pay the plan's financial obligations (ANQ 2002, art. 39 and 131)[2]. However, some studies show that companies often draw from pension plans when they need liquidities (Thomas 1989; Mittelstaed 1989). When companies are facing financial difficulties, it is really important for DB pension plan members to determine if one can draw from the plan's assets without endangering the future payment of benefits. In fact, pension plans are exposed to high asset yield deficiency risk. Indeed, in 1997, about 70 percent of assets of DB pension plans under RRQ's authority were invested in equity securities (51.6 percent) or in foreign securities (17.7 percent) (RRQ 2000). At present, in a going-concern valuation, some risks, such as asset yield deficiency risk, are not measured. In a bear stock-exchange context, such as the one that North America has just experienced in 2002, this preoccupation is particularly relevant because plans can become underfunded rather quickly. This implies that actuaries could do more to determine the minimum amount of assets needed to secure future benefits than what is now required according to the current SSPA since 2001.

[2] However, after negotiations with members, part of the amortization of the deficit can be transferred to them by way of an increase in employees' contributions.

This study aims to measure, for the first time, the amount of surplus needed to take into account for currently unaccounted risks, such as asset yield deficiency risk. It is proposed that, in order to secure the payment of future benefits, DB pension plans should keep assets in the amount measured in addition to the amount of actuarial liability determined on a going-concern basis before authorizing any appropriation of asset surplus for employer contributions. Surpluses so determined are compared with current DB plan surpluses to assess the impact of modifying requirements as proposed.

1.1 Proposed Valuation Method and Considerations Motivating Its Choice

Actuarial valuations of plan obligations and contributions needed to fund pension plans periodically allow, at least every three years, a reduction of the risks incurred by plan principals (employer and plan members) with regard to the expected return from assets and the choice of demographic and economic assumptions. However, the valuation methods used by actuaries are not probabilistic in nature. Thus, plan benefits are not sufficiently protected against future risks, as demonstrated by the liquidation of some life insurance companies in Canada since 1990, such as Les Coopérants, Société Mutuelle d'assurance-vie (Cloutier 1992) and Confederation Life Insurance Company and Sovereign Life (Presse Canadienne 1994).

In the case of life insurance companies, the National Association of Insurance Commissioner (NAIC)[3] in the United States, the Office of the Superintendent of Financial Institutions (OSFI) in Canada (CDOJ 2002b; OSFI 2002) and the Inspecteur général des institutions financières (IGIF) of Quebec (ANQ 2000) all use a similar risk-based formula to quantify the minimum amount of capital required over liabilities on a going-concern basis. The formula takes into account such risks as yield deficiency risk, mortality risk and changes in interest rates risk. The amount of surplus so determined is then compared to the amount of assets held by life insurance companies. This comparison allows the determination of life insurance companies' solvency level and the undertaking of appropriate actions by the

[3] In 1992, the NAIC formulated a new law, the Risk-Based Capital for Life and/or Health Insurance Model Act. (Webb and Lilly 1994).

authorities to protect the public interest. DB pension plans have common characteristics with products sold by life insurance companies. Among others, they are complex contracts that are legally considered as adherent contracts. They are funded in anticipation of an enforceable promise in a distant future. Both have a responsibility as trustee regarding the sums they administer.

In this context, determination on a going-concern basis of the minimum amount of plan assets over actuarial funding assets[4] required for DB pension plans according to the provisions of the IGIF capital adequacy requirements guideline (IGIF 2002a) would provide a better evaluation of the amount of assets needed to protect employee deferred benefits in the case of employer bankruptcy than the evaluation currently obtained by a conventional actuarial valuation. Furthermore, taking into consideration this additional funding amount in decision making concerning appropriation of asset surplus by employers for contribution holidays would reduce the risk of nonpayment of deferred pension benefits. It is proposed that this additional minimum amount of asset surplus be disclosed in employers' financial statements, in those of DB pension plans and in actuarial reports that must be filed with the RRQ.

Until now, no study has tried to measure the financial impact on DB pension plan surplus of taking additional risks into account in the determination of capital requirements as do life insurance companies. This study offers a new perspective on DB pension plans' asset surplus for legislators, employers and plan members. Moreover, another purpose of this study is to determine if requiring the application of the IGIF guideline would also require a revision of the maximum funding limits imposed by the Income Tax Act of Canada (CDOJ 2002a).

2. Context of the Study

2.1 Nature of Pension Benefits and Property of Net Plan Assets

Pension benefits represent deferred compensation in exchange for services performed (Treynor, Regan and Priest 1978; Logue 1979; Stone 1982). Amounts contributed to fund a pension plan comprise its assets and

[4] Actuarial funding assets are the assets needed to cover the actuarial liability to members.

return obtained on these assets and may result in plan net assets exceeding liabilities to beneficiaries.

Ownership of plan assets (and so of any surplus of assets over liabilities) can be looked at in various ways. Some researchers believe that plan assets may be viewed as being part of the employer's assets (Treynor 1977; Bruner, Harrington, and Marshall, 1987). Others contend that plan assets are separated from those of the employer (Alderson and Chen 1986; VanDerhei 1987; Mitchell and Mulherein 1989; Hsieh and Ferris 1994). Lanoie and Arvin (1994) consider that the position of the employees is that of creditors to their employer. Lastly, one can analyze the situation under the angle of the very regime, the latter being a trust of which the principals are the employer and the employees. This view was adopted for our study. According to the SPPA (ANQ 2002, art. 6), the pension fund constitutes a fiduciary patrimony. The Civil Code of the Province of Québec mentions the distinct and autonomous character of the trust (ANQ 1991, art. 1261). The constituent, the beneficiary and the trustee have no rights on the fiduciary patrimony.

The SPPA prescribes an evaluation of obligations for funding purposes prepared by an actuary at least every three years. A plan is fully funded when the value of its assets is at least equal to the value of its obligations at the actuarial valuation date. When the value of assets is less than the actuarial liability (partial funding), an unfunded actuarial liability is constituted and must be amortized within 15 years (ANQ 2002, art. 121). A solvency valuation must also be performed based on the assumption of plan termination at the valuation date (ANQ 2002, art. 137 and 138). The plan is solvent if the liquidation value of its assets is at least equal to its liabilities, assuming plan termination (ANQ 2002, art.136). The plan may be partly solvent, but the amount needed to be fully solvent must be funded within five years.

Thus, the SPPA (ANQ 2002) comes somewhat in contradiction with the view that plan assets are separated from those of the employer. Indeed, by allowing partial funding and partial solvency, the legislator half-opens the door to future use of the employer's assets to meet actuarial liabilities. As the employer keeps a residual risk due to the undercapitalization of the pension plan, employees keep a residual risk in case of their employer's bankruptcy. Indeed, plan assets may be insufficient to cover payment of benefits if the employer went bankrupt. In fact, the risk related to the

potential lack of assets could be canceled only if deferred annuities were bought from a life insurance company. As principals, the employer and employees both appoint the trust by way of the pension plan committee for management of the funds and payment of the deferred benefits. Both principals share the risk of inadequate return on assets besides the risk related to insufficient funding due to nonrealization of the underlying actuarial assumptions. These risks are higher when funding is spread over longer periods and when payment of deferred benefits is more remote.

According to the RRQ (2000), two-thirds of Quebec DB pension plans in 2000 had an asset surplus. Between 1984 and 1997, plans granted their principals $2.4 billion for contribution holidays. In 40 percent of cases, surpluses were used for contribution holidays and, in 60 percent of cases, they were used to improve pension plan benefits. So, both principals (employers and employees) wish to take advantage of surpluses without terminating plans. According to the RRQ (2000), the employers' right regarding contribution holidays was not previously established explicitly in the SPPA. Besides, there was no requirement to disclose employers' contribution holidays to plan members. Plan texts were often silent or ambiguous regarding contribution holidays. Jurisprudence was not very reassuring; employers have been sued in some cases. All of this ambiguity generated plan members' distrust concerning contribution holidays.

