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Private pensions and government guarantees: clues from Canada

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Abstract

The Pension Benefits Guarantee Fund (PBGF) was established in the province of Ontario in 1980, thus creating in Canada a rare opportunity for intranational empirical research on the impacts of governmental protection on private plans and their participants. This paper examines Canadian data on pension plans for effects attributable to Ontario's government guarantees for some plans. We find that significant variables related to an increase in the number of pension plans in Canada are higher interest rates, a larger labour market, and, consistent with the deferred compensation theory from labour economics, lower real disposable income of workers. The number of members in pension plans is related significantly to the same variables and also to tax rates and unemployment. The analyses show that the Ontario environment for pension plans is significantly different from the rest of Canada. Those plans covered by the Pension Benefit Guarantee Fund exhibit a lower degree of funding per participant than do the remainder of the plans in the sample, supporting the argument that a government guarantee is related to a moral hazard problem in Ontario pension financing.

This research examines the effect of government guarantees on the behaviour of employers and workers in the natural experiment offered in Canada, e.g. where the largest province offers a government guarantee for private pension plans but all others do not. We begin with a review of the theoretical literature on pension guarantee systems and a description follows of the guarantees provided by the Pension Benefit Guarantee Fund in Ontario. Then, the paper provides a basic factual background on Canadian pensions and introduces models showing the relationship between two important measures of pension accessibility – formation and membership – and various economic factors. The article then presents analytical results relating to the Pension Guarantee Fund and concludes with a discussion of the implications.

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Pension guarantees

Theory regarding pension guarantees by government

Early works appearing in the literature, e.g. Langetieg, Findlay, and daMotta (1982) modeled pension guarantees using contingent claims techniques. Later publications use restrictive assumptions, such as requiring knowledge about the term to maturity of the government guarantee. The models developed later in this paper build upon the theoretical foundation established in Ippolito's *The Economics of Pension Insurance* (1989) for public pension guarantees and other later works.

Government guarantees in the United States

The *Employee Retirement Income Security Act* (*ERISA*) of 1974 established the Pension Benefit Guaranty Corporation (PBGC) in the United States. Much of the literature on the PBGC examines the adequacy and appropriate level of premiums to charge plan sponsors for the public guarantee. The 2004 annual report from the PBGC clearly describes the financial difficulties facing the US system of defined benefit (DB) pension guarantees. The guarantee program was sent reeling by the downturn in the economy and financial markets in the second half of 2001 with a net loss in the most recently reported year (2004) of $12.067 billion. These results followed on the heels of record losses of US$11.4 billion in 2002 and US$7.6 billion in 2003 (PBGC, 2005).

The US system of pension guarantee has been the subject of considerable amounts of research, including such works as Niehaus (1990), VanDerhei (1990), Hsieh, Chen, and Ferris (1994), and Pennacchi (1999). Boyce and Ippolito (2002) describe the inadequacies of net present value and options pricing formulae for estimating the cost of the US pension insurance program. After examining these shortcomings they use Monte Carlo methods that 'model the insurance program in its full complexity' to estimate the cost of that policy and characterize the nature of subsidies implicit in the program. They find that the 'full cost' of the insurance, including the value assigned to market risk, is approximately $24.60 annually per $1,000 of insured exposure. This compared with PBGC pricing at the time of their research equivalent to about $4.60 per $1,000. Total PBGC premiums (including a 'fixed' per-participant charge) are currently about half the market price for this insurance.

The US system is being examined for possible reform. Holtz-Eakin (2005) testified before the US Senate that 'the underfunding of defined benefit pension plans is a pervasive and sizable phenomenon'. Though clearly articulating that as a matter of statute the PBGC is not backed by the full faith and credit of the US government, he states on the record that 'as a practical matter … the public probably views the pension insurance system as carrying an implicit federal guarantee'. Preliminary estimates put the cost of honouring that guarantee at $71 billion in the first decade and $91 billion over 20 years. Changes in policy can mitigate future costs and the administration is supporting an increase in premiums, including explicit adjustment for the riskiness of the plan, changes to

improve the accuracy in the measurement of pension liabilities and funding requirements, as well as increased public disclosure of pension plans' funding status.

Government guarantees in Canada

In 1980 the Pension Commission of Ontario amended the *Pension Benefits Act* to establish the Pension Benefits Guarantee Fund (PBGF). Through that *Act*, Ontario became the only Canadian province to provide a system of governmental protection for the pension promises of private employers. The PBGF guarantees specified benefits, up to C$1,000 per month per member, in respect of service in Ontario.[1] In general, a retiree would receive total payments equal to 100% of the benefits guaranteed by the PBGF, plus a proportion of other benefits included in calculating the Ontario wind-up liability. For participants to receive PBGF benefits, a pension plan must be (1) registered under the Ontario legislation or a designated province, (2) wound up in whole or in part, and (3) determined by the Pension Commission of Ontario not to be able to satisfy the funding requirements of the legislation. The PBGF does not apply:

- to a plan that has been established for less than three years,
- to increases in benefits within the preceding three years,
- to multi-employer plans,
- to benefits under a DB plan where the employer's contributions are set by collective agreement, or
- to pension plans excluded in the regulations.

The PBGF is intended to be self-financing via contributions from sponsors of DB plans. The Fund is compulsory and requires the plan to pay an annual premium based on the number of employees and the actuarial deficiency of the plan. Risk-based premiums paid by sponsors begin at the level of $1.00 per member for a plan that is fully funded. If underfunded, the premiums increase. The maximum PBGF premium is $5 million per year; premiums from all plans total about $20 million to $25 million annually.

