

# Reports



# Introduction

**R**eports address specific issues of relevance to the financial system (whether institutions, markets, or clearing and settlement systems) in greater depth.

Defined-benefit plans are by far the most important part of "pillar three" of Canada's retirement system, which includes employer-sponsored pension plans.<sup>1</sup> However, the future of defined-benefit pension plans is being increasingly jeopardized. Sponsors are worried about the mounting costs of maintaining these plans. Pension regulators are concerned about the large deficits being run by many of these plans and, consequently, about the exposure of plan participants to the potential insolvency of the sponsor. And many active and retired employees are wondering about the security of their promised benefits. In this context, government initiatives are currently under way to review the legislative and regulatory framework for pension plans to ensure that it remains effective and responsive to market conditions. In "Strengthening Defined-Benefit Pension Plans," Jim Armstrong and Jack Selody highlight the major impediments to viable employer-sponsored defined-benefit plans and propose possible options for strengthening these plans. The authors conclude that changes must be made if employer-sponsored pension plans are to remain a viable option for Canadian savers.

The financial health of Canadian public non-financial companies is important to the stability of the financial system. Corporate bonds and equities make up a large part of the asset holdings of banks, insurance companies, and households (through pension plans and mutual

funds). Hence, a rash of corporate failures could have a widespread economic impact by eroding the capital of financial institutions and the wealth of households. When aggregated data are used to assess corporate financial health, important information about the underlying distributions is overlooked. Microdata can provide information about the "vulnerable tails" that are thought to be more relevant for analyzing financial stability. In "The Use of Microdata to Assess Risks in the Non-Financial Corporate Sector," Meyer Aaron and Dylan Hogg focus on company-level accounting measures to assess the financial health of the corporate sector. In particular, they construct a vulnerability indicator using the "vulnerable tails" of the distributions for certain financial ratios. Preliminary analysis shows that the vulnerability indicator can be a useful tool for assessing risks to financial stability in the non-financial corporate sector. The authors also apply their methodology at the sectoral level.

1. It is generally understood that the Canadian retirement system is supported by three pillars. The first pillar consists of the Old Age Security and Guaranteed Income Supplement programs. The second pillar comprises the Canada and Quebec Pension Plans.



# Strengthening Defined-Benefit Pension Plans

*Jim Armstrong and Jack Selody*

**T**he purpose of this report is to provide a framework for discussing ways of strengthening the viability of defined-benefit pension plans.

*Responsibility for pension regulation and supervision in Canada is shared between federal and provincial governments. The largest regulator is the Financial Services Commission of Ontario, which supervises almost 40 per cent of all plan assets. About 10 per cent of plan assets fall under federal jurisdiction and are supervised by the Office of the Superintendent of Financial Institutions. The federal government and the province of Quebec have each initiated public consultation processes aimed at strengthening their respective legislation and regulations.<sup>1</sup>*

## Introduction

The future of defined-benefit pension plans is increasingly being questioned. Sponsors are worried about the growing difficulty of maintaining these plans. Pension regulators are concerned about the large deficits that many of these plans are running and, consequently, about the exposure of these plans to the insolvency of the sponsor. As a result, many active and retired employees are unsure about the security of their promised benefits.

Employer-sponsored defined-benefit pension plans are a very important part of the third pillar of Canada's retirement system, which comprises tax-deferred private retirement savings.<sup>2</sup> Defined-benefit pension plans provide features not provided by other types of plans. They provide a guarantee of retirement income that

ultimately helps risk-averse savers to efficiently achieve their optimal savings rate. The associated pension funds represent large pools of capital with a very long-run investment perspective that contribute importantly to the efficiency of the financial system.

The potential for continued erosion of the viability of defined-benefit plans raises concerns with respect to the financial system, particularly in the area of efficiency. Without the option of defined-benefit pensions, risk-averse savers are likely to pursue less-efficient allocations of capital. And without the presence of such plans, the financial system is less likely to experience the efficiency gains provided by active market investors with a long-term perspective. Inefficiencies from either of these sources could result in significant costs to the Canadian economy.

This report first provides background on the difficulties currently facing defined-benefit plans. A key current impediment is the asymmetry faced by sponsors, whereby pension fund surpluses are increasingly seen as the property of plan members, while deficits remain the sole responsibility of the sponsor. An associated problem is the high opportunity cost of pension fund surpluses for sponsors, which significantly reduces their incentive to maintain surpluses.<sup>3</sup>

This is followed by an examination of the conceptual underpinnings of defined-benefit plans. The basic elements that the regulatory and legal environment should support to maintain the viability of defined-benefit pension plans are then highlighted.

1. See Department of Finance (2005) and Régie des rentes (2005).  
2. The first pillar consists of government income security programs (OAS/GIS), and the second pillar is made up of government pension programs (CPP/QPP).

3. Armstrong (2004) discusses the financial stability implications of the current funding problems facing defined-benefit pension plans.

## Defined-Benefit Plans: Their Position in the Canadian Retirement System

The Canadian retirement system consists of three pillars, the first of which comprises government income support, the second public pensions, and third private pension arrangements (Department of Finance 2005).

Government-sponsored minimum income programs—*Old Age Security* and *Guaranteed Income Supplement*—are intended to ensure a minimum level of retirement income for Canadian seniors. The Old Age Security (OAS) program provides a flat monthly pension for Canadians aged 65 and over, who meet certain residency requirements. The Guaranteed Income Supplement (GIS) is an income-based program that provides an additional pension over and above the OAS benefit.