Since 2001, the SPPA requires that the text of the pension plan indicates the employer's right, if needed, to appropriate all or part of the asset surplus for the payment of its contributions (ANQ 2002, art 14.17) if, at the last actuarial valuation date, there was asset surplus both on a funding basis and on a solvency basis (ANQ 2002, art. 146.1). The maximal amount that may be appropriated is the lesser of the surplus determined according to the funding basis and of that according to the solvency basis (taking into account the value of additional obligations arising from amendments subsequent to last actuarial valuation) (ANQ 2002, art. 146.2). Partial or complete contribution holidays can also be awarded to employees by way of a plan modification stipulating that contributions are reduced or canceled for a certain period. The new SPPA rules confirm the trustee view of DB pension plans, where both parties (employers and employees) act as principals and share risks and residual profits resulting from asset management.

2.2 Funding Required to Cover All Pension Plan Risks

2.2.1 Actuarial Liability Calculation

The SPPA prescribes no actuarial valuation method or assumptions. Assumptions must be suited to plan obligations as well as to the particular situation. Valuation must be consistent with generally accepted actuarial principles (ANQ 2002, art. 122). In Canada, the "Consolidated Standards of Practice—Practice-Specific Standards for Pension Plan" (CIA 2002) details the standards that must be followed for valuation of pension plans[5].

According to the SPPA, current service contribution and valuation of pension plan assets and obligations must be determined on a going-concern basis (ANQ 2002, art. 122 and 123). Valuation of plan obligations must take into account foreseeable increases in benefits, notably those related to increases in members' remuneration (ANQ 2002, art. 125).

Going-concern valuation is a static valuation based on "best-guess" assumptions which reflect the actuary's best estimate of future experience, including a provision for *plausible* unfavorable variations. This estimation is not based on known probability distribution of relevant assumptions (mortality, interest, etc.). Furthermore, as Brender (1999) mentions, CIA members do not agree on a uniform definition of the adjective *plausible* in terms of statistical confidence levels for adverse deviations taken into account in the valuation of obligations[6]. Besides, actuaries do not know the exact probability distributions of future obligations.

Applying the IGIF guideline would allow for reduction of the impact of these gaps on the valuation of obligations and actuarial funding of pension plans. Going-concern valuation is used by life insurance companies and is suited to calculate the minimum funding level required to face future

[5] The revised standards were adopted in May 2002. Study results are not affected.

[6] For example, a definition of a "plausible variation" could be a variation which is within a confidence interval of 95 percent.

contingencies when taking the IGIF guideline into account. The amount that would be obtained for pension plans on this basis would represent the minimum amount to be funded to protect the plans' benefits from all future risks before considering distribution of any surplus[7].

2.2.2 The IGIF Guideline Regarding Capital Adequacy Requirements

In Quebec, the IGIF adopted a guideline for capital adequacy requirements for life insurers under its authority to increase the transparency and accuracy of the criteria that it uses to estimate the quality and caution of financial institution management. The capital adequacy requirements set out in the guideline are similar to those of the U.S. formula for risk-based capital (RBC) requirements and of the Canadian formula for minimum continuing capital and surplus requirements (MCCSR). The IGIF wants to make sure that insurers have the financial capacity to meet their obligations toward life insurance policyholders and depositors. The stockholder equity requirements of the guideline allow the determination of the necessary amount to be funded in addition to actuarial liabilities established according to a set of *plausible* assumptions (including a margin for unfavorable deviations) in the case that these assumptions are not realized. These capital adequacy requirements reduce the risk that policyholders and depositors will not receive the sums due to them.

According to the guideline, the capital required in addition to the actuarial liability takes five risk categories into account: (1) asset yield deficiency risk; (2) mortality, morbidity and lapse risk; (3) interest margin pricing risk; (4) changes in interest rates risk; and (5) off-balance-sheet items risk. The total amount of capital required to cover all of these risks is compared with the available capital to demonstrate capital adequacy.

First, the IGIF formula takes into account yield deficiency risk characteristics of balance sheet assets (such as bonds, mortgage loans, common stocks). Risk-weighted based factors are applied to the different types of assets to determine the capital amount required to cover the yield deficiency risk. Prescribed factors were determined by taking different risk characteristics affecting assets into account.

[7] A solvency valuation may be considered as an evaluation of the cash amount to be transferred at the valuation date to meet DB pension plan obligations. The IGIF guideline is not suited to an evaluation of the plan on a termination basis because it takes into account future risks such as asset yield deficiency risk, changes in interest rates risk and mortality risk.

The second risk category considered by the guideline is mortality, morbidity and lapse risk. The guideline identifies capital requirement for mortality risk of annuities involving life contingencies. It is required only on amounts for which an insurance company is subject to risk. For DB pension plans, this requirement is relevant only for deaths after retirement[8]. The guideline also deals with morbidity risk. However, since pension plans do not always disclose disability income benefits in their Annual Information Return (AIR) to RRQ, plans that disclosed them were excluded from the study for uniformity purposes; therefore, morbidity risk was not taken into account for this study. Furthermore, capital for the lapse risk is required only for individual life contracts, not for group contracts. Since pension plans are similar to group contracts, there is no lapse risk.

The next risk category identified by the guideline is the interest margin pricing risk. This requirement covers interest margin losses resulting from future investment yield and current insurance prices. When there is no repricing risk, such as for DB pension plans, there is no capital requirement for this risk. Furthermore, the guideline identifies changes in interest rate risk. DB pension plans do not guarantee any rate of return to members. The return credited to the pension fund is the one that is earned on portfolio assets. To guard against the risk related to future changes in interest rates, a percentage factor is applied to actuarial liabilities[9]. Finally, the guideline deals with default of counterpart risks connected with off-balance-sheet assets, such as forward contracts. No plan under study disclosed off-balance-sheet assets in its AIR.

In summary, applying the IGIF formula to DB pension plans requires taking asset yield deficiency risk, mortality risk and changes in interest rates risk into consideration. The resulting funding requirement (or surplus requirement in addition to the actuarial liability) compensates for the funding liability, which does not take these three risks into account.

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[8] Death benefits before retirement are usually member contributions accumulated with interest or the value of a deferred-benefit annuity for services recognized since membership. So, there is no risk connected with mortality before retirement.

[9] We refer here to the risk of change in interest rates on the part of assets corresponding to the actuarial liability. This risk is linked to depreciation of asset values resulting from variations in interest rates. The surplus requirement allows compensating for the impact of variations in interest rates that affect, at the same time, assets as much as liabilities but in an opposite direction. However, calculation is made with regard to the actuarial liability only.

2.3 Reporting the Required Asset Surplus in Financial Statements

2.3.1 Purposes and Criteria for Reporting Information in Financial Statements

2.3.1.1 Canadian Institute of Chartered Accountants (CICA)

Chapter 1000 of the *CICA Handbook* (CICA 1996) stipulates that financial statements aim to disclose common financial information needed by external users. Financial statements must help investors, members and other users to predict enterprise capacity to make profits, to generate cash flows to meet their commitments and to get a return on equity. Disclosed information must be relevant. It must be able to influence user decisions concerning companies that result from their analysis of past, present or future events. Financial statements must be accurate, neutral and careful reports. Reported information in financial statements concerning pension plans meets these purposes, but, as it will be noted below, it is incomplete with respect to the measure and to the disclosure of the amount of assets needed to cover all risks, because this amount is not calculated or supplied.

2.3.1.2 Agency Theory

The theory of risk sharing in a contractual context, first elaborated by Borch (1962), then generalized by Wilson (1968), refers to the optimal way of dividing risk among several agents. Information disclosed helps to reduce uncertainty compared to past or future events and allows investors, debenture holders and other companies' creditors to share risk. Without enough detailed accounting information, these financial statements' users cannot share risk in an optimal way. Valuation of the relative credibility of various economic events must also be shared among contracting parties. If valuation is different, one contracting party can increase its wealth to the detriment of the other contracting party. So, disclosed information must be detailed enough to allow similar valuation of the relative credibility of various economic events and of their probability.

