

Looking Ahead

PROJECTING ONTARIO'S PENSION BENEFITS GUARANTEE FUND



Eckler
CONSULTANTS + ACTUARIES

*The Pension Benefits Guarantee Fund (PBGF) is governed by the Ontario **Pension Benefits Act** (“the Act”) and regulations made under the Act. It guarantees pension benefits of Ontario members and beneficiaries under a covered single-employer defined benefit plan, up to a specified maximum and subject to specific exclusions, in the event of the insolvency of the plan sponsor. Currently, the PBGF covers over 1,500 defined benefit plans with members and beneficiaries in Ontario.*

The report that follows describes the PBGF projection study developed by Eckler Ltd. for the Ministry of Finance to be used to evaluate the sustainability of the PBGF.



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Executive Summary

Introduction

The Pension Benefits Guarantee Fund (PBGF) provides protection to Ontario members and beneficiaries of privately sponsored single-employer defined benefit pension plans in the event of plan sponsor insolvency. It is the only fund of its kind in Canada and is administered by the Superintendent of Financial Services for the Financial Services Commission of Ontario (FSCO).

The PBGF is intended to be self financing through annual premiums based on per-member and partially risk-related fees. Participation in the PBGF is mandatory for most defined benefit pension plans registered in Ontario.

The PBGF currently guarantees specified benefits up to \$1,000 per month for members who meet certain age and service criteria for service while employed in Ontario, with some exclusions.

This study was commissioned by the Ministry of Finance, consistent with the recommendation of the Expert Commission on Pensions (ECOP) in its 2008 report - *A Fine Balance: Safe Pensions, Affordable Plans, Fair Rules*. The primary objective of the study is to evaluate the sustainability of the PBGF under its current structure.

This study was completed in March 2010, in advance of the release of the 2010 Ontario Budget. As a result, it does not address the impact of any changes to the PBGF that may have been introduced in the Budget.

Data

For the purposes of the study, the Ministry of Finance and the Financial Services Commission of Ontario (FSCO) provided data on the 1,580 plans covered by the PBGF. The Ministry of Finance specified 52 “main plans” that collectively represent 70% of the current claims exposure to the PBGF. The main plans were those plans where the employer was the sponsor of at least one plan that could have a very large impact on the PBGF (either \$500 million in PBGF liabilities, or \$50 million in PBGF assessment base). Sufficient data was provided to model the main plans individually. More limited data was provided on the remaining plans covered by the PBGF. Modelling for these plans was therefore based on representative sample plans.

Having individual member data would produce more credible results for the study. However, in our opinion, the data available was sufficient and reliable for the purposes of the study.

In addition, having access to the plan documents would enable a more complete valuation of the plan benefits and would produce more credible results for the study. However, in our opinion, the plan provision information available was sufficient and reliable for the purposes of the study.



Demographics

Approximately 49% of covered plans have between 100 and 999 members, and 36% have less than 100 members. Less than 1% of covered plans have 10,000+ members.

The PBGF covers over 1.1 million plan members. Of these, approximately 48% are active members, 36% are in receipt of a pension, and 16% are deferred pensioners.

Final average plans represent 39% of the plan universe, hybrid plans 21%, flat benefit plans 19%, career average plans 13%, and other plans 8%. The majority (73%) of the main plans remain open to new members.

There is a significant concentration in the manufacturing sector, which represents 59% of all plans, 54% of plan members and 87% of the current claims exposure to the PBGF.

Current Funding

The data provided by the Ministry of Finance and FSCO was projected, where necessary, to January 1, 2008 to arrive at estimates of the average and aggregate funded position of the plan universe. The General Motors plans were treated separately from the others due to their magnitude and the special provisions established for them in 2009. So as not to distort results, they have been included in the plan universe using a measurement date of January 1, 2010.

These projections estimate that more than 73% of the plan universe was in a deficit position on a solvency basis. The total deficit for plans in a deficit position was \$9.6 billion and their average funding level was 87%. Plans with 10,000+ members accounted for \$4.6 billion of the \$9.6 billion deficit. The highest concentration is in the manufacturing sector, contributing \$6.1 billion to the deficit.

The 52 main plans had an average funding level of 96% and a total deficit for plans in a deficit position of \$5.7 billion, representing 59% of the total deficit. Projecting the main plans to January 1, 2010 showed a dramatic worsening of their funded status – the total deficit for plans in a deficit position increased to \$7.9 billion and the average funding level dropped to 90%.

The concentration of significant deficits spread between a few large plans speaks to the kind of low-frequency, high-severity claims that have impacted the PBGF in recent years. The failure of even one of these very large, underfunded plans could have a significant impact on the sustainability of the PBGF well into the future.

Methods and Assumptions

In order to model the PBGF, the following modules were utilized:

- a Plan Projection Module, which consists of:
 - a Plan Data Projector, and
 - a Stochastic Asset and Liability Pension Plan Projector;
- an Economic Scenario Generator;
- an Insurance Model; and
- an Insolvency Projection Module.

The assets, liabilities and PBGF claims exposures of the 52 main plans were modelled individually, using plan provision and membership information derived from the most recent actuarial reports provided to us by the Ministry of Finance. Two plans from these 52 main plans were selected as representative sample plans and were used to extrapolate results for each of the remaining plans, starting from the plan-specific funded positions.

An Economic Scenario Generator was used to stochastically generate 500 random economic scenarios. These scenarios were used to estimate the projected funded positions and maximum PBGF claims of the plan universe over a 10-year period, beginning on January 1, 2010.

The Insolvency Projection Module used Ontario-specific historic economic data to stochastically model estimated future insolvency rates relevant to sponsors of plans covered under the PBGF. These rates and the projected PBGF exposures were then stochastically modelled in the Insurance Model, generating a stochastic distribution of future expected claims and assessments.

In our opinion, the methods and assumptions used in this study are, in aggregate, appropriate for the purposes of the study.

Results

At March 31, 2009, the PBGF had assets of \$146 million on a cash basis and a deficit of \$47 million on an accrual basis.

For the purposes of assessing the sustainability of the PBGF, we considered the fund on both an actuarial present value and a projected cash flow basis.

The PBGF currently has insufficient funds to cover new claims anticipated by the Ministry of Finance in 2010. In the absence of external funding, the PBGF funds will be depleted and unable to cover these anticipated 2010 claims.

On an actuarial present value basis, if treated as a private insurer, the PBGF would require an up-front reserve net of current claims at January 1, 2010 of between \$680 million and \$1.023 billion to cover expected future claims, depending on the desired level of margin for adverse deviation.

With immediate one-time external funding to cover the anticipated 2010 claims, assessments would be sufficient to cover most expected future claims, but would not be sufficient to cover a future catastrophic claim. Hence, current assessments would be insufficient for the PBGF to be sustainable over the long-run due to the volatile nature of future catastrophic claims.

In addition to one-time external funding to cover anticipated 2010 claims, an increase in overall assessments in the order of 450% could be sufficient over the long-run to cover existing funding loan repayments and expected future claims plus expenses at the present coverage level of \$1,000. If coverage was increased to \$2,500, a 650% increase in assessments would be required.

In the absence of any future external funding, and at the present coverage level of \$1,000, an increase in overall assessments in the order of 800% would be required to ensure the sustainability of the PBGF with a high degree of certainty. If coverage was increased to \$2,500, a 1000% increase in assessments would be required.



Securing external financing on all future claims above a pre-defined catastrophic threshold, in combination with an increase in assessments and/or a reduction in coverage, could achieve PBGF sustainability.

Looking Ahead

Currently, the PBGF has insufficient funds to cover the anticipated 2010 claims. If continued, the PBGF will either need to build up reserves and/or secure future external funding to cover future catastrophic claims. The amount of reserves or funding required will depend on future assessment levels and the desired degree of confidence with which future claims will be covered by assessments.

Other strategies for improving the PBGF's viability include:

- restructuring the assessment rate model;
- amending coverage; and/or
- modifying the payment structure to better accommodate catastrophic claims.

If the PBGF is continued, regular reviews should be conducted to monitor the appropriateness of the assessment levels and address the impact of changing risks.

This report has been prepared, and our opinions given, in accordance with accepted actuarial practice.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Jill Wagman".

Jill Wagman, FSA, FCIA

A handwritten signature in blue ink, appearing to read "Sylvain Goulet".

Sylvain Goulet, FSA, FCIA, MAAA

Eckler Ltd.
June 2010

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Introduction

Summary

- *The PBGF provides protection for Ontario members and beneficiaries of most registered defined benefit pension plans in the event of plan sponsor insolvency.*
- *It is the only fund of its kind in Canada.*
- *The PBGF operates at a sub-national level, unlike its counterparts in the U.S. and the U.K.*
- *Participation is mandatory for most registered pension plans, with annual premiums based on per-member and partially risk-related fees.*
- *The Expert Commission on Pensions recommended a study of the PBGF be undertaken in their 2008 report – A Fine Balance: Safe Pensions, Affordable Plans, Fair Rules.*
- *The primary objective of this study is to evaluate the sustainability of the current PBGF structure.*

History of the Pension Benefits Guarantee Fund

The Pension Benefits Guarantee Fund (PBGF) was established under the Ontario Pension Benefits Act in 1980. To this day, Ontario remains the only province to provide a protection program for members and beneficiaries of privately sponsored single-employer defined benefit pension plans in the event of plan sponsor insolvency.

Similar funds exist in other countries, most notably the Pension Benefits Guaranty Corporation (PBGC) in the U.S. and the Pension Protection Fund (PPF) in the U.K. Annual actuarial reviews of the PBGC and PPF funds are conducted by these national corporations.

The PBGF operates at a sub-national level, unlike its U.S. and U.K. counterparts, which operate at a national level. As a result, the PBGF has limited geographical diversification and limited resources compared to its U.S. and U.K. counterparts.

Participation in the PBGF is mandatory for all registered defined benefit pension plans in Ontario, with a few exceptions, namely:

- multi-employer pension plans,
- jointly-sponsored pension plans,
- plans established for fewer than three years, and
- select plans named in Regulations made under the Ontario Pension Benefits Act.



PBGF Structure

Premiums

The PBGF is intended to be self-financing. Premiums are levied on an annual basis. The current fee structure has been in place since 1993 and includes a per-member fee plus a risk-based fee. The per-member fee is currently set at a nominal \$1 per Ontario member. The risk-based fee is levied on underfunded plans, based on a sliding scale depending on the level of underfunding, as follows:

Amount of Underfunding	Premium
Up to 10% of the liabilities	0.5% of deficiency
Between 10% and 20% of the liabilities	1.0% of deficiency
Over 20% of the liabilities	1.5% of deficiency

The risk-based fee is calculated by dividing the total deficiency into three “slices” (up to 10% of liabilities, between 10% and 20%, and over 20%) and applying a different premium rate to each slice in accordance with the table above. For example, if an Ontario plan is 75% funded, with assets of \$7.5 million and liabilities of \$10.0 million, the risk-based fee would be \$22,500, calculated as follows:

Plan assets	\$ 7,500,000
Plan liabilities	<u>10,000,000</u>
Total deficiency	\$ 2,500,000

<u>Amount of deficiency</u>	<u>Deficiency</u>	<u>Premium</u>	<u>Fee</u>
Up to 10% of plan liabilities:	1,000,000	× 0.5%	5,000
Between 10% and 20% of plan liabilities:	1,000,000	× 1.0%	10,000
Over 20% of liabilities:	<u>500,000</u>	× 1.5%	<u>7,500</u>
	\$ 2,500,000		\$ 22,500

The total premium is then set equal to the lesser of (a) the sum of the per-member and risk-based fees, and (b) \$100 per Ontario member.

Plans that provide plant closure and/or permanent layoff benefits are subject to an additional premium equal to 2% of the liability for the unfunded benefits.

The premium per plan is capped at \$4 million annually. During the early 1990s, a qualifying plan provision was adopted that allowed sponsors of plans with combined assets of at least \$500 million to elect not to fund solvency deficiencies and pay a higher premium to the PBGF (capped at \$5 million). The provision was amended in June 2002 to prohibit any additional plans from becoming qualifying plans. The few plans that had made an election to become qualifying plans before this date were grandfathered, but have since all either wound up or been restructured, and no qualifying plans remain.

Benefits

The PBGF currently guarantees specified benefits up to \$1,000 per month for members who meet certain age and service criteria for service while employed in Ontario. The following benefits are not covered:

- Benefit improvements that became effective within three years before the date of plan wind-up.
- Benefits provided under a pension plan where the employer's obligation to contribute is limited to a fixed amount set out in a collective agreement.
- Future indexation.

The Superintendent of Financial Services for the Financial Services Commission of Ontario (FSCO) is responsible for administering the PBGF. On the wind-up of a plan, in part or in whole, if the Superintendent is of the opinion that the funding requirements of the Act cannot be satisfied, he or she declares whether the Guarantee Fund will apply. The PBGF pays a claim up-front based on the expected cost of settling the covered benefits. At final plan wind-up, plan experience dictates whether an additional payment is required from the PBGF, or if there are excess amounts to be recovered by the PBGF.

Since inception, the PBGF has paid \$853 million in claims (net of recoveries), which represents 164 claims in respect of 123 companies. Of this total, \$536 million was in respect of only two companies. More on the history of the PBGF's financial status can be found at the beginning of Section 8.



Expert Commission on Pensions

The 2008 Report of the Expert Commission on Pensions (ECOP) - *A Fine Balance: Safe Pensions, Affordable Plans, Fair Rules* - supported continuation of the PBGF for at least five years. In addition, the ECOP recommended that:

- benefit improvements granted over the last five years be excluded;
- coverage be increased to \$2,500;
- the fund be:
 - self-financing,
 - allowed to borrow from the government on a commercial basis, and
 - adjusted at regular intervals in terms of both benefits and levies.

The ECOP also recommended that a study of the PBGF be undertaken. The primary goals of the study are to:

- evaluate the sustainability of the current PBGF structure,
- quantify risk exposures, and
- consider alternatives.

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Data

Summary

- *Our analysis is based on the universe of 1,580 covered plans.*
- *Of these 1,580 plans, 14 plans were omitted from the study as they had no reported assets or liabilities.*
- *52 main plans, representing 70% of the PBGF risk exposure, were modelled individually.*
- *The remaining 1,514 plans were modelled based on representative sample plans.*
- *All plan data was provided by the Ministry of Finance and the Financial Services Commission of Ontario (FSCO).*

Introduction

The Ministry of Finance identified a total of 1,580 plans that are covered by the PBGF and specified 52 “main plans”, which represent 31 main plan sponsors. The 52 main plans were those plans where the employer was the sponsor of at least one plan that could have a very large impact on the PBGF (either \$500 million in PBGF liabilities, or \$50 million in PBGF assessment base). Therefore, the main plans could include some very large plans of a given employer and some smaller plans of the same employer. The main plans collectively represent 70% of the current claims exposure to the PBGF.

Sufficient data was provided to model the main plans individually. More limited data was provided on the remaining plans covered by the PBGF. Modelling for these plans was therefore based on representative sample plans. Two plans from the 52 main plans were selected as the representative sample plans and were used to extrapolate results for each of the remaining 1,514 plans, starting from the plan-specific funded positions.

Note that the 1,514 plans that were not identified as main plans were identified by industry only. No individual identifier was provided for these plans.

Primary Sources

The primary sources of data for the project were:

A. General data provided by the Ministry of Finance and FSCO

For all plans, we were provided with:

- membership counts;
- solvency assets;
- solvency liabilities;
- PBGF liabilities; and
- plan type.



For the main plans, we also received:

- NAICS industry code;
- an extract of the last filed actuarial valuation report;
- Investment Information Summaries (IIS);
- Annual Information Returns (AIR);
- PBGF Assessment Certificates; and
- Actuarial Information Summaries (AIS).

The “NAICS industry code” noted above refers to the North American Industry Classification System (NAICS) industry code. While these codes are not used by the FSCO, they were provided by the Ministry of Finance for the 31 sponsors of the main plans for the purposes of the projection. Eckler matched up the remaining sponsors in the plan universe with an appropriate NAICS industry code.

B. Data on the PBGF

- annual financial statements for the years 1988 through 2009;
- claims data for all claims to date; and
- plan sponsor insolvencies by year, including entity name, type of plans sponsored, and effective dates of the plans.

C. Data on plan sponsor insolvencies

- The number of bankruptcies of incorporated businesses across Canada (January 1987 to September 2009) including Ontario, provided on special request by the Office of the Superintendent of Bankruptcy Canada.
- The number of incorporated businesses in Ontario from Statistics Canada, CANSIM Table 178-0001 (March 1980 to December 2006, extrapolated to December 2008).

Reliance

We have relied entirely on the data and reports provided to us by the Ministry of Finance and FSCO. More specifically, we have relied on the information contained in the actuarial reports, IIS, AIR, AIS and PBGF Assessment summaries as they were prepared by firms or individuals other than FSCO or the Ministry of Finance.

The validity and credibility of this study is dependent on the validity and accuracy of the data provided.

Having individual member data would produce more credible results for the study. However, in our opinion, the data available was sufficient and reliable for the purposes of the study.

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Demographics

Summary

- *Approximately 49% of covered plans have between 100 and 999 members, and 36% have less than 100 members.*
- *Less than 1% of covered plans have 10,000+ members.*
- *The majority (73%) of the main plans remain open to new members.*
- *Final average plans represent 39% of the plan universe, hybrid plans 21%, flat benefit plans 19%, career average plans 13%, and other plans 8%.*
- *Active members constitute 48% of the total plan universe of 1.1 million, while pensioners account for 36% and deferred pensioners account for 16%.*
- *The manufacturing sector dominates the plan universe, with 59% of all plans and 54% of plan members.*

Plan Universe Demographics

Introduction

To a significant degree, a plan's liabilities are driven by the demographic characteristics of its members. The section that follows analyzes the demographics of the PBGF plan universe from the following perspectives:

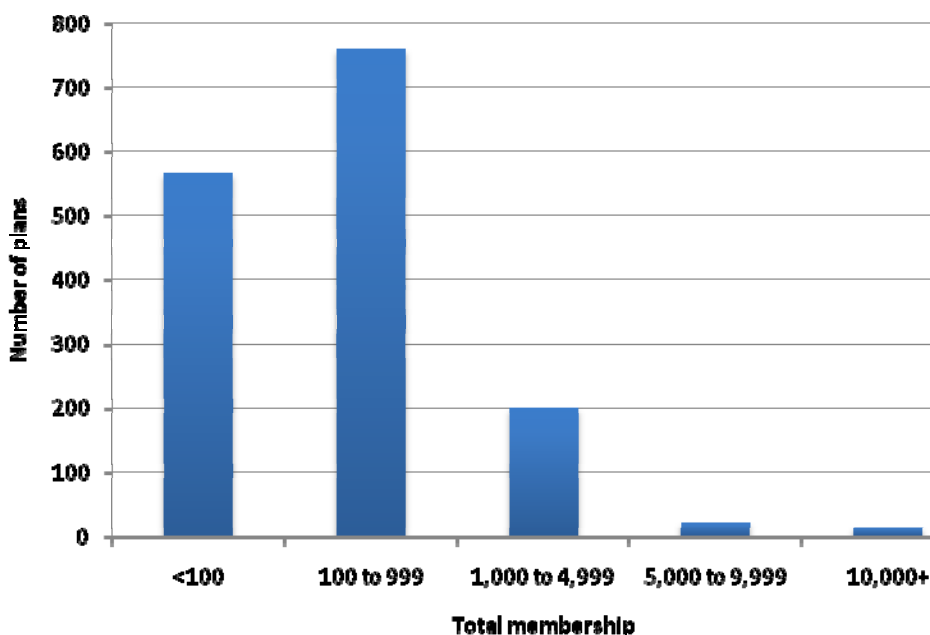
- plan size;
- plan status (open or closed to new members);
- plan type (e.g., flat benefit, final average earnings, hybrid);
- plan membership; and
- plans by industry.



Plan Size

Based on plan membership information from the most recent AIR data, the plan universe is heavily weighted in small- to mid-size plans (those with fewer than 1,000 members).

Chart 4.1: Plan universe by plan size



By definition, the main plans tend to have more members than the other plans in the plan universe. These are the plans where the employer is the sponsor of at least one plan that could have a very large impact on the PBGF. (Note that not all of the main plans are necessarily large, as a sponsor of one of these “large impact” plans could also be the sponsor of a smaller plan.)

Table 4.1 shows the distribution by membership for both the plan universe and the 52 main plans.

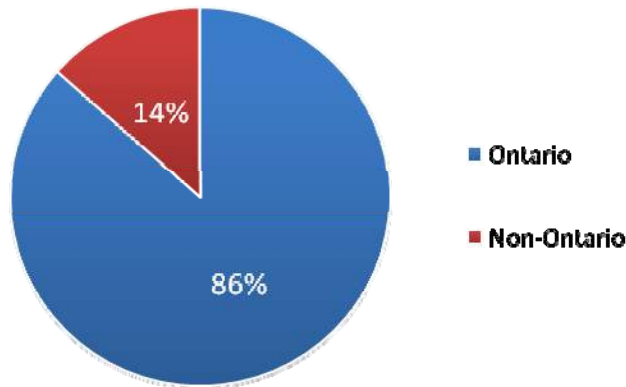
Table 4.1: Plan universe and 52 main plans in terms of plan size

Membership:	<100	100 to 999	1,000 to 4,999	5,000 to 9,999	10,000+	TOTAL
Plan universe	567	761	200	23	15	1,566
52 main plans	1	15	12	10	14	52

Ontario Membership

For the 52 main plans, the number of Ontario members was provided in the most recent AIR data. As expected, the majority of plan members were employed in Ontario.

Chart 4.2: Province of employment for members of 52 main plans



Plan Status

Plan status categories were determined by reviewing the plan provisions in the most recent actuarial reports provided for the 52 main plans. The valuation dates of these reports ranged from October 1, 2005 to September 1, 2008.

The 52 main plans were sorted into three plan status categories:

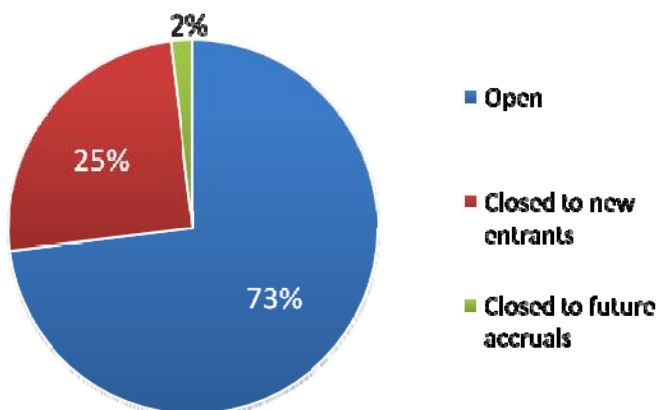
- **Open:** new members can join the plan and accrue benefits.
- **Closed to new entrants:** existing members can continue to accrue benefits.
- **Closed to future accruals:** existing members can no longer accrue new years of service (i.e., benefits are frozen).



Based on our review of the most recent actuarial reports, 73% of the 52 main plans remain open, while 25% are closed to new entrants, and only 2% are closed to future accruals.