In the second pillar, the Canada and Quebec Pension Plans are compulsory earnings-based plans that are financed solely through employee and employer contributions, with benefits partially pre-funded and backed by a portfolio of assets held at arms length from government. The aim of the CPP/QPP retirement benefit is to ensure that all Canadians have a basic level of earnings-related, defined-benefit, price-indexed pension income. The maximum pension is equal to about 25 per cent of the average industrial wage in Canada over the last five years.

The private plans that make up the third pillar provide opportunities for tax-efficient retirement savings. These are intended to fill the gap between the government income support and pension programs and the desired post-retirement income objectives of individual Canadians. Included in this pillar are tax-deferred private retirement savings consisting of registered employer-sponsored pension plans and registered retirement savings plans (RRSPs), which are individual tax-deferred savings accounts. While employer-sponsored pension plans are voluntary in Canada, they must be registered federally for tax purposes in order to operate as a registered pension plan that can provide tax-deferred pension benefits.<sup>4</sup> They

must also be registered either federally or with the appropriate provincial authority for the purpose of complying with pension benefits standards.

Registered pension plans are broadly classified as *defined benefit* (DB) or *defined contribution* (DC).<sup>5</sup> Defined-benefit plans provide members with benefits related to their earnings and years of service. They are designed to provide predictable retirement income for plan members. To achieve this predictability, the employer commits to delivering a certain level of benefits and incurs the risk associated with delivering on that promise.<sup>6</sup>

Under DC plans, employers and/or employees make contributions to an individual account for each member, and retirement benefits are based on the amount contributed to the account plus investment income, gains and losses, less expenses. Benefits paid depend upon the return on investment. Under these arrangements, plan members essentially assume all the risks of providing an adequate income at retirement.

### Recent Trends: DB Plans in Decline

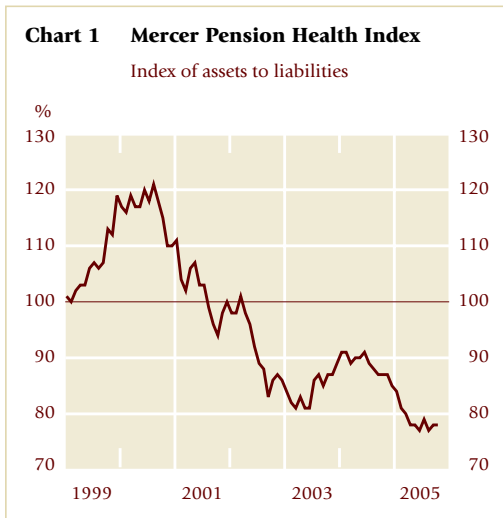
Developments in recent years have led many commentators to suggest that the future of corporate defined-benefit pension plans in Canada is in doubt if reforms are not forthcoming. While defined-benefit plans still account for almost 80 per cent of members covered by registered plans in Canada, this ratio is declining. Very few new defined-benefit plans are being created, and some existing plans have been closed to new members and, in some cases, are being replaced by defined-contribution plans.

Indeed, the proportion of Canadian workers covered by any type of registered pension plan in Canada (DB, DC, and other) has been falling. While over 40 per cent of workers were in employer-sponsored pension plans in 1992 (either DB or DC), this fell to 35 per cent by 2004. Over this same period, the proportion of workers covered by DB plans fell from about 38 per cent to 29 per cent. This drop was concentrated in private sector DB plans.

4. To be registered, plans must adhere to the pension tax rules, which place limits on benefits and transfers. The rules also control the tax-deferral costs associated with amounts over and above those required to fund the promised pension benefits.

5. A small proportion of plans in Canada—often referred to as *hybrid plans*—have characteristics of both DB and DC plans.

6. One risk that sponsors cannot assume is the risk of their own insolvency, the implications of which are discussed later in this article.



Although the decline in DB plans in Canada has not been as fast as that in the United States, the United Kingdom, or Australia, the expectation is that the process will accelerate. For example, a survey by Hewitt Associates (2004) of a diverse group of 174 plan sponsors found that 49 per cent of respondents provided a DB plan for newly hired employees in 2000, but only 39 per cent were expecting to offer one by the end of 2006.

### Recent adverse developments

An unfavourable conjunction of events in recent years has caused corporate sponsors in Canada to reconsider sponsoring a DB plan because of the significant risk that these plans pose for the corporate balance sheet. The evolving interpretation of pension law and pension regulation has helped to increase this risk.

In general, the size of pension obligations relative to the size of corporate balance sheets has been rising, as demographic and workforce trends pushed such plans into their mature phase. Furthermore, movements in equity markets and interest rates have caused a sharp deterioration in the funding position of many DB plans since 2000 (Chart 1). Projected movements in market prices seem unlikely to help plans that are in severe deficit positions to recover any time soon (Armstrong 2004). Pension-funding regulations are requiring the sponsors of plans that are in deficit to make additional payments, thus increasing the costs of funding these plans.<sup>7</sup>

At the same time, many argue that legal and regulatory developments have eroded the incentive to sponsor DB plans because of the basic asymmetry mentioned earlier, and some argue that this erosion is significant enough to make DB plans non-viable.<sup>8</sup>

In this context, court rulings have tended to increasingly restrict a sponsor's access to any pension fund surplus. In an important ruling in 1994, the Supreme Court of Canada in *Schmidt v. Air Products* held that pension funds set up as pension trusts are subject to classic trust

7. The deficits of DB plans can also create pressure to increase employee contributions or to reduce future benefits.
8. Regulations pertaining to defined-benefit pension plans are also more complex, and likely more costly, than those governing other types of plans and effectively pose another disincentive to sponsoring these plans.