Definite valuation of the residue (terminal profit) and its distribution cannot be finalized before contractual agreement maturity (Canning 1929). Meanwhile, contractual parties should share risks based on information that will allow them to estimate relative risks. In the context of decisions concerning contribution holidays, it is important that every party know the amount available to appropriate, after having taken all risks into account, so that parties can share risks optimally. This amount is not disclosed nor even calculated according to current accounting standards.

2.3.2 Justification for Calculation and Disclosure of the Required Funding Asset Surplus

Disclosure of surplus funding requirements would meet the criterion of information relevance according to agency theory and to the CICA. Useful information concerning future risks for the employer, shareholders and plan members would be available. This information would allow these users to better quantify the real pension plan surplus, having taken into account a necessary margin to cover asset yield deficiency risk, mortality risk and changes in interest rates risk.

Disclosing the required funding asset surplus would allow, by reducing information asymmetry, a fairer risk sharing between the employer and pension plan members. Contracting parties would improve their valuation of the relative credibility of future economic events. Probability would be reduced that events, such as unwarranted contribution holidays, would endanger plan solvency. Finally, knowledge of the amount of asset surplus that may be "distributed" while protecting for most risks would allow a more accurate valuation of a company's value by its investors and shareholders.

2.4 Tax Rules Related to Employer and Employees' Contributions

To ensure advance funding of pension plan obligations, the Income Tax Act of Canada (CDOJ 2002a)[10] allows, under some conditions, the deduction of employers' and employees' paid contributions from their respective

[10] This Act expresses current tax rules in Canada concerning employers' and employees' contributions to DB pension plans. The Act's provisions agree with the Quebec legislation (AU: ANQ 2000) concerning the elements related to this study.

taxable income (CDOJ 2002a, art. 20[1]q and 8[1]m). However, as deductions represent an important government expense, the law limits their deductibility for both employers and employees (CDOJ 2002a, art. 147.2 [2] and 147.2 [4]). This impacts the funding and solvency levels of DB pension plans and, consequently, employer and employee contribution holidays. Limiting the deductibility of contributions also has an impact on any additional amount of funding that would be required according to the IGIF guideline.

The first condition for tax eligibility of employer contributions is certification by the pension plan's actuary that the contribution payment is necessary to provide advance funding of pension plan benefits (CDOJ 2002a, art. 147.2 [2]). To avoid having employers taking undue fiscal advantages in deducting their contributions, the Income Tax Act of Canada limits these contributions when pension plans are overfunded. In that case, employer contributions are not deductible if the funding surplus is superior to ceilings defined in the Act.

For mature DB pension plans, the plan surplus is generally limited to 10 percent of the actuarial funding liability. No test is mandated concerning the deductibility of employee contributions in relation with the funding surplus of DB pension plans[11]. In Quebec, pension plans for which contributions are no longer allowed according to the provisions of the Act have three choices: They can make improvements to the plan, such as increase the indexation of benefits; they can refund the surplus to members; or they can allow contribution holidays for the employer.

According to the modified funding requirement, contribution holidays for the employer would be granted only when funding assets would be superior to the lesser of asset surplus as determined on the modified going-concern basis and asset surplus determined on the solvency basis. This study will help determine if the funding requirement for additional surplus that would result from application of the guideline would be inside the funding limits imposed by the Income Tax Act of Canada.

[11] If the pension plan requires contributions from employees, these are deductible from an employee's income if contributions are equal to or less than a certain percentage of his or her income.

3. Methodology of the Study

3.1 Data

Data were supplied by the RRQ, covering years 1995 to 1997. They came from DB pension plan valuation reports produced every three years by pension plan committees and from the AIRs produced by plan administrators. The AIR retained for a particular plan is the one corresponding to the year of the actuarial valuation. So, a single actuarial valuation and a single AIR were kept for each plan.

The data from the last actuarial valuation includes assets and liabilities on the funding basis, as well as on the solvency basis and the valuation date. The financial information in the AIR is established according to the accrual basis, and investments presented at financial year-end are at market value. For each plan, the AIR presents total assets in Canadian dollars broken down by type of assets as well as total liabilities.

The pension plans retained for the study were selected by RRQ staff according to criteria supplied by the authors among 2,304 plans under RRQ authority that filed an AIR for years 1995 to 1997 (see Table 1). Terminated plans (60), simplified plans (13), defined contribution plans (966), hybrid plans (182), plans of public employers (177), insured plans (19), plans offering a disability allowance (171), multiemployer plans (120), plans having no matching AIR and actuarial valuation reports (110), plans having less than 50 active and nonactive members (279)[12], a plan having more than 4,999 members[13] and plans presenting data abnormalities (22) were

[12] The quality of data supplied by the employer to the plan administrator is often less accurate for small pension plans, as the employer is more preoccupied with his own business than with plan data bookkeeping. Besides, member movement has an important financial impact on plan funding when there are few members. These plans are frequently established for key employees. On one hand, it is possible that these plans are more funded than others because these highly paid employees can consider the plan as a tax shelter. On the other hand, officer wages may vary from year to year, depending on several factors, like company profit, making it difficult to adequately fund the plan. To obtain more homogeneous results for this study, pension plans with less than 50 employees were excluded.

[13] To preserve the anonymity of this plan, its identity was not disclosed to the researchers of present study. In fact, there are several plans having more than 4,999 active or nonactive members under RRQ's authority; however, they were excluded by the other criteria mentioned above.

excluded. In total, 2,109 plans were removed from the study. Thus, 195 DB pension plans were included in this study.

3.2 Description of the Method Used for Calculating the Required Funding Surplus

In this study, the IGIF guideline for calculating the required funding surplus was applied to DB pension plans. When life insurance companies calculate their capital requirement, they have to follow the guideline literally. The guideline stipulates the factors that must be applied to the various balance sheet items—such as assets, premiums and actuarial liabilities—found in statutory reports. The greater the risk, the higher the factor applied to the balance sheet item.

3.2.1 Asset Yield Deficiency Risk

Pension plan committees must adopt a written investment policy (ANQ 2002, art. 169). Pension plan administrators, as fund trustees, must act in the best interest of the members. They must administer pension funds as prudent experts, which means that they must not take unjustified risks and must not unexpectedly make investments that could endanger future payment of participant benefits. Plan administrators must create a diversified portfolio to minimize the risk of major losses (ANQ 2002, art. 171.1). In this study, it is to be assumed that plan assets are not invested in risky securities based on the premise of a prudent investment strategy.

The method described in the guideline to determine the amount of surplus required for asset yield deficiency risk consists of applying a factor to each type of asset. The factors used depend on the risk level linked to asset realization. Thus, they take into account various characteristics of the elements for which they quantify risk. For example, factors for municipal bonds vary from 0.125 percent for those rated AAA up to 8 percent for those quoted B. Unfortunately, the AIR does not supply such detailed information. In fact, government bonds and other debt securities are combined. Consequently, it is difficult to establish with certainty the risk level of assets listed in this category. It is similar for other investment categories. To bypass this difficulty, a number of conservative hypotheses were made to enable the quantification of the risk level of DB pension plans and to calculate the required asset surplus according to the guideline. The

factors to be used for the various types of assets will be described in the next paragraphs starting with the greater risk factors (see Table 2).

