

# **Underfunding of Defined Benefit Pension Plans and Benefit Guarantee Insurance - An Overview of Theory and Evidence\***

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**Abstract:** I review the theoretical literature on defined benefit (DB) pension plans, particularly focusing on the issue of plan underfunding and benefit guarantee insurance schemes. Under reasonable assumptions underfunding can be an equilibrium outcome even in the absence of benefit insurance. The introduction of benefit guarantee funds was a reaction to the problem of underfunding, and I summarize the ensuing problems of moral hazard and adverse selection. I then discuss the still rather small body of empirical research on the subject and propose directions for future research.

## 1. Introduction

There is growing concern about the funding status of defined benefit (DB) pension plans both in Canada and internationally. Although the number of Canadian DB plans has steadily decreased in recent years,<sup>1</sup> there are still a large number of employees (both in the private and public sectors) that rely on this type of pension provision for their retirement. DB plans currently seem much less secure than initially anticipated and many current and future retirees might receive less than expected from their pensions. This has prompted reactions by policy makers and led to calls for reform of the DB institutional framework. Ontario recently appointed the Expert Commission on Pensions, and the United States implemented the Pension Protection Act in 2006, intended to reduce some of the problems DB plans are currently facing.<sup>2</sup>

In this paper I summarize the existing literature on the funding of DB plans, highlighting two aspects: i) underfunding of DB plans can be an *equilibrium outcome* if markets are not perfectly competitive; ii) one way to deal with the problem of underfunding is to introduce pension benefit insurance, but that, in turn, gives rise to the common insurance problems of moral hazard and adverse selection.<sup>3</sup>

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<sup>1</sup> The “raw” number of DB plans does not show a significant decline and there are even new DB plans that are created. However, these plans include one or few members only and are targeted at high level management. Arguably, the goal of these plans is somewhat different from standard pension plans for employees.

<sup>2</sup> Wilcox (2006) provides an exhaustive discussion of the reforms in the U.S.

<sup>3</sup> Note that DB pension plans are, in general, regulated in terms of contributions, portfolio allocation, etc. Wherever benefit insurance schemes exist they are additional to

Underfunding has been documented empirically (Armstrong 2004). However, the effects of benefit insurance, while well established theoretically, have not been studied much empirically. I argue that more empirical work should be carried out to better characterise the nature and magnitude of the effects arising from benefit insurance. Particularly useful would be studies that can inform the ongoing policy reforms. I suggest further analysis of the “natural experiment” in Canada, where Ontario is the only province that has introduced a pension benefit guarantee insurance scheme.

The remainder of the paper is structured as follows. Section 2 reviews the theoretical literature regarding underfunding as an equilibrium outcome without pension benefit insurance and the issues arising from introducing such insurance. Section 3 discusses the degree of underfunding observed in the US and Canada (particularly Ontario), while Section 4 looks at the empirical literature and indicates directions for future research. Section 5 concludes.

## **2. Review of the theoretical literature**

### *2.1 Underfunding as an equilibrium outcome*

Underfunding of pension plans does not arise with perfectly competitive labour and financial markets. The wage rate will be determined by market forces and

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regulation. For example, all but one of the Canadian provinces have regulatory authorities, but only Ontario has added benefit insurance. I discuss some regulatory aspects briefly below, but a comprehensive analysis is beyond the scope of this paper.

workers will acknowledge pensions as a part of their remuneration package. Workers will pay for their pensions, while firms act as insurance providers. As long as firms are less risk averse than individual workers this improves efficiency (see Gustman, Mitchell, and Steinmeier 1994, 422).

The issue becomes more interesting if we step away from perfectly competitive markets. Pensions then have an economic function for the firm, beyond a savings mechanism for workers. Ippolito (1985a) builds a model of a labour contract that includes a DB pension plan. He describes two different “views” of the evaluation of pension promises. In the “legal” view, workers recognize that the firm could terminate the plan at any time. They are thus willing to contribute only what they would get back upon immediate termination. By contrast, in the “implicit contract” view, workers believe that the firm will maintain the plan and fulfill pension promises. They agree to an implicit long-term contract with the firm.<sup>4</sup> This implies that plan members are willing to increase their contributions beyond the value associated with the immediate termination of the plan. It implies also that two market imperfections are at play: i) the labour contract does not cover all contingencies, since the firm has the legal right to terminate the plan at any time; and ii) accumulated pension savings cannot be observed directly, but instead have to be inferred from the promised pension benefits.