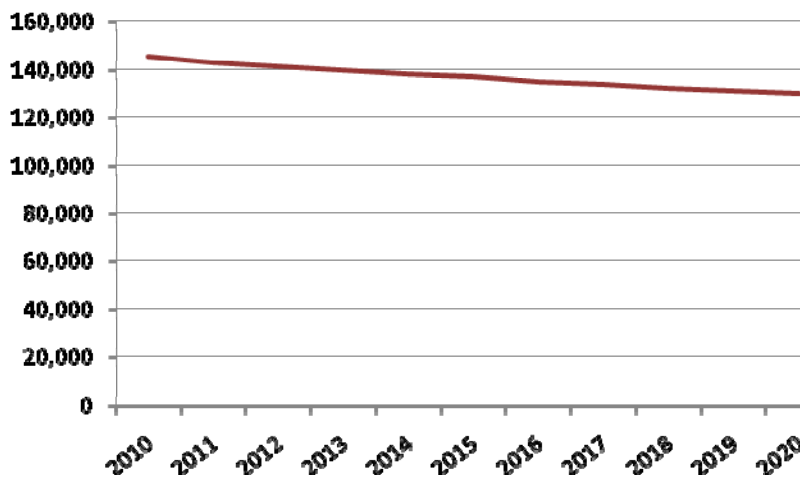
This information was not provided for the remaining 1,514 plans in the plan universe. While we anticipate these percentages to vary, perhaps significantly, for the total plan universe, we have assumed that all of the 1,514 plans are open for the purpose of the study.

Chart 4.3: Distribution of plans by plan status for 52 main plans



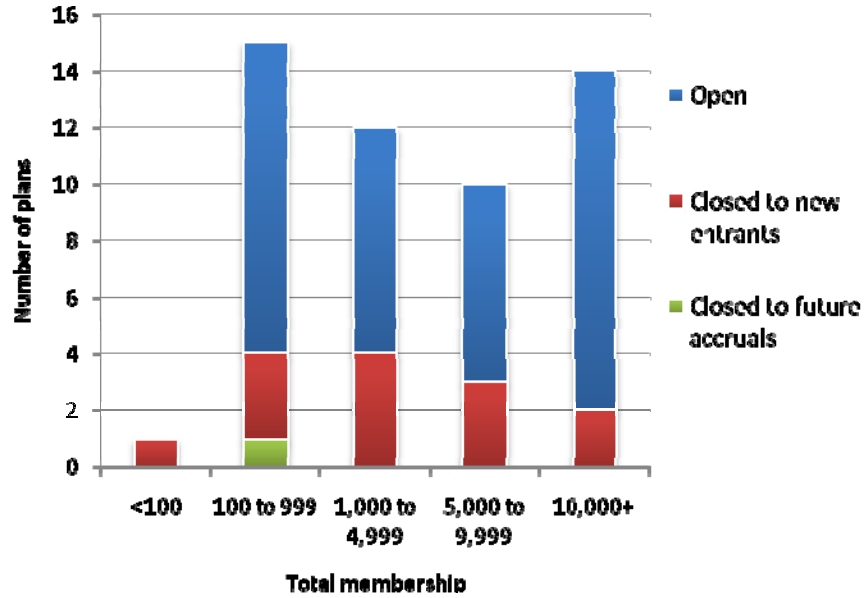
Given that 25% of the main plans are closed to new entrants, we anticipate a decline in active membership over time. The chart below illustrates our projected active membership totals over the next 10 years for the 52 main plans, assuming a level active population is maintained within the open plans.

Chart 4.4: Estimated active membership by year for 52 main plans



As fewer new members are covered by the PBGF, we expect a decline in membership-based assessments in the future. Future plan closures will accelerate this trend.

Chart 4.5: Distribution of plan status by plan size for 52 main plans



The majority of very large plans (10,000+ members) are still open to new entrants. However, future plan closures or declining new entrants could have a significant impact on member-based premiums over the long-run.



Plan Type

Plan type information was provided by the Ministry of Finance for all plans.

The plans are categorized as one of the following five plan types:

- **Flat Benefit:** pension formula is generally expressed as a dollar amount per year of service.
- **Final Average Earnings (FAE):** pension formula is a percentage of average earnings over the last several years prior to retirement, multiplied by service.
- **Career Average Earnings (CAE):** pension formula is a percentage of earnings in each year over the member's career (i.e., a percentage of average earnings over the member's career, multiplied by service).
- **Hybrid:** has both defined benefit (DB) and defined contribution (DC) components. The most common type of hybrid plan provides the greater of a DB pension and the pension that may be purchased with the member's DC account.
- **Other:** any plan type that does not fall into one of the four categories above (e.g., a plan with a frozen DB component and all future accruals occurring under a DC component).

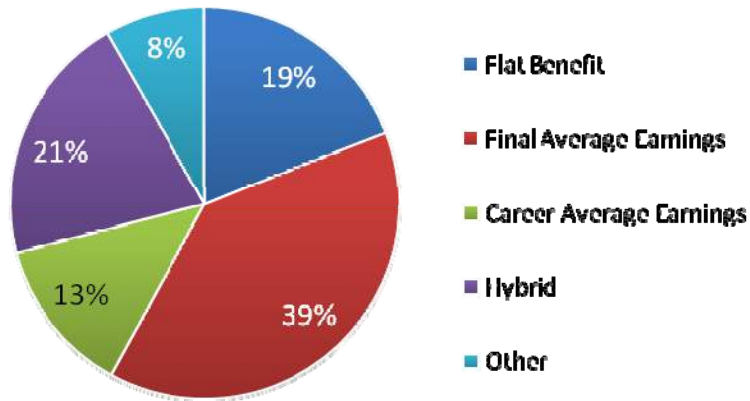
Table 4.2: Number of plans by plan type

Plan type:	Flat Benefit	FAE	CAE	Hybrid	Other	TOTAL
Plan universe	300	608	204	324	130	1,566
52 main plans	14	24	1	12	1	52

Plan Universe

FAE plans represent the largest proportion (39%) of the plan universe, followed by Hybrid plans (21%), Flat Benefit plans (19%), CAE plans (13%), and Other plans (8%).

Chart 4.6: Distribution of plan universe by plan type



The number of members, however, is distributed more evenly between FAE plans (35%) and Hybrid plans (32%). A further 23% of members are in Flat Benefit plans and 7% are in CAE plans; the remaining 3% are in Other plans.

Chart 4.7: Distribution of membership in plan universe by plan type

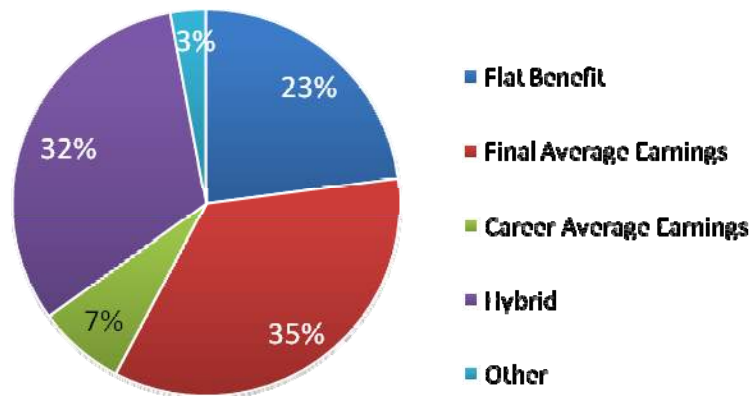
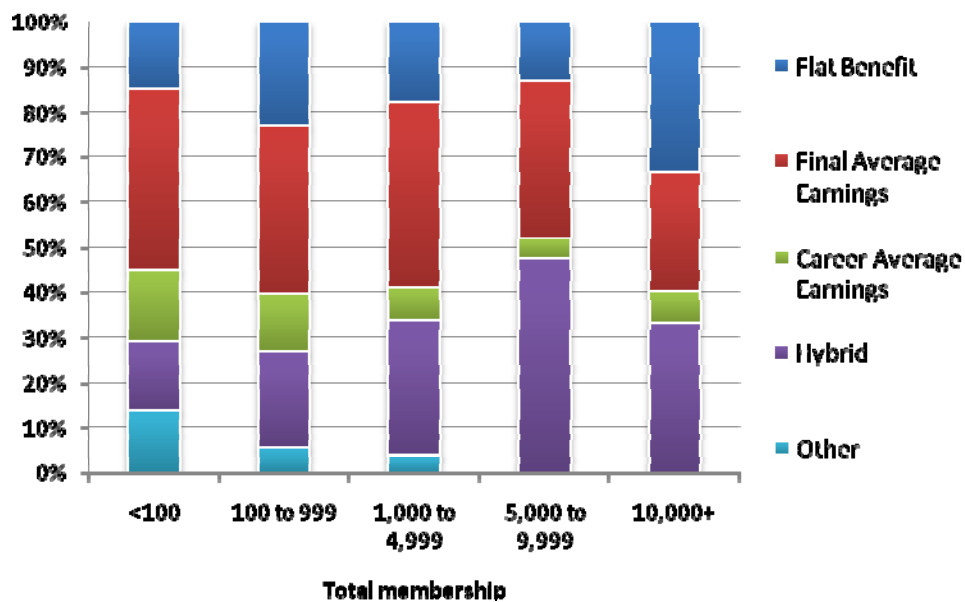




Chart 4.8 shows that the proportion of each plan type can vary significantly with plan size. While the proportion of FAE plans remains fairly steady across plan sizes, the proportion of Hybrid plans tends to increase with plan size. We can also see that a higher proportion of very large plans (10,000+ members) are Flat Benefit.

Chart 4.8: Distribution of plan type by plan size (for plan universe)



Plan Membership

Plan membership information was taken from the most recent AIR data available for each plan in the plan universe.

Note that, because some deferred and/or pensioner members may have pension entitlements in more than one plan, these members may be double-counted in our summaries.

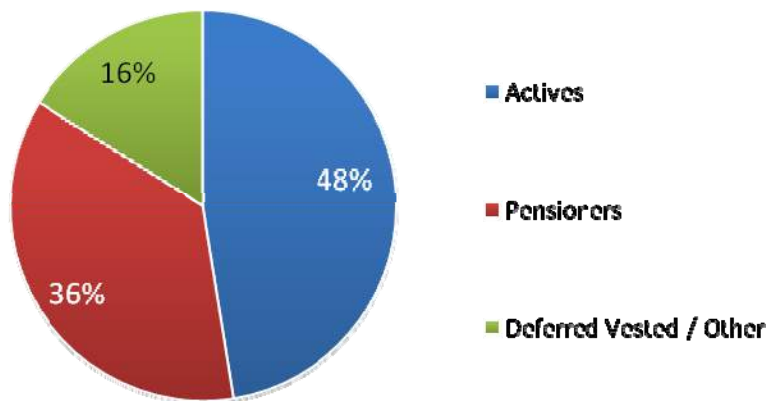
Table 4.3: Plan membership distribution

	Actives	Pensioners	Deferred Vested / Other	TOTAL
Plan universe	525,000	403,000	178,000	1,106,000
52 main plans	146,000	183,000	41,000	370,000

Plan Universe

There are over 1.1 million members in the plan universe, including 370,000 (or 33%) who are members of the 52 main plans. Active members comprise the largest membership group, accounting for approximately 48% of plan universe membership. Pensioners account for 36% of total membership, with the remaining 16% being deferred vested and other members.

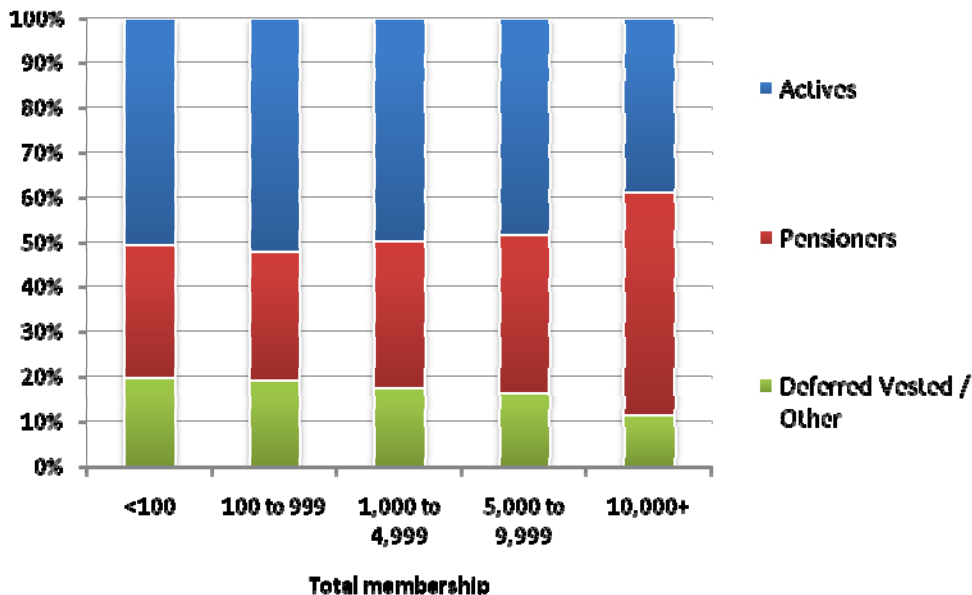
Chart 4.9: Distribution of member types in plan universe





The proportion of pensioners tends to increase with plan size. There is a significantly lower proportion of active members in the largest (10,000+ member) plans relative to the other-sized plans.

Chart 4.10: Distribution of member types in plan universe by plan size



Plans by Industry

For the purposes of this study, plans were classified according to a “NAICS industry code.” These codes were provided by the Ministry of Finance for the 31 sponsors of the main plans for the purposes of the projection. Eckler matched up the remaining sponsors in the plan universe with an appropriate industry code.

For ease of presentation, the NAICS industry code classifications have been modified slightly for the purposes of the analysis below – for example, the various services categories (educational services; accommodation and food services; professional, scientific and technical services; etc.) have been grouped together under “Services.”

Plan Universe

Manufacturing represents the majority of plans and plan membership in the plan universe. As illustrated below, 59% of all plans and 54% of members are in the manufacturing sector.

Chart 4.11: Proportion of plans by NAICS industry classification (plan universe)

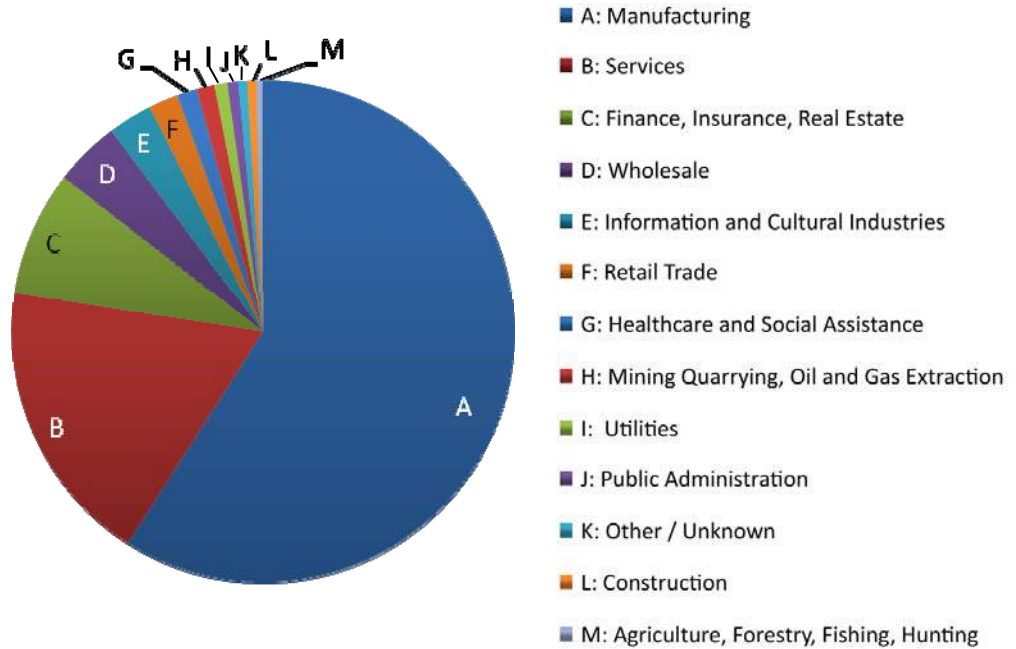
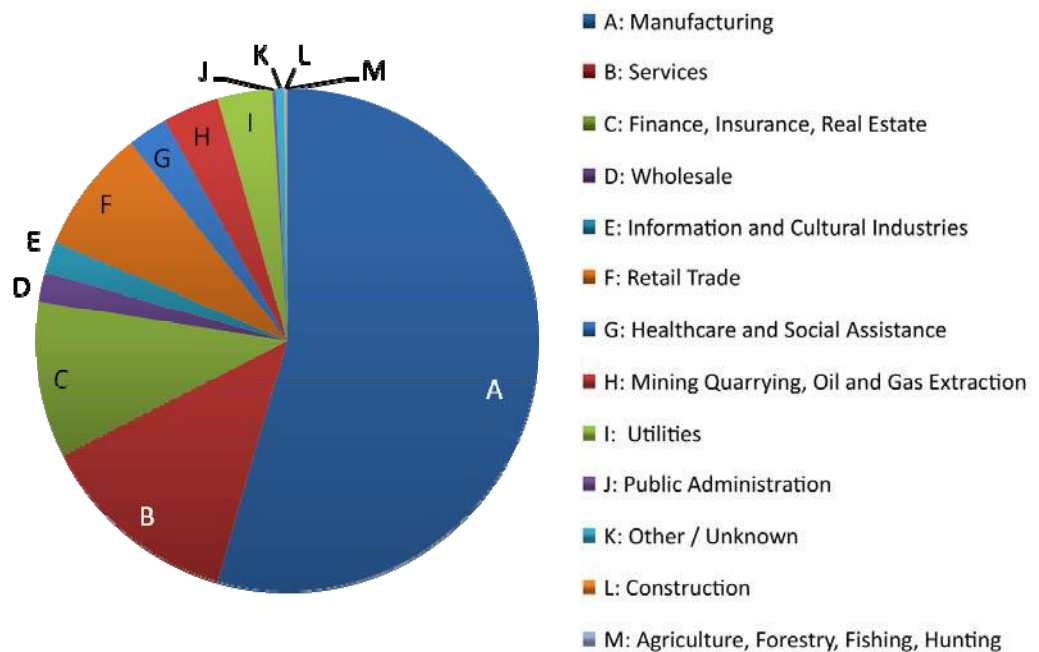


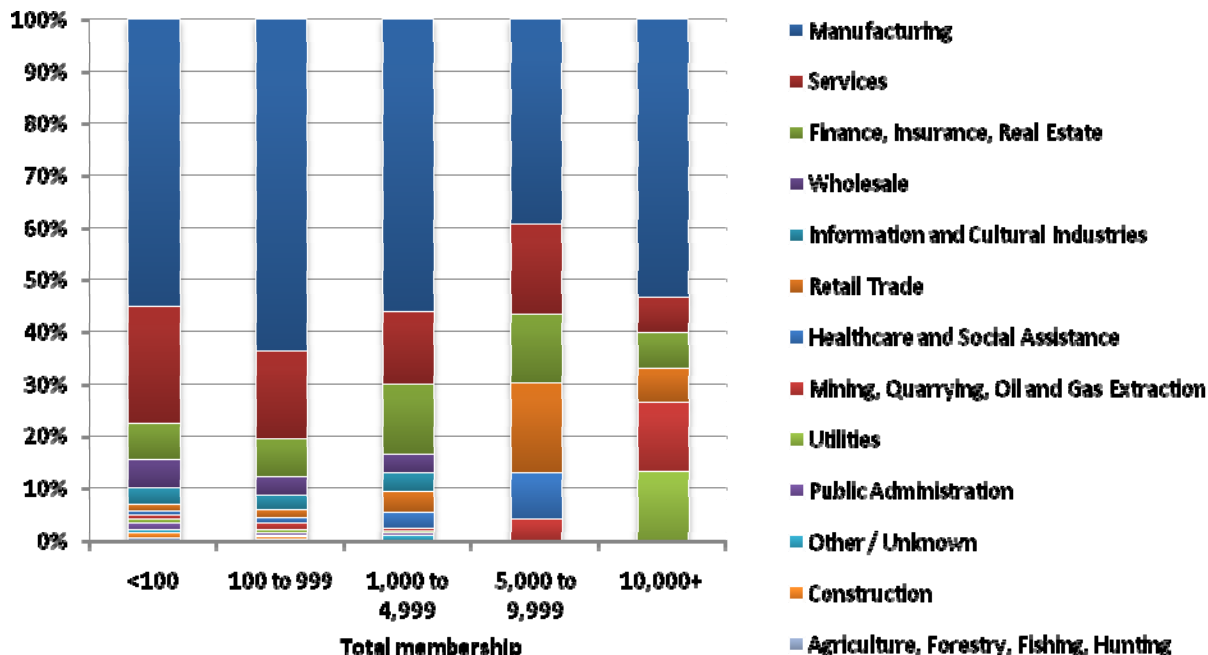
Chart 4.12: Proportion of membership by NAICS industry classification (plan universe)





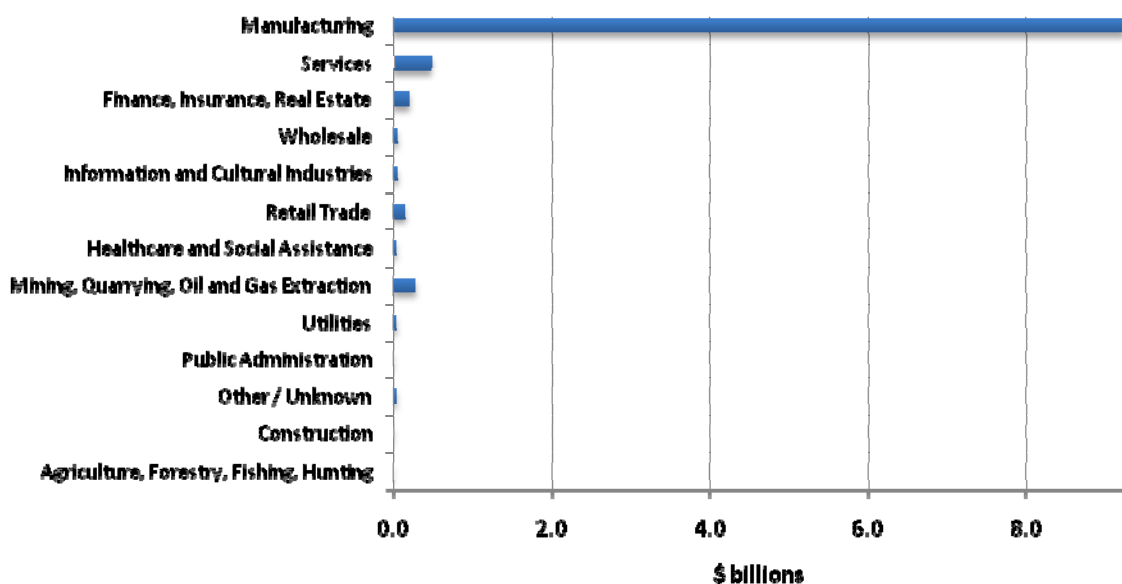
Nearly half of all plans in the plan universe have between 100 and 999 members; this is also the group with the highest proportion of plans in the manufacturing sector.