The more detailed available information concerning plan assets comes from the AIR; the actuarial valuation supplied by the RRQ provides only the total value of assets and liabilities. So, the AIR data are used to calculate the surplus required for asset yield deficiency risk, according to the following:

- *Risk factor of 15 percent:* A factor of 15 percent will be applied to the market value of bond mutual funds and fixed income funds, mortgage mutual funds, Canadian stock mutual funds, foreign stock mutual funds, real estate mutual funds, balanced investment mutual funds, Canadian shares of real estate companies, other Canadian shares and foreign shares (see Table 2). The guideline does not allow any leeway for these types of investments; it does not discriminate for share or mutual fund types and is silent for the additional risk related to exchange rates.
- *Risk factor of 12 percent:* A factor of 12 percent will be applied to other investments, which include, among others, shares in limited partnerships, other mutual funds and loans other than mortgage loans.
- *Risk factor of 8 percent:* Other receivables and other assets will require a surplus of 8 percent as indicated in the guideline.
- *Risk factor of 7 percent:* As mentioned previously, pension plan committees have to administer as prudent experts. Consequently, a factor of 7 percent will be applied to the market value of the real estate properties because these usually have to have a return of at least 4 percent on book value[14].
- *Risk factor of 4 percent:* Pension plan administrators have to be careful not to endanger the payment of benefits, so there should be few restructured loans or doubtful loans in their portfolios. The factor applied to mortgage loans will be 4 percent, based on the assumption that pension plans make commercial loans rather than residential loans that would have to be administered at high cost.
- *Risk factor of 2 percent:* It will be hypothesized that bonds included in pension plan portfolios will be highly rated. To take into account the

[14] The risk factor is 7 percent for real estate properties that have a book value return of at least 4 percent. The factor is 35 percent for real estate in the oil and gas industry, while a factor of 15 percent applies to all other real estate. However, pension funds invest little in such real estate because these are subject to fiscal subsidies. Pension funds have no advantage to possess titles that are subsidized fiscally because the amounts invested in pension funds are tax sheltered as long as they are not paid as lump sums or in settlements.

inherent conservatism in determining the surplus required, a factor of 2 percent will be used for Canadian corporate bonds and other debt securities, and for those from foreign sources. In fact, this is the risk factor applied to BBB rated corporate bonds[15].

- *Risk factor of 0.5 percent:* An average factor of 0.5 percent will be used for government bonds and other debt securities[16].
- *Risk factor of 0.25 percent:* For purposes of the present study, a factor of 0.25 percent was used for amounts deposited in the general fund of an insurer, for short-term notes and securities, for money-market mutual funds and for other term deposits ending in more than six months, such as certificates of deposits of institutions registered with the Quebec Deposit Insurance Corporation.
- *Risk factor of 0 percent:* Receivables, including member contributions and additional voluntary contributions, employers' current service contributions, amortization amounts related to unfunded liabilities, investment income and negative assets have no surplus requirement since the guideline does not require it for premiums to be received or for overdue and accrued investment income because there is no asset yield deficiency risk.

3.2.1.1 Conversion of the Required Surplus for Asset Yield Deficiency Risk from the AIR Basis to the Funding Basis

The funding valuation does not usually contain exactly the same assets as those disclosed in the AIR because the statements are not always filed on the same day[17]. As we only had total funding assets, we had to convert, for each and every plan, the surplus required established on the AIR asset basis into the surplus required according to the funding asset basis. Consequently, a ratio representing funding assets divided by AIR net assets

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[15] Actuarial practice shows that pension plan investment policy usually requires that borrower credit quality be at least of average quality, or quoted BBB or more.

[16] According to the guideline, bonds of Canadian, provincial and territorial governments, bonds of central governments and of central banks of the Organization for Economic Cooperation and Development (OECD) are considered risk free, so a factor is 0 percent is applied. The IGIF formula applies a factor of 1 percent for BBB quoted municipal bonds. To determine the factor to be used, an assumption had to be made regarding the breakdown between government bonds and other debt securities in the portfolio. When there is a lack of formal indication, average values are used in actuarial practice. For the present study, it will be hypothesized that half of the assets were invested in government bonds (factor of 0 percent) and the other half were invested in average BBB-quoted municipal bonds (factor of 1 percent).

[17] For the sample plans, funding assets represent 93.8 percent of assets disclosed in the AIR. Ratios go from 77.1 percent to 125.5 percent.

was applied to AIR required surplus to obtain the required funding surplus for asset yield deficiency risk[18].

3.2.2 Mortality Risk

A factor of 1 percent was applied to actuarial liabilities as required in the guideline for the mortality risk of annuities involving life contingencies.

3.2.3 Changes in Interest Rates Risk

DB pension plans do not guarantee any rate of return to members. The return credited to the pension fund is the one that is earned on the portfolio of assets. A factor of 0.5 percent was applied to actuarial liabilities to cover the risk related to changes in interest rates.

[18] The use of such ratios implies that the asset distribution on the funding basis is the same as the one disclosed in the AIR. For lack of more precise information, this assumption is the only one that we can make to take into account funding values.

4. Analysis and Discussion of Results

4.1 Sample Description

The detailed data concerning the assets of the 195 DB plans under study came from the AIRs of 1995 (33.3 percent, 65 plans), 1996 (32.8 percent, 64 plans) and 1997 (33.8 percent, 66 plans), respectively (see Table 3). Every plan was included only once in the sample. The sample plans offered coverage to 81,180 active and nonactive members[19] (see Table 4), for an average of 416 members by plan.

The plans selected for study managed $3,995,157,194 according to the AIR data supplied (see Table 5)[20]. For these plans, funding assets disclosed in the funding valuation added up to $3,722,723,510, which represents 93.8 percent of AIR net assets (see Table 6). Funding liabilities for all plans were $3,615,499,898. So, considered globally, the study's pension plans were overfunded. Assets on the solvency basis were higher than those on the funding basis. This is attributable to the different asset valuation methods used[21]. It is to be noted that, globally, the amount for liabilities differed little according to both valuation bases. It follows that funding surplus was less than solvency surplus.

4.1.2 Characteristics of Plans with Asset Surplus on Funding and Solvency Bases

Of the 195 pension plans included in this study, 71.3 percent were overfunded, while 62 percent (121) had asset surpluses on both funding and solvency basis. These plans were entitled to contribution holidays according to the SPPA (ANQ 2002) (see Table 7). Their average funding ratio was 118.38 percent. The total amount that could have been appropriated by

[19] Plan membership figures include active and nonactive members but exclude plan beneficiaries.

[20] Average total assets by pension plan disclosed in the AIR were $20,487,986. On the whole, equity securities represent 53 percent of investments, including 14.8 percent of a portfolio that is invested in foreign stocks or foreign stock mutual funds. Pension funds debts represent only 0.6 percent of assets.

[21] Valuation of assets on the solvency basis rests on monetary values, while valuation of assets on the funding basis is estimated by a method which smoothes market value variations. So, in contexts where market values increase, the most recent values are not completely recognized in the value of assets on a funding basis, while they are recognized according to the solvency basis, resulting in lower asset values in the first case.

employers for contribution holidays added up to $279,275,372[22]; the average amount by plan was $2,308,061, and the average by member was $6,663.

4.2 Results of Applying the Guideline

4.2.1 Results for All Sample Plans

4.2.1.1 Asset Yield Deficiency Risk

The surplus required for asset deficiency risk for all sample plans, calculated according to the guideline's factors, added up to $396,416,808, representing 9.92 percent of assets under management which were valued at $3,995,157,194 (see Table 8). In the sample, 63.6 percent of portfolios were invested in equity securities, adding up to $2,540,375,158. The risk factor of 15 percent was applied to the market value of these equity securities. The surplus thus required was $381,056,274, or 96 percent of the total surplus required for asset yield deficiency risk for assets listed in the AIR.

A ratio of funding actuarial assets to AIR net assets, which was calculated individually for every plan, was used to convert the surplus determined on the basis of AIR assets to that of funding actuarial assets. After conversion, the surplus required for yield deficiency risk for funding assets was $371,456,475 (9.98 percent of funding assets) (see Table 9)[23].

4.2.1.2 Mortality Risk and Changes in Interest Rates Risk

As required by the guideline, a factor of 1 percent was applied to funding actuarial liabilities for mortality risk of annuities involving life contingencies. The minimum surplus required for this risk was $36,154,999. The surplus required for changes in interest rates allowed compensation for the effect of interest rates variations on cash flows related to assets and

[22] As previously indicated, the amount that could have been appropriated by employers for contribution holidays (with members' approval) was the smaller of surplus determined on the funding basis and surplus determined on the solvency basis.