PBGF liabilities have been subject to some political maneuvering in the past, most notably the exception to Ontario's solvency rules that appeared during the last major recession. For example, the present exposure with respect to Algoma Steel was greatly impacted when Algoma announced it would be taking advantage of this 'qualifying plans' provision. On 28 June 2002, Ontario's Minister of Finance passed an amendment to the *Pension Benefits Act* that prevented any new companies from

[1] For purposes of the *Pension Benefits Act*, a worker is deemed to be employed in the province in which the establishment of his or her employment is located and to which the person is required to report for work. Employees who are not required to report to a specific location for work are considered to be employed in the province from which they are paid. That the PBGF coverage can apply to participants in plans not registered in Ontario was clearly articulated in a 22 May 2002 letter that the Pension Plans Branch of the Financial Service Commission of Ontario sent as part of a program initiated to systematically recover PBGF assessments from all plans with members who are eligible for coverage.

declaring their plans as 'qualifying plans'. Such 'see-saw' effects definitely complicate the ability of researchers to contribute anything of value to the outstanding policy questions.[2]

Ontario's PBGF undoubtedly has experienced similar losses to the US PBGC because of both agencies' exposures in the steel industry. Without audited financial statements, it is difficult to estimate the current financial position of the PBGF,[3] but one estimate was provided in a December 2003 economic statement by Ontario's Finance Minister which made specific reference to the impact of Ontario's Pension Benefits Guarantee Fund (PBGF). The economic statement and its accompanying background documents suggested that the liabilities associated with the PBGF could amount to $500 million (O'Reilly, 2004).

Pension plans in Canada

In order to assist non-Canadian readers in relating this research to their own country, this section provides background on the number of Canadian pensions, the types of Canadian pensions, and the membership in Canadian pensions. We also introduce models showing the relationship with various economic factors and the membership numbers of pension plans.

Number of pension plans

The total number of pension plans in Canada has been declining since 1990, a phenomenon that is observed in all provinces. Figure 1 shows the absolute numbers of plans and numbers of members for the years 1970 to 2001 respectively.

One fact that can elude a casual observer when examining these trends is that they contain a substantial increase in the number of plans that are *Closed to New Membership*. From 1990 to 2001, the number of plans in this category increased from 1108 to 1349; much of that growth was seen in Nova Scotia, Manitoba, Saskatchewan, and British Columbia. During the same time period, the number of members in closed plans, demonstrating the attrition that would be expected, dropped from 86,276 to 61,881. Although the majority of the plans continue to be sponsored by single employers, the data reveal that plans with more than one sponsor (those organized under special legislation for multi-employer plans and as well as other forms of multiple sponsorship) have gained somewhat in popularity over the illustrated time frame.

Figure 2 shows the information on number of pension plans by province. Overall, the trend in provinces across Canada is similar to the national trend, with the

[2] The only literature to look at the Canadian system reviews public documents disclosing the cost and funding status of the government agency and draws conclusions which, while reasonable given the absence of research, are based largely on the authors' economic intuition. See, for example Arvin and Lanoie (1993), Lanoie and Arvin (1994).

[3] Data come primarily from Statistics Canada samples (collected biennially from 1970 to 1990 and annually from 1992 to 2001) and from provincial pension regulatory authorities, although some additional information was obtained from the Financial Executives Institute of Canada and from a special report prepared by the *Globe and Mail*.

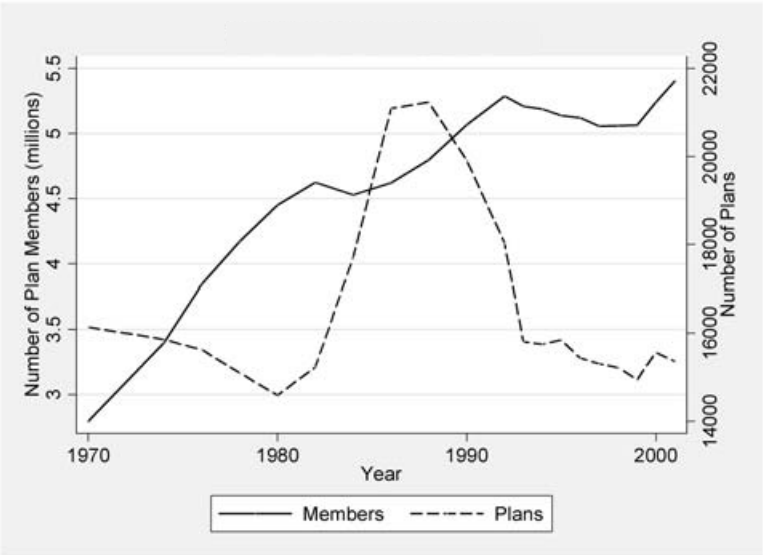

Figure 1. Number of pension plans in Canada

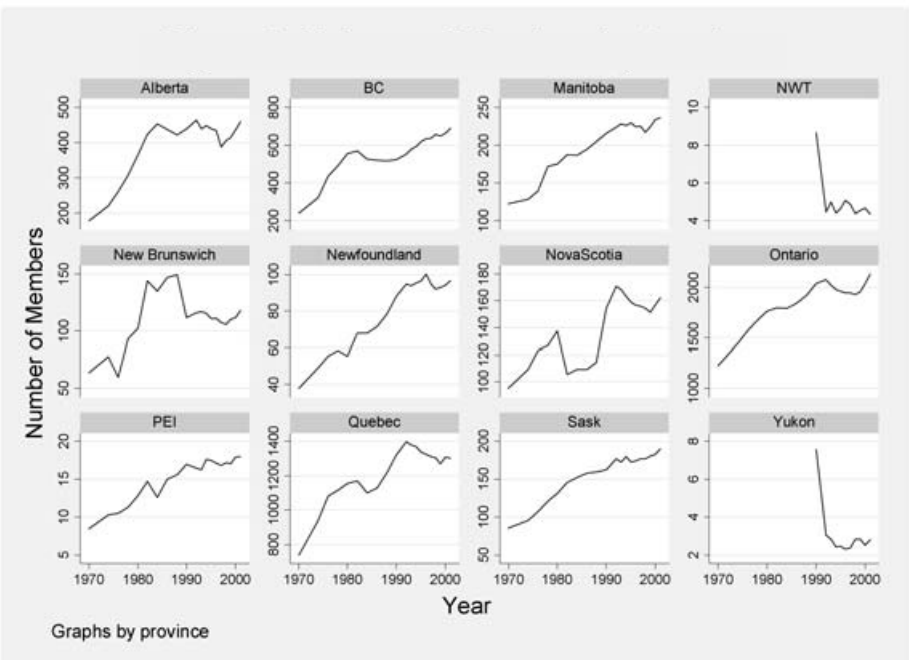

Figure 2. Number of plans by province

numbers of plans in Ontario and Quebec driving the national trend. The raw number of plans has been decreasing for most provinces; British Columbia and North West Territory are the only exceptions.