principles. As a consequence, if a defined-benefit pension plan is funded through a trust, then, practically speaking, the only way a firm could gain exclusive access to a surplus on plan wind-up was if it expressly reserved that right at the time the trust was set up.<sup>9</sup> If the pension plan was not a trust, however, the Court ruled that ownership of a surplus could be determined according to the principles of contract law.<sup>10</sup>

Another landmark ruling occurred in 2004, when the Supreme Court held in *Monsanto* that at the time of a partial windup of the plan Ontario pension legislation requires that a surplus must be partially distributed to the owners of the surplus.<sup>11</sup> Many believe that this decision exacerbated the above-noted asymmetry for sponsors (Watson Wyatt Worldwide 2004). The decision allows for the possibility that a proportion of a surplus may have to be paid out to plan members and is therefore unavailable to the sponsor to reduce the chance that it may need to make additional contributions to the fund in the future. Furthermore, since most firms will have to reorganize their business operations at some future time, they would then face the prospect of a partial windup of their pension plans and a partial distribution of any surplus.<sup>12</sup>

Accounting rules for DB plans also tend to be much more complex than those for DC plans. While pension arrangements are typically “off-balance-sheet,” developments in pension funds can impart volatility to reported

corporate earnings and increase the perceived riskiness of the firm to financial market participants, who then may discount the value of the firm. The larger the size of the pension plan relative to the sponsoring firm, the greater this effect tends to be. Companies must deal with ongoing changes to these rules, as well as a likely shift towards “fair value” accounting in coming years, which has the potential to amplify such effects.

These developments have all reduced the incentives for many plan sponsors to make more than the minimum required contributions to their pension funds. The asymmetry of risks and rewards in the “pension deal” in Canada is increasingly seen as unacceptable from the viewpoint of sponsors. For an example, see the arguments put forth by the Certified General Accountants Association (2004).

### Factors influencing trends

Concerns about the “DB pension deal” have been underlined in a recent survey of chief financial officers (CFOs) conducted by the Conference Board of Canada and Watson Wyatt Worldwide in early 2005 (Conference Board 2005). The survey found considerable pessimism about the ultimate fate of DB plans, and this pessimism has actually increased since the first survey conducted a year earlier. For example, the proportion of CFOs who believe that there is a widespread problem that will persist for the next few years increased from 20 per cent in 2004 to 43 per cent in 2005. This survey reflects the fact that employers have serious reservations about sponsoring DB plans. The trend in DB plans in Canada appears to be influenced mainly by the concerns of the sponsors.<sup>13</sup>

### Benefits of DB Plans

The establishment of a pension plan is not mandatory for Canadian employers. But most large employers consider some form of pension or retirement plan to be a valuable feature of a

9. The *Schmidt* ruling held that sponsors could not unilaterally revoke the trust in order to access a surplus unless the power to do so was expressly reserved from the start. In some cases, a sponsor could still potentially access a surplus by obtaining a sufficient level of member consent. *Schmidt* does not preclude a sponsor from taking a contribution holiday when the plan is in surplus. See Gillese (1996) for additional background information.

10. It should be noted, however, that there is nothing to prevent any new DB plan from defining, in the trust agreement, who owns the surplus under what conditions.

11. This ruling applies only to pension plans under Ontario’s jurisdiction, but a number of other provinces and the federal government have similar wording in their legislation.  
Note that the *Monsanto* decision does not address the issue of who is entitled to a surplus. It simply requires a partial distribution of the surplus upon partial windup. This would, of course, be contingent on there being a surplus at the time of the partial termination.

12. It should be noted, however, that not every corporate reorganization would lead to a partial windup. This typically depends on a determination by the pension regulator.

13. It is important to note, however, that other forces can affect the mix of pension plans. These include a shift in workforce characteristics (Aaronson and Coronado 2005) and changes in regulatory and accounting standards. In the United Kingdom for example, it appears that a shift to “fair value accounting”—which has amplified the effect of volatility in the pension funding position on corporate balance sheets—has been a major contributing factor to the recent shift away from DB plans.



competitive compensation package. As a result, there are over 14,000 employer-sponsored pension plans in Canada, covering just under 5.5 million employees or 35 per cent of the total Canadian workforce.

As mentioned, the largest proportion of plan members in Canada are currently covered by DB plans. To assess the types of reforms that will enhance financial system efficiency, it is useful to consider the unique characteristics that DB plans offer to employers, employees, and to financial markets.

### Employer perspective

In a recent Canadian survey, sponsors were asked for their rationale in providing pension/capital accumulation programs to their employees (Hewitt Associates 2004). The number one answer, by a wide margin, was “to provide a competitive total compensation package.” Other responses included “to attract and retain employees” and to “enable employees to achieve an adequate retirement income so that they transition out of the workplace.”

DB plans have traditionally been viewed as a way to attract and keep high-quality employees because they provide certainty about retirement income. In essence, the employer is offering to insulate the retirement income of employees against the volatility of financial markets and “longevity risk.” It is important to note that the longevity risk assumed by the employer is less than the sum of the individual risks to the employees, because the employer is in a position to effectively “pool” this risk in the DB plan.

On the other hand, DB plans can add to workforce inflexibility by making it more difficult or costly to lay off older or long-standing employees who have become redundant.<sup>14</sup>

### Employee perspective

The pension literature has generally shown that, from an employee’s perspective, attitude to risk is an important dimension in assessing the intrinsic value of various types of pension plans. Risk-averse workers will typically prefer DB plans because they offer a stream of retirement

income guaranteed by the sponsor. Thus, employees do not have to face the investment risk of managing their own retirement account, and their retirement income is secure even if they live beyond a normal life expectancy.