[23] A liberal and a conservative scenario that modulates risk factors other than those for equity securities were also developed for the purposes of the present study. The very strong representation of equity securities in pension plan portfolios, combined with the high, nonnegotiable, surplus factor applied to this kind of securities according to the guideline, explain the results obtained, namely the minimum surplus required for the three scenarios were not very different from one another. So, the liberal scenario requires a minimum surplus of $389,558,594, which represents 98.3 percent of the minimum required surplus of basic scenario, while the conservative scenario requires a minimum surplus of $406,962,814, or 102.7 percent of the minimum required surplus of the basic scenario.

liabilities. A factor of 0.5 percent was applied to actuarial liabilities and the minimum surplus required added up to $18, 077,499.

4.2.1.3. Minimum Required Surplus to Cover All Three Risks

Overall, for all sample plans, the minimum required surplus, according to the proposition of this study, that should be disclosed in employer and pension plan financial statements to cover asset yield deficiency risk, mortality risk and changes in interest rates risk, added up to $425,688,973. The average minimum surplus needed was $2,183,020 by plan, or $5,244 by member (see Table 10). This represents an average ratio of asset surplus overfunding liability of 13.42 percent. It is to be remembered that the average funding surplus for all sample plans was $549,865 by plan and $1,321 by member (see Table 6). So, the impact of applying the guideline is important.

The funding surplus, which was originally of $107,223,162, has disappeared and there is now an unfunded liability of $318,465,361 after taking into account the minimum surplus required when applying the IGIF guideline (see Table 11). This variation represents 11.77 percent of liabilities. The average modified unfunded liability is $1,633,156 by plan, or $3,923 by member. However, more than 25 percent of plans included in the sample still had a funding surplus after having taken into account the required minimum surplus. So, some plans may still appropriate asset surplus for employer contribution holidays, even when they take into account risks according to IGIF guideline.

A Student *t* test on the difference between funding surplus and modified funding surplus indicates, with a 5 percent risk of error, that this difference is statistically significant, the *t* value (8.492) being superior to the critical value of 1.96 (see Table 12). The average funding ratio for the sample is 108.18 percent. The modified funding ratio, computed by dividing funding assets by the sum of funding liabilities and of the minimal surplus required according to the guideline, is 95.11 percent. This ratio demonstrates that, on average, the sample plans become underfunded.

Disclosure of the modified funding ratio, besides those already disclosed in the employer and the pension plan financial statements, would decrease information asymmetry between the employer, shareholders and plan members by providing relevant information. The current proposition's

objective is to increase the security of future benefit payments by providing information to make all parties aware that part of the funding surplus should be kept in the fund to protect plan benefits against future risks regarding asset yield deficiency, mortality and changes in interest rates. Thus, the amount of asset surplus that might be appropriated by employer for contribution holidays could be limited to the smaller amount between the modified funding surplus and the solvency surplus (ANQ 2002, art. 146.2).

4.2.2 Results for Plans Entitled to Contribution Holidays

Applying the guideline to the sample plans had a very important impact on their overfunding and underfunding status. From 139 plans (71.3 percent) that were overfunded, only 68 (34.9 percent) were still over funded on the modified funding basis (see Table 13). For these plans, the guideline application reduced the average modified surplus to 47 percent of the initial average surplus. As there was only one overfunded plan on the modified funding basis that is not also overfunded on the solvency basis, this leaves 67 plans that were entitled to appropriate the modified surplus for employer contribution holidays, while there were 121 according to the initial funding basis (see Table 7).

The total surplus according to the funding basis for these 67 plans added up to $239,014,983, representing an average of $3,567,387 by plan and $10,963 by member (see Table14). The required minimum surplus added up to $127,253,159, with an average of $1,899,301 by plan and $5,837 by member. The modified surplus, after deduction of the required surplus, added up to $111,761,824, representing $1,668,087 by plan and $5,126 by member. So, for overfunded plans on the modified funding basis, the average modified surplus represented only 46.8 percent of the original average funding surplus.

On the other hand, total funding surplus for the 54 plans entitled since 2001 to contribution holidays according to the SPPA (ANQ 2002, art. 146.1), but not entitled anymore according to the modified funding basis adds up to $54,215,014 (see Table 14). The average surplus by plan is $1,003,982 and $2,696 by member. This amount represents 28.1 percent ($1,003,982/$3,567,387) of the average surplus of plans that are overfunded according to both bases, even though average plan assets for the plans that are not entitled anymore to contribution holidays represent 116.1 percent

($21,150,467/$18,220,701) of that of plans that are still entitled to it. On average, it is the plans that have more assets that lose the right to grant employer contribution holidays. These plans also had more liabilities than those that were still entitled to contribution holidays. Furthermore, while average assets by member were rather similar for both categories, the surplus by member for those in plans no longer entitled to contribution holidays was 24.6 percent ($2,696/$10,963) of surplus by member in plans that were still entitled to contribution holidays.

The minimum surplus required for plans that lost the right to contribution holidays according to the modified funding basis added up to $141,138,603, representing an average of $2,613,678 by plan or $7,018 by member. For these plans, the modified unfunded liability resulting from taking into account the minimum required surplus added up to $86,923,589, representing $1,609,696 by plan or $4,322 by member. So, for these 54 overfunded plans that now show a modified unfunded liability, the average required minimum surplus by plan represents 2.6 times ($2,613,678/$1,003,982) the average surplus by plan on the funding basis, while the average minimum surplus required for plans that remained overfunded on the modified funding basis was only 53.2 percent ($1,899,300/$3,567,387) of the average funding surplus by plan. The importance of the minimum surplus required for plans that now have an unfunded liability on the modified basis reflects the fact that these plans have more assets and that their liabilities to members are greater than those of the plans that remain overfunded. The risk considerations identified in the guideline, thus, affect them particularly.

For the 74 plans that had never been entitled to contribution holidays according to the SPPA (ANQ 2002), the average modified unfunded liability was $4,639,238 by plan. Even though average assets by plan were almost equivalent to that of overfunded plans on the modified funding basis, the liabilities were much higher, resulting in higher minimum surplus required for the underfunded plans than for the overfunded plans.

The average modified funding ratio for plans with asset surplus that can be appropriated by employers for contribution holidays is 111.53 percent, while their average funding ratio is 128.12 percent (see Table 15). Consideration of the risks identified in the guideline brings a more important reduction in the ratio of highly overfunded plans (75th percentile) than in the ratio of plans that are less overfunded (25th percentile).

The total amount allowed to employers for contribution holidays for the 67 DB plans for which asset surplus may be appropriated, with member approval, after taking into account the minimum funding surplus required to cover the risks identified in the guideline, added up to $110,919,847[24] (see Table 16). The decrease is very important with regard to the amount of $228,928,011, which is allowed for employer contribution holidays according to the SPPA (ANQ 2002, art.146.2) for these 67 plans (a decrease of 51.6 percent). This decrease is even more important when compared to the total amount of $279,275,372 (ANQ 2002) allowed to the 121 pension plans entitled to holidays according to the SPPA (a decrease of 60.3 percent).

For the 67 plans entitled to contribution holidays, the average amount by plan that may be appropriated was $1,655,520, or an average of $5,087 by member. This amount was 48.44 percent of the amount allowed for these plans according to the SPPA (ANQ 2002, chap. 146.2). Thus, using the modified funding basis to estimate the funding situation of plans and their eligibility for contribution holidays would have a significant impact.

4.3 Impact of the Income Tax Act on the Guideline's Applicability to Pension Plans

The Income Tax Act of Canada limits deductibility of employer-paid contributions from employer taxable income (CDOJ 2002a, art. 20[1]q). Currently, 58 (29.7 percent) DB plans among the sample plans are not allowed to deduct employer paid contributions, representing 25.7 percent of members (see Table 17). Their funding surplus adds up to $127,782,614 above the ceiling imposed by the Income Tax Act. The average funding surplus above the tax ceiling is $2,203,149 by plan, or $6,131 by member.