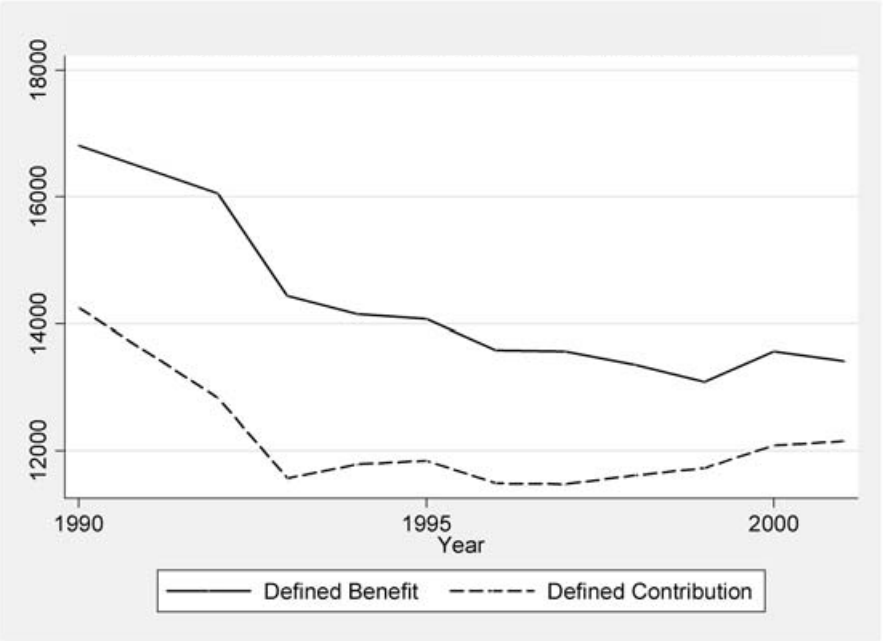

Figure 3. Number of pension plans (by plan types) in Canada

Pension plan types

Pension plans typically are divided into defined benefit (DB) and defined contribution (DC) plans with each of these major types encompassing several specific designs. Collapsing the Statistics Canada data from seven plan types into these two basic types, Figure 3, illuminates important trends behind the modest decline observed in the aggregate numbers of plans (see Figure 1).

A substantial drop occurred in the number of both types of plans during the period 1990–1992. Since that time, however, the trends have diverged. The number of DB plans has generally continued to exhibit a slight decline. Meanwhile the number of DC plans nationally has been edging upward since 1993. The use of profit sharing plans, which have long represented a small share of the DC market, continues to decrease in all provinces.

Modeling Canada's pension plan formation

Before examining the data for effects of a specific public policy, a baseline model was needed. This section presents the best-fit models that could be achieved with available data for the number of pensions and number of pension participants respectively. The details and fit of these two models is presented for both national and Ontario-only data. One source of data was that maintained from 1970 by Statistics Canada in their biennial data series entitled *Pension Plans in Canada*. From 1987 onwards, data were gathered and reported on an annual basis. A custom

tabulation by province of data from the *Pension Plans in Canada* survey was purchased for the period 1990–2001. For the period prior to 1990, the only data available by province are the number of pension plan members from the published report. This limitation means that, for the full period 1970–2001, pension-specific data are available for (1) the number of pension plans, (2) the total number of participants in pension plans, (3) the number of male plan participants, and (4) the number of female plan participants.

Economic data for the following variables were gathered to define the key relationships and to serve as control variables:

- combined federal and provincial corporate tax rates (1970–2003)
- unemployment rate by province (1966–2003)
- CPI by province (1914–2003) Base year = 1992
- Personal disposable income by province (1961–2003)
- 90-day treasury bill rates (1946–2003)
- provincial GDP (1981–2003)
- size of labor force (1970–2003)

The period of data actually used in the analyses varied across models; those periods are noted in each respective table.

A random effects panel regression technique[4] was used to model the relationship of key economic variables to the number of plans (*n_plans*) and separately to plan membership (*n_members*) in pensions. Included variables are interest rate, personal disposable income, unemployment rate, and income tax rate:

int: interest rate (91day T-bill)
RPDI: real personal disposable income[5]
unemploy: unemployment rate
tax: corporate tax rate
labor: labor force

Regressions based on the period 1970–2001 (see Table 1) demonstrate a good fit between number of pension plans and general economic conditions. Three variables emerged as statistically significant:

- the number of plans increases when interest rates are high,
- the number of plans increases when there is a larger labour market, and
- where more pensions exist, the real disposable income of workers is less.

The latter result is consistent with the deferred compensation theory from labour economics that says pension costs are ultimately borne by workers.

This is the extent to which we examine the absolute numbers of pension plans in force. It can be influenced heavily by decisions of the smallest companies and also exhibits significant swings with merger and acquisition activity when little has actually

[4] As some of the dependent variables did not vary across sample periods (e.g. tax rate), fixed-effect modeling with its use of internal differencing was not feasible.
[5] Real Gross Domestic Product was also tested in the models, but RPDI proved a better measure.