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<sup>4</sup> Ippolito’s implicit contract description is often called “going-concern”. The alternative framework is also described as “plan wind-up” or “solvency”. Ippolito (1985a) offers empirical evidence that supports the implicit contract view of pensions.

The important difference between these two views arises in calculating the present value of pension benefits. In the legal view, the pension is evaluated at the current wage rate and the discount rate is the nominal interest rate ( $i$ ). In the implicit contract view, the pension is evaluated at the wage rate at retirement age, and hence includes expected increases in compensation. If one assumes a constant growth rate ( $g$ ) of wages, the discount rate to evaluate pension benefits is the difference between the nominal wage growth rate and the nominal interest rate ( $g - i$ ). Since plans use only the nominal interest rate to report to the regulatory authorities, there exists a difference between reported pension liabilities and “economic” liabilities (Ippolito 1985a, 1031), and firms will *underfund pension plans in equilibrium*. Hence “...workers have a direct financial stake in the firm...” (Ippolito 1985a, 1041). We note also the following implications of the model: i) reduced mobility of workers; ii) higher contributions to the pension plan early in the career (with a steeper wage-tenure profile for pension covered workers); and iii) attenuation of union strength (or “hold-up”) in wage bargaining (Ippolito 1985b).<sup>5</sup>

In contrast, Cooper and Ross (2002) build a model introducing a financial market imperfection in the form of firm’s borrowing constraints. In their model, the firm hires one worker for two periods. The worker provides labour in the first period. Realization of production in the second period is stochastic and depends on market conditions. The firm promises the worker a pension for period two, which

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<sup>5</sup> More specifically, workers and their unions will be less well positioned to bargain for the rents associated with their specific human capital.

is funded by setting aside a pension fund in the first period. Their proposition 1 (Cooper and Ross 2002, 674) characterizes the efficient labour contract. It shows that, if firms have sufficient internal funding, wages are constant over workers' tenure (the wage profile is flat) and pensions are fully funded. In this situation the risk-neutral firm acts as an insurance provider, via the pension, to the risk-averse worker.

Underfunded pensions arise when firms face borrowing restrictions (Proposition 5).<sup>6</sup> If firms do not have access to sufficient internal capital they will offer upward sloping wage profiles while at the same time reducing the funding of the plan. Intuitively, the lack of capital prevents the firm from credibly committing to pay the pension in the second period. This implies that, in some states of the world, the worker will face a reduced value of her pension. The financial market imperfection on which the model rests is one that plausibly affects many firms.

To sum up, under realistic assumptions about labour and financial markets, underfunding of DB pension plans is an equilibrium outcome even in the *absence of pension benefit insurance*. I next turn to the consequences of introducing such insurance.

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<sup>6</sup> Alternatively, regulation of pension portfolios leading to lower rates of return on investment can lead to underfunding.



## 2.2 *Theoretical aspects of pension benefit guarantee insurance*

The problem of underfunded DB pension plans was a major motivation for the introduction of pension benefit guarantee insurance in a number of countries. In the US, for example, big bankruptcies, such as the one of the Studebaker-Packard Corporation, led to the implementation of the Employee Retirement Income Security Act (ERISA) and the Pension Benefit Guaranty Corporation (PBGC) (see e.g. Brown (2008)).<sup>7</sup> In Canada, most private pension plans are regulated at the provincial level<sup>8</sup> although some industrial sectors (e.g. banking and transportation) are under federal supervision. However, Ontario is the only jurisdiction with benefit guarantee insurance, the Pension Benefit Guarantee Fund. This type of insurance, as most insurance schemes, faces challenges along the lines of *moral hazard* and *adverse selection*.<sup>9</sup>

Cooper and Ross (2003) apply their model to analyze the effect of the introduction of public insurance. They find that underfunding is accentuated - a moral hazard argument. Without insurance only firms with insufficient capital would underfund their plans; however the introduction of a benefit guarantee induces *all* firms to reduce their contributions.