When the guideline is applied to pension plans according to the proposition of this study, the resulting required minimum surplus is above the ceiling imposed by the Income Tax of Canada for the majority of the sample plans. So, 104 (53.3 percent) DB pension plans among the 195 plans, representing 54.2 percent of members, would have a required minimum surplus that is above the tax ceiling. Their required minimum surplus adds

[24] The global amount that may be appropriated according to the proposition of this study is smaller than the funding surplus appearing in Table 14 for these plans since it is the smaller of asset surplus determined on the funding basis and asset surplus determined on the solvency basis that may be appropriated by employer for contribution holidays.

up to $57,945,423 above the tax ceiling, representing an average of $557,168 by plan or $1,316 by member.

Applying the guideline to DB pension plans to determine a minimum surplus required over their funding liabilities to decrease risk of nonpayment of future benefits would imply a revision of the maximum financing limits imposed by the Income Tax Act of Canada since, in the majority of cases, employers under study cannot finance the minimum surplus required.

5. Conclusion

In this study, the effects of applying the IGIF guideline were measured and described for a sample of DB pension plans from Quebec to demonstrate the impact on the funding surplus of considering additional risks besides those already taken into account in current actuarial practice regarding funding valuation calculations. The impact of applying the guideline was also estimated for the subset of plans entitled to contribution holidays according to the 2001 SPPA (ANQ 2002).

The pension plans under study that were, on average, overfunded have now become, on average, underfunded on the modified funding basis after considering the risks identified in the guideline. The average funding ratio of the plan is about 108 percent and their average solvency ratio about 123 percent. Applying the IGIF guideline to the sample plans requires a minimum surplus of approximately 13.5 percent of funding liabilities, resulting in an average modified funding ratio of 95 percent.

After applying the guideline, only 34 percent of the sample plans remain entitled to contribution holidays. These plans, which have an average funding ratio of 128 percent, have a modified funding ratio of 111 percent. The average amount currently available for employer contribution holidays is about $1.7 million by plan, or $5,000 by member. Applying the guideline results in a decrease of 45 percent in the number of plans entitled to contribution holidays as well as a decrease of 25 percent in the average amount of contribution holidays by plan and just as much by member.

Currently, 30 percent of DB pension plans may not deduct employer paid contributions according to the Income Tax Act of Canada (CDOJ 2002a,

art. 20[1]q), representing 26 percent of members. The average funding surplus over the tax ceiling is about $2.2 millions by plan, or $6,000 by member. To apply the guideline results in a required minimum surplus that would be above the tax ceiling for the majority of sample plans (53.3 percent). The average required minimum surplus above the tax ceiling is about $500,000 by plan, or $1,300 by member. Decreasing the risk of nonpayment of future benefits would, thus, require a revision of the maximum financing limits imposed by the Income Tax Act of Canada because, in the majority of cases, employers cannot finance the required minimum surplus (CDOJ 2002a, art. 20[1]q).

Disclosure of the modified funding ratio resulting from the application of the guideline to DB pension plans would decrease information asymmetry between the employer, shareholders and plan members, and would meet the criterion of information relevance according to agency theory and CICA. The current proposition aims to make financial statement users aware that part of the funding surplus should be kept to protect plans against future incurred risks regarding asset yield deficiency, mortality and changes in interest rates. Thus, the amount of asset surplus that could be appropriated by employers for contribution holidays could be limited to the lesser of the modified funding surplus and the solvency surplus. This would decrease the probability that events such as unwarranted contribution holidays would endanger plan solvency. Finally, knowledge of the amount of surplus that may be appropriated, while offering a better protection against future risks, would allow a more accurate valuation of companies by investors and shareholders by reducing the uncertainty related to the realization of assets.

5.1 Limitations and Research Avenues

The information used to measure the impact of applying the IGIF guideline came from the AIRs. Unfortunately, detailed information on investment characteristics was not provided. To have a more precise valuation of the required minimum surplus, it would have been necessary to have access to actuarial valuation reports as well as complete descriptions of valuation assets used in quantifying funding asset risks. Working with pension committees to have access to this information would be an alternate way to proceed. Besides, it would make it possible to include plans having disability benefits and, thus, to quantify the risks that are associated to them.

Also, it would be interesting to be able to quantify the impact of applying the guideline to the plans that were excluded from the study to ensure sample homogeneity. Another research avenue would be to re-do the study with financial data for the years 2001–2002 to determine the importance of the impact of capital market conditions, since plans are highly invested in shares. Performing such a longitudinal study would allow a better assessment of the relevance of applying the IGIF guideline to protect future pension benefits without having to increase contributions.

Table 1
Sample

Number of Plans Under RRQ Authority That Filed an AIR for Years 1995 to 1997			2,304
Plans excluded and justification			
1.	Terminated plans	60	
2.	Simplified plans	13	
3.	Defined-contribution plans	966	
4.	Hybrid plans	182	
5.	Plans of public employers	177	
6.	Insured plans	19	
7.	Plans offering a disability allowance	171	
8.	Multiemployer plans	120	
9.	No matching AIR and actuarial valuation reports	110	
10.	Plans having less than 50 members	279	
11.	Plans having more than 4 999 members	1	
12.	Abnormalities in data received from RRQ	11	
Total number of plans excluded			2,109
Total number of plans retained for the study			195

Table 2
Risk Factors

Type of Element	**Factors** (%)
Asset yield deficiency risk:	
Bond mutual funds and fixed income funds	15.00
Mortgage mutual funds	15.00
Canadian stock mutual funds	15.00
Foreign stock mutual funds	15.00
Real estate mutual funds	15.00
Balanced investment mutual funds	15.00
Canadian shares of real estate companies	15.00
Other Canadian shares	15.00
Foreign shares	15.00
Other investments	12.00
Other receivables	8.00
Other assets	8.00
Real estate properties	7.00
Mortgage loans	4.00
Canadian corporate bonds and other corporate debt securities	2.00
Foreign bonds and other foreign debt securities	2.00
Government bonds and other debt securities	0.50
Amounts deposited in the general fund of an insurer	0.25
Other term deposits (term ending in more than 6 months)	0.25
Short term notes and securities and money market mutual funds	0.25
Cash on hand	0.00
Member and voluntary contributions receivable	0.00
Employer current service contributions receivable	0.00
Contributions receivable for amortization of unfunded plan liability	0.00
Investment income receivable	0.00
Mortality risk	1.00
Changes in interest rates risk	0.50

Table 3
Year of Origin of Sample Data

	Number of Plans	% Plans
Data from AIR for the year 1995	65	33.3
Data from AIR for the year 1996	64	32.8
Data from AIR for the year 1997	66	33.8
Total number of plans in sample	195	100

Table 4
Plan Membership Figures

Total number of active and inactive members	81,180
Average number of members by plan	416
Median number of members by plan	183

Table 5
AIR Plan Asset Distribution for All Sample Plans

Elements of Asset	Total Assets $	Total Assets %	Average Assets $	Standard Deviation $
Cash on Hand	**13,370,197**	**0.3**	**68,565**	**211,470**
Debt securities				
· Short term notes and sec.	160,385,421	4.0	822,489	2,411,487
· Canadian bonds and other Canadian debt securities				
- issued or guaranteed by government or	873,690,819	21.9	4,480,466	9,457,829
municipality	280,174,899	7.0	1,436,794	4,157,325
- of companies				
· Foreign bonds and debt securities	3,548,392	0.1	18,197	183,080
Bonds mutual funds and	212,245,378	5.3	1,088,438	3,826,488
fixed income funds	26,545,101	0.7	136,129	868,800
· Mortgage mutual funds	1,717,408	0.0	8,807	59,775
· Mortgage loans				
· Deposits				
- Amounts deposited in the general fund of	19,414,689	0.5	99,563	566,035
an insurer	5,072,162	0.1	26,011	153,874
- Other term deposits	**1,582,794,269**	**39.6**	**8,116,894**	**21,684,693**
Subtotal				
Equity securities				
· Canadian shares				
- Shares in real estate companies	206,783,525	5.2	1,060,428	5,064,725
- Other	803,747,439	20.1	4,121,782	10,299,180
· Foreign shares	200,528,325	5.0	1,028,350	3,898,832
· Stock mutual funds and growth mutual funds				
- Canadian shares	476,021,114	11.9	2,441,134	6,891,821
- Foreign shares	393,271,681	9.8	2,016,778	5,130,590
· Real estate	24,029,089	0.6	123,226	979,714
· Real estate mutual funds	11,985,021	0.3	61,462	233 919
Subtotal	**2,116,366,194**	**53.0**	**10,853,160**	**32,498,781**
Balanced mutual funds	**209,247,574**	**5.2**	**1,073,064**	**3,545,260**
Other investments	**17,085,377**	**0.4**	**87,617**	**315,190**
Accounts receivable	**56,072,790**	**1.4**	**287,553**	**902,166**
Other assets	**220,793**	**0.0**	**1,132**	**15,491**
Total assets	**3,995,157,194**	**100**	**20,487,986**	**32,232,953**
Total liabilities	**(25,719,347)**	**(0.6)**	**(131,894)**	**453,370**
Net asset	**3,969,437,847**	**99.4**	**20,356,092**	**35,029,439**