Chart 4.13: Proportion of membership by NAICS industry classification (plan universe)



Manufacturing accounts for 87% of the initial PBGF exposure (measured as the PBGF Assessment Base as of the most recently filed actuarial valuation report).

Chart 4.14: PBGF exposure as of most recent valuation



5

Current Funding

Summary

- *All plans were estimated at January 1, 2008, with the exception of the General Motors pension plans (to accommodate the special solvency rules and contributions made for this employer). As a result, the measurement date for the assets and liabilities of the GM plans is January 1, 2010.*
- *More than 73% of the plan universe was in a deficit position as of January 1, 2008, on a solvency basis.*
- *The estimated total deficit for plans in a deficit position was \$9.6 billion.*
- *The average plan funding level across the plan universe was 97%. The average plan funding level for plans in a deficit position was 87%.*
- *Plans with 10,000+ members accounted for \$4.6 billion of the \$9.6 billion deficit.*
- *Plans in the manufacturing sector accounted for \$6.1 billion of the \$9.6 billion deficit.*

Introduction

This section summarizes the reported funding levels of the pension plans under study. The Ministry of Finance provided approximate asset and liability data on an anonymous basis for all 1,580 covered plans. This data was provided to model the plan universe.

The estimated figures provided by the Ministry were taken from the most recently submitted Actuarial Information Summary (AIS) or PBGF Assessment Certificate for each plan, and were therefore not measured at a consistent date. Where necessary, the data was adjusted to estimate plan asset and liability figures at a consistent measurement date of January 1, 2008.

With regards to the asset and liability data for the plan universe:

- 14 plans were omitted from the study because they showed no assets or liabilities, producing a plan universe of 1,566 plans.
- For the remaining plans, where not on a calendar year basis, the valuation date was shifted to the nearest January 1 prior to adjusting assets and liabilities to January 1, 2008.
- The General Motors pension plans were valued separately from other plans to accommodate the special solvency rules established for this employer. As a result, the measurement date for the assets and liabilities of these plans is January 1, 2010, to reflect the additional special contributions made in 2009. These plans have been included in the summaries, but based on January 1, 2010 data.



Measuring Assets and Liabilities

The assets summarized in this section were measured at market value. The assets do not reflect any smoothing, nor do they reflect any provision for assumed wind-up expenses.

Note that while the assets summarized in this section (other than those of the General Motors plans) reflect a measurement date of January 1, 2008, assets for all the main plans were extrapolated to January 1, 2010 for the purposes of the study. For each of the main plans, the assets were taken at market value as of the last filed actuarial valuation report, and assumed to be invested 40% in bonds, 30% in Canadian equities, 15% in U.S. Equities and 15% in International Equities (based on the average asset mix for the 52 main plans as taken from the 2008 IIS reports). The extrapolation to January 1, 2010 was based on benchmark asset returns from the valuation date to the end of November 2009. The return in December 2009 was unknown at the time assets were being projected and was assumed to be zero.

Allowance was made in the projection of assets for the expected contributions and benefit payments based on the projected liability runs and the appropriate actuarial assumptions. Future asset values were stochastically projected, based on the average asset mix as noted above. (For more information, see *Asset Projections* under the *Economic Scenario Generator* subsection of Section 6.)

The liabilities summarized in this section are measured on a solvency basis. Solvency liabilities are calculated as if the plan had been wound up as of the valuation date and do not reflect any smoothing.

Plan Universe Funding

Analysis of Overall Funding Levels

Table 5.1 shows key funding figures for the 1,566 plans in the plan universe, as well as the 52 main plans. The estimated deficit across all plans in a deficit position is \$9.6 billion for the plan universe and \$5.7 billion for the main plans. All plans other than the General Motors plans were estimated at January 1, 2008. The General Motors plans were estimated at January 1, 2010.

Table 5.1: Estimated aggregate funding figures for plan universe and 52 main plans

	Plan universe	Main plans
Total plans	1,566	52
Total assets at market value (\$ billions)	131.6	69.1
Total solvency liabilities (\$ billions)	135.1	72.3
Aggregate deficits (\$ billions)	(3.5)	(3.2)
Total deficits for plans in deficit (\$ billions)	(9.6)	(5.7)
Total surpluses for plans in surplus (\$ billions)	6.1	2.5

Note that more than 73% of the plans under study (1,153 of 1,566) were in a deficit position.

Analysis by Plan Size

An analysis of the plan universe shows that, to a significant degree, the small number of very large plans (10,000+ members) is driving the overall funding levels. Only 15 plans have 10,000+ members, yet these plans accounted for \$4.6 billion of the \$9.6 billion total deficit for plans in a deficit position.

Table 5.2 shows the distribution of estimated aggregate funding levels by plan size. All plans other than the General Motors plans were estimated at January 1, 2008. The General Motors plans were estimated at January 1, 2010.

Table 5.2: Estimated funding levels for plan universe by plan size

Number of members	Number of plans	MV of Assets (\$ billions)	Solvency Liabilities (\$ billions)	Surplus / (Deficit) (\$ billions)	Aggregate Funding Level	Average Funding Level
< 100	567	2.4	2.5	(0.1)	96%	98%
100 to 999	761	22.9	23.7	(0.8)	97%	95%
1,000 to 4,999	200	37.8	38.3	(0.5)	99%	98%
5,000 to 9,999	23	19.4	18.6	0.8	104%	105%
10,000+	15	49.1	52.0	(2.9)	94 %	94%
Total	1,566	131.6	135.1	(3.5)	97%	97%

As illustrated by Chart 5.1, plans with 10,000+ members accounted for over 37% of plan assets and liabilities and, as noted above, nearly half of the total deficits for plans in a deficit position.

Chart 5.1: Distribution of assets/liabilities by plan size for plan universe

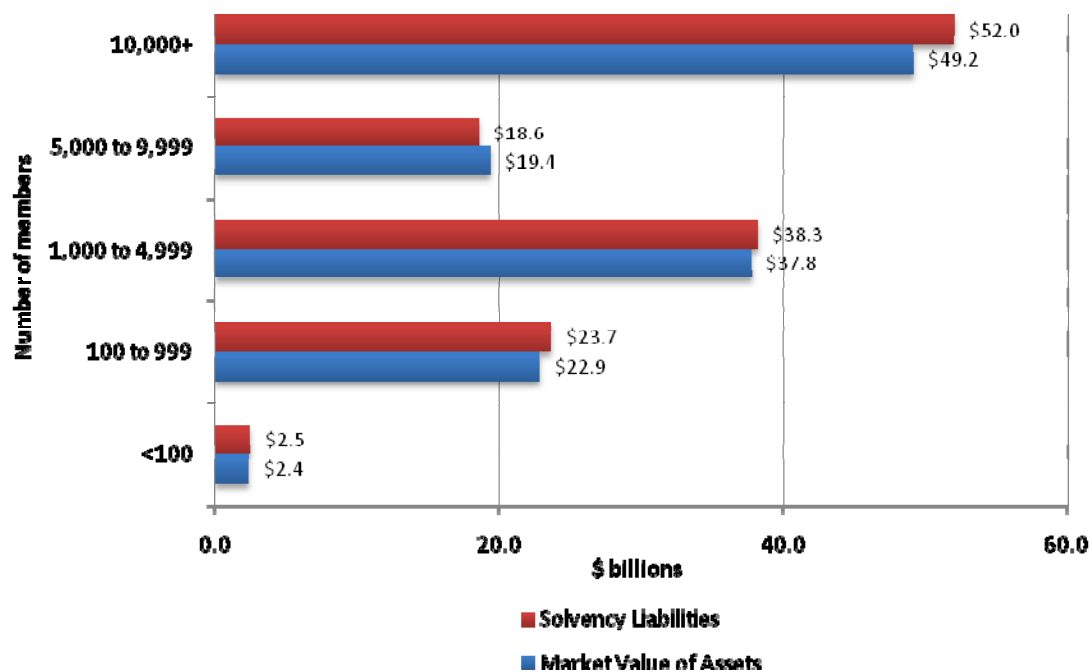
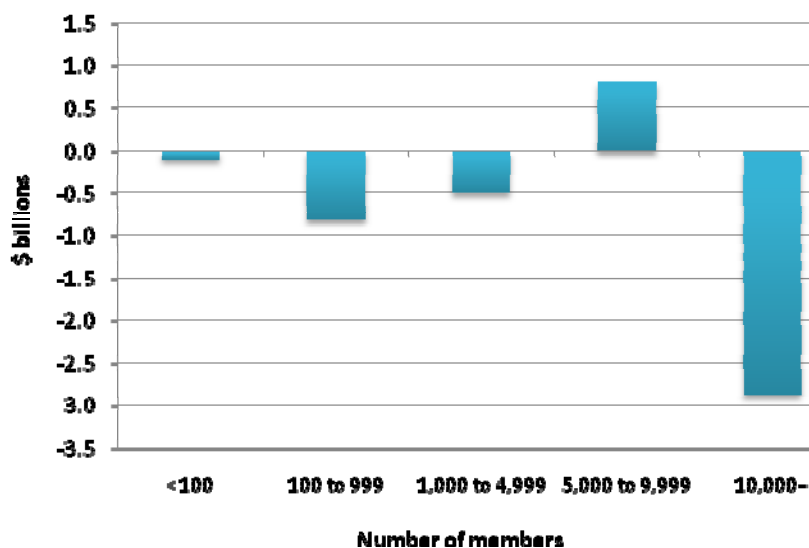
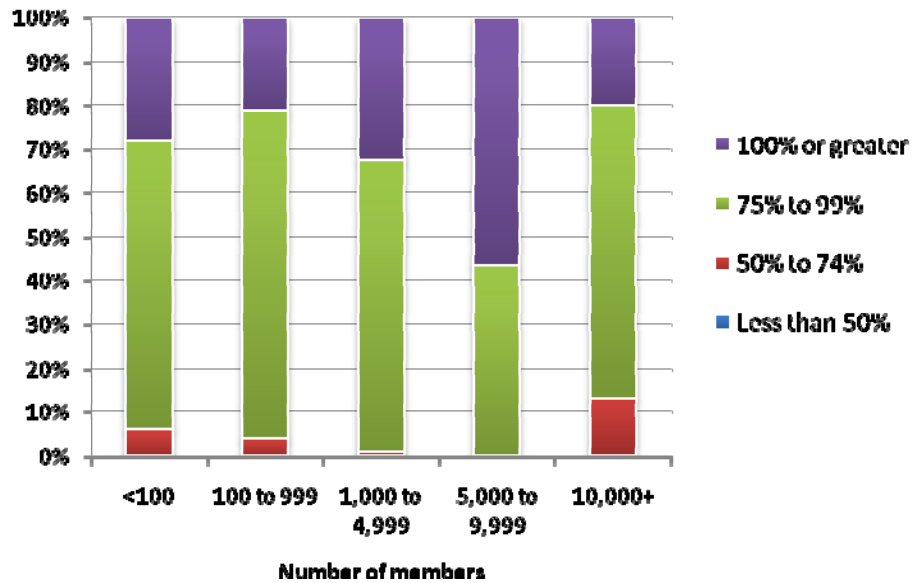


Chart 5.2: Level of aggregate surplus/deficit by plan size for plan universe



The distribution of funding by plan size further illustrates the impact that very large plans can have on the overall funding level. As shown in Chart 5.3, the majority of plans with 10,000+ members are at least 75% funded. The proportion of these plans that are less than 75% funded, however, accounted for \$2.2 billion of the \$4.6 billion deficit associated with plans in a deficit position that have 10,000+ members.

Chart 5.3: Distribution of funding levels by plan size for plan universe



The concentration of significant deficits spread between a few large plans speaks to the kind of low-frequency, high-severity claims that have impacted the PBGF in recent years. The failure of even one of these very large, underfunded plans could have a significant impact on the sustainability of the PBGF well into the future.

Analysis by Industry

As previously noted, for the purposes of this study, plans were classified according to their “NAICS industry code.” These codes were provided by the Ministry of Finance for the 31 sponsors of the main plans for the purposes of the projection. Eckler matched up the remaining sponsors in the plan universe with an appropriate industry code.

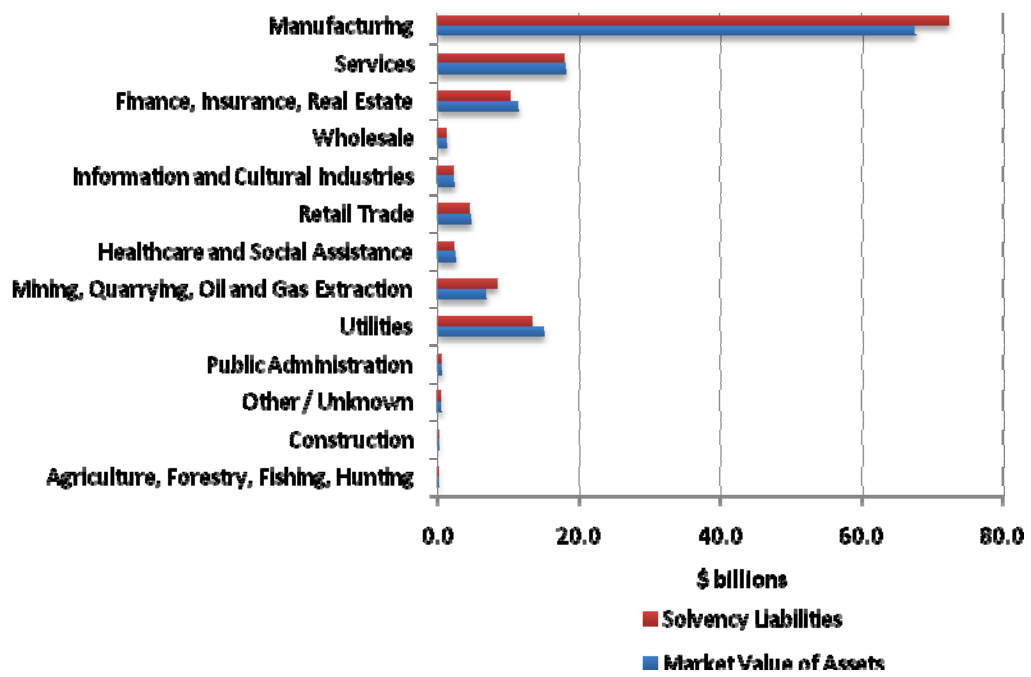
For ease of presentation, the NAICS classifications have been modified slightly for the purposes of the analysis below – for example, the various services categories (educational services; accommodation and food services; professional, scientific and technical services; etc.) have been grouped together under “Services.”

Plan liabilities and assets are concentrated in three broad industry groups: manufacturing, services and utilities. Together, these three sectors accounted for 77% of both liabilities and assets.

The manufacturing sector has the largest number of plans (924 of 1,566), the highest level of solvency liabilities (\$72.5 billion, 54% of total), and the highest aggregate deficit (\$4.9 billion).

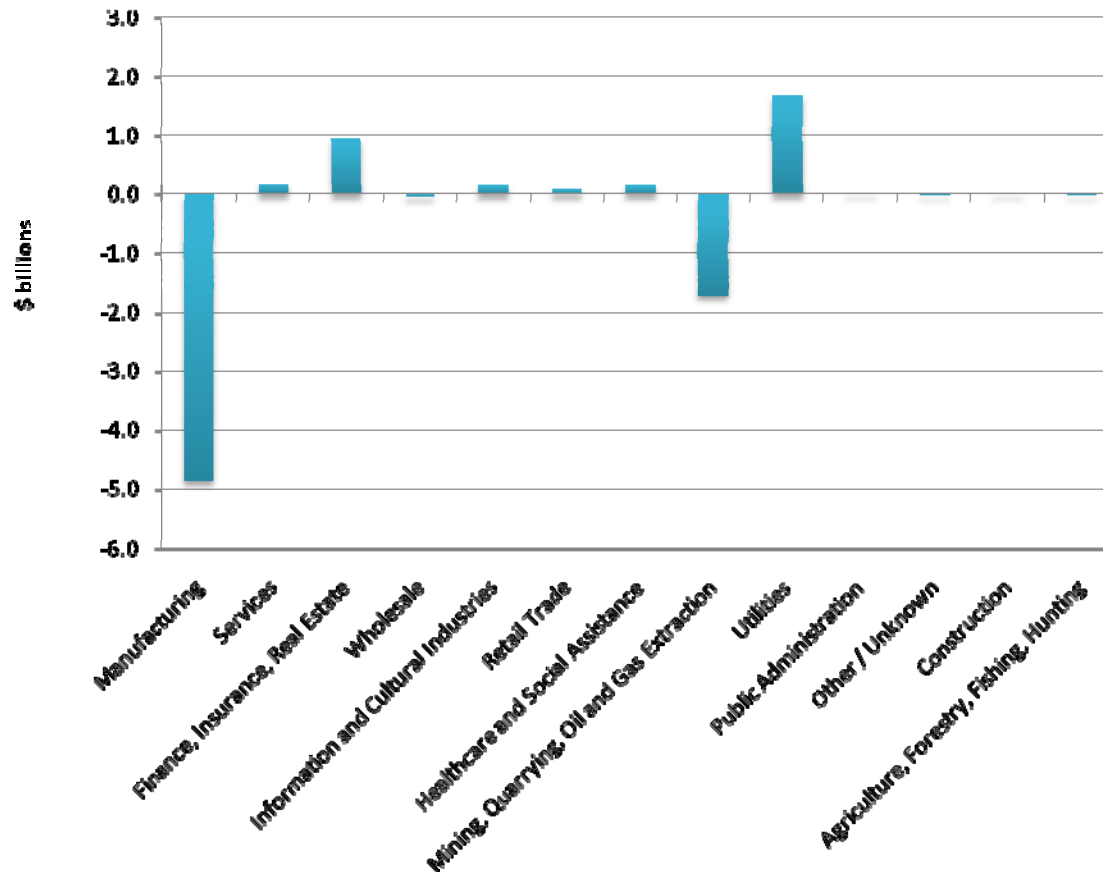
Chart 5.4 illustrates the distribution of assets and liabilities by industry, while Chart 5.5 shows the distribution of aggregate surplus or deficit. All plans other than the General Motors plans were estimated at January 1, 2008. The General Motors plans were estimated at January 1, 2010.

Chart 5.4: Distribution of assets/liabilities by industry for plan universe



Of the eight sectors with an aggregate surplus, the largest surplus is found in the utilities sector (\$1.7 billion). Although the majority of sectors actually have an aggregate surplus, these surpluses are dwarfed by the deficits in manufacturing.

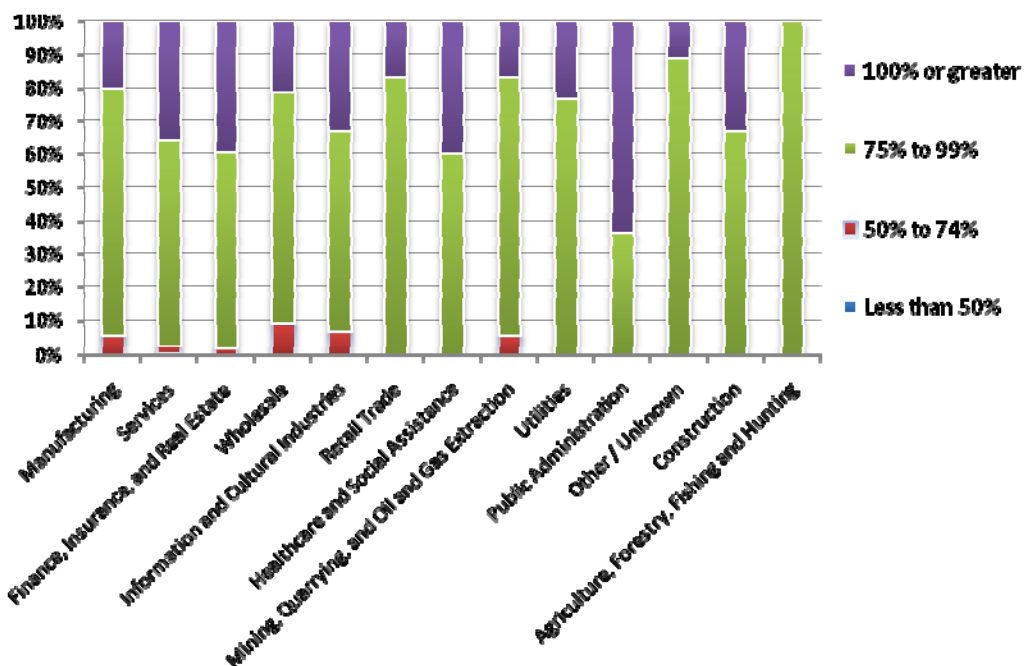
Chart 5.5: Level of aggregate surplus/deficit by industry for plan universe





As shown in Chart 5.6, the funded status of the majority of plans in each sector falls between 75% and 100% – except for the public administration sector, where the majority of plans are actually fully funded or overfunded (these plans are generally small, with more than half having less than 100 members). The public administration sector accounts for less than 0.5% of assets and liabilities in the overall plan universe, as many of the large public sector plans are not covered by the PBGF.

Chart 5.6: Distribution of funding levels by industry for plan universe



The concentration of liabilities in the manufacturing sector, coupled with the significant deficits, could have a significant impact on the sustainability of the PBGF if manufacturing suffers further decline in Ontario.

Funded Status of Main Plans

As at January 1, 2008 (except for GM, which was measured at January 1, 2010 as described previously), the aggregate funded position for the main plans was a deficit of \$3.2 billion. The total deficit for the main plans in a deficit position was \$5.7 billion. This amount represents 59% of the total \$9.6 billion deficit for all plans in a deficit position within the plan universe. Individually, 38 of the 52 main plans were in deficit positions. The average funded ratio for the main plans was 96%.

Assets and liabilities for the 52 main plans were projected to January 1, 2010, as described in Section 6. Based on the economic scenario that most closely approximates the actual economic environment at the beginning of 2010, the projection shows that as of January 1, 2010, all but two of the 52 main plans were estimated to be in a deficit position. The estimated total deficit for plans in a deficit position totalled \$7.9 billion and the estimated average funded ratio was 90%.

The funded positions of the main plans as at January 1, 2010 have significantly worsened since January 1, 2008. In particular:

- the total deficit for plans in a deficit position increased from \$5.7 billion to \$7.9 billion,
- the number of plans in a deficit position increased from 38 to 50,
- the average funded ratio decreased from 96% to 90%.

Table 5.3 summarizes aggregate funding figures for the 52 main plans, measured as at January 1, 2008 (except for GM, which was measured at January 1, 2010 as described previously) and January 1, 2010.

Table 5.3: Estimated aggregate funding figures for main plans

	January 1, 2008	January 1, 2010
Total plans	52	52
Total assets at market value (\$ billions)	69.1	68.0
Total solvency liabilities (\$ billions)	72.3	75.7
Aggregate deficits (\$ billions)	(3.2)	(7.7)
Total deficits for plans in deficit (\$ billions)	(5.7)	(7.9)
Total surpluses for plans in surplus (\$ billions)	2.5	0.2

6

Methods & Assumptions Part I: Plan Projection Module & Economic Scenario Generator

Introduction

In order to model the PBGF, the following components were utilized:

- a Plan Projection Module, which consists of:
 - a Plan Data Projector, and
 - a Stochastic Asset and Liability Pension Plan Projector;
- an Economic Scenario Generator;
- an Insurance Model; and
- an Insolvency Projection Module.