That said, workers who plan to change jobs tend to prefer DC plans, which are more portable because benefits accrue more evenly over a career than is the case for DB plans.

### Investor role

The pension funds associated with DB plans play an important role in the financial system: that of institutional investor. Because DB plans in Canada tend to be sponsored by large organizations—corporations and public sector entities—they result in large pools of capital to invest in stocks, bonds, and short-term instruments. These pension funds provide a stable source of long-term capital for the economy and contribute to financial market liquidity. Furthermore, they have the sophistication and long-term perspective to invest in “alternative asset classes,” such as infrastructure projects (Tuer and Woodman 2005), involving complex analysis and very long time horizons.<sup>15</sup>

## A Conceptual Framework

Before discussing possible solutions to the problems facing DB plans, it is useful to consider the conceptual underpinnings of these plans.

In principle, any sponsored pension plan is a contract between a firm and its workers. Conceptually, the sponsor is the residual risk-taker for the pension plan. Residual risk is the risk that ex post outcomes differ from those assumed ex ante.

The benefits purchased with the pension contributions, whether paid by the firm or by workers, represent future income earned by the workers as part of a competitive total compensation package. Total compensation includes current wages and benefits in addition to deferred benefits provided by the pension plan, and is

14. Because the benefit accruals in many DB plans (for example, career-average plans) are concentrated in the last few years of employment, when mid-career employees are laid off, the “optics” can be difficult.

15. Large pools of defined-contribution funds, as exemplified by the Teachers Insurance and Annuity-College Retirement Equities Fund (TIAA-CREF) in the United States, can provide some of the financial efficiency gains currently provided by DB funds in Canada. But, ultimately, the investment mix of pooled DC plans reflects the preferences of individual investors, who tend to be relatively risk averse.

set competitively by market forces beyond the control of the individual firm. The sponsor accumulates and invests contributions and promises a future benefit to workers, as plan members, such that the ex ante final expected value of the pension benefits is equal to the final expected value of the assets bought with contributions.

Defined-benefit pension plans are unique in that their sponsors guarantee that ex ante expected benefits will, in fact, be paid ex post. This means that sponsors assume residual pension risk; namely, the risk that the assets accumulated with pension contributions will not match promised benefits. Examples of such outcomes include economic and financial developments that preclude the delivery of the asset returns expected in the ex ante calculation, or plan members, in aggregate, living longer than was anticipated at the time contributions were set. By taking on residual pension risk, the sponsor is assuming responsibility for the difference between the promised benefits and the ex post value of the pension fund. In effect, the sponsor owns both residual pension risk and the outcomes of that risk, which materialize in the form of a deficit or a surplus.

The sponsor's role in a defined-benefit pension plan is particularly demanding, since such plans tend to be dynamically unstable. This is because the funding shortfalls that result from a period of low returns accumulate at a compounded rate over time. Similarly, an extended period of high returns can lead to runaway surpluses.<sup>16</sup>

Thus, to maintain stability between pension fund liabilities and assets, the sponsor must actively manage the funding situation of the DB plan by repeatedly injecting funds should there be a deficit, or withdrawing funds (or stopping contributions) should there be a surplus. The more frequently such injections and withdrawals

are allowed to happen, the closer the value of fund assets will be to those of fund liabilities. The sponsor must actively manage the pension fund to keep it dynamically stable, because, ex post, assets and liabilities will differ from those assumed ex ante, and these deviations will grow at a compound rate if not counteracted continually.

This analysis highlights some implications for the regulation of defined-benefit pension plans.

First, sponsors must be able to continually make injections to and withdrawals from the pension fund so that it remains in balance with promised pension liabilities. Impediments that reduce the incentive to inject funds—such as ambiguous ownership of the pension fund surplus—effectively reduce this flexibility.<sup>17</sup>

Second, negotiations concerning pension benefits and contributions are economically feasible only in a forward-looking context where property rights have not yet been implicitly assigned. In particular, once the ownership of residual risk has been determined, it is not appropriate to reassign the outcomes of that risk through negotiation. For example, if the sponsor tries to make workers pay for past outcomes that have resulted in a current deficit (for example, by reducing current salaries), workers will tend to leave the firm to work for a competitor that offers the market-determined competitive compensation package. If workers try to capture the value of a current surplus when it is not clear that they own it, the sponsor could be motivated to underfund the pension fund, potentially putting the workers' benefits at risk.

## The Focus of Reform

The conceptual framework presented above highlights two fundamental problems with defined-benefit plans as they now exist.

First is ambiguity about who owns a pension fund surplus. This ambiguity reduces the

16. The runaway nature of deficits and surpluses results from two fundamental characteristics of financial-asset accumulation. First, the future expected return on an asset is independent of past returns. For example, observing 20 consecutive heads in a series of coin flips does not increase the probability that the next flip will be tails. Second, an event today will have a greater impact on the final value of an investment than will an equivalently sized event in the future, because of compounding. There will inevitably be a "string" of positive or negative returns that will lead to instability in the funding position.