Table 6
Actuarial Valuation Data for All Sample Plans

Funding Basis	Assets ($)	Liabilities ($)	Surplus ($)
Total	3,722,723,510[a]	(3,615,499,898)	107,223,612
Average by plan	19,090,890	(18,541,025)	549,865
Median	7,757,057	(7,054,000)	264,100
Standard deviation	32,695,312	33,285,375	5,823,014
Average by member	45,858	(44,537)	1,321
Solvency Basis			
Total	4,064,412,630[b]	(3,577,888,142)	486,524,488
Average by plan	20,843,142	(18,348,144)	2,494,998
Median	8,021,200	(6,934,100)	629,759
Standard deviation	35,517,999	34,361,445	9,516,198
Average by member	50,067	(44. 074)	5,993

[a] This amount represents 93.8 percent of AIR net assets.

[b] This amount represents 102.4 percent of AIR net assets.

Table 7

Actuarial Valuation Data on Funding Basis for Plans That Surplus Assets May Be Appropriated by Employer for Contribution Holidays [a]

Funding Basis	**Assets**		**Liabilities**		**Surplus**	
	($)	(%)	($)	(%)	($)	(%)
Total	2,362,912,159	63.5[b]	(2,069,682,162)	57.29	293,229,997	273.59
Average by plan	19,528,200		(17,104,811)		2,423,388	
Median	8,414,000		(6,871,023)		1,000,400	
Standard deviation	3, 239,171		(30,237,549)		4,159,796	
Mean by plan	56,376		(49,380)		6,996	
Funding ratio		(%)				
Average		118.38				
Median		114.02				
25th percentile		106.82				
75th percentile		123.29				
Minimum		100.18				
Maximum		285.81				
Standard deviation		20.46				
Statistical data		Number or (%)				
Number of plans		121				
% Plans		62.1 %				
Total number of members		41,913				
% of sample members		51.6 %				
Average number of members by plan		346				
Median number of members by plan		150				

[a] According to ANQ 2002.

[b] This percentage represents the proportion of the element with regard to the total of this element for the 195 sample plans.

Table 8

Surplus Required for Asset Yield Deficiency Risk by Type of Asset Listed In AIR for All Sample Plans

Elements of Asset	Total Assets $	Factor applied %	Surplus Required $	Surplus Required %
Cash in hand	**13,370,97**	**0**	**0**	**0.0**
Debt securities				
· Short term notes and sec.	160,385,421	0.25	400,964	0.10
· Canadian bonds and other Canadian debt securities				
- issued or guaranteed by government or	873,690,819	0.50	4,368,454	1.10
municipality	280,174,899	2.00	5,603,498	1.41
- of companies				
· Foreign bonds and debt securities	3,548,392	2.00	70,968	0.02
Bonds mutual funds and	212,245,378	15.00	31,836,807	8.03
fixed income funds	26,545,101	15.00	3,981,765	1.00
· Mortgage mutual funds	1,717,408	4.00	68,696	0.02
· Mortgage loans				
· Deposits				
- Amounts deposited in the general fund of	19,414,689	0.25	48,537	0.01
an insurer	5,072,162	0.25	12,680	0.00
- Other term deposits	**1,582,794,269**		**46,392,369**	**11.70**
Subtotal				
Equity securities				
· Canadian shares				
- Shares in real estate companies	206,783,525	15.00	31,017,529	**7.82**
- Other	803,747,439	15.00	120,562,116	**30.41**
· Foreign shares	200,528,325	15.00	30,079,249	**7.59**
· Stock mutual funds and growth mutual funds				
- Canadian shares	476,021,114	15.00	71,403,167	**18.01**
- Foreign shares	393,271,681	15.00	58,990,752	**14.88**
· Real estate	24,029,089	7.00	1,682,036	**0.42**
· Real estate mutual funds	11,985,021	15,00	1,797,753	**0.45**
Subtotal	**2, 116,366,194**		**315,532,602**	**79.60**
Balanced mutual funds	**209,247, 574**	**15.00**	**31,387,136**	**7.92**
Other investments	**17, 085, 377**	**14.13**	**2,414,997**	**0.61**
Accounts receivable	**56,072,790**	**1.20**	**672,041**	**0.17**
Other assets	**220,793**	**8.00**	**17,663**	**0.00**
Total assets	**3,995,157,194**	**9.92**	**396,416,808**	**100.00**
Total liabilities	**(25,719, 347)**	**0**	**0**	**0**
Net asset	**3,969,437,847**	**9.99**	**396,416,808**	**100.00**

Table 9

Minimum Surplus Required Over Funding Liability for All Sample Plans

Required Surplus for	Amount ($)
Asset yield deficiency risk	371,456,475
Mortality risk	36,154,999
Changes in interest rates risk	18,077,499
Total minimum surplus required	425,688,973

Table 10

Statistics on the Required Minimum Surplus and the Ratio of the Required Minimum Surplus over the Funding Liability for All Sample Plans

	Required Minimum Surplus ($)	Ratio over the Funding Liability (%)
Average by plan	2,183,020	13.42
Median	910,669	12.94
25th percentile	355,776	10.39
75th percentile	2,207,184	16.95
Minimum	2,280	1.79
Maximum	28,312,978	32.09
Standard deviation	3,589,887	4.51
Average by member	5,244	--

Table 11

Surplus on Modified Funding Basis Taking Into Account the Required Minimum Surplus for All Sample Plans

	Amount ($)
Assets	3,722,723,510
Liabilities	(3,615,499,898)
Surplus	107,223,612
Minimum surplus required (see Table 9)	(425,688,973)
Modified unfunded liability	(318,465,361)

Table 12

Statistics on the Modified Funding Surplus and the Ratio of the Modified Funding Surplus over the Funding Liability

	Amount ($)	**Funding Ratio** (%)	**Modified Funding Ratio** (%)
Average	(1,633,156)	108.18	95.11
Median	(233,932)	107.16	93.71
25th percentile	(1,324,787)	98.55	86.77
75th percentile	166,716	118.48	103.32
Minimum	(50,445,361)	36.87	34.94
Maximum	17,609,153	285.81	216.37
Standard deviation	6,947, 637	22,61	17.54
Average by member	(3,923)	--	--
Value of *t* [a]	8.492 (p = 0.000)	--	--

[a] Test of *t* on differences between funding surplus and modified funding surplus.