The first two components are explained in detail in this section and the latter two in Section 7.

Plan Projection Module

The Plan Projection Module was used to generate stochastically projected liabilities and assets under going-concern and solvency bases and stochastically projected PBGF exposure liabilities for the 52 main plans. The module consists of:

- a Plan Data Projector, and
- a Stochastic Asset and Liability Pension Plan Projector.

Plan Data Projector

Membership Data Extraction

The starting point to derive the data used for the projections for the main plans was the data summaries included in the valuation reports and AIRs provided for the study. These membership summaries generally provided data grouped into cohorts by age and sex; or by age, sex and service; and overall membership statistics, such as the average age for all members.

Grouping Algorithm

The “grouping algorithm” refers to the process by which grouped data from the valuation reports was extrapolated into data records that reflected the average age, service, salary and accrued benefit statistics contained in the valuation reports. A weight was assigned to each of these records, representing the number of members in the respective cohort. The main goal of the grouping algorithm was to ensure that the resulting data adequately represented the distribution of the plans’ membership.



The following key aspects were incorporated into the development of the algorithm:

- For each cohort, members were assumed to be at the midpoint of the age and service ranges. To enable the algorithm to effectively match the overall average age and average service of the extrapolated data to the overall average age and average service in the valuation report, adjustments were made by adding a positive or negative number (“delta factor”) to the midpoint of the age and service ranges for each cohort. This effectively adjusted the overall average for both age and service up or down, ensuring that the grouped data would closely mimic actual member data in aggregate when compared with membership statistics from the valuation report.
- Average salaries were included as stated in the valuation report for their respective cohorts. Where cohorts contained only one or two members, most valuation reports omitted average salaries and other private information. The calculation of this information varied on a case-by-case basis and in general was computed manually, based on the overall averages and the data available.
- Most valuation reports did not include sufficient information regarding contributions (if any) by cohort. Contribution estimates were developed and included, where relevant, in the data used for the projection module, by utilizing the ratio of the total accumulated contributions to the total liabilities.
- Cell weighting in each cohort was further refined to incorporate Ontario and non-Ontario membership, using the overall ratio of Ontario to non-Ontario members for both active and inactive member cohorts as reported in the last AIR.
- In cases where cohorts were not explicitly split by gender in the age and service distributions, a similar technique was used, and the ratio of male to female members for both active and inactive member cohorts, available either elsewhere in the report or from the last AIR, was applied.
- The data was then reviewed for reasonableness, and adjusted as appropriate (e.g., in cases where the adjusted midpoint of the age and service ranges resulted in an implied hire age of less than 18 years, the algorithm adjusted the delta factor for the respective cohort such that the restricted hire age equalled 18 years).
- Cohorts were grouped into the following membership types, consistent with the categories provided in the valuation report:
 - Active,
 - Transferred,
 - Disabled,
 - Retired,
 - Survivor, and
 - Vested.

For the Active and Disabled groups, a yearly service accrual rate of 1 was assumed. All members were assumed to be employed on a full-time basis. For all other groups, no service accrual was assumed.

Having individual member data would produce more credible results for the study. However, in our opinion, the data available was sufficient and reliable for the purposes of the study.

Stochastic Asset and Liability Pension Plan Projector

Introduction

The main plans were valued using a valuation and projection tool that stochastically projects plan assets and going-concern and solvency liabilities.

Matching Initial Results

For the 52 main plans, the projector was populated with the data from the grouping algorithm and the main actuarial assumptions from the valuation report. Demographic assumptions such as mortality, termination, disability and retirement rates were input, as well as economic assumptions, such as discount rates and cost-of-living increases. The plan provisions valued were based on the summaries available in the valuation reports, reflecting the significant benefits, features and provisions, in order that the model would produce reasonable approximations of plan liabilities and current service cost for the main plans, within a tolerance level set at +/- 5%.

The initial results generated from the model on both a going-concern and solvency basis were compared to the results in the valuation report, broken down by membership category. If the initial results for a membership category from the model did not match the valuation results within 5%, the data from the grouping algorithm was reviewed for a better fit. In cases where a review of the data did not provide a better fit, a scaling factor was applied to match the valuation results for the membership category.

A scaling factor was applied, rather than amending data for a best fit, in cases where the valuation reports included limited member data for particular categories and/or limited benefit descriptions. Judgment was applied on a case-by-case basis and consideration was given to materiality.

In programming the plan provisions, a number of simplifications were implemented as follows:

- In valuing the liabilities for active members, pre-retirement death and disability benefits were not explicitly valued, unless the value of these benefits was expected to have a material impact on the active liabilities.
- In some plans, there are basic benefits for non-contributory service and enhanced or more generous benefits for contributory service. Where no details regarding the breakdown of contributory vs. non-contributory service were available, it was assumed that all service was contributory.
- In some flat benefit plans, there are several categories of active members that each accrue benefits at a different benefit rate. Information regarding the number of members in each category was generally not available in the report. The benefit valued was based on an average rate that produced the best fit over the active membership.
- In many cases, limited or no information was available regarding the form of payment for pensioners (e.g., guarantees remaining, joint and survivor percentages, etc.). It was assumed that one payment form applied to all non-survivor pensioners in payment, based on the best fit.



Having access to the plan documents would enable a more complete valuation of the plan benefits and would produce more credible results for the study. However, in our opinion, the plan provision information available was sufficient and reliable for the purposes of the study.

Initial PBGF Exposure Liability

Once the initial valuation results were matched for the 52 main plans, an initial PBGF exposure valuation was set up. This valuation is intended to replicate the claim under the PBGF if a plan sponsor becomes insolvent, assuming the plan had no assets. The assumptions described below are intended to represent the actual PBGF rules, where data was available:

- The liabilities were based on the maximum of the accrued benefit as of the valuation date and \$1,000 per month for active members whose age plus plan membership (points) equalled at least 60 at the valuation date.
- No coverage under the PBGF was assumed for active members whose age plus plan membership (points) equalled less than 50 at the valuation date.
- For active members who had between 50 and 60 points, coverage was assumed at 20% with 50 points, increasing linearly to 100% with 60 points.
- In the absence of service data for deferred members, they were assumed to be 100% covered under the PBGF.
- In the absence of sufficient information on benefit improvements, it was assumed that no improvements had taken place in the three years prior to the valuation date.
- No liability was included for any benefit not guaranteed by the fund, as listed in Regulation 47(2) of the Ontario Pension Benefit Regulations.

Asset and Liability Projections

Following the matching of initial results and setting up initial PBGF exposure liability runs, the 52 main plans were stochastically projected across 500 economic scenarios over a 55-year period. Plans were assumed to be ongoing with no voluntary wind-ups where the plan sponsor was deemed to be solvent. The stochastic scenarios were generated using GEMS[®] (“General Economy and Market Simulator”), an Economic Scenario Generator (ESG) developed by DFA Capital Management Inc.

Economic Scenario Generator

Introduction

In developing asset and liability projections, it was necessary to develop a prediction of how certain variables would behave during the time horizon analyzed. We have modelled variables that impact both the assets and liabilities. The following is a summary of the variables that were modelled:

Asset Classes

- S&P/TSX Composite (Canadian Equity)
- S&P 500 (U.S. Equity)
- MSCI EAFE (International Equity)
- DEX Universe Bond Index (Canadian Bonds)
- Cash

Canadian Macroeconomic Variables

- Gross Domestic Product (GDP)
- Consumer Price Inflation (CPI)
- Wage inflation
- Unemployment rate

Ontario Macroeconomic Variables

- Gross Domestic Product (GDP)
- Unemployment rate

Interest Rates

- Short-term interest rates (6- and 12-month T-bills)
- Series V122542 – 7-Year Government of Canada Bond
- Series V122544 – Long-Term Government of Canada Bond
- Series V122553 – Long-Term Real Return Government of Canada Bond



Types of Models

Generally speaking, there are two types of models that can be used to analyze future economic outcomes:

- Deterministic, and
- Stochastic.

Deterministic Models

Deterministic models develop one or more possible scenarios of how economic variables will unfold over the next several years. These types of models can be interesting but may not be very informative, as they will produce the same results for a given starting condition.

Stochastic Models

Stochastic models use advanced modelling techniques to generate thousands of possible scenarios, each with its own likelihood or probability of occurring. Typically, these models use a Monte Carlo simulation approach in generating the thousands of possible scenarios. Critical components of these models are the assumptions used to calibrate the models and the validation of the results. The probability of a certain outcome refers to the proportion of trials calculated by the model which resulted in the given outcome. The major advantage of this modelling approach is that it allows us to review all of the results and to assign a probability to an outcome or a range of outcomes.

Our Model

After evaluating several viable options, we determined the most appropriate model to address the objectives of the project was the GEMS[®] model developed by DFA Capital Management Inc. (DFA). This product is designed to stochastically simulate consistent real-world scenarios.

Key features of GEMS[®] include:

- multi-economy and multi-currency modelling,
- comprehensive set of asset classes,
- advanced modelling of equities,
- extensive calibration and validation,
- incorporation of low-probability stresses, and
- transparency and documentation.

Multi-Economy and Multi-Currency Modelling

GEMS[®] models individual economies as well as the correlations between multiple economies on a simulated basis. In modelling multiple economies, GEMS[®] couples bond and stock markets into a simulated “global” economy in which foreign exchange rates can depend on the global economy as a whole.

The following individual economies have been calibrated and validated within GEMS[®]:

- United States,
- Germany,
- Switzerland,
- United Kingdom, and
- Canada.

Comprehensive Set of Asset Classes

GEMS[®] includes a range of asset classes, which enables simulation of effective asset and liability management. Asset classes include:

- treasury bonds,
- corporate bonds,
- mortgage-backed bonds,
- interest rate derivatives,
- equity price indices,
- alternative investments, and
- real estate.

Advanced Modelling of Equities

GEMS[®] combines stochastic volatility with jump diffusion to model equities. This stochastic volatility with jumps, or SVJ, model is one of the most sophisticated models currently used to model equities and produces the following desired features:

- stochastic volatility, which produces heavy or fat tails,
- jump clustering (large changes, positive or negative, clustered together),
- volatility persistence (periods of increased volatility that tend to last longer), and
- leverage effect (where past returns are anti-correlated with future volatilities).

These model features are important in reproducing equity market characteristics, including rare but severe draw downs as observed in real equity markets. Modelling such real-world behaviour is critical in assessing the actual risk of a plan sponsor or investment portfolio.

GEMS[®] contains models of most major market indices, including the S&P 500 and the S&P/TSX Composite.

Extensive Calibration and Validation

An ESG's reliability depends on correctly calibrating each of its model's parameters (numbering in the hundreds) and correctly identifying the market data sources. DFA combines automated and interactive validation and calibration methods to ensure that a GEMS[®] simulation possesses economic behaviour consistent with history. Quarterly updates and validation reports are provided to Eckler by DFA.



Incorporation of Low-Probability Stresses

An important requirement imposed on any ESG is that it be able to produce a wide range of infrequently occurring, but plausible, scenarios. Generating plausible events that capture stresses going beyond recent history is crucial for sound capital allocation and risk assessment. In some cases, such low probability events may not arise frequently enough to be represented in the sample of historical data used to calibrate the models.

GEMS[®] is able to generate such events, even if it is calibrated against data not containing them.

Limitations of the Model

The limitations of our GEMS[®] model are as follows:

- Calibration of the model is based largely on historical information. It is possible that historical behaviour will not be a good predictor of future events.
- Models are highly dependent on assumptions. It is possible that the assumptions used will ultimately be incorrect.
- Our model has assumed that the Bank of Canada will continue to target and manage inflation between 1% and 3%. The simulated behaviour and the results would likely be different if this assumption was not made.
- The model may not predict or capture all possible outcomes.

Economic Scenarios

At the request of the Ministry of Finance, we used the ESG to stochastically generate 500 random economic scenarios. In developing the CPI projections, we have assumed that the Bank of Canada will maintain the inflation control range of 1% to 3% with a target of 2%. The GEMS[®] ESG was adjusted accordingly. In addition, to reflect current equity risk premiums, we have reduced the risk premium for all equity returns by 2.5%. This results in an overall adjustment or decrease of 150 basis points (60% of 2.5%) to total fund returns and produces returns in line with current market expectations.

The resulting scenarios were used to value the going-concern, solvency and PBGF exposure liabilities. The remainder of this section describes in detail the projection process.

The Projection Process

Going-Concern Liability Projections – Assumptions and Methods

The discount rate used to value the going-concern liabilities for the projections was set at 6.0% per annum. This was based on an expected long-term rate of return of 4.25% per annum for bonds and 7.5% per annum for equities, assuming a continuation of the current average asset split of 40% bonds and 60% equities, based on the IIS data provided for the 52 main plans. We added an allowance of 0.7% for active management, subtracted 0.5% for investment fees and 0.4% for adverse deviation, to produce the rate of 6.0%.

Mortality for all plans was based on the Uninsured Pensioner 1994 Mortality Table projected to 2020, using projection scale AA. No additional improvements were contemplated over the projection period.

Termination, disability and retirement rates were assumed to continue to be based on the plan-specific tables used in the matching valuation for each plan.

Future salary increases were assumed to include a merit and inflationary component, depending on the assumptions used for the matching valuation. The merit component, if specified, was assumed to continue at the same rate as in the matching valuation. The inflationary component was stochastically generated.

Increases to the Year's Maximum Pensionable Earnings (YMPE), where relevant, and assumed increases in the maximum pension allowed under the Income Tax Act (ITA) were set at an initial rate of 2.5%, and stochastically modelled in the future based on changes in the stochastic inflation assumption.

The percentage of members assumed to be married and the age difference between males and females were based on the same assumptions used in the matching valuation.

For flat benefit plans, it was assumed that benefit rates for actives and pensions in payment would be increased on an annual basis by 2% each year.

In all cases, the projected unit credit method prorated on service was used and assets were taken at market value.



Solvency Liability and PBGF Exposure Projections – Assumptions and Methods

The future discount rates used in the projection of the solvency liabilities were stochastically generated. For members whose benefits were assumed to be settled by commuted value, we modelled the yield curves from the bond series dictated by the Canadian Institute of Actuaries (CIA) to be used to generate the discount rates. We assumed that the current method outlined by the CIA to determine the initial rate would remain unchanged over the projection period. For simplicity's sake, we also assumed the thereafter rate would equal the initial rate.

Similarly, for members whose benefits were assumed to be settled by annuity purchase, we modelled the yield curve from the bond series currently dictated by the Canadian Institute of Actuaries (CIA) to be used to generate the discount rate, and we assumed that the current method outlined by the CIA to determine the rate would remain unchanged over the projection period.

The assumptions for members assumed to elect a commuted value compared to an annuity were based on the same assumptions used in the matching valuation.

Mortality for all plans was based on the Uninsured Pensioner 1994 Mortality Table projected to 2020, using projection scale AA. No additional improvements were contemplated over the projection period.

Each year, the plan membership data was projected based on the plan-specific termination, disability and retirement rates included in the matching valuation for each plan and the mortality table noted above.

Salary increases, increases to YMPE (where relevant), increases to ITA maximum pensions and benefit increases for flat benefit plans were incorporated year by year, using the same stochastically generated assumptions as used for the going-concern projections.

The percentage of members assumed to be married and the age difference between males and females were based on the same assumptions used in the matching valuation.

In all cases, assets were taken at market value.

The benefits valued were adjusted each year to include a further year of service for active and disabled members (in cases where the plan was not closed to future accrual), and to incorporate any additional benefits, such as funded special allowance benefits, that a member would qualify for at the projected valuation date based on projected age and service, as relevant.

New Entrants

Within the liability projections, an assumption for new entrants was included for plans that are open to new entrants. A new-entrant profile was set up on a plan-specific basis, based on the average age of actual new entrants that entered the plan in the past five years, and introduced so as to maintain a constant number of active members over the projection period.

Asset Projections

For each of the main plans, the assets were taken at market value as of the last filed actuarial valuation report. Assets were assumed to be invested 40% in bonds, 30% in Canadian equities, 15% in U.S. Equities and 15% in International Equities. These figures are based on the average asset mix for the 52 main plans based on data provided in the 2008 Investment Information Summaries. Actual asset mixes were not used due to the volume of data and the general observation that the majority of plans were invested closely in line with the assumed asset mix of 40% bonds and 60% equities.

Assets for all of the main plans were extrapolated to January 1, 2010, based on the benchmark asset returns from the valuation date to the end of November 2009. The return in December 2009 was unknown at the time assets were being projected, and was assumed to be zero. Allowance was made in the projection of assets for the expected contributions and benefit payments based on the projected liability runs and the appropriate actuarial assumptions. Future asset values were stochastically projected, based on the average asset mix as noted above.

Each plan was assumed to file a valuation as of January 1, 2010, and take advantage of the solvency funding relief provision available in Ontario to consolidate and re-amortize any past solvency deficiency payments over a five-year period commencing on January 1, 2010. All plans were assumed to file annual valuations thereafter, regardless of future funding levels. Future contributions were determined each year in line with the minimum funding requirements of the Ontario Pension Benefits Regulations, for each of the 500 economic scenarios based on the projected going-concern and solvency funded positions. Plan sponsors were assumed to take a contribution holiday in scenarios where the plan was in both a going-concern and solvency surplus for a particular year under a particular scenario.

Special Cases

The Ontario Regulations 99/06 (Stelco Inc. Pension Plans) and 321/09 (General Motors Pension Plans) were reflected.

Stelco Inc. Pension Plans

Allowance was made within the relevant plans for the contribution requirements set out in the Regulations, where these requirements were greater than the minimum requirements under the Ontario Pension Benefits Regulations.

General Motors Pension Plans

The plans' assets as of January 1, 2010 were calculated as outlined above, including the additional contributions made after the last valuation date and prior to January 1, 2010, as outlined in the Regulations. Allowance was then made in the projections for the future contribution requirements set out in the Regulations, where these requirements were greater than the minimum requirements under the Ontario Pension Benefits Regulations. The split of the contributions between the two plans was based on the estimated solvency liabilities as of January 1, 2010. No allowance was made for any grow-in benefits, since these benefits will only be provided on wind-up if there are funds available, in which case there would be no claim against the PBGF. The claim against the PBGF and the PBGF premiums were reviewed under all 500 scenarios and set to equal zero where the plan had not been fully funded on a solvency basis for three consecutive prior years on or after January 1, 2010.



Given the special circumstances required to be reflected for these two plan sponsors, projections of these plans were only carried out over a 10-year time horizon. For this reason, the actuarial present value analysis discussed in Section 8 was also limited to a 10-year time horizon (to allow for the inclusion of the Stelco Inc. and General Motors pension plans in our analysis).

Unfunded Plant Closure/Permanent Layoff Benefits

The value of any unfunded plant closure/permanent layoff benefits is required to determine the PBGF premium. In all cases where it was relevant, the value was available in the last filed valuation report. In general, though, the valuation reports did not provide sufficient detail on these benefits to value them to a sufficient degree of accuracy. As a result, we assumed that the relative value of these benefits would remain consistent from year to year, and we adjusted the value only to reflect changes in the discount rates, based on the ratio of their value to the plan's solvency liabilities.

Modelling the Other Plans

The data provided for the other 1,514 plans was limited to the following data as of January 1, 2008:

- market value of assets,
- solvency liabilities,
- PBGF liabilities,
- total membership,
- industry, and
- plan type.

An Ontario ratio was determined as the ratio of the PBGF liabilities to the solvency liabilities, and applied to the total number of members and to the market value of assets to estimate the number of Ontario members and the Ontario assets as of January 1, 2008. Two of the main plans (one flat benefit and one final average) that were deemed to be suitably representative of the other plans were used to extrapolate results for each of the other plans, for each future year and for each scenario, using the base data provided for these other plans as the starting point. We assumed that none of these plans had any unfunded plant closure/permanent layoff benefits. We assumed all of these plans were open to new entrants in the future.

Results

The following data was extracted from the Plan Projection Module for each plan, for each year, and for each scenario and fed into the PBGF Insurance Model:

- solvency funded ratio,
- Ontario assets,
- PBGF liabilities,
- PBGF claims exposure,
- Ontario membership, and
- unfunded plant closure/permanent layoff benefits.

7

Methods & Assumptions Part II: Insurance Model & Insolvency Projection Module

Insurance Model

Introduction

The PBGF currently falls somewhere between a pay-as-you-go insurance model and level annual premium insurance model in terms of assessments. However, because future expected claims and future expected assessments are not taken into account in the determination of the current assessment level, it functions primarily as a pay-as-you-go plan. The pay-as-you-go model works well when expected costs (claims) are aligned with expected contributions (assessments). However, it is not appropriate when costs are expected to rise against contributions.

Given the lack of new defined benefit pension plans, the PBGF's universe of covered plan sponsors represents a closed block of business. For every plan sponsor that becomes insolvent, there is one less plan to support PBGF risks and the cost to remaining plan sponsors rises. One way to address this problem is to amortize the cost and replace the pay-as-you-go premium by a level annual premium that fully recognizes future expected claims and assessments. However, between the extremes of the pay-as-you-go model and the level annual premium model, there is an infinite range of permutations based on establishing appropriate reserves.

Calculating Reserves

At its simplest, an insurance model should generate a level of contributions that, on a present value basis, is expected to be sufficient to pay for all future expected claims (costs), after recognizing the existing fund's balance.

The level of assessments (contributions) will be derived as follows:

$$C = (\text{Plans} \sum PV(\text{BEN}_t) - \text{FB}_{t=0}) / \text{Plans} \sum PV(\text{AP}_t)$$

where:

C = Level of contributions

$\text{FB}_{t=0}$ = fund balance of the PBGF, used to reduce the total expected cost

BEN_t = future expected benefits in year t

$\text{Plans} \sum PV(\text{BEN}_t)$ = sum over all future years of the present value of future expected benefits for all plans

AP_t = the active population, which could be expressed based on members, assets, or any other factor or combination of factors



${}^{\text{Plans}}\Sigma\text{PV}(\text{AP}_t)$ = sum over all future years of the present value of the active population for all plans

The future expected benefits (BEN_t) referred to above are based on calculations generated from our stochastic projections. In this context, “expected” does not necessarily mean an average cost.

It should be noted that the above present values were generated on the assumption that no plan sponsors terminate their participation in the PBGF other than by insolvency.

If future expected contributions equalled the future expected benefits, not only on a present-value basis but also every year, namely:

$${}^{\text{Plans}}\Sigma\text{PV}(\text{BEN}_t) = {}^{\text{Plans}}\Sigma\text{PV}(C_t)$$

and,

$$\text{BEN}_t = C_t \quad - \text{ for every year } t$$

there would be no need to build an insurance reserve. An insurance reserve (${}^{\text{INS}}R$) can be defined as the amount of accumulated funds an insurer must retain from current earnings in order to pay for future benefits in excess of future contributions. In the case of pay-as-you-go funding, there is no need to build up a reserve, as every premium is sufficient to pay for the benefits. In the case of a level annual premium, however, where there is an excess in the early years and a deficit in the later years, a reserve will be built at every year in the future.