Table 1. *Number of pension plans in Canada*

(Random-effects model using StatCan data 1970–2001; Z scores given in brackets)

Constant	*−476282.9***
	(−2.68)
Real income per worker	*−31.84****
	(−3.84)
Interest rate	*41331.39****
	(5.02)
Unemployment	*−9979.34*
	(−1.57)
Tax rate	*4529.92*
	(1.49)
Labour force	1204.26***
	(4.11)
R^2	0.36
F	17.52

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.

changed in terms of the pension coverage of workers. For the remainder of the paper we examine the number of pension plan participants rather than the number of plans.

Modeling Canada's pension membership

For the reasons described above, the remainder of this paper focuses on data regarding the number of Canadians covered by pension plans. Plan membership[6] increased from the early 1970s through the early 1990s but flattened considerably beginning around 1992.[7] See Figure 4. Most provinces have seen pension plan membership shift from public to private sector plans. However, British Columbia, Manitoba, and Saskatchewan have experienced increases in the plan memberships in public pension plans gradually over the years. Most of these pension observations are consistent with economic and political environment of the period under study.

The regression model presented in Table 2 provides very strong statistical explanations of the variation observed in the number of pension plan members in Canada. Four variables emerged as statistically significant, two of them the same as were measured in the results presented above for numbers of plans. The other two variables that demonstrate statistical significance – tax rates and unemployment – require additional consideration. The strong positive coefficient for unemployment, indicating greater pension membership when there is higher unemployment, suggests

[6] Provincial data including Newfoundland, PEI, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia are extracted from the Statistics Canada pension database. The data from the remaining provinces main from Yukon, Northwest Territories, and Nunavut were discarded due to incompleteness.

[7] Examining the historical data by province shows that all provinces except British Columbia experienced a reduction in pension membership in the 1990s with BC exhibiting an annual growth rate of less that 0.03%.

Table 2. *Membership in pension plans in Canada*

(Random-effects model using StatCan data 1970–2001; Z scores given in brackets)

Constant	*22289.93*
	(0.66)
Real income per worker	*−0.603*
	(−0.36)
Interest rate	3906.35***
	(3.35)
Unemployment	*6210.76****
	(3.61)
Tax rate	*−1899.96****
	(−3.06)
Labour force	*355.56****
	(5.79)
R^2	0.9903
F	520.47

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.

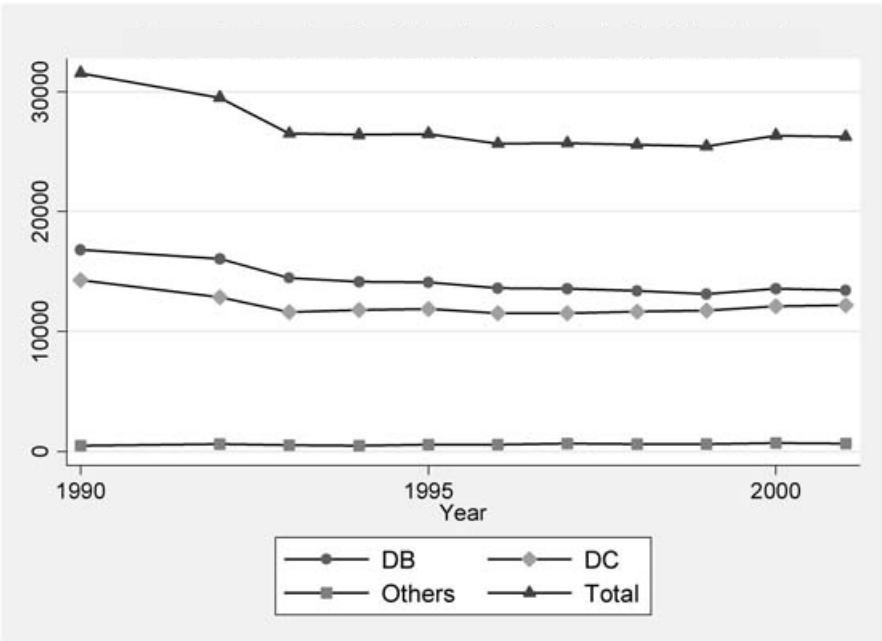

Figure 4. Pension plan members in Canada (by plan type)

a strong difference between the marginal employee and the typical employee. More of the workers in the labour force are getting pensions at the same time those at the margin are having difficulty even getting jobs.

A similarly counterintuitive result appears with respect to the *tax rate* variable. The tax incentives available to pension plans produced an *a priori* expectation that higher taxes would encourage companies to expand pensions in order to take advantage of the tax shield. However, the negative sign on this model indicates just the opposite; higher taxes produce pension coverage for fewer workers. One explanation for this result is simply that, at the margin, the reduced cash available to firms facing higher taxes limits the growth of pensions more than the tax shield facilitates it. Another possible explanation that also was explored grew out of the fact that aggregate data showed that plan membership increased by a substantial margin in both the private and the municipal government sector. These results are interesting but, because they are not directly related to the issue of governmental pension guarantees, are presented in the Appendix of this article.

Pension characteristics

Plan type

As reported earlier, North America has observed a general shift from DB to DC plans. Defined contribution plans' membership rose 77% from 1990 to 2001, with most of that growth observed in money purchase plans. The steady rise in DC membership reflects, in part, the conversion of a number of DB plans into DC in recent years (Statistics Canada, 2000). Despite the recent expansion in DC plans, the data reveal that such plans covered 14.4% of the total pension plan members in 2001.

The next pair of models separates the data to examine the DB and DC plan types individually, allowing a better understanding of whether the same factors explain pension plan membership variation across different plan designs. Table 3 shows the plan membership model separately for DB pensions and for DC plans. Both regressions are highly significant overall.