Table 13

Actuarial Valuation Data of Overfunded and Underfunded Plans on Modified Funding Basis

	Overfunded Plans on Modified Funding Basis		Underfunded Plans on Modified Funding Basis	
Total	($)	(%) [a]	($)	(%) [a]
Assets	1,233,897,963	33.1	2,488,825,547	66.9
Liabilities	(992,144,238)	27.4	(2,623,355,660)	72.6
Surplus or unfunded liability	241,753,725	225.5	(134,530,113)	(125.5)
Minimum surplus required	(128,204,750)	30.1	(297,484,226)	69.9
Mod. surplus or unf. liability	113,548,975	(35.7)	(432,014,339)	135.7
Average by Plan	($)		($)	
Assets	18,145,558		19,597,052	
Liabilities	(14,590,356)		(20,656,344)	
Surplus or unfunded liability	3,555,202		(1,059,292)	
Minimum surplus required	(1,885,364)		(2,342,396)	
Mod. surplus or unf. liability	1,669,838		(3,401,689)	
Average by Member				
Assets	56,399		41,969	
Liabilities	(45,349)		(44,237)	
Surplus or unfunded liability	11,050		(2,268)	
Minimum surplus required	(5,860)		(5,017)	
Mod. surplus or unf. liability	5,190		(7,285)	
Median				
Assets	7,757,059		7,757,057	
Liabilities	(6,034,967)		(7,488,900)	
Surplus or unfunded liability	1,697,093		55,200	
Minimum surplus required	(880,749)		(919,207)	
Mod. surplus or unf. liability	622,394		(751,817)	
Average Standard Deviation by Plan				
Assets	24,979,339		36,240,342	
Liabilities	20,394,670		38,363,154	
Surplus or unfunded liability	5,118,294		5,549,080	
Minimum surplus required	2,562,293		4,034,578	
Mod. surplus or unf. liability	2,882,328		7,801,408	
Statistical Data	Number or (%)		Number or (%)	
Number of plans	**68**		**127**	
% Plans	34.9 %		65.1 %	
Total number of members	21,878		59,302	
% members	26.9 %		73.1 %	
Average members by plan	322		467	
Median members by plan	152		253	

[a] This percentage represents the proportion of the element with regard to the total of this element for all sample plans.

Table 14
Actuarial Valuation Data on Modified Funding Basis and on Solvency Basis

	Valuation Data on Modified Funding Basis for Plans Entitled to Contribution Holidays		Valuation Data on Solvency Basis for Plans Entitled to Contribution Holidays	
Total	($)	(%) [a]	($)	(%) [a]
Assets	1,220,786,963	32.8	1,333,891,473	32.8
Liabilities	981,771,980	27.2	(885,192,328)	24.7
Surplus or unfunded liability	239,014,983	222.9	448,699,145	92.2
Minimum surplus required	(127,253,159)	29.1		
Mod. surplus or unf. liability	111,761,824	(35.1)		
Average by Plan	($)		($)	
Assets	18,220,701		19,908,828	
Liabilities	(14,653,313)		(13,211,826)	
Surplus or unfunded liability	3,567,387		6,697,002	
Minimum surplus required	(1,899,300)			
Mod. surplus or unf. liability	1,668,087			
Average by Member				
Assets	55,992		61,179	
Liabilities	(45,029)		(40,600)	
Surplus or unfunded liability	10,963		20,579	
Minimum surplus required	(5,837)			
Mod. surplus or unf. liability	5,126			
Median				
Assets	7,532,900		7,699,300	
Liabilities	(5,951,933)		(5,304,097)	
Surplus or unfunded liability	1,689,000		2,655,869	
Minimum surplus required	(850,829)			
Mod. surplus or unf. liability	612,049			
Average Standard Deviation by Plan				
Assets	25,160,120		27,790,376	
Liabilities	20,541,935		17,756,516	
Surplus or unfunded liability	5,155,929		12,942,479	
Minimum surplus required	2,579,034			
Mod. surplus or unf. Liability	2,904,045			
Statistical Data			Number or (%)	
Number of plans			**67**	
% Plans			34.40 %	
Total number of members			21,803	
% Members			26.9	
Average (median) number of members by plan			325 (153)	

[a] This percentage represents the proportion of the element with regard to the total of this element for all sample plans.

Notes: Actuarial valuation data on modified funding basis and on solvency basis for plans that surplus assets may be appropriated by employer for contribution holidays and data on modified funding basis for plans not entitled to contribution holidays according to this study and for those that have never been entitled.

Table 14 (continued)

	Valuation Data on Modified Funding Basis for Plans Not Entitled to Contribution Holidays		Valuation Data on Modified Funding Basis for Plans Never Entitled to Contribution Holidays	
Total	($)	(%) [b]	($)	(%) [b]
Assets	1,142,125,196	30.7	1,359,811,351	36.5
Liabilities	(1,087,910,182)	30.1	1,545,817,736	42.8
Surplus or unfunded liability	54,215,014	50.6	(186,006,385)	173.5
Minimum surplus required	(141,138,603)	33.2	(157,297,214)	37.0
Mod. surplus or unf. liability	(86,923,589)	27.3	(343,303,599)	107.8
Average by Plan	Amount ($)		Amount ($)	
Assets	21,150,467		18,375,829	
Liabilities	(20,146,485)		(20,889,429)	
Surplus or unfunded liability	1,003,982		(2,513,600)	
Minimum surplus required	(2,613,678)		(2,125,638)	
Mod. surplus or unf. liability	(1,609,696)		(4 639,238)	
Average by Member				
Assets	56,794		34,630	
Liabilities	(54,098)		(39,367)	
Surplus or unfunded liability	2,696		(4,737)	
Minimum surplus required	(7,018)		(4,006)	
Mod. surplus or unf. liability	(4,322)		(8,743)	
Median				
Assets	8,665,900		18,375,829	
Liabilities	(8,205,700)		(20,889,429)	
Surplus or unfunded liability	498,900		(2,513,600)	
Minimum surplus required	(1,116,587)		(735,334)	
Mod. surplus or unf. liability	(577,521)		(950,795)	
Average Standard Deviation by Plan				
Assets	39,780,907		33,394,995	
Liabilities	39,085,000		37,846,286	
Surplus or unfunded liability	1,538,628		6,806,914	
Minimum surplus required	4,426,545		3,714,081	
Mod. surplus or unf. liability	3,766,621		9,549,337	
Statistical Data	Number or (%)		Number or (%)	
Number of plans	**54**		**74**	
% Plans	27.7 %		37.9 %	
Total number of members	20,110		39,267	
% members	24.7 %		48.4 %	
Average (median) members by plan	372 (148)		531 (265)	

[b] This percentage represents the proportion of the element with regard to the total of this element for all sample plans.

Table 15

Funding Ratio and Modified Funding Ratio for Plans Which Surplus Assets May Be Appropriated by Employer for Contribution Holidays According to the Proposition of This Study

	Modified Funding Ratio (%)	**Funding Ratio** (%)
Average	111.53	128.12
Median	106.63	122.10
25th percentile	102.52	116.74
75th percentile	116.45	133.46
Minimum	100.06	109.53
Maximum	216.37	285.81
Standard deviation	15.91	23.07

Table 16

Amount Allowed to Employer for Contribution Holidays for Plans That Surplus Assets May Be Appropriated by Employer for Contribution Holidays [a]

Employers Entitled to Contribution Holidays ($)		**ANQ 2002** ($)
Total	110,919,846	228,928,011
By Plan		
Average	1,655,520	3,416,836
Median	612,049	1,689,000
25th percentile	143,705	503,000
75th percentile	1,938,878	4,027,900
Minimum	1,348	10,600
Maximum	17,609,153	30,602,154
Standard deviation	2,901,035	5,135,524
By Member		
Average	5,087	10,500

[a] According to the proposition of this study.

Table 17

Plans for Which Actual Surplus and Surplus Required Are Superior to the Ceiling, According to the IGIF Guideline [a]

	Actual Surplus Above the Ceiling of the Income Tax Act of Canada	**Surplus Required on the Modified Basis Above the Ceiling of the Income Tax Act of Canada**
Number of plans	**58**	**104**
% Plans	29.7 %	53.3 %
% Members	25.7 %	54.2 %
	Amount ($)	Amount ($)
Total	127,782,614	57,945,423
By Plan		
Average	2,203,149	557,168
Median	1,202,500	282,144
25th percentile	243,842	78,630
75th percentile	2,301,528	700,229
Minimum	3,891	1,658
Maximum	18,543,384	5,071,830
Standard deviation	3,427,886	811,394
By Member		
Average	6,131	1,316

[a] (CDOJ 2002a)

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