17. It should be noted that pension regulators have rules that contribute to keeping pension plans stable. They require plans reporting solvency deficits to make contributions to eliminate them over five years. In addition, under the Income Tax Act, sponsors cannot make contributions when plans report a surplus in excess of 10 per cent. Although helpful from a stability perspective, these rules reduce the flexibility that sponsors have to optimally manage pension funding.

incentive for sponsors to fully fund defined-benefit pension plans. Second is the heightened risk of insolvency that plan members face when defined-benefit pension plans are chronically underfunded, which is amplified by the first problem.<sup>18</sup>

Pension reform would be most effective if it focused on providing sponsors with the flexibility they need to actively maintain a balance between the final value of the pension fund and the final value of promised benefits. One way of achieving the needed flexibility would be to clarify the sponsors' ownership rights to the pension fund surplus. Some have suggested that this might require changes in the legal framework.<sup>19</sup>

Giving the sponsor unambiguous ownership of the surplus would encourage sponsors to maintain surpluses in their pension funds, which would help eliminate the risk of sponsor insolvency. In addition, tax distortions that discourage the maintenance of a reasonable surplus in the pension fund could be removed, and other existing disincentives to maintaining significant surpluses could be eliminated. These surpluses would then act as a buffer against unanticipated negative shocks to pension assets (or positive shocks to liabilities) at a time when it was not convenient for the sponsor to make an immediate injection into the pension fund to offset the shock.<sup>20</sup>

In such a system, it would be important to protect workers from very big shocks by insisting that a sponsor make an immediate injection of funds if the value of pension assets relative to the value of pension liabilities fell below some critical value—for example, a pension fund with

a value less than 95 per cent of pension liabilities.

It would also be important to eliminate all significant disincentives for the sponsor to maintain a surplus. One large disincentive is the opportunity cost borne by the sponsor when putting its scarce capital in the pension fund in the form of a surplus. One solution might be for the sponsor to be paid an annual return on surplus pension funds, most simply set to equal the average return on the pension fund itself.

## Conclusion

The future of defined-benefit pension plans in Canada is an important public policy issue. The choices that savers make should ultimately determine the appropriate mix of pension plan types in the economy. But governments should review current pension legislation and regulations to ensure that they remain appropriate and do not create disincentives to the provision of one particular type of plan. Such initiatives are now under way.

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18. The risk is that the sponsor will become insolvent at a time when there is a pension fund deficit, leaving plan members with less-than-promised benefits.
19. For example, the Association of Canadian Pension Managers in a recent study (ACPM 2005), suggested that the ambiguity regarding surplus ownership that stems from current pension trust law could be resolved by the passage of legislation that would bring pension plans out from under trust law, making contract law supreme. The study also explores a number of other reform options.
20. Other possible ways of mitigating insolvency risk are pension insurance funds and pension collectives. Both approaches suffer from the presence of moral hazard, where it is in the interest of the sponsor to inappropriately transfer pension liabilities to either the insurance fund or the collective.

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# The Use of Microdata to Assess Risks in the Non-Financial Corporate Sector

*Meyer Aaron and Dylan Hogg*

The objective of this report is to assess the use of individual-firm data (henceforth microdata) for the surveillance of risks in the non-financial corporate sector. The financial health of Canadian public non-financial companies (PNFCs) is important for financial system stability. Corporate loans, bonds, and equities make up a large part of the asset holdings of banks, insurance companies, and households (through pension plans and mutual funds). Hence, a rash of corporate failures could have widespread effects on the economy by eroding the capital of financial institutions and the wealth of households.

The analysis of financial accounts data is one way to assess corporate financial health. There is a large body of literature linking corporate financial health to three broad categories of financial ratios: profitability, liquidity, and leverage (Altman 1983; Scott 1981; Ohlson 1980; Bunn and Redwood 2003; and Vlieghe 2001). The following ratios from the above categories of financial ratios are selected to assess financial health: *leverage*, which is the ratio of total assets to total equity; *current ratio*, a measure of liquidity, is the ratio of current assets to current liabilities; and *net profit margin*, a measure of profitability, is the ratio of net income to total revenue.<sup>1</sup>

This analysis of the financial health of PNFCs can be conducted with either aggregated data or microdata.<sup>2</sup> To date, aggregated data have been used most often because these data are easier to obtain. There are, however, a number of reasons to use microdata. Aggregated measures mask information about the underlying distributions,

whereas microdata can provide information about the “vulnerable tails” that are thought to be relevant for the analysis of financial stability (Benito and Vlieghe 2000). This masking is illustrated using the three ratios studied here.

Chart 1 shows part of the histogram for the inverse of the leverage ratio, the current ratio, and the net profit margin for the corporate sample used in this report.<sup>3</sup> Vertical lines showing the ratio values calculated from the aggregated data for the same dataset are also included for comparison.<sup>4</sup>

The histograms reveal that the distributions for all three ratios are highly skewed (asymmetrical) and exhibit a large degree of kurtosis (fat tails). Note that the single value calculated for each ratio from the aggregated data masks the distributional information provided by the microdata.

Another reason to use microdata is the flexibility in the way that results can be combined to investigate a point of economic significance. In this case, microdata allow the calculation of the leverage ratio at the level of the individual company. Then, if company size is thought to be relevant for financial stability, the individual leverage values can be combined using asset weights. On the other hand, if debt or employment is of interest, then this analysis could be done using weights that emphasize the amount of debt or number of employees associated with each company in the sample. Hence, microdata allow the construction of various financial

1. These ratios are commonly used in accounting-based models of corporate financial health.  
2. The December 2004 *Financial System Review* (pp. 5–7) highlighted an analysis of corporate financial structure using aggregated data.

3. The inverse of the leverage ratio is used here to provide a continuous ordering of companies, given that some of them have negative equity.  
4. The ratios for the aggregated data are calculated by summing the numerator and denominator for all companies in the sample prior to calculation of the ratio.



health measures, depending upon the issue under consideration.