Therefore, at any year t :

$${}^{\text{INS}}R_t = {}^{\text{Plans}}\Sigma\text{PV}(\text{BEN}_t) - {}^{\text{Plans}}\Sigma\text{PV}(C_t)$$

where

${}^{\text{Plans}}\Sigma\text{PV}(C_t)$ = sum over all future years of the present value of future expected contributions for all plans

In other words, the reserve at a future time t is equal to the present value of future expected benefits less the present value of future expected contributions.

These concepts apply to the PBGF in respect of expected benefits and expected contributions, however, the contributions at time t (C_t) are not equal to the assessments at time t (A_t), nor are their respective present values.

$$C_t \neq A_t$$

and

$${}^{\text{Plans}}\Sigma PV(C_t) \neq {}^{\text{Plans}}\Sigma PV(A_t)$$

where

$$A_t = \text{the actual assessment in year } t$$

This creates a disparity between the fund or reserve actually built up and the one that would exist if the PBGF had to recognize a true insurance reserve.

If we substitute the contribution factor in the above formula with the assessment factor, we obtain a new and different reserve (${}^{\text{PBGF}}R_t$):

$${}^{\text{PBGF}}R_t = {}^{\text{Plans}}\Sigma PV(\text{BEN}_t) - {}^{\text{Plans}}\Sigma PV(A_t)$$

It is important to note that if the PBGF were to increase the assessments by any factor, the reserve would be correspondingly reduced. If the PBGF were to decrease the assessments by any factor, the reserve would be correspondingly increased.

Therefore, the two main components that must be determined to calculate the reserve are future expected claims (benefits) and future expected assessments (contributions).

Projecting assessments and claims

Future expected claims are determined based on three factors:

- the current benefits based on the PBGF formula;
- the number of future expected insolvent plan sponsors, year-by-year; and
- a reasonable discount rate.

While the benefits payable under the PBGF are known, the value must be estimated, as it will ultimately depend on economic and demographic assumptions and experience. However, the key unknown factor is the number of future expected insolvent plan sponsors.

Assessments are determined based on three factors:

- the current assessment formula;
- the number of future expected solvent plan sponsors, year-by-year; and
- a reasonable discount rate.

Here again, the first factor is known, and a reasonable assumption can be used for the third factor. The key unknown factor is the number of future expected solvent plan sponsors.



Once we have determined the insolvency rates, the final main formula will become:

$${}^{\text{PBGF}}R_t = \text{Plans} \sum \text{PV}(\text{IR}_t \times \text{EXP}_t) - \text{Plans} \sum \text{PV}(A_t)$$

where:

IR_t = insolvency rates in year t

EXP_t = the exposure in year t of plan sponsors to a claim under the PBGF

In effect, we have replaced the general BEN_t term in the previous formula and generated a PBGF-specific formula.

The discount rate used in the above formula and in our calculations is a simple flat discount rate. If the PBGF was funded in a way to build up a reserve, then a proper asset-liability management (ALM) program would be the normal practice to manage the reinvestment risk. By implementing an ALM program, the reserve would be impacted and, in all likelihood, reduced.

We used the current PBGF assessment formula in our calculations.

Insolvency Projection Module

Introduction

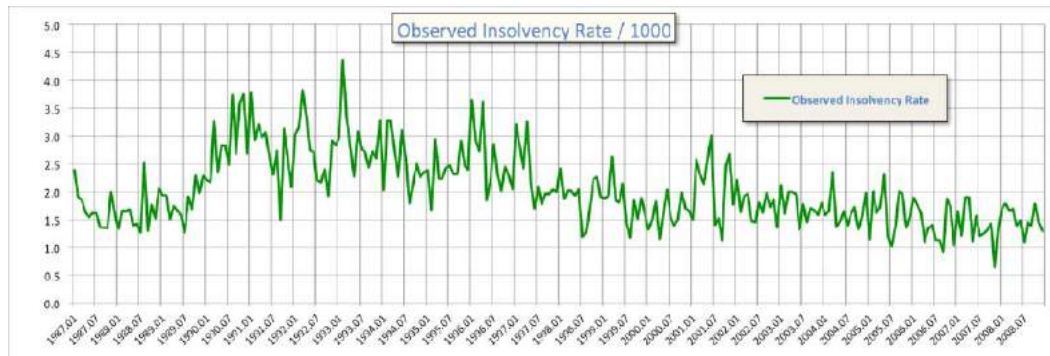
Insolvency risk is a “systemic” risk. The rate of occurrence of this type of risk can vary widely based on external factors (such as GDP or unemployment rates) or an event that affects a large number of entities, such as a drop in the stock market. This is contrary to a “deterministic” risk, where the probability of occurrence is both easily determinable and credible.

From a technical perspective, the key difference between a systemic risk and a deterministic risk is that the former must be priced on a percentile (see *Glossary* for definition) or distribution basis (e.g., 90% certainty that the risk premium is sufficient) and the latter can be priced on an average basis on account of its predictable level. The percentile approach can also be replaced by what is called Conditional Tail Expectation (CTE). This approach is explained in Section 8 (see *Level of Funding from an Insurance Company Perspective*).

To project plan sponsor insolvencies, we began by analyzing the insolvency rates of corporations in Canada over a 21-year period based on the following sources:

- The number of business bankruptcies (incorporated businesses), data provided by the Office of the Superintendent of Bankruptcy Canada (OSBC) on special request, and for Ontario incorporated businesses (January 1987 to September 2009 – the data was limited to this period, hence the reason for the 21-year range); and
- The number of incorporated businesses for Ontario from Statistics Canada, CANSIM Table 178-0001 (March 1980 to December 2006, extrapolated to December 2008).

Chart 7.1: Insolvency rates of Canadian corporations over past 21 years



Over this 21-year period, the observed rates of business bankruptcies varied from a low of 0.65 per 1,000 to a high of 4.36 per 1,000.

Our objective was to reliably project future expected insolvency rates by determining a correlation between relevant economic factors and the insolvency rates. To this end, we analyzed and determined the relationship between these insolvency rates and three economic series, as projected by GEMS®:

1. 6-month Treasury Bill (positively correlated),
2. Ontario GDP growth rates (inversely correlated), and
3. Ontario unemployment rates (positively correlated).

Although we also explored the correlation between insolvency rates and the Ontario CPI, the fit was not close, so we excluded it from any further comparisons. The following three graphs show the correlation between the observed insolvency rates and each of the three economic series:

Chart 7.2: Comparison of observed insolvency rates and 6-month T-bill over past 21 years

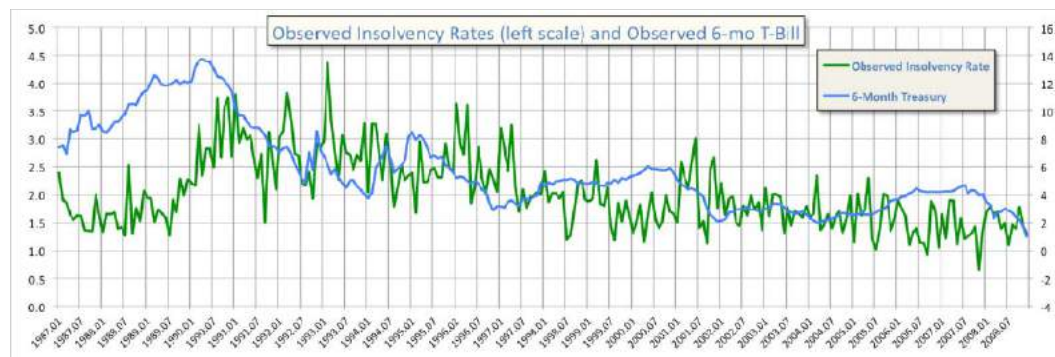




Chart 7.3: Comparison of observed insolvency rates and Ontario GDP growth rates over past 21 years

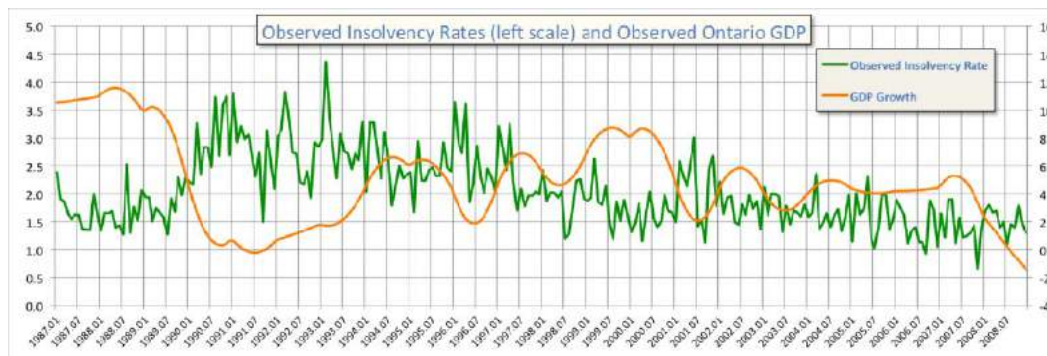
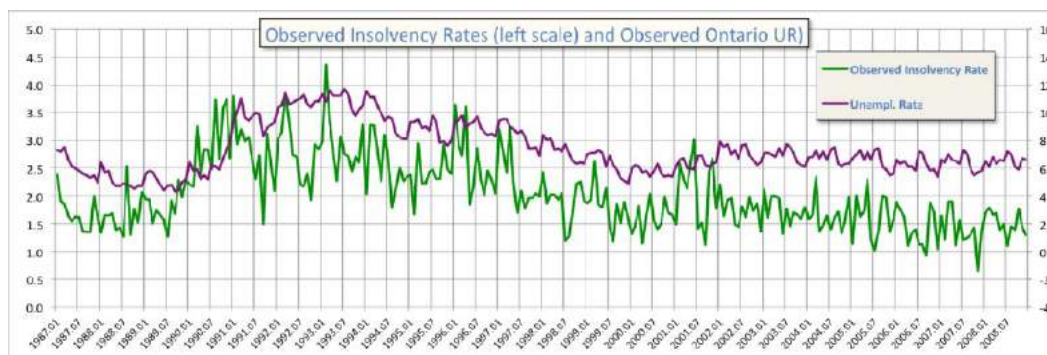


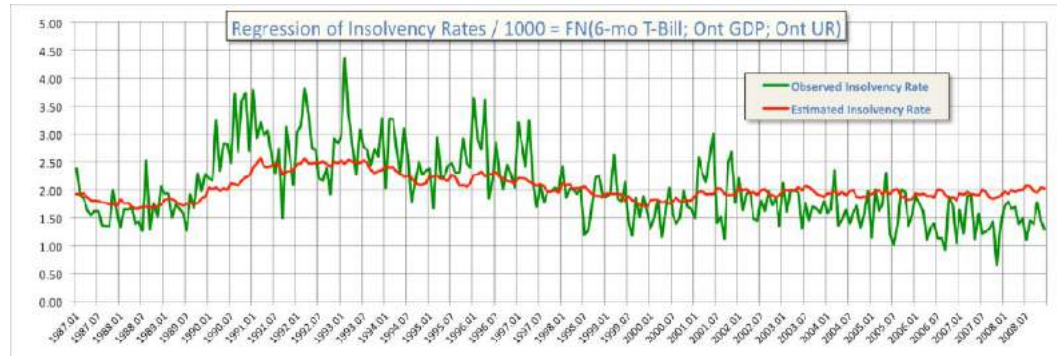
Chart 7.4: Comparison of observed insolvency rates and Ontario unemployment rates over past 21 years



The correlation between the insolvency rates and the economic series can be easily observed, albeit not perfectly. The overall average of the observed rates was 2.03 per 1,000 with a standard deviation of 0.64. This means that about two-thirds (68%) of the observed insolvency rates fall between 1.39 and 2.67 per 1,000 businesses (the equivalent of one standard deviation).

Our first attempt (as graphed below) was to use a simple three-factor linear regression. The derived calculated rates had the same average of 2.03 but a standard deviation of only 0.22. The correlation between the observed rates and the calculated ones under this first attempt was 67.7%. The R^2 coefficient of determination, indicating how well the regression model matches observed experience (an R^2 value of 100% indicates a perfect match), was 45.8%.

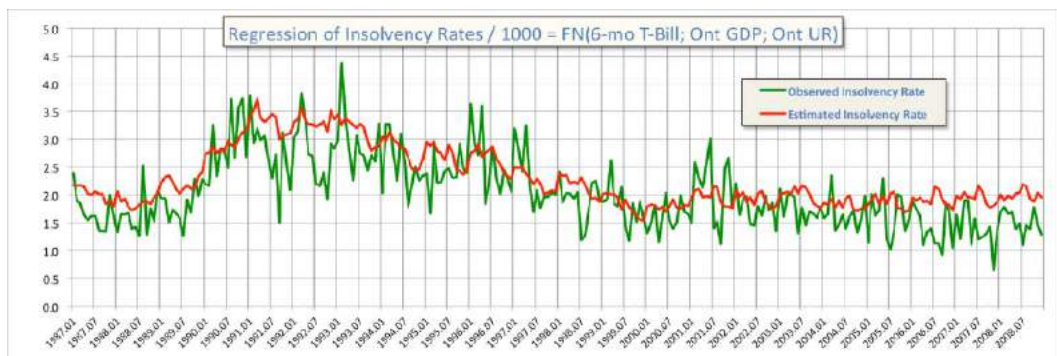
Chart 7.5: Comparison of observed insolvency rates and calculated insolvency rates using three-factor linear regression



The calculated rates did not capture as many of the extreme cases as those observed. Therefore, it was necessary to refine the regression formula to achieve a better fit.

We applied manual adjustments to the regression factors based on judgment with respect to the fit. The end result was a new fitting formula with a higher correlation of 73.9% and a closer standard deviation of 0.53 (vs. 0.64 on the observed rates). However, the trade-off was to increase the overall average rate from 2.03 to 2.29 insolvencies per 1,000, or a 12.8% increase. Since this is not a significant variation from the original average, no further adjustment was judged necessary. The R^2 coefficient of determination was 54.5%.

Chart 7.6: Comparison of observed insolvency rates and calculated insolvency rates using three-factor linear regression with adjustments





The final regression formula used is as follows:

$$IR_t = (0.40 \times (1.5 + 0.25 \times 6\text{-Mo.TBill}_t)) + (0.3 \times (2.1 - 0.16 \times GDP_t)) + (0.30 \times (-3.1 + 0.75 \times UR_t))$$

Correlation = 73.9%, Mean = 2.29, Standard Deviation = 0.53

The above three-factor insolvency risk regression formula represents a mathematical determination of the risks based on economic factors on average. No margin for adverse deviation was added to the above formula.

To address the differences in insolvency rates between specific industries, we applied the following multipliers based on Annual Business Insolvency Rates by NAICS Economic Sectors (Canada):

1. Average risk and general industries: multiplier factor of 1.00.
2. Manufacturing industries: multiplier of 2.00 (based on empirical observations).
3. Sector judged to be low-risk, such as hospitals and universities: multiplier factor of 0.50 (based on empirical observations).

The following industries/plan sponsors were considered separately:

4. Sector judged to be governmental-type: multiplier of 0.05 (close to, but not, nil).
5. Plan sponsors considered insolvent: the insolvency rate is set to 1.

We explicitly projected 52 individual plans and the remaining plans were modelled using the two representative sample plans. We randomly determined the risk factor for the modelled plans so there was a 50% probability of being categorized with a risk factor of 1.00 (average risk) or 2.00 (manufacturing level of risk).

The use of the average (the mean) is generally accepted to be sufficient to determine the premium (pricing) or the cost of a benefit in the case of a very large number of observations of homogeneous risks, such as mortality risk. However, in the case of the PBGF, risks are not homogeneous for the following reasons:

1. There are a variety of different plans, from small plans to very large plans.
2. The funded ratio may vary significantly from plan to plan.
3. The risk is of a systemic nature as opposed to deterministic, based on reliable observed past experience.
4. The number of risks is not statistically credible — there are only 1,580 plans covered by the PBGF.

Stochastic Determination of Insolvency

The way to address a lack of statistical credibility is to estimate the incidence of insolvency stochastically. For this purpose, we used a Monte Carlo simulation.

For every one of the 500 economic paths, and for each of the projection years, we calculated the deterministic insolvency rate following the derived formula for IR_t (see the regression formula following Chart 7.6).

For example, if the calculated insolvency rate is 3.00 per 1,000, or 3,000 per 1,000,000, for a particular path and a particular year, with a Monte Carlo approach we, in effect, roll a 1,000,000-face die for each plan. If the number is between 1 and 3,000, we assume insolvency for this plan that will generate a claim against the PBGF if the plan is underfunded. If the number is between 3,001 and 1,000,000, we assign an insolvency rate of 0 (the plan sponsor remains solvent and continues to pay assessments for that year). We roll 20 times for every one of the 500 paths, every year, so 10,000 times in total for each plan and each year. A 1,500-roll process is usually considered sufficient to provide reasonably accurate stochastic projections, although 5,000 is the preferred minimum target. With 10,000 rolls, we increase the statistical probability of covering virtually all possibilities.

With 500 paths, 55 years, 20 rolls, and 1,543 plan sponsors (insolvencies are determined on a plan sponsor basis, not an individual plan basis), we stochastically produce 848,650,000 tests – nearly one billion. The insolvency rates that we have produced using this technique range from a minimum of 0.3 per 1,000 to a maximum of 6.2 per 1,000. Considering that the past empirical experience upon which we have determined the relationship was a range of 0.65 to 4.36 per 1,000, we have a slightly wider range of insolvencies going forward.

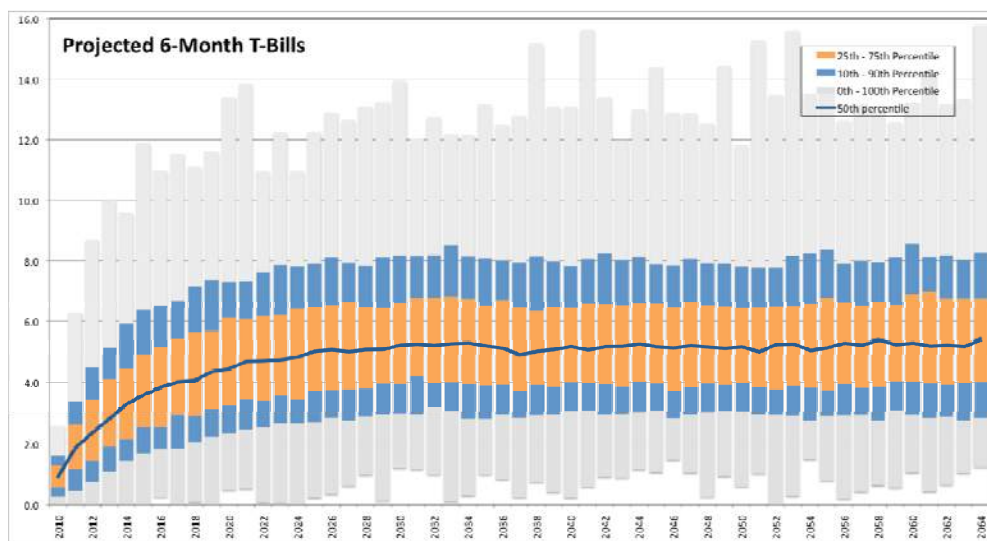


Results

Looking forward to the next 55 years, we now reflect the 500 economic paths together with 20 simulated insolvencies for each year and each plan sponsor. What we show is a distribution together with various percentiles, first for each of the three factors that we have considered, and finally with the projected insolvency rates.

Projected 6-Month T-bills

Chart 7.7: Projected 6-month T-bills between 2010 and 2064

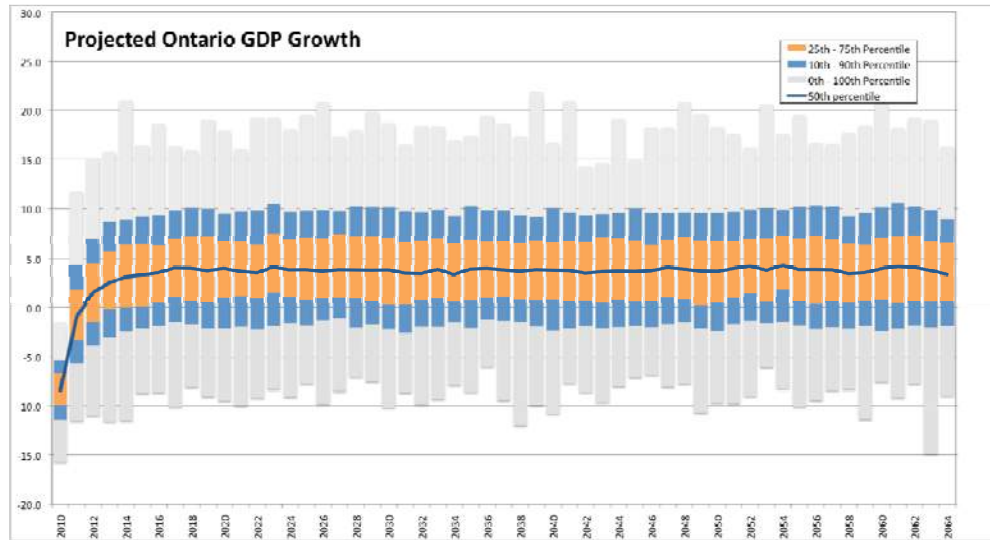


The minimum rate reached is 0% and the maximum is 15.8%. While these are the extremes, actual past experience in 1982 and 2009 clearly demonstrates that these extreme rates are possible.

The variation is wide if we include 100% of the observations, but significantly narrower for the 10th and 90th percentiles. We can also clearly observe a reversion to the mean at about 5%.

Projected Ontario GDP Growth

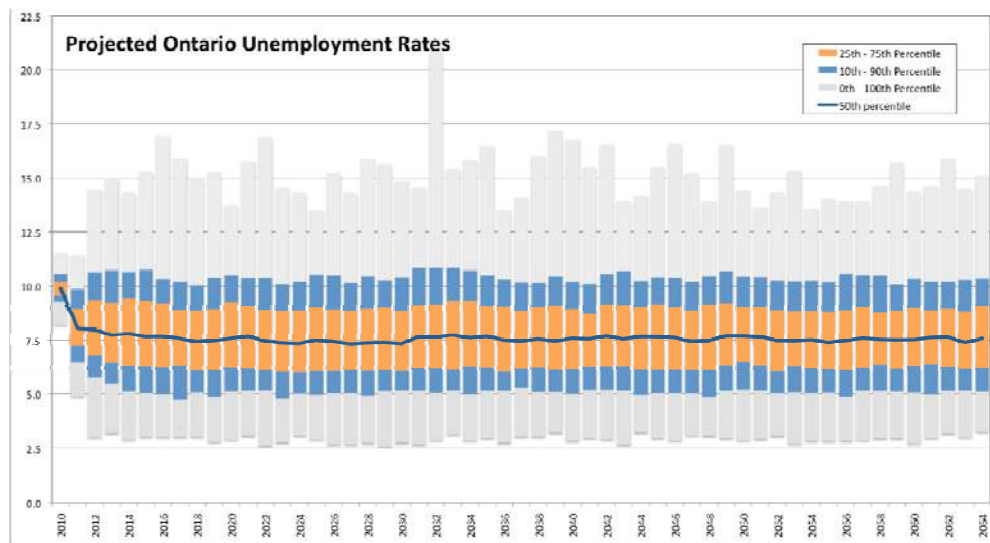
Chart 7.8: Projected Ontario Nominal GDP growth rates between 2010 and 2064



The minimum rate reached is -15.7% and the maximum is 21.8%. Again, the range is wide but roughly -2.5% to 10% for the 10th and 90th percentiles, respectively. We can also clearly observe a reversion to the mean at about 4%.