Not surprisingly, given the proportion of membership in DB plans, the regression result for DB plans more closely resembles that for the all-Canadian pension membership than do the results for DC plans. Clearly, employers use DB plans quite differently than they do DC plans. It is particularly remarkable that, even though the same variables are significant in each of these regressions (at the 5% level or above), *all* signs go in the opposite directions. Anecdotal evidence would suggest that the DB plans are exhibiting the characteristics of larger, more established firms with perhaps an older employee population. On the other hand, the DC plans are smaller in number, more recently established, and cover workers who are perhaps newer to the labour force.

Plan availability and elasticity

An employee cannot choose to join a pension plan unless his or her employer offers one. Therefore, an understanding of the conditions and constraints facing the employer making the implementation decision can be important. In general, analysis of the available data supports the common perception that pension plans are difficult to start and difficult to end, as measured by an empirical observation of low elasticity.

Table 3. *Membership in Canada's pension plans*

(Random-effects model using StatCan data 1987–2001; Z scores given in brackets)

	Defined benefit	Defined contribution
Constant	−159382**	4965.86
	(−3.76)	(0.33)
Real income per worker	−12.09***	2.93***
	(−3.76)	(4.64)
Interest rate	7260.97***	−1705.93***
	(4.55)	(−5.86)
Unemployment	13525.56***	−2414.09***
	(5.07)	(−4.65)
Tax rate	−890.99	70.8
	(−1.64)	(0.74)
Labour force	722.61	−43.85*
	(6.31)	(−1.85)
R^2	0.99	0.91
F	121.80	85.25

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.

Rigourous testing[8] revealed a partial double-log model to be the functional form[9] that permits extraction of the most information about elasticity from the available data. Short-run elasticity measured at 0.82, as expected, shows inelasticity. Long-run income elasticity is 0.96 and, while still indicating inelasticity, the level of that inelasticity is less than was observed in the short run. These measures are important reminders that any policy measures that may develop out of research results, such as those presented in this article, must necessarily incorporate a long time horizon.

Pension funding

Anecdotal evidence of sponsors 'dumping' underfunded pension funds on government guarantee programs is supported in part by recent work that attempts to quantify that risk. Theoretical work by McCarthy and Neuberger (2005), evaluating stochastic bankruptcy probabilities in the UK, illustrates that firms can increase the

[8] Different functional forms, double-log or log-linear, were tested to obtain a preliminary estimate of the marginal effects and elasticities of the variables.

[9] Using the functional form:

$$n\_members = \alpha_0 \mathrm{rpi}^{\beta 1} \mathrm{rpdi}^{\beta 2} e^{\beta 3 \mathrm{ur}} e^{\beta 4 \mathrm{tax}} e^{\beta 5 \mathrm{intr}}\ n\_members_{t-1}{}^{\beta}$$

and converting to a double log format yields the following regression coefficients:

$$\ln(n\_members) = 0.58 + 0.18\ \ln(RPDI) - 0.002\ ur - 0.001\ tax + 0.006\ intr + 0.82\ \ln(n\_members_{t-1})$$

that are converted into the elasticity measures presented.

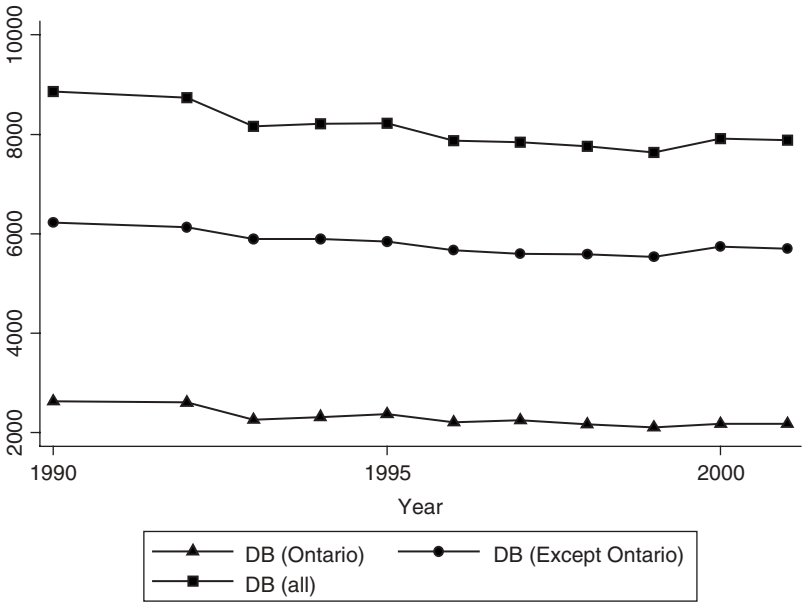

Figure 5a. Number of defined benefit plans

value of the pension put option in the DB case by reducing contributions, increasing the volatility of fund assets, and increasing pension plan liabilities. Research by Coronado and Liang (2005) suggests that moral hazard brought about by US pension insurance does have a significant influence on DB plan finances for some firms, particularly those with a high risk of bankruptcy. That influence is manifested primarily through reduced contributions and a firm with a 1% probability of default is estimated to be seven percentage points better funded than a firm with an 1% probability of default.

This section explores the available information about issues of pension funding in Canada with a focus on the level of funding. A lack of data has forced this research to defer any examination of the types of investments into which funds are placed. Figure 5a shows data on the number of defined benefit plans in Canada as whole as well as breaking that number down into Ontario and the rest of the provinces; Figure 5b shows the same geographic breakdown for the membership in defined benefit plans.

Each year, registered private pension plans are required to submit financial records to supervisory authorities for record keeping and monitoring purposes. In Ontario, qualified plans submit their information along with the annual assessment form to the Pension Benefit Guarantee Fund.[10] Plans in the remaining

[10] Readers should also understand the researchers experienced some difficulty in determining from aggregated plan data what portion of a plan's participants and financial resources are subject to the Ontario legislation. Pension credit for employment 'in respect of Ontario' can and does occur under pension plans that are not themselves registered in Ontario. It is also possible that the databases supplied separately by different provinces could contain a small percentage of repeated entries from particular companies during the reporting. Despite these challenges it was determined that the best way to proceed was by pooling the data and producing a panel estimator.