This report focuses on using financial accounting microdata at the company level to assess corporate financial health. In particular, we construct a microdata indicator using the “vulnerable tails” of the distributions for certain financial ratios. A preliminary comparison of this microdata indicator with other commonly used measures of financial vulnerability (bond spreads, ratings action, and leverage calculated from aggregated national accounts) shows that it is a good tool for assessing risks to financial stability in the non-financial corporate sector.

## Using Microdata

The corporate data are from the *Financial Post's* database on public companies. It contains about 1,200 Canadian public companies from which a sample ranging from 106 to 1,191 companies was compiled annually for the period from 1994 to 2004.<sup>5</sup> Companies indexed as financial companies were deleted from the sample. The assets covered in our sample represent, on average, 54 per cent of the total assets of non-financial corporations as reported in Statistics Canada's National Balance Sheet releases (ranging from 6 per cent to 68 per cent over the sample period).

### The microdata indicator

Generally, increasing leverage, decreasing liquidity, and decreasing profitability are thought to increase corporate vulnerability. However, the interaction among these measures is also important.<sup>6</sup> Hence, an indicator based on the microdata is constructed using the “vulnerable tails” of the distributions for each of the three financial ratios.

The construction of the indicator is straightforward. A threshold is chosen for each of the leverage ratio, the current ratio, and the net profit margin to define the “vulnerable tail” of the distribution for that ratio. In this case, the thresholds

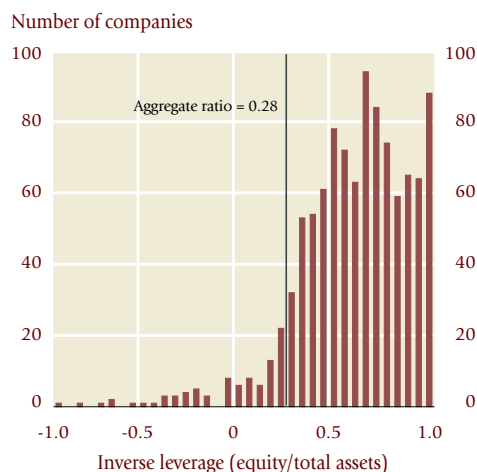
5. The sample size of 106 companies was for 1994. The other years ranged between 675 and 1,191 companies. Excluding 1994 from the study did not change the conclusions reported here.

6. For example, high leverage by itself may not be a cause for concern if liquidity and profitability are high.

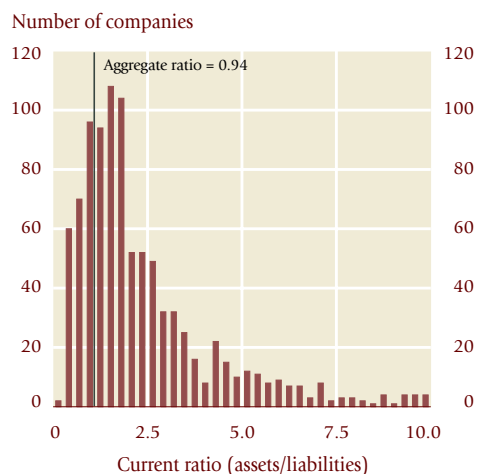
**Chart 1 Distribution of Ratios (2004)**

Sample size equals 1,049 companies

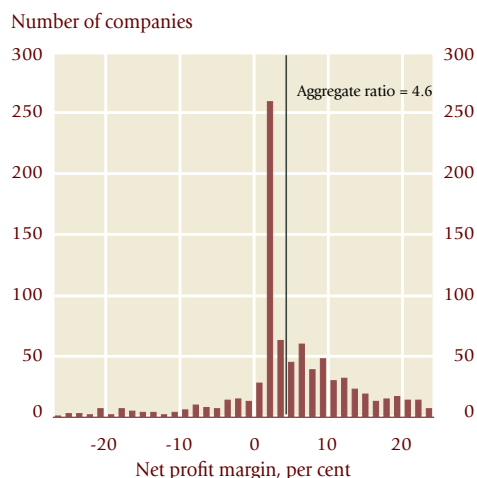
Inverse Leverage



Current Ratio



Net Profit Margin



are set at the average level of the 50th percentile over the entire sample period.<sup>7</sup> A company is considered to be in the vulnerable tail of the distribution for a ratio if the value for that ratio for that company is “worse” than the value for the 50th-percentile threshold chosen here. Companies that appear in the vulnerable tails of all three ratios are identified, and the indicator is calculated as a percentage of the total sample assets held by these companies.<sup>8</sup> A higher value indicates higher vulnerability for the sample as a whole.

The choice of the thresholds used to define the vulnerable tails is arbitrary, since there is no theoretical framework to determine these a priori. Sensitivity analysis showed that the indicator was relatively robust to the choice of thresholds ranging from the 25th to the 75th percentile for each ratio.<sup>9</sup>

For the purpose of financial system surveillance, it is useful to have an indicator with leading properties: the signal from the indicator anticipates vulnerability concerns. Here, the leading-indicator properties of this microdata indicator are evaluated using its correlation, one year ahead, with two financial-stress indicators of interest: bank gross impaired business loans and corporate bond defaults.<sup>10</sup> It is also compared with other commonly used measures of corporate health: bond spreads (BBB over AA), ratings action (downgrades as a percentage of ratings actions), and the leverage ratio calculated from the *Quarterly Financial Statistics* for non-financial companies published by Statistics Canada (QFS leverage). Bond spreads reflect the additional return required by investors to compensate for the increased default risk of BBB-rated bonds

compared with the less-risky AA-rated bonds. Therefore, widening bond spreads reflect a higher risk of default and corporate vulnerability. Similarly, a rise in downgrades (changing the rating of a bond to a lower quality) as a percentage of ratings actions, is also taken as an indicator of increasing corporate vulnerability.