Projected Ontario Unemployment Rates

Chart 7.9: Projected Ontario unemployment rates between 2010 and 2064

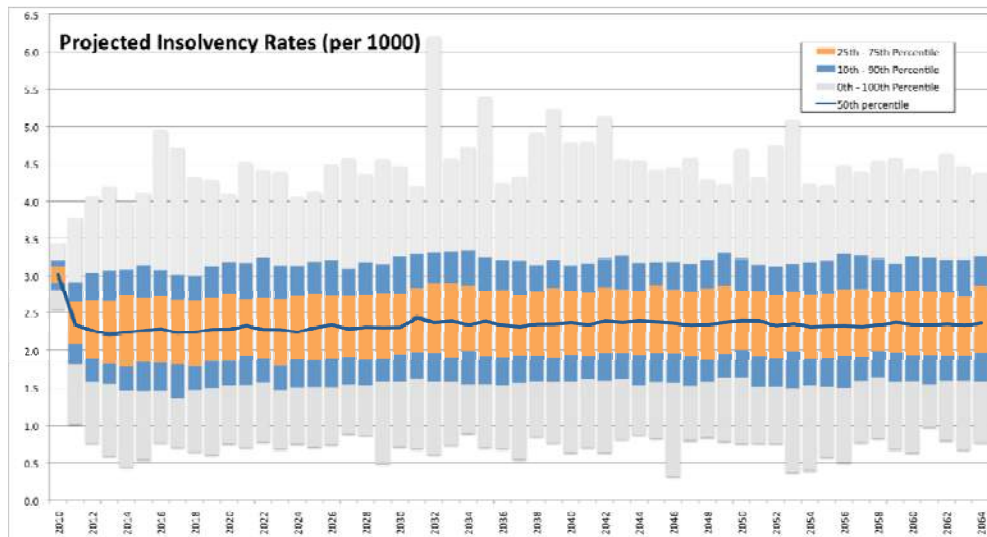


The minimum rate reached is 2.6% and the maximum is 20.9%. The range is wide but otherwise realistic. The range is roughly 5% to 11% for the 10th and 90th percentiles, respectively. We also observe a reversion to the mean at about 7%.



Projected Insolvency Rates (per 1,000)

Chart 7.10: Projected insolvency rates between 2010 and 2064



By applying our derived regression formula for IR_t (see boxed formula following Chart 7.6), the minimum rate reached is 0.3 per 1,000 and the maximum is 6.2 per 1,000. The range is wide but roughly 1.5 per 1,000 to 3.25 per 1,000 for the 10th and 90th percentiles, respectively. The reversion to the mean at 2.3 per 1,000 is very close to the average of the past 21 years (determined as 2.29 per 1,000).

In our opinion, the economic factors projected using GEMS[®] are reasonable and the resulting insolvency rates are likewise reasonable.

8

Results & Looking Ahead

Summary

- *At March 31, 2009, the PBGF had assets of \$146 million on a cash basis and a deficit of \$47 million on an accrual basis.*
- *For the purposes of assessing the sustainability of the PBGF, we considered the fund on both an actuarial present value and a projected cash flow basis.*
- *On an actuarial present value basis, if treated as a private insurer, the PBGF would require an up-front reserve net of current claims at January 1, 2010 of between \$680 million and \$1.023 billion to cover expected future claims, depending on the desired level of margin for adverse deviation.*
- *In the absence of external funding, the PBGF funds will be depleted and unable to cover anticipated 2010 claims or any future claims.*
- *One-time external funding solely to cover anticipated 2010 claims would be insufficient for the PBGF to be sustainable over the long-run due to the volatile nature of future catastrophic claims.*
- *In addition to one-time external funding to cover anticipated 2010 claims, an increase in overall assessments in the order of 450% could be sufficient over the long-run to cover existing funding loan repayments and expected future claims plus expenses at the present coverage limit of \$1,000.*
- *If the coverage limit was increased to \$2,500, a 650% increase in assessments would be required.*
- *In the absence of any future external funding, an increase in overall assessments in the order of 800% would be required to ensure the sustainability of the PBGF with a high degree of certainty. If coverage was increased to \$2,500, a 1000% increase in assessments would be required.*
- *Securing additional financing on all future claims above a pre-defined catastrophic threshold, in combination with an increase in assessments and/or a reduction in coverage, could achieve PBGF sustainability.*

Historical Statistics on the PBGF

For the year ending March 31, 2009, the Pension Benefits Guarantee Fund received \$40.5 million in assessments. The assets of the fund totalled \$146 million on a cash basis at that date. The assets were invested mainly in short-term deposits, with some investment in government and corporate bonds, and asset-backed commercial paper.

The PBGF initially pays claims up-front based on the expected cost of settling benefits. The plan experience at final wind-up dictates whether an additional payment is required from the PBGF or if the PBGF recovers excess amounts paid. As of March 31, 2009, current outstanding claims (i.e.,



known insolvencies where the payment has not yet been made from the PBGF) were estimated at \$83.5 million.

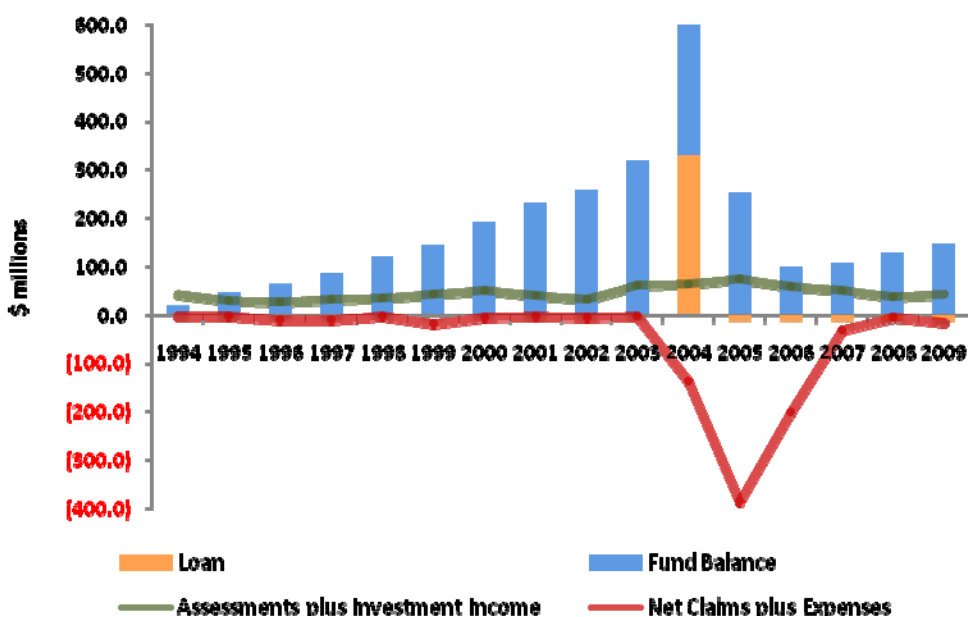
In addition, the Ontario government provided an interest-free loan to the PBGF in the amount of \$330 million on March 31, 2004, which is repayable in 30 annual instalments of \$11 million.

Table 8.1: PBGF Balance Sheet on Accrual Basis at March 31, 2009 (in \$millions)

Current Assets	\$195.2
Current Liabilities	(\$99.1)
Loan Payable	(\$143.5)
Deficit	(\$47.4)

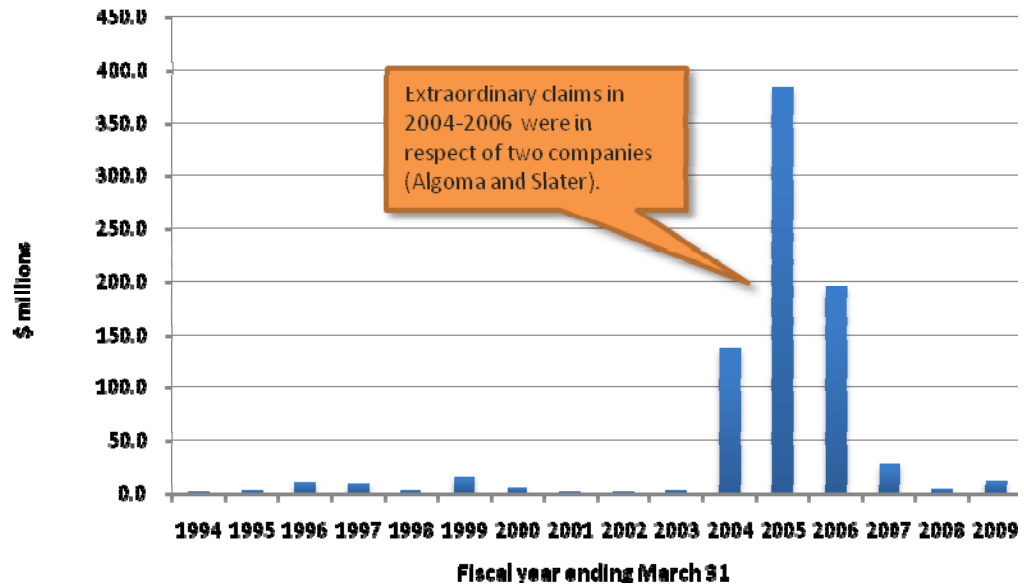
Since 1993, when the most recent change to premium rates was implemented, the total revenue (premiums and investment income) under the PBGF has been approximately \$724.2 million and the total claims (net of recovery) and expenses have been approximately \$831.6 million.

Chart 8.1: PBGF historical financial results in \$ millions



Since inception, the PBGF has paid \$853 million in claims (net of recoveries), which represents 164 claims in respect of 123 companies. Of the total claims paid, \$536 million relates to two companies.

Chart 8.2: Total PBGF claims (net of recoveries) in \$ millions



This highlights the extremely volatile nature of PBGF claims and the significant challenge catastrophic claims pose for the PBGF.

Table 8.2: Historical claim experience for PBGF in \$ millions

Average annual revenue (premiums and investment income):	\$45.3
Average annual claims (net of recovery) and expenses:	\$52.0
Average annual deficit	\$6.7
Largest annual total claims (net of recovery) and expenses:	\$383.1
Smallest annual total claims (net of recovery) and expenses:	\$1.0



Assessing Sustainability

For the purposes of assessing the sustainability of the PBGF, we have defined “sustainability” as the ability to meet the following conditions:

1. Future assessments must be sufficient to cover expected future claims plus expenses, with a high degree of probability based on the stochastically modelled result, on a present value basis.
2. In all situations where an employer becomes insolvent and there is an underfunding in the pension plan on its wind-up, the PBGF must have sufficient funds on a projected cash flow basis to meet the claim, within the prescribed limits, at any point in time.

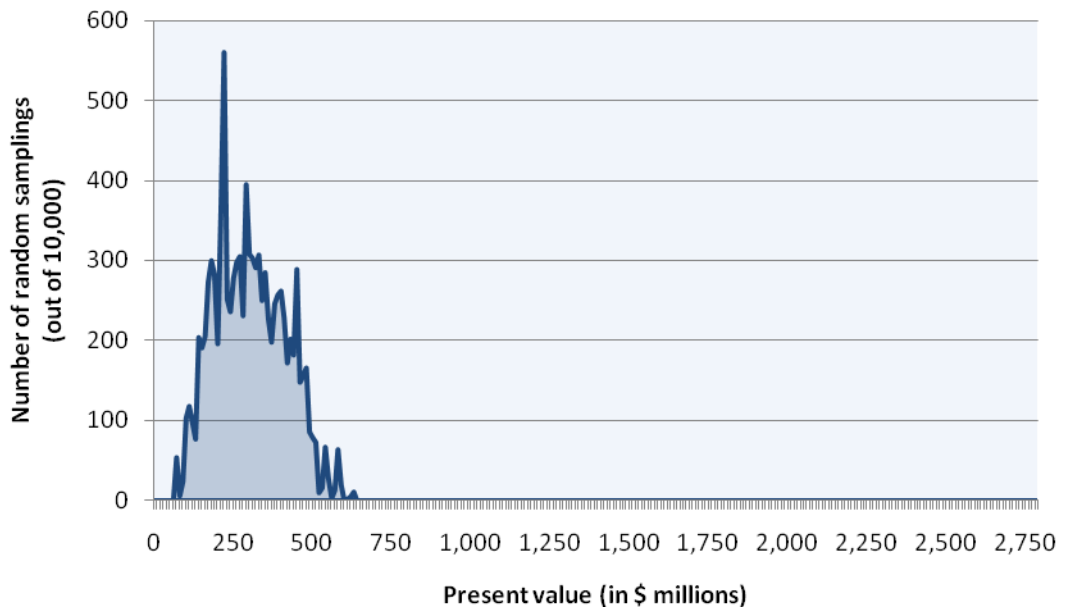
The sustainability of the PBGF was analyzed and assessed on both an actuarial present value basis and a projected cash flow basis. Under both bases, a Monte Carlo simulation consisting of 10,000 paths was used to project the expected PBGF assessments and the expected PBGF claims plus expenses over 10 years (from January 1, 2010 to December 31, 2019).

Actuarial Present Value Analysis

In this section, we look at an actuarial present value analysis of assessments versus claims. The present value is the value on a given date of a future payment or series of future payments, discounted to reflect the time value of money. The actuarial present value of a payment or series of payments, which are random variables, is the expected value of the present value of the payments, or equivalently, the present value of their expected values. Present value analysis is one method that can be used to determine an amount of reserve or “working capital.”

Chart 8.3 below shows the simulated distribution of the present value of assessments from 2010 to 2019 over 10,000 random samples.

Chart 8.3: PBGF simulated distribution of the present value of assessments from 2010 to 2019



Comparisons of key statistics are shown in Table 8.3.

Table 8.3: Statistics on present values of assessments from 2010 to 2019 (in \$ millions)

Percentile	Present Value of Assessments for Next 10 Years
99%	570
90%	448
75%	382
50%	289
25%	210
10%	157
1%	92
Average	296
Median	289
Std. Dev.	111

Chart 8.3 and Table 8.3 above show that the average present value of assessments over the 10 years commencing January 1, 2010 is \$296 million, with a median of \$289 million. In other words, 50% of the time we expect a present value of assessments over \$289 million and 50% of the time a value less than this amount.



Chart 8.4 and Table 8.4 below look at a similar comparison of the present value of net claims to the PBGF over the same period. They show two simulated distributions of the present value of net claims from 2010 to 2019 over 10,000 random samples. The first, shown in blue, is based on the current PBGF coverage limit of \$1,000. The second, shown in orange, is based on recommendations by the ECOP and assumes an increase in the PBGF Limit to \$2,500. As expected, increasing the PBGF Limit from its current level of \$1,000 to \$2,500 increases the net claim amount at every year/trial pairing in the simulation. Comparisons of key statistics are shown in Table 8.4.

Chart 8.4: PBGF simulated distribution of the present value of net claims from 2010 to 2019

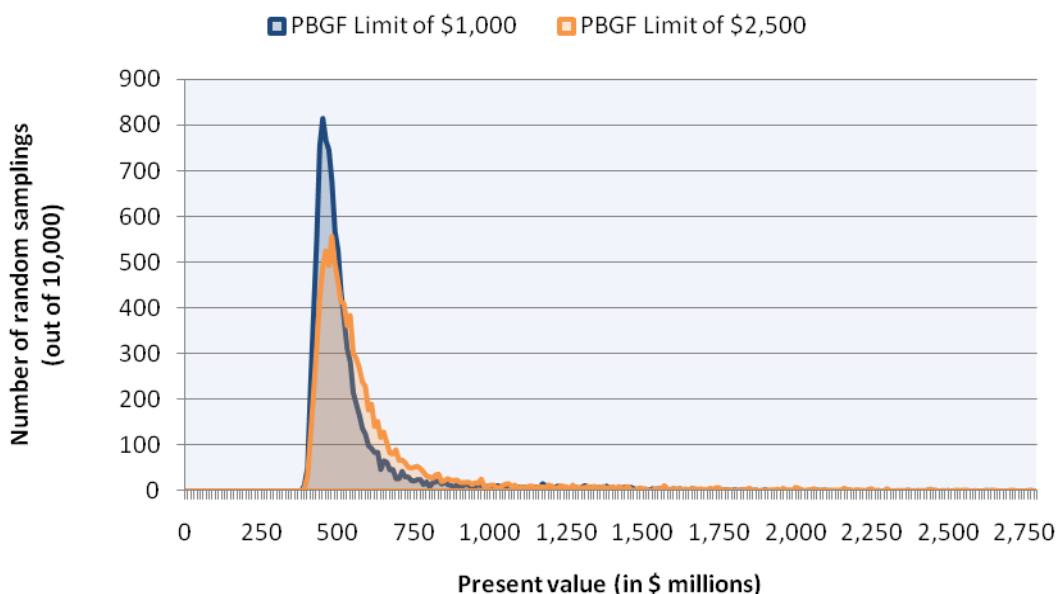


Table 8.4: Statistics on present values of net claims from 2010 to 2019 (in \$ millions)

Percentile	Net claims with PBGF Limit of \$1,000	Net claims with PBGF Limit of \$2,500
99%	1,545	2,156
90%	696	853
75%	540	618
50%	480	521
25%	446	467
10%	426	438
1%	403	406
Average	546	618
Median	480	521
Std. Dev.	218	323

Chart 8.4 and Table 8.4 show that the median present value of net claims over the 10 years commencing January 1, 2010 is \$480 million based on a maximum limit payable under the PBGF of \$1,000 per month and \$521 million based on a maximum limit payable under the PBGF of \$2,500 per month. This compares to the median present value of assessments over the 10 years commencing January 1, 2010 of \$289 million.

Based on the stochastic analysis above, the present value analysis shows that the present value of assessments is expected to be considerably lower than the present value of net claims.

We can take this analysis one step further and consider the present value of the assessment shortfall. We define the actuarial present value of assessment shortfall as follows:

$$APV_s = APV_c(1 + e) - APV_a$$

Where:

$$\begin{aligned} APV_s &= \text{Actuarial Present Value of Assessment Shortfall} \\ APV_c &= \text{Actuarial Present Value of Claims} \\ APV_a &= \text{Actuarial Present Value of Assessments} \\ e &= \text{Expenses} \end{aligned}$$

Note that a positive actuarial present value of assessment shortfall here indicates a deficiency in assessments versus net claims on a present value basis (i.e., the expected present value of assessments is lower than the expected present value of net claims).

Chart 8.5 and Table 8.5 show two simulated distributions of actuarial present value of assessment shortfall from 2010 to 2019 over 10,000 random samples. The first, shown in blue, is based on the current PBGF coverage limit of \$1,000. The second, shown in orange, is based on recommendations by the ECOP and assumes an increase in the PBGF coverage limit to \$2,500 after 2010.

Another way to read these results is that, in the absence of an increase in assessments, the actuarial present value of assessment shortfall is the amount of additional funding required up-front such that the desired probability of having sufficient funds in the PBGF to pay expected claims is met. For example, Table 8.5 suggests that a reserve of \$680 million would be required to have a 95% probability of having sufficient funds in the PBGF to meet the expected claims at any point over the next 10 years. If reserves are not available up-front, the amount required will be greater due to the accrual of interest, all else being equal.



Chart 8.5: PBGF simulated distribution of assessment shortfall from 2010 to 2019

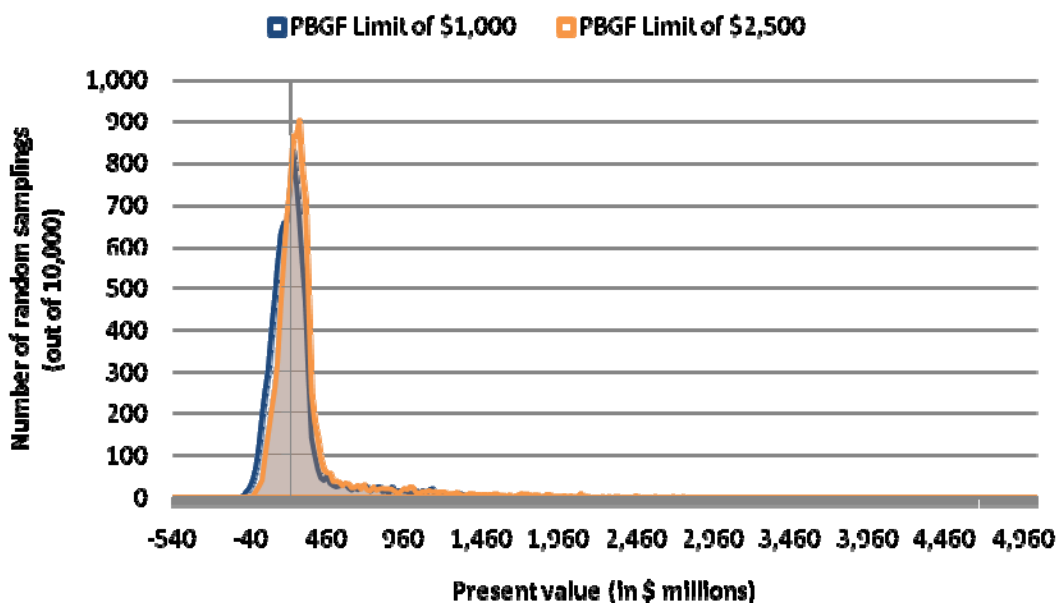
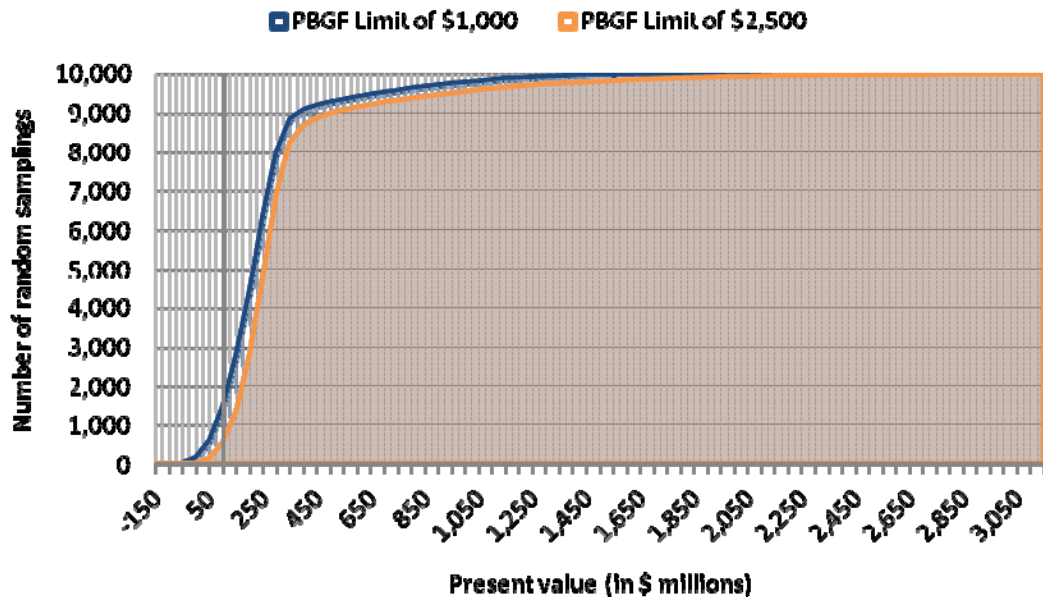


Table 8.5: Actuarial reserve requirement percentiles (in \$millions)

Percentile	Assessment Shortfall with PBGF Limit of \$1,000	Assessment Shortfall with PBGF Limit of \$2,500
99%	1,214	1,795
98%	1,031	1,442
97%	879	1,199
96%	771	1,047
95%	680	937
94%	584	817
93%	512	711
92%	452	628
91%	404	557
90%	376	498
75%	281	316
50%	215	254
25%	140	191
10%	77	134
5%	41	97
1%	(14)	43
Average	250	322
Median	215	254
Std. Dev.	220	310

Chart 8.6 shows a cumulative distribution of actuarial present values over the same 10-year horizon. It graphs the actuarial reserve requirements against the frequency of occurrences out of the 10,000 simulated paths. Chart 8.6 can also be interpreted as a graphical representation of the percentiles from 0% to 100% of the level of funding required to make the present value of assessments equal to the present value of claims plus expenses as of January 1, 2010. A subset of these percentiles is listed in Table 8.5. For example, in 9,500 out of 10,000 paths, the present value of required reserves is \$680 million assuming a PBGF Limit of \$1,000, or \$937 million when assuming a PBGF Limit of \$2,500. These numbers correspond to the values given in Table 8.5 at the 95th percentile. In other words, to be 95% certain that the present value of assessments will not fall below the present value of claims plus expenses, a fund balance of at least \$680 million would be necessary on January 1, 2010, when using a PBGF Limit of \$1,000 (or \$937 million when using a PBGF Limit of \$2,500).