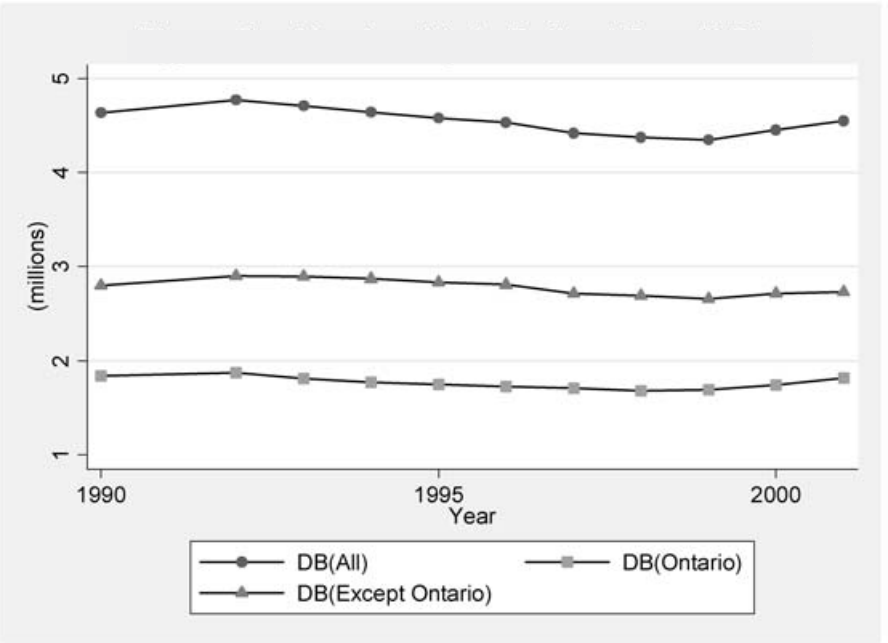

Figure 5b. Membership in defined benefit plans

provinces present the required reports to their respective provincial finance department.[11] Using data from 1999 to 2002 supplied by the Financial Services Commission of Ontario and Departments of Finance of Alberta, British Columbia, and Saskatchewan, we examine the actual level of funding observed in Canadian pension plans in those four provinces (which comprised 64% or almost two-thirds of all plan membership in 2001). Unlike the aggregated (or 'macro') data series supplied by Statistics Canada, provincial data from the five provinces is 'micro', i.e. provides details at plan level.

A study of actual funding levels is important because plan sponsors have varying degrees of discretion as to the timing of plan contributions depending on the type of plan selected. The existence of a government guarantee program creates an important difference in the environment in which Ontario funding decisions are made. That government has essentially given plan sponsors a put option that protects them from downside risk, an option that may provide an incentive to fund at a lower level. The more underfunded a plan is, the greater is the implied value of the put option. As a result, decisions by plan sponsors have a direct impact on the risk to which Ontario's guarantee program is exposed.

[11] For the purpose of this study, multi-employer plans are excluded. Fifty-two multi-employer companies are included in the data sample supplied by Ontario PBGF and are included in the estimate for the Ontario vs. other provinces comparison purposes. Upon further testing (not shown), the exclusion of such sample does not alter regression results by any substantial means.

Table 4. *Plan asset value (in $10,000) per DB participant*

(Random-effects model using provincial data 1999 and 2000; Z scores given in brackets)

Constant	−154.33***
	(−4.50)
Real income per worker	−0.15***
	(−3.92)
Interest rate	9.89***
	(4.74)
Unemployment	6.01***
	(3.96)
Tax rate	5.46***
	(4.94)
R^2	0.012
F	14.29

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.

The variable used in this study to further examine funding is normalized as an amount per plan participant.[12] The resulting regression examines the extent to which the level of funding in pension plans is explained by macroeconomic factors tested in the Canada-wide models described earlier. To incorporate regional influences, all data are at provincial level except interest rate, for which a national indicator is used. The regression result, given in Table 4, produces a low raw explanatory power (R^2), but the overall regression is significant as indicated by the high F-statistic. Once again, plan assets are negatively related to real income, supporting the view that employees 'trade off' wages to receive pensions.

Comparing Ontario with the rest of Canada's pension system

Plan participation in Ontario

Economic intuition argues that employees, especially those for whom contributions are required as a condition of participation, might rationally participate in their employer's pension plan at a lower rate if they are concerned about the security of that fund. Findings that Ontario workers participate in pension plans at a different rate than do workers in other provinces could serve to support conclusions about the validity of that argument. Any research-based evidence of greater worker confidence in the pension system would be useful in the public policy debate.

To examine the available data for information to support this intuition, we tested the null hypothesis that, even when appropriately controlling for economic

[12] Theoretically, the ideal way to examine this proposition would be to look at 'fundedness' rather than 'funding', i.e. to compare plan's assets with its liabilities. However, in practice the variability in the methods used to determine a plan's liabilities is likely to introduce even more error into any such analysis.