A comparison of these indicators is shown in Chart 2. The associated correlations are presented in Table 1. This preliminary analysis shows that the microdata indicator appears to lead banks’ gross impaired business loans and corporate bond defaults by one year. Over the sample period, increases in the indicator in one period are generally followed by increases in impaired business loans and corporate bond defaults in the following period. The microdata indicator performed better than bond spreads in anticipating gross impaired business loans one period ahead. It appears to outperform the indicator from ratings actions, and the indicator using QFS leverage in anticipating both bank gross impaired loans and bond defaults one period ahead.<sup>11</sup> Note, however, that this is largely a qualitative assessment, since the limited number of yearly observations in this data set does not permit a more rigorous test.

## Sector analysis

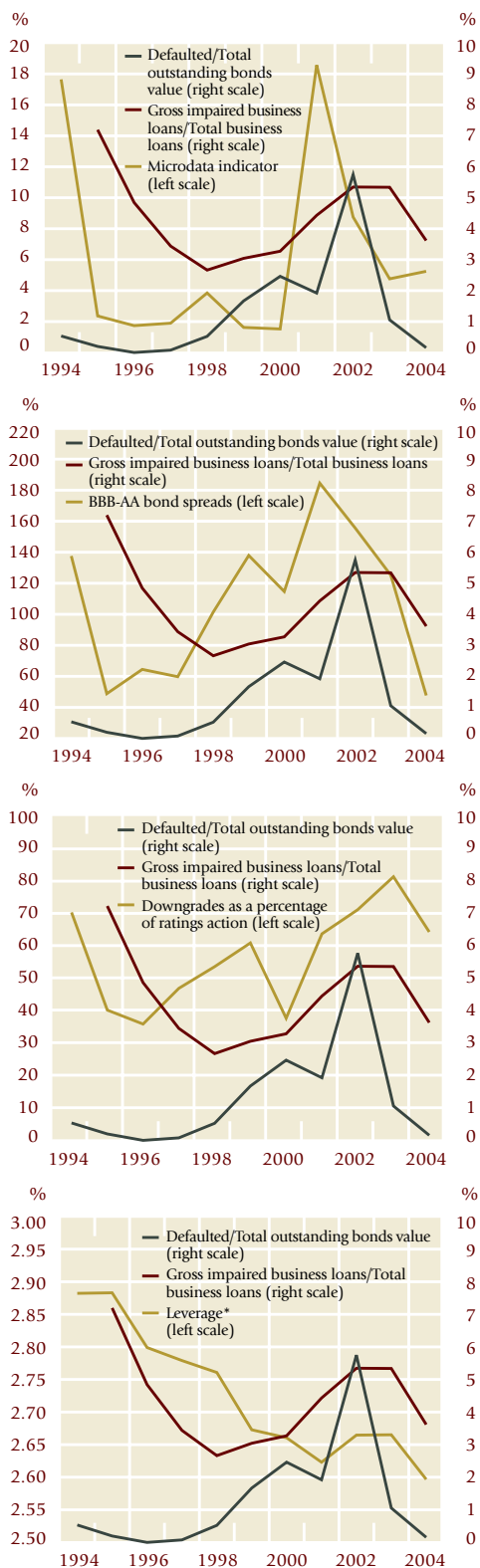
A further refinement is to extend the analysis to the sector level for PNFCs.

For this purpose, the companies identified as being in the vulnerable tails of all three financial ratios (as above) are categorized into eight sectors: consumer, energy, health care, industrials, information technology, materials, telecom, and utilities. The microdata indicator for a sector is calculated as the percentage of that sector’s assets held by the companies from that sector that are found in the vulnerable tails of all three ratios.

7. The 50th-percentile thresholds were: inverse leverage less than 0.606; current ratio less than 1.6; net profit margin less than 0.1 per cent.
8. Although only the asset-based indicator is discussed here, indicators were constructed for each ratio and combinations of ratios on the basis of the percentage of debt and the percentage of companies in the tails, with similar conclusions.
9. The choice of thresholds did affect the level of the indicator and the width of the peaks.
10. Correlation is a measure of the similarity in how two series move together. Here, we mean the correlation between the value of the microdata indicator in one period with the financial-stress indicator in the next period. A high degree of correlation is evidence that the microdata indicator has some leading information about financial stress.

11. There is some overlap of the information contained in these indicators. The microdata indicator has a correlation of 0.65 and 0.54 with the bond spreads and ratings actions, respectively. Note also that the microdata indicator is using information from three financial ratios, whereas the QFS leverage uses information from only a single ratio. Ideally, a proper comparison would require an aggregate index that uses information from aggregated QFS data for the other ratios as well.