Chart 8.6: PBGF simulated cumulative distribution of actuarial reserves from 2010 to 2019



Level of Funding from an Insurance Company Perspective

As explained in Section 7, the risk to which the PBGF is exposed, namely the cost of unfunded pension plan liabilities for insolvent plan sponsors, is of a systemic nature. Systemic risks cannot be reliably priced or reserved based on averages. A better approach is to quantify this type of risk using stochastic simulation to analyze the distribution of results and, in particular, the outliers or the tail of the distribution.

The Canadian Institute of Actuaries (CIA) has developed Standards of Practice (SoP) that address a number of risks, including systemic risks. The Conditional Tail Expectation (CTE) is the measure used by the CIA to define the range of acceptable policy liabilities when stochastic methods are used. The CTE can be defined as the average of the outcomes that exceed a specified value such as the Qth percentile, represented as CTE(Q). For example, CTE(60) is the average of the 40% highest cost scenarios and CTE(0) would represent the overall mean, or the average of all scenarios.



In the Canadian insurance industry, it is generally accepted by the CIA and by the regulator, the Office of the Superintendent of Financial Institutions (OSFI), that there are three levels of determination of risk:

1. Pricing – this is a reflection of the true best-estimate,
2. Valuation or reserve – this is based on best-estimate assumptions plus a margin for adverse deviation (“MfAD”) to account for a misestimation and deterioration of the mean, and
3. Surplus or solvency – target level of capital that enables a company to absorb significant unforeseen losses and fulfill its obligations with very high probability.

The range of acceptable practice for a life insurance company's valuation and solvency basis is mandated by the CIA and OSFI, while the pricing basis is left to the judgment of the actuary. However, the pricing best-estimate basis comes first (the valuation basis and cost of solvency capital is reflected in the pricing). The results in this report represent our best-estimate assumptions, analogous to the pricing basis used by a life insurance company. The question remains as to the recommended level of funding for the PBGF.

A reasonable pricing basis for systemic risks would be at a level of CTE(50). This means that the pricing basis would be equal to the average of all projected claims above the 50th percentile. Because the distribution of the risks is of a long-tail nature and not a normal curve, CTE(50) generates a level just above the 89th percentile.

With respect to the valuation basis, the CIA's SoP recommends a range of CTE(60) to CTE(80). In other words, CTE(60) should be the minimum reserve, which generates a level just above the 91st percentile. CTE(80) would represent the maximum reserve level, which generates a level above the 93rd percentile.

For solvency purposes, CTE(95) is usually the recommended level for the total asset requirement. The total asset requirement is the sum of the reserves plus additional required solvency capital. This represents a level just below the 98th percentile. In other words, there would still be a residual risk of about 2% that future expected claims would exceed the reserve and surplus of the company.

From an insurance company perspective, the three levels of funding as explained above would be necessary (i.e., up to CTE(95)). While the PBGF is not an independent insurance company, it should not be assumed that the PBGF can't be made independent of government and act like a private insurer. Otherwise, ongoing government assistance may be required, as the PBGF may not be sustainable as a self-financed organization. Given the high degree of uncertainty in the estimate of the PBGF liabilities, and the need to be able to absorb significant unforeseen claims and fulfill its obligations with a high degree of certainty, an appropriate CTE level would be at the solvency funding level, CTE(95). This implies that the PBGF's capital requirement would be \$1.023 billion assuming a PBGF Limit of \$1,000, or \$1.452 billion assuming a PBGF Limit of \$2,500.

Table 8.6 shows the CTE(Q) values for various percentiles, Q.

Table 8.6: CTE measurement at Qth percentile

Q	CTE(Q) with PBGF Limit of \$1,000 (10-year projection)	CTE(Q) with PBGF Limit of \$2,500 (10-year projection)
99	1,514	2,230
98	1,310	1,917
97	1,189	1,715
96	1,098	1,570
95	1,023	1,452
94	958	1,355
93	899	1,269
92	848	1,195
91	802	1,128
90	759	1,068
80	542	724
75	491	648
60	405	513
50	369	464
25	306	385
10	273	348
5	262	336
1	252	325

Projected Cash Flow Analysis

Comments on the charts

Charts 8.7-8.12 represent stochastic projections of the end-of-year fund balances under six scenarios. In each case, we show an orange line that represents the median fund balance (i.e., half of the projected fund balances are higher and half are lower than this amount in each year of our projection period). We also show blue bars each year that represent percentiles. A percentile is the value of a variable below which a certain percent of observations fall. Therefore, the 75th percentile represents the value under which fund balances fell in 75% of the simulations. Finally we show a red box, which estimates the probability of a negative fund balance in the year of projection.

We define the “probability of ruin” to be the percentage of paths out of the 10,000 produced in the Monte Carlo simulation where the fund balance is negative at least once in any year from 2010 to 2019. This probability of ruin is based on the methods and assumptions used in the stochastic analysis.

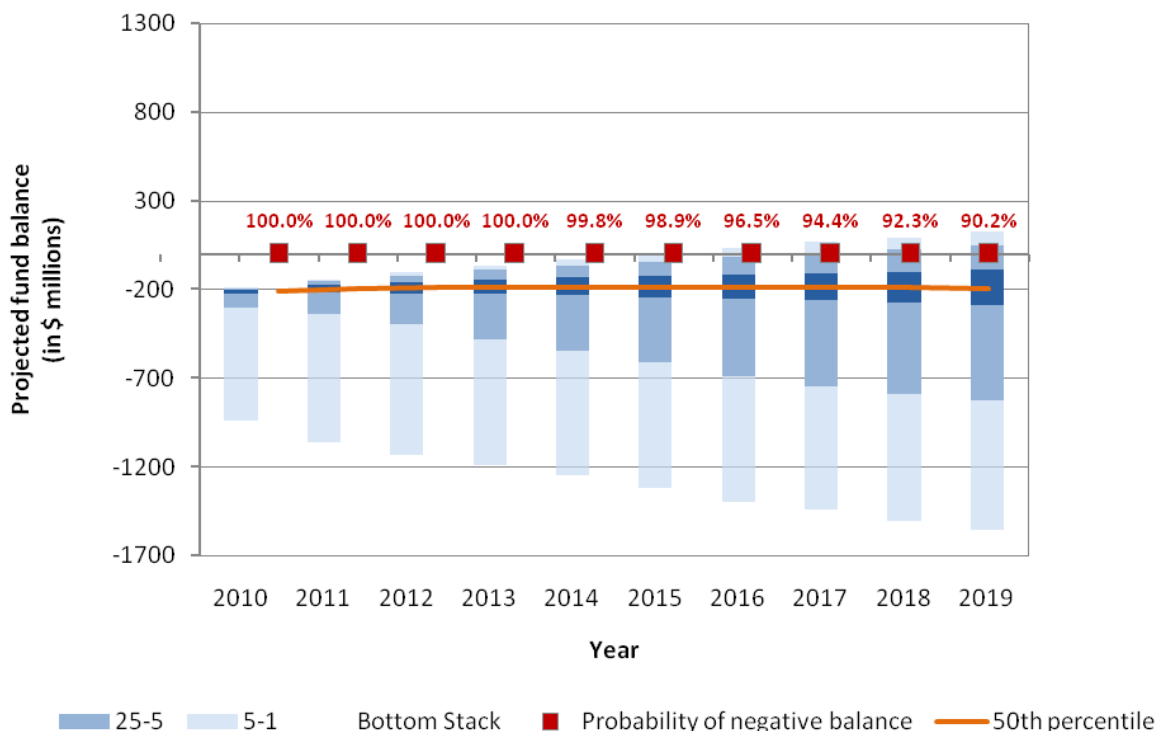


Status Quo

Chart 8.7 below shows the results of a stochastic projection of the PBGF end-of-year fund balance based on the assessment level and the maximum coverage limit of \$1,000 per month currently in force at March 2010. The position of the fund as at January 1, 2010 was estimated to be equal to the last fiscal year-end balance less outstanding obligations of \$83.5 million. All known outstanding claims were assumed to be paid from the fund on January 1, 2010. The chart also reflects anticipated claim obligations of \$294 million in 2010 relating to plan sponsors that have filed for bankruptcy or are currently under CCAA protection, as identified by the Ministry of Finance.

The status quo does not reflect any changes that may be made to the PBGF as a result of the 2010 Ontario Budget measures, nor does it reflect any future changes to the assessment formula or to the coverage provided.

Chart 8.7: Stochastic projection of fund balance under status quo



Assumptions for Chart 8.7

Investment return	3.5%
Expenses as a percentage of claims	2.0%
Assessment level effective January 1, 2010	Current
External funding in 2010	\$0
Probability of ruin	100%

The chart shows that the PBGF is not sustainable in its current form on an expected cash flow basis. Expected future assessments are insufficient to cover expected future claims plus expenses. In particular, there are insufficient funds currently held in the PBGF to meet the anticipated claims in 2010. In the absence of external funding or an immediate increase in assessments, the PBGF will be depleted and unable to fully cover the anticipated 2010 claims or any future claims.

Note that the chart above includes negative fund balances. However, since the PBGF would be unable to pay any claims when in a negative position, this scenario is hypothetical and represents the extent to which future claims plus expenses exceed the current fund balance plus future assessments.

If external funding to cover anticipated 2010 claims was not made available, an immediate increase in assessments in the order of 800% would be required to bring the probability of ruin down to an acceptable level of approximately 3%.

Alternative Scenarios

The following charts show the results of the stochastic projection of the PBGF under various alternative scenarios that incorporate increases to the assessment level, access to additional funding in the event of catastrophic claims, and access to initial working capital.

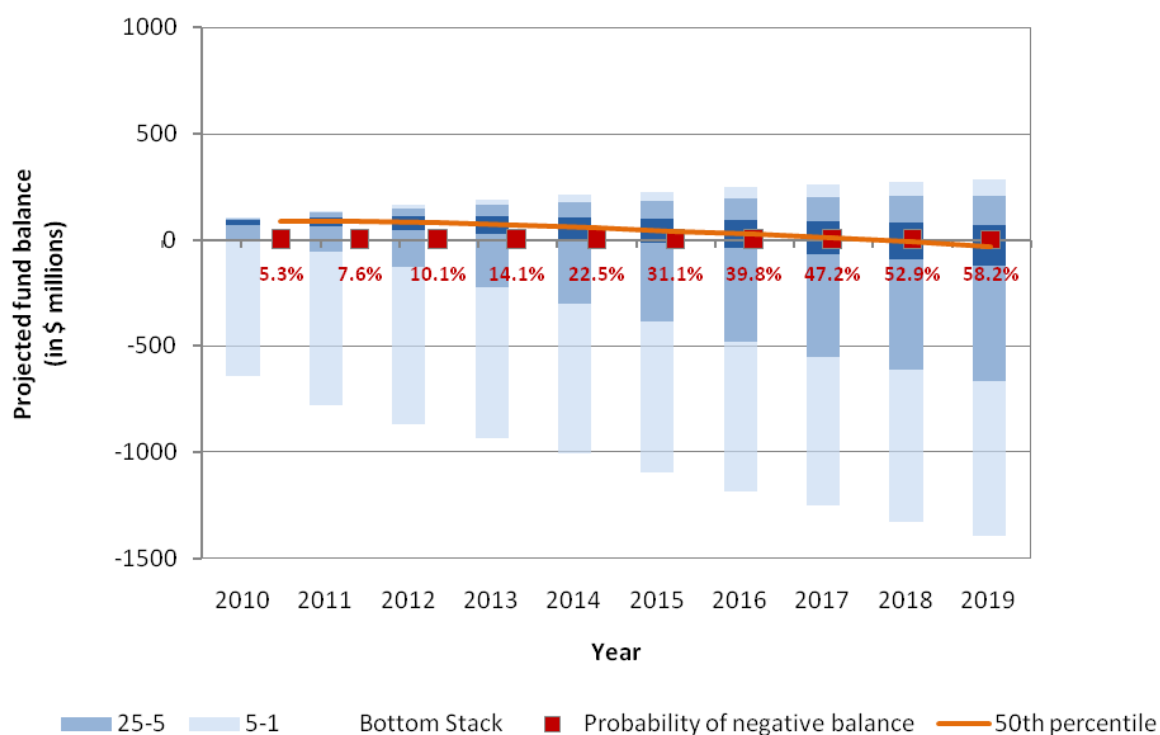


External funding for anticipated claim obligations in 2010

As noted above, the Ministry of Finance provided information on all outstanding claims, plus some anticipated bankruptcies, which we assumed would result in a claim to the PBGF in 2010. The magnitude of the sum of these estimated claims would immediately reduce the PBGF fund balance below zero when paid.

Chart 8.8 below assumes that external funding of \$294 million is secured by the PBGF at the end of 2010. This amount is set to equal anticipated 2010 claim obligations, and is assumed to be financed over 20 years at 4.75% per year, with approximate annual payments of \$23 million.

Chart 8.8: Stochastic projection of fund balance assuming external funding of \$294M in 2010



Assumptions for Chart 8.8

Investment return	3.5%
Expenses as a percentage of claims	2.0%
Assessment increase effective January 1, 2010	Current
External funding in 2010	\$294M
Terms of financing	4.75% p.a. over 20 years*
Probability of ruin	66%

* This rate is representative of the yield on a 20-year province of Ontario bond and was estimated using information available at March 2010.

Chart 8.8 shows that under this scenario, there is a small probability of a negative fund balance in the first few years, with this probability gradually increasing in future years. The range of the downside widens with time, mainly due to the random incidences of catastrophic claims over the 10,000 stochastic paths. It is apparent that one-time external funding in respect of anticipated 2010 claims is insufficient for the PBGF to be sustainable over the long-run with an acceptable probability due to future claims volatility and catastrophic claims. It is also interesting to note the downward trend of projected fund balances over the 10-year period. This can be observed by examining the diminishing slope of the orange line representing the median fund balance. Table 8.7 also illustrates this trend by listing the marginal change in the median year over year.

Table 8.7: Marginal change in median fund balance year over year

Year	Marginal Change in 50 th Percentile Fund Balance (in \$ millions)
2010	-
2011	(2)
2012	(5)
2013	(12)
2014	(13)
2015	(15)
2016	(16)
2017	(16)
2018	(18)
2019	(23)
2020	(21)

A downward trend in the median's slope indicates that the projected fund balances are decreasing year after year. Assuming that this trend continues, it can be concluded that over the long-run, expected future assessments are insufficient to cover the funding loan repayments in addition to expected claims plus expenses.

If anticipated 2010 claim obligations were \$100 million greater – implying additional external funding of \$100 million would be required – estimated loan payments would increase to approximately \$31 million per annum and the probability of ruin would increase from 66% to 83%.

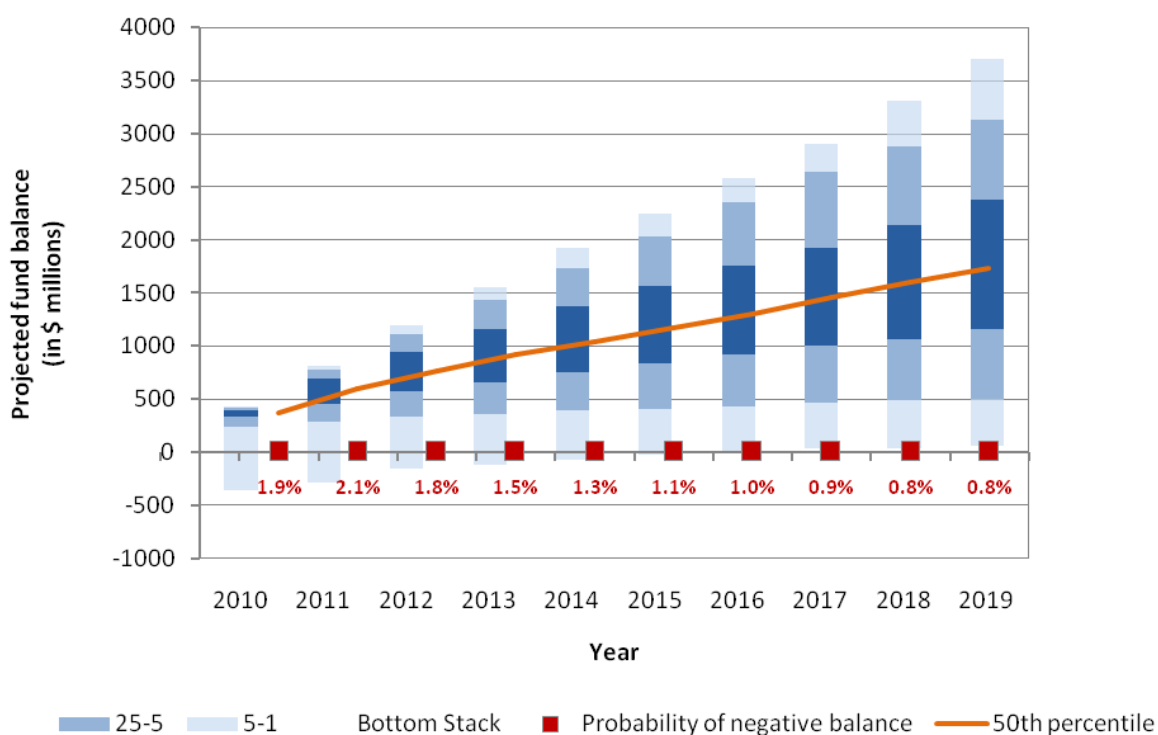


External funding for anticipated claim obligations in 2010 with an increase in assessments

As noted above, one-time external funding in respect of anticipated 2010 claims is insufficient for the PBGF to be considered sustainable because expected future assessments are insufficient to cover expected claims plus expenses within an acceptable probability. The following analysis illustrates the effect that an increase in future assessments would have on the PBGF.

Chart 8.9 below is based on the same scenario as Chart 8.8, except that an overall increase in assessments of 450% is assumed, effective January 1, 2010.

Chart 8.9: Stochastic projection of fund balance assuming external funding of \$294 million in 2010 and an overall increase in assessments of 450%



Assumptions for Chart 8.9

Investment return	3.5%
Expenses as a percentage of claims	2.0%
Assessment increase effective January 1, 2010	+450%
External funding in 2010	\$294M
Terms of financing	4.75% p.a. over 20 years
Probability of ruin	3%

Chart 8.9 illustrates that external funding in 2010, coupled with an increase in overall assessments of 450%, stabilizes the probability of a negative fund balance in later years at less than 1.0%. Over 10 years, the probability of ruin is 3%, implying that the PBGF under this scenario would be sustainable 97% of the time. Also note the reversal in trend of the median projected fund balance from Chart 8.8. An upward trend of the median indicates that the projected fund balances are increasing year after year, with an expected median fund balance of over \$1 billion by 2014.

However, even with a notable upward trend in the median fund balance, the probability of a negative projected fund balance in each year stabilizes towards the end of the 10-year horizon. This underscores the significance of catastrophic claims when measuring sustainability of the PBGF. As highlighted by recent experience, claims can exhibit significant volatility. The potential persists for low-frequency, high-severity claims that can significantly exceed annual revenue from assessment.

The increase in assessments was modelled by multiplying the sum total of all assessments in each year of each path by a factor of 5.5, which represents an increase in overall assessments of 450%. It was assumed that the increase would apply equally to the member-based and risk-based components of the current assessment model. This is not the only option available and may not produce the most efficient result. Alternatives include, but are not limited to, applying a different increase rate to the member-based and risk-based components and/or restructuring the assessment model.