Table 5. *Plan membership in Ontario*

(OLS model using StatCan data 1970–2001; Z scores given in brackets)

Constant	−1916733
	(−1.50)
Real income per worker	−5.05
	(−1.19)
Interest Rate	25514.39***
	(6.35)
Unemployment	78936.51***
	(5.07)
Tax rate	−1784.404
	(−0.83)
Labour force	444.92**
	(2.19)
R^2	0.97
F	17.37

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.

conditions, Ontario workers participate in pension plans at the same rate as do workers in other provinces. The regression results for Ontario workers (only) are shown in Table 5. Using the standard Chow test[13] principle it is possible to examine whether Ontario is statistically different from other provinces. The Chow test, which follows a Wald test procedure where the restricted model is benchmarked against the unrestricted,[14] produces a high F-statistic (19.23) that leads to rejection of the null hypothesis that these results are statistically identical to those developed for all of Canada (see Table 2). We conclude from the two regressions that pension formation is indeed different in Ontario than in other Canadian provinces.[15] Ontario workers do NOT participate in pension plans at the same rate as workers in other provinces. One difference observable in the model is that plan participation in

[13] The Chow test (Chow, 1960) was used to test the models without constants; however, for ease of comparison and interpretation, we report the version of the model that does contain intercept constants. Relaxing the assumption of independence of the observations implicit in the Chow Test and applying robust variance estimators, did detect some small, but still noticeable, differences.

[14] As the restricted sample in this instance contains observations solely from Ontario, there are insufficient observations to perform random-effects estimation; therefore, OLS estimates are used to construct sums of squares for both unrestricted and restricted models.

[15] An alternative method, using a dummy variable test, also was used to confirm these results. The two methods are mechanically and mathematically identical, but still a worthwhile exercise since they reflect slightly different intuitions behind the curtain. For this test three additional variables were added:

- *Ontario* is a '1' for an observation from Ontario; '0' otherwise
- the time trend is denoted as *t*, and
- *dum2*, the cross product of *t* and *Ontario*, is introduced to permit differentiation between the slope coefficients of the Ontario and non-Ontario formulations.

Both *Ontario* and *dum2* are significant, providing strong indications that the regressions for the categories are different and supporting the same conclusion as was achieved using the Chow test.

Table 6. *Membership in Canadian pension plans*

(Random-effects model using StatCan data 1987–2001; Z scores given in brackets)

	Defined benefit	Defined contribution
Constant	*−101600.3***	*+14234.26*
	(2.16)	(1.18)
Real income per worker	*−15.37***	*+3.50****
	(−4.87)	(5.68)
Interest rate	*7028.14***	*−1743.92****
	(4.62)	(−6.00)
Unemployment	*+11399.61***	*−2192.50****
	(4.42)	(−4.22)
Tax rate	*−1039.76***	*90.86*
	(−2.01)	(0.94)
Labour force	*+790.40***	*−61.29***
	(7.24)	(−2.71)
Ontario	*+388718.9***	*−149263.1***
	(3.53)	(−4.52)
R^2	0.9864	0.7746
F	131.00	76.79

Notes: *** significant at 1%.
** significant at 5%.
* significant >at 10%.

Canada overall tends to trend negatively with tax rate, while the relationship between taxes and pension membership in Ontario is not significant. Though no solid cause-and-effect relationship can be confirmed, this does seem consistent with the fact that a large number of public employees are located in the seat of federal government in Ottawa, Ontario.

The analysis presented earlier for DB and DC plans is modified here to include a simple dummy variable that is set at 1 for an Ontario plan and 0 otherwise. The resulting coefficients for DB plans are presented in the middle column of Table 6, while the coefficients of the DC regression are shown in the last column. Individually each of these regressions is statistically significant at the 5% level; the two regressions once again tested significantly different from each other when the Chow Test was applied. Most notable for its possible insight into the role of the government guarantee is the fact that the *Ontario* variable in those regressions carries a positive sign for DB plans while exhibiting a negative relationship for DC plans. Ontario workers are significantly more likely to belong to a DB plan than their counterparts in other provinces and significantly less likely to belong to a DC plan, even correcting for economic conditions. The significance of the *Ontario* coefficient in both the DB and DC regressions suggests the need to look more deeply for explanations of Ontario's distinct and statistically differentiable behaviour. However, in a very real sense, data limitations require that we employ a process of elimination that begins in the following section.

Table 7. *Plan asset value per DB participant*

(Fixed-effects model using provincial data 1999 and 2000)

		Private plans only
Constant	957880.256***	95247.4***
	(19.59)	(19.97)
Real income per worker	−17028.158***	−16891.42***
	(−19.19)	(−19.49)
Interest rate	1,773.039	1509.58
	(0.78)	(0.68)
Unemployment	−18719.488***	−18776.26***
	(−6.76)	(−9.82)
Tax rate	−520.703***	−521.806)***
	(−9.55)	(−9.82)
Ontario	93585.194***	92994.53***
	(19.24)	(19.60)
R^2	0.18	0.086
F	166.56	95.50

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.

Plan funding

In this section the results presented earlier on plan funding are amended to attempt to measure the extent to which a fund might be more inclined to intentionally underfund in a jurisdiction where the government bears the downside risk of that decision. The regressions in Tables 7 and 8 utilize individual company data provided by the pension regulatory bodies of Alberta, British Columbia, Ontario, and Saskatchewan. The use of company-level data, which allows the use of internal differencing, permits a fixed-effects estimator to be used to control individual company effects; this was not feasible with provincial-level data (see footnote 4). Table 7, which presents the first look at that question, shows statistically significant results for the dummy variable indicating a plan is incorporated in Ontario. This provides further evidence that the pension system in Ontario differs from the rest of the country and is, in fact, systematically funded at a lower level. Again the raw explanatory power of the model (R^2) is low, but the overall regression is significant as indicated by the high F-statistic.

The fact that not all DB pensions in Ontario are covered by the PBGF[16] will inevitably introduce noise into any research examining the full population of DB plans. In order to improve upon that situation, a different variable was examined

[16] A 'multi-employer pension plan established pursuant to a collective bargaining agreement or a pension plan providing defined benefits and the employer obligation is limited to a fixed amount set out in a collective bargaining agreement' and is exempt under subsection 6 of the Regulations as is a plan established within the last three years. Also, 12 public plans have specifically been exempted by Ontario law from paying the PBGF assessment.