**Chart 2 Indicators of Financial Health**



\* Statistics Canada, *Quarterly Financial Statistics*  
 Sources: Moody's, OSFI, Bank of Canada, Statistics Canada, *Financial Post*, and authors' calculations

**Table 1**

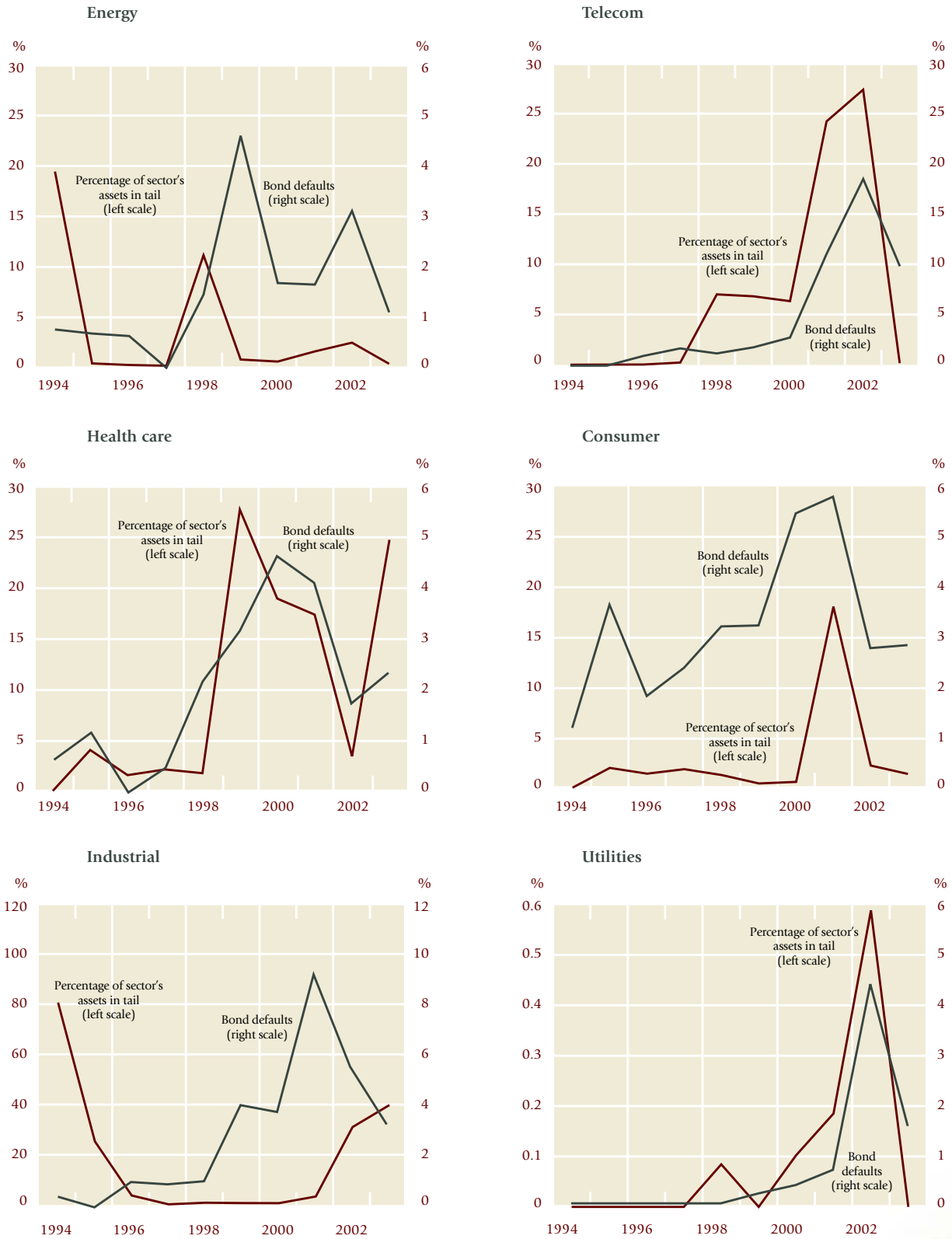
**Correlation Coefficients for Indicators\***

	Microdata indicator	Bond spreads (BBB-AA)	Downgrades as a percentage of ratings actions	QFS leverage
	T-1	T-1	T-1	T-1
Gross impaired business loans	0.79	0.48	0.34	0.21
Corporate bond defaults as a percentage of bonds outstanding	0.46	0.68	0.13	-0.65

\* T-1 refers to the indicator one year in the past.  
 Sources: Moody's, OSFI, Bank of Canada, *Financial Post*, Statistics Canada, and authors' calculations



**Chart 3 Sector Analysis**



Sources: Standard & Poor's, *Financial Post*, and authors' calculations

Chart 3 shows the relationship between the percentage of a sector's assets represented in the vulnerable tails and bond defaults for that sector.<sup>12</sup> For the telecom, energy, health care, and utilities sectors, the representation of the sector in the tails increases prior to a rise in bond defaults in these sectors. The results were less promising for the consumer and industrial sectors.

Nevertheless, this type of analysis has the potential to be of use to regulators of financial institutions who monitor sectoral exposures for these intermediaries.

## Conclusion

This report has focused on the ways that microdata can be used for the surveillance of potential risks to the financial system originating from PNFCs.

Microdata analysis can augment analysis based on aggregated data by utilizing the information about the underlying distributions of vulnerability measures. Microdata also allow flexibility in the way that information can be combined to emphasize a point of economic significance. As such, this type of analysis could prove to be a useful addition to the other tools currently available for assessing financial stability.

The type of analyses presented here can be used for the surveillance of financial stability on a regular basis. At the moment, this is being done annually. However, given that public companies report quarterly, the analysis could be updated more frequently. One concern with financial data is the three- to six-month delay between a company's year-end and the availability of the data for analysis. This delay may largely mitigate the value of the leading-indicator properties described above.

Further work is required to refine the microdata indicators. For instance, a data set for a longer time period is being constructed to allow a more rigorous investigation of the statistical properties of the microdata indicator. A company-level study using panel data will also be conducted to extend this line of research by investigating the relationship between corporate financial health and macroeconomic factors such as output growth.

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12. Data on bond defaults were not available for the materials and information technology sectors.