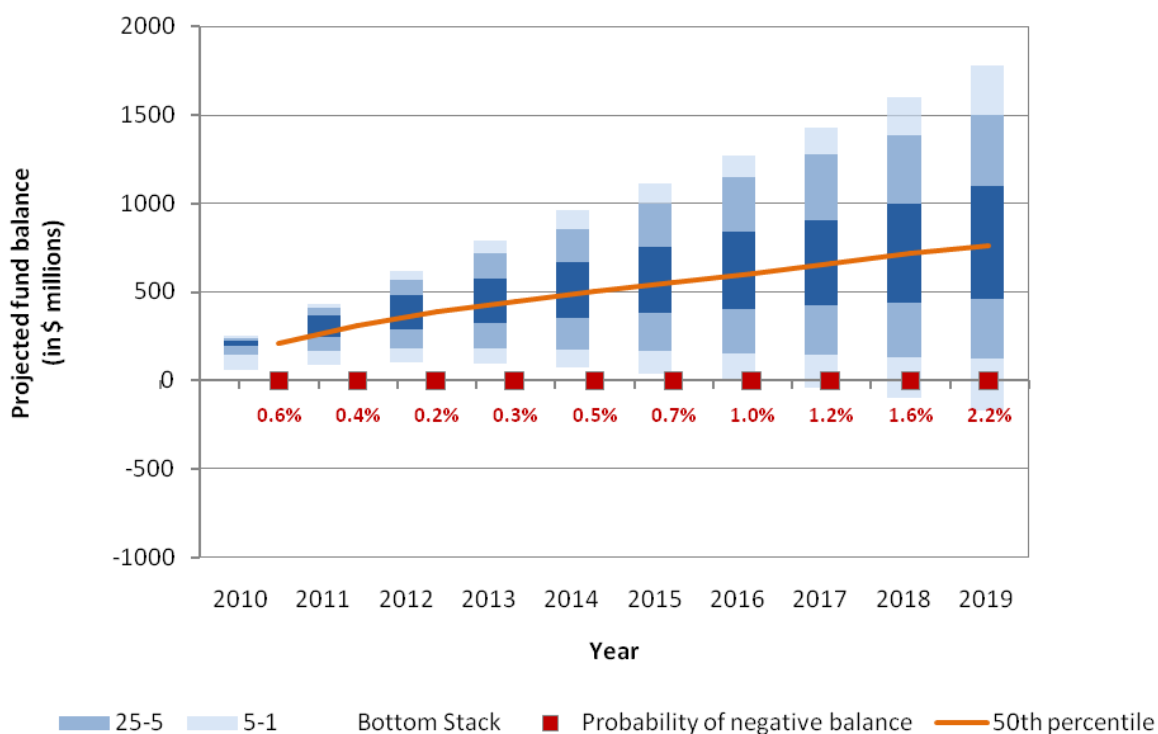
If anticipated 2010 claim obligations were \$100 million greater – implying additional external funding of \$100 million would be required – an increase in assessments of 470% (from 450%) would be required to cover the increase in loan payments and maintain a probability of ruin of 3%.



External funding for anticipated claim obligations in 2010 with an increase in assessments and ongoing external funding for future catastrophic claims

Assessments could be increased further to cover the potential for catastrophic claims. However, another alternative is to consider the availability of additional funding to cover claims volatility and catastrophic claims. Chart 8.10 builds on Chart 8.9, including an assumption that ongoing external funding would be available for future catastrophic claims, defined as claims above the 99th percentile (i.e., the top 1% of claims). Note that in modeling this scenario, no limits were assumed on the accumulation of external funding or to the number of outstanding loans, which may pose challenges in a real-world scenario.

Chart 8.10: Stochastic projection of fund balance assuming external funding of \$294 million in 2010, an overall increase in assessments of 200% and external funding to cover catastrophic claims



Assumptions for Chart 8.10

Investment return	3.5%
Expenses as a percentage of claims	2.0%
Assessment increase effective January 1, 2010	+200%
External funding in 2010	\$294M
Terms of financing	4.75% p.a. over 20 years
Catastrophic claim threshold	\$400M
Probability of ruin	3%

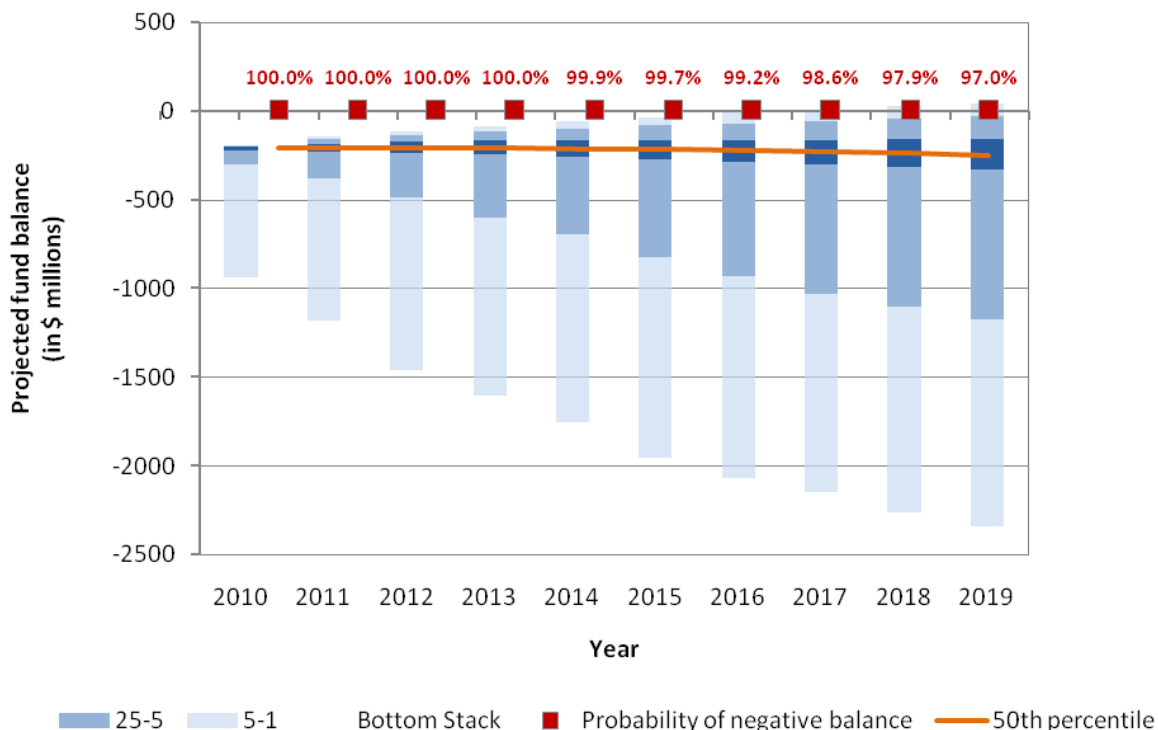
In the above stochastic projection, it was assumed that all claims above \$400 million (the “catastrophic claim threshold”) were financed at 4.75% per year over 20 years. It was also assumed that external funding (in the form of loans) would be available to the PBGF as required to satisfy all claims. Mitigating the risk of catastrophic claims by securing external funding reduced the required increase in assessment rates from 450% to 200% when compared to the previous stochastic scenario.



Increasing the PBGF Coverage Limit to \$2,500

The Expert Commission on Pensions (ECOP) recommended that the coverage limit under the PBGF be increased from \$1,000 per month to \$2,500 per month. Chart 8.11 below assumes this recommendation is implemented effective January 1, 2011.

Chart 8.11: Stochastic projection of fund balance under status quo with an increase in the PBGF coverage limit to \$2,500



Assumptions for Chart 8.11

Investment return	3.5%
Expenses as a percentage of claims	2.0%
Assessment level effective January 1, 2010	Current
External funding in 2010	\$0
PBGF coverage limit	\$2,500
Probability of ruin	100%

Section 8: Results & Looking Ahead

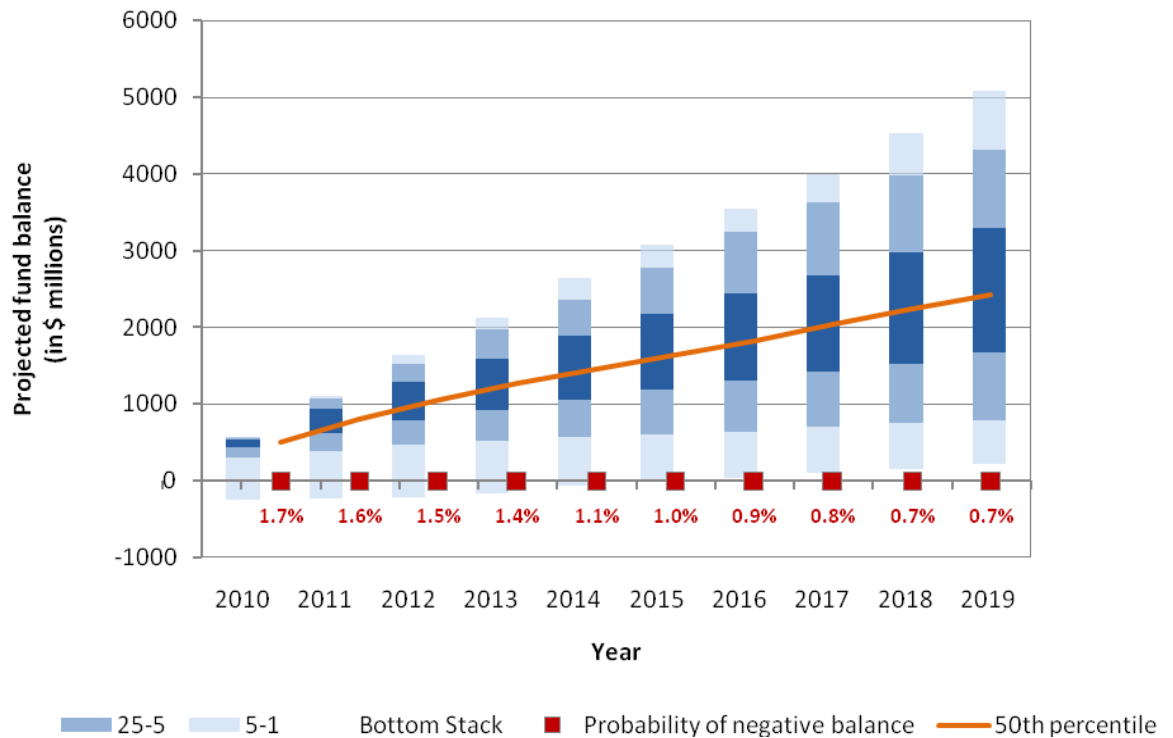
As expected, Chart 8.11 shows that an increase in the PBGF coverage limit to \$2,500 widens the range of the downside over time when compared to Chart 8.7, mainly due to the increase in severity of catastrophic claims. The probability of ruin under this scenario is unchanged from the status quo (probability of ruin of 100%), which is also expected.

Similar to Chart 8.7, in the absence of external funding or an immediate increase in assessments, the PBGF will be depleted and unable to fully cover the anticipated 2010 claims or any future claims. If external funding to cover anticipated 2010 claims was not made available, an immediate increase in assessments in the order of 1,000% would be required to bring the probability of ruin down to an acceptable level of approximately 3%.

External funding for anticipated claim obligations in 2010 with an increase in assessments and an increase in the PBGF Coverage Limit to \$2,500

Chart 8.12 below is based on the same scenario as Chart 8.9, except that the PBGF Coverage Limit is increased to \$2,500 starting in 2011.

Chart 8.12: Stochastic projection of fund balance assuming external funding of \$294 million in 2010, an overall increase in assessments of 650%, and an increase in the PBGF Coverage Limit to \$2,500





Assumptions for Chart 8.12

Investment return	3.5%
Expenses as a percentage of claims	2.0%
Assessment increase effective January 1, 2010	+650%
External funding in 2010	\$294M
Terms of financing	4.75% p.a. over 20 years
PBGF coverage limit	\$2,500
Probability of ruin	3%

The above illustration is analogous to Chart 8.9 with the exception of an increase in the PBGF coverage limit from \$1,000 to \$2,500. Under this scenario, an increase in assessments in the order of 650% (versus 450% in Chart 8.9) would be required to achieve a probability of ruin of 3%.



Glossary

Accrual Basis

Accounting basis in which:

- Revenue is recognized in the fiscal period during which it was *earned* (regardless of when it is actually received).
- Expenses are recognized in the fiscal period during which they were *incurred* (regardless of whether they were actually paid or not).

Active Member

In relation to a pension plan, a person who is currently accruing pensionable service under the plan.

Actuarial Present Value

The actuarial present value of a payment or series of payments that are random variables is the expected value of the present value of the payments, or equivalently, the present value of their expected values.

Actuarial Information Summary (AIS)

A form that must be filed with FSCO concurrently with the actuarial valuation report, summarizing prescribed information, including the key assumptions and results of both the going-concern and solvency valuations.

Actuarial Valuation Report

A report that is prepared on a defined benefit pension plan, usually including, among other things, the results of the going-concern and solvency valuations.

Aggregate Funding Position

Sum of assets less sum of liabilities across all plans under study; or, sum of plan funding positions. In a pool of plans where plans in deficit outweigh plans in surplus, there is an aggregate deficit.

Annual Information Return (AIR)

A form that must be completed by the plan administrator and filed with FSCO each year, providing details about the plan's membership and funding.

Beneficiary

A person who is the surviving spouse or beneficiary of a former active member, deferred vested member or pensioner of a pension plan, and is receiving a pension from the plan as a result of the death of the former member.

CANSIM

Canadian Socio-Economic Information Management System; Statistics Canada's socio-economic database profiling Canada's people, economy and industries.

Career Average Earnings (CAE) Plan

A type of defined benefit pension plan in which the pension formula is based on earnings in each year of the plan member's career.



Cash Basis

Accounting basis in which:

- Revenue is recognized when cash is received for revenue earned (regardless of when the revenue was earned).
- Expense is recognized when cash is paid for expenses incurred (regardless of when the expenses were incurred).

CCAA

Companies' Creditors Arrangement Act of Canada.

CIA

Canadian Institute of Actuaries.

Closed to Future Accruals

Describes a plan that does not admit new members or allow existing members to accrue new years of pensionable service. These plans are commonly referred to as "frozen plans."

Closed to New Members

Describes a plan that does not admit new members. Existing members can continue to accrue pensionable service and benefits.

Commercial-Basis Loan

A loan in which the borrower must pay interest on the amount borrowed, in addition to repayment of principal.

Conditional Tail Expectation (CTE)

The average of the outcomes that exceed a specified value such as the Qth percentile, represented as CTE(Q). For example, CTE(60) is the mean result of the 40% highest cost scenarios and CTE(0) would represent the overall mean, because CTE(0) is the average of all scenarios.

CPI

Consumer Price Index.

Deferred Vested Member

A plan member who is entitled to a future pension benefit, but who has terminated employment with the plan sponsor and is no longer accruing pensionable service under the plan.

Defined Benefit (DB) Pension Plan

A pension plan in which benefits are based on a formula that is usually related to the plan member's pensionable earnings and/or length of service. The amount of pension payable to a retiree is determined solely by the plan formula, and is not based on accumulated contributions plus investment income.

Defined Contribution (DC) Pension Plan

A pension plan in which benefits are based on the amount of contributions paid, plus the amount of investment return earned on those contributions. The total accumulated contributions plus investment income in the plan member's account at retirement is used to provide the member with income in retirement. Unlike a pension payable under a Defined Benefit plan, the amount of pension payable at retirement is based solely on the amount of pension that can be provided by the accumulated contributions plus investment income at retirement, and is not determined by a pension formula.

Deterministic Projection

Projection based on one or more predetermined scenarios regarding the future values of relevant economic variables over the projection periods.

Economic Scenario Generator (ESG)

In general, a financial model that simulates future states of the economy and financial markets. For more information regarding the ESG used in the study, please refer to the description in Section 6.

Expert Commission on Pensions (ECOP)

A commission established by the government of Ontario to examine the legislation that governs the funding of defined benefit pension plans in Ontario, the rules relating to pension deficits and surpluses, and other issues concerning the security, viability and sustainability of the provincial pension system. The ECOP released a report on its findings in 2008.

Final Average Earnings (FAE) Plan

A type of defined benefit pension plan in which the pension formula is based on earnings over several years of membership in the plan only, rather than all years of membership (CAE plan). Typically, earnings in the last few years before retirement are used.

Financial Services Commission of Ontario (FSCO)

An arm's-length agency of the Ministry of Finance. FSCO regulates all pension plans that are subject to the Ontario Pension Benefits Act.

Flat Benefit Plan

A type of defined benefit pension plan in which the pension formula is expressed as a dollar amount per year of service, and is not generally related to an individual plan member's earnings. Flat benefit plans are common among unionized employee groups, and increases to the flat dollar benefits are often negotiated as part of the collective bargaining process.

Frozen Plans

See *Closed to Future Accruals*.

GDP

Gross Domestic Product.

Going-Concern Valuation

A method of valuing a defined benefit pension plan that assumes that the plan will be ongoing and that its assets must be sufficient to meet its liabilities when they come due in the future. If a plan is underfunded on a going-concern basis, the unfunded liability must generally be amortized over 15 years.

Hybrid Plan

A type of pension plan that has both DB and DC characteristics; the most common type of hybrid plan provides the greater of a DB pension and the pension that may be purchased with the member's DC account.

Insolvency Risk

For the purposes of this study, the risk that a plan sponsor will become bankrupt under the terms of the Companies' Creditors Arrangement Act. It is assumed that the plan sponsor will be unable



to meet any underfunding in its pension funding obligations, and a claim will be made on the PBGF.

Investment Information Summary (IIS)

A form that must be filed with FSCO summarizing prescribed information on the amount of plan assets of a defined benefit pension plan, the sources of year-over-year changes and the asset mix.

Jointly-Sponsored Pension Plan (JSPP)

A contributory defined benefit plan in which both employer(s) and plan members contribute in respect of the plan's normal cost and share in the responsibility for making special payments towards any going-concern unfunded liability and/or solvency deficiency. JSPPs are not covered by the PBGF.

Main Plan

For the purposes of this study, one of 52 plans that were identified by the Ministry of Finance based on their cumulative PBGF exposure. These are plans where the sponsor sponsors at least one plan that could have a very large impact on the PBGF, based on either PGBF liabilities (greater than \$500 million) or PBGF assessment base (greater than \$50 million).

Market Value (MV) of Assets

The sum of the prices at which each individual security underlying the plan assets would change hands between a willing buyer and a willing seller, neither being under any compulsion to buy or sell, and both having reasonable knowledge of relevant facts.

Median

The numeric value separating the higher half of a probability distribution from the lower half.

Ministry of Finance

The Ministry of Finance is a central agency within the government that:

- provides key fiscal, taxation and economic policy advice and support to the Minister of Finance, Cabinet and the Premier;
- reports on the province's economic and fiscal plans and results to the public;
- prepares the provincial budget and a mid-year fiscal and economic update (Fall Economic Statement); and
- promotes the principles of modern controllership within the Ontario Public Service and accountability for the use of public funds in all Ontario public sector institutions, including universities, hospitals and school boards.

Monte Carlo Simulation

An analytical technique that involves generation of the results of a model under a large number of scenarios, where the relevant economic assumptions are modelled as random variables (i.e., stochastically). Analysis of the model results allows for assessment of probabilities for particular outcomes. In general, the terms Monte Carlo Simulation, Stochastic Simulation and Stochastic Projection are often used interchangeably.

Multi-Employer Pension Plan (MEPP)

A pension plan to which two or more non-affiliated employers contribute and where contributions are made by reason of an agreement, statute or municipal by-law. These plans usually permit reduction of accrued benefits and are not covered by the PBGF.

NAICS

North American Industry Classification System.



Ontario Assets

The solvency assets multiplied by the PBGF liabilities and divided by the solvency liabilities.

Ontario Pension Benefits Act

Provincial legislation enforced by FSCO that determines minimum standards for eligibility, funding and benefits under defined benefit pension plans.

Ontario Pension Benefits Regulations

Regulations associated with the Ontario Pension Benefits Act.

Open Plan

A plan in which new members are accepted and existing members can continue to accrue pensionable service and benefits.

OSBC

Office of the Superintendent of Bankruptcy Canada.

OSFI

Office of the Superintendent of Financial Institutions of Canada.

Pension Benefits Guarantee Fund (PBGF)

A fund established by the Ontario Pension Benefits Act to guarantee a minimum level of coverage for certain benefits provided by a defined benefit pension plan in the event of plan sponsor insolvency.

Pension Benefits Guarantee Fund (PBGF) Assessment

An annual levy payable to the PBGF by all employers with defined benefit plans that have members working in Ontario whose benefits are covered by the PBGF. It includes a levy based on the number of Ontario members covered by the plan and a levy based on the financial status of the plan.

PBGF Assessment Base

The amount by which the PBGF liabilities exceed the Ontario assets at a given valuation date.

PBGF Assessment Certificate

A certificate that must be filed with FSCO each year for defined benefit pension plans in respect of the annual assessment payable by the employer to the PBGF, including the information used to calculate the assessment.

PBGF Claims Exposure

The value of liabilities covered by the PBGF in the event of a plan sponsor insolvency.

PBGF Exposure

PBGF assessment base.

PBGF Liabilities

The portion of the solvency liabilities of a defined benefit pension plan that relates to employment in Ontario.

PBGF Limit

The cap applied to the amount of pension income covered by the PBGF; currently set at \$1,000 per month.

Pension Benefits Guaranty Corporation (PBGC)

A federal corporation in the U.S. that protects the pensions of American workers and retirees in private single-employer and multi-employer defined benefit pension plans in case of plan sponsor insolvency.

Pension Protection Fund (PPF)

A fund established in the U.K. to provide compensation to members of eligible defined benefit pension schemes when there is a qualifying insolvency event in relation to the employer, and where there are insufficient assets in the pension scheme to cover the PPF level of compensation.

Pensioner

A plan member who is currently receiving a pension from the plan.

Percentile

The value of a variable below which a certain percent of observations fall; for example, the 25th percentile is the value below which 25 percent of the observations may be found.

Plan Administrator

The party responsible for ensuring that the pension plan is administered in line with the Ontario Pension Benefits Act and Regulations.

Plan Funding Position

The difference between the assets and liabilities of a pension plan (referred to as a plan deficit, if negative, and a plan surplus, if positive).

Plan Member

In relation to an employer-sponsored pension plan, any person who is:

- an active member;
- a deferred vested member;
- a pensioner; or
- a beneficiary.

Qualifying Plan Provision

Adopted in the 1990s, this provision allowed sponsors of plans with combined assets of at least \$500 million to elect not to fund solvency deficiencies and pay a higher premium to the PBGF. The provision was amended in June 2002 to prohibit any additional plans becoming qualifying plans, and no qualifying plans remain today.

R²

The coefficient of determination, which provides a measure of how well future outcomes are likely to be predicted by the model.

Reserve

In general, an actuarial reserve is an estimate of the liability associated with the present value of the expected future cash flows of a contingent event. The term is commonly used to refer to the estimated liability itself (a calculated amount) or the assets held in respect of the estimated liability.



Retired Member

See *Pensioner*.

Solvency Assets

The market value of investments held by a plan, plus any cash balances and accrued or receivable income items of the plan, excluding the value of any qualifying annuity contract of the plan.

Solvency Liabilities

Plan liabilities that are calculated as if the plan had been wound up as of the valuation date, including liabilities for plant closure benefits or permanent layoff benefits that would become payable if the employer's business were terminated.

Solvency Valuation

A method of valuing a single-employer defined benefit pension plan that assumes the plan is about to be wound up so that its assets will have to be used immediately to meet its existing liabilities. If there are more liabilities than assets, the plan has a solvency deficiency that must, generally, be amortized over five years.

SoP

Standards of Practice produced by the Canadian Institute of Actuaries.

Stochastic Projection or Stochastic Simulation

Projection or simulation based on a large number of scenarios, where the relevant economic assumptions are modelled as random variables (i.e., stochastically). Analysis of the projection results allows for assessment of probabilities for particular outcomes. In general, the terms Monte Carlo Simulation, Stochastic Simulation and Stochastic Projection are often used interchangeably.

Winding up / Wound-up

The termination of a pension plan, after which there are no assets or liabilities left in the plan and the plan will cease to exist as a legal entity. "Winding up" describes the process of reaching wind-up from normal ongoing status. The plan must be wound up in accordance with plan rules and relevant legislation.

YMPE

Year's Maximum Pensionable Earnings.