Table 8. *Plan asset value per DB participant*

(Fixed-effects model using provincial data 1999 and 2000)

Constant	34723.76
	(1.00)
Real income per worker	−3413.036***
	(−4.45)
Interest rate	19658.47***
	(4.56)
Unemployment	17342.37***
	(6.13)
Tax rate	−104.266**
	(−1.69)
PBGF	−4470.842***
	(−6.07)
R^2	0.0029
F	41.95

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.

which essentially moved the PBGF-exempt Ontario DB plans into the population of plans from other provinces without any such guarantee program.

In order to refine the model to look specifically at the issue of public guarantees, a dummy variable was introduced to indicate coverage by the Pension Benefit Guarantee Fund. The *PBGF* dummy equals 1 for Ontario plans, where either the PBGF liability or PBGF assets indicated in the data were not equal to zero. For all other Ontario plans, as well as all plans outside of Ontario, the *PBGF* dummy variable is zero. Examining plan-level data in this fashion does present statistical challenges, however. In order to examine this particular variable, methodological requirements dictate that characteristics that do not vary within provinces (such as real income, unemployment rate and tax rate) must be dropped from the regression. Table 8 presents the resulting model and coefficients.

As expected, market interest rates are significant and carry a positive sign: each 1% increase in interest rates can be expected to produce an aggregate increase on average of an additional $19,658 of funding per DB plan participant. The dummy variable introduced to indicate coverage by PBGF is statistically significant and carries a negative sign, indicating that plans that are protected by PBGF have lower market asset value per participant than other Canadian DB plans. Although the overall explanatory power of the model is weak, the significance of the PBGF variable indicates that those covered by the PBGF have an average of $4,471 less in funding behind their promises than those covered by DB plans that are not backed by a government guarantee. To put this number in perspective, some 312 of the 907 pension plans reporting to the Financial Services Commission of Ontario in 1999 report non-zero PBGF liabilities. These plans cover almost one million workers, so

funding at the average level (an additional $4,471) would cover approximately $45 billion of the unfunded liabilities reported by Ontario pension plans.

The future

Ontario's PBGF may face changes in the near future. The members of the Canadian Institute of Actuaries (CIA) 'differ in their opinions as to whether or not the PBGF should be continued … In the interest of promoting uniform legislation across all jurisdictions, the CIA suggests that the government reassess whether the PBGF should be continued.'

O'Reilly (2004) and others argue that not only the PBGF but indeed many aspects of the Ontario *Pension Benefit Act* need to be overhauled. The surging deficit in recent years reinforces arguments, such as those by Arvin and Lanoi (1993) that policy-makers should, at a minimum, redefine the position of the PBGF in bankruptcy proceedings[17] to protect Ontario taxpayers against some losses. These authors also link the Fund's deficit to:

> flat benefit plans that exist in the union sector. When these plans are periodically and retroactively enriched, new unfunded liabilities are created if union leaders do not negotiate substantial increases in plan contributions at the same time

and further recommend a slower phase-in of coverage for retroactively enriched benefits.

Conclusions and recommendations for further study

Economists and others have debated extensively the role of government in ensuring that pension benefits promised during a worker's career are realized after that career ends. By and large, those debates are philosophical (or political) rather than research-based. History has created in Canada a situation where approximately one-half of the workforce resides in a location that does offer a government-backed guarantee while the other half do not. As a result, Canada offers the potential to provide some of the highest quality research in the world on public guarantees of private pension plans. While the available data have limitations, the results are informative. Overall, the results presented in this paper demonstrate that the state of interest rates and the economy carry much more weight in the area of pensions than does the issue of a government guarantee.

With respect to governmental guarantees, the results given here show conclusively that the one Canadian province that offers a governmental guarantee (Ontario) exhibits a market for private pensions that behaves significantly different from the rest of Canada. Furthermore, the existence of a government guarantee is related to lower funding of DB pensions to the amount of approximately $4,500 per participant. Expanding upon the strength of the conclusions possible from this research in the future will require an improvement in the quantity and quality of data available.

[17] Currently the Fund falls behind preferred creditors and, in most instances, is not represented on creditors' committees.

As well, future researchers are encouraged to incorporate into their methodology the opposing effects of higher taxes for public and private sector employers to better understand the inconclusive or counterintuitive results that can sometimes appear with aggregated data.

Despite its limitations, the authors of this study hope that the results presented here provide meaningful insights for public policy makers in Canada and in other countries that may have or may wish to consider a system of pension guarantees.

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Appendix

After subdividing the data to look separately at for-profit and not-for-profit organizations, we determined that the expected (positive) effect of tax rates does indeed apply to private plans. This analysis explicitly recognizes that only organizations that pay taxes will be encouraged to form pensions because of the tax shield they provide.

While it is not the key point of this paper, the results we obtained make sense and support the argument given for the coefficient of the *Tax Rate* variable in the aggregate model. The more detailed results in Table A1 support the proposition that, because public entities benefit from higher taxes, such an environment actually permits stronger pension coverage for employees of those organizations. Future researchers are encouraged to incorporate the opposing effects of higher taxes for public and private sector employers into their model to better understand the inconclusive or counterintuitive results that can sometimes appear with aggregated data.

Table A1. *Number of pension plans in Canada*

(Modeled using StatCan data 1990–2001; Z scores given in brackets)

	For-profit sponsors	Not-for-profit sponsors
Constant	149.77	92.12
	(0.44)	(2.50)**
Real income per worker	0.065***	−0.017***
	(3.51)	(−8.53)
Interest rate	78.47***	−1.11
	(4.20)	(−0.05)
Unemployment	−57.15***	0.617
	(−4.28)	(0.43)
Tax rate	14.38**	−1.14*
	(2.51)	(−1.84)
Labour force	−1.02	0.63***
	(−1.54)	(8.96)
R^2	0.96	0.78
F	99.19	14.58

Notes: *** significant at 1%.
** significant at 5%.
* significant at 10%.