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<sup>7</sup> Ippolito (1987) uses his implicit contract model with union hold-up to provide an economic rationale for the PBGC.

<sup>8</sup> The province of PEI does not have a regulatory authority.

<sup>9</sup> *Moral hazard* characterizes the potential to increased risk taking by insured agents, while *adverse selection* represents the situation where high risk agents have an increased incentive to buy insurance, see e.g. Mas-Colell, Whinston, Green (1995).

In addition, the authors look at the investment decisions of plan sponsors by introducing a risky asset. They find three effects, one positive and two negative: i) the risky asset increases the incentives of the sponsor to fully fund the plan – a positive effect; ii) but it might also induce excessive risk taking; and iii) the risk taking increases with insurer imposed minimum funding levels. Hence, the goal of the benefit guarantee “to increase funding of pensions may create an incentive for firms to adopt risky portfolios” (Cooper and Ross 2003, 268).

A different feature of moral hazard is presented in Niehaus (1990): If the insurance premium does not depend on the default risk of plans, all firms have an incentive to increase benefits, provided that they stay below the maximum guaranteed benefit,<sup>10</sup> but the incentive to increase benefit levels for firms at high risk of default is especially great. Intuitively, higher benefits imply that the firm is able to lower its labour cost. However, insurance costs remain the same and the expenses of the higher benefits are incurred only if the economy is good and the firm survives. Note that this form of moral hazard increases with the level of underfunding of the plan.

Finally, turning to adverse selection, benefit insurance premiums which do not adequately reflect bankruptcy risks might induce firms with well funded DB pension arrangements to terminate their plans (or convert them into defined

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<sup>10</sup> A flat fee was common for the PBGC in the US and the PBGF in Ontario. Below I discuss the issue of risk adjusted premium rates.

contribution plans), leaving the benefit guarantee insurance with a bad risk portfolio.<sup>11</sup>

In summary, the existence of a benefit guarantee insurance can i) increase (but need not cause) the degree of underfunding; ii) induce plan managers to invest in riskier portfolios; and iii) induce firms to terminate well funded plans.

### **3. The degree of underfunding**

Underfunding of pension plans is well documented. Ippolito (1986) performs an early evaluation of the funding status of a sample of U.S. DB plans and finds significant underfunding. The average funding ratio was 65.5% in 1978 and 76.8% in 1981. These figures are much lower than the ones reported by the PBGC. Hence, the fact that regulatory authorities report underfunded plans could mean that “true” economic liabilities (as defined by Ippolito) are even higher.

The funding situation of Canadian DB plans might not seem alarming according to the latest data. Selody (2007) presents data from Mercer for 2006. His Table 1 (Selody 2007, 8) shows that in 2006 44% of DB assets were held in plans with some degree of underfunding, with 12% having a solvency ratio of less than 80%. However 2006 seems to have been a good year; only one year prior (December 2005) 82% of assets in plans in Canada had some degree of

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<sup>11</sup> See e.g. Wilcox (2006) for a discussion.

underfunding (Selody 2007).<sup>12</sup> Similarly, while the pension plan regulator in Ontario, the Financial Services Commission of Ontario (FSCO 2007), reports that for the filing period ending June 30, 2005, median solvency ratios were 87%<sup>13</sup>, we observe also that the same report shows that **more than 50%** of DB pension plans in Ontario had some degree of underfunding, in some cases quite severe.<sup>14</sup> Of the 855 filings for that year more than 38% of plans had solvency ratios of less than 80%.

One aspect that cross-sectional data do not convey is the persistence of funding deficits for individual plans. How long do plans stay underfunded? And do plans with high funding deficits remain in this position significantly longer than plans with relatively low deficits? An analysis with longitudinal data could help to shed light on these questions.

Finally, two additional concerns arise that are not addressed by the theory. First, the funding assessment by the regulator/insurer might be inadequate. Brown (2008) contends that the US PBGC might face future liabilities that go well beyond the current deficit of over US\$18 billion. In the case of *Bethlehem Steel*

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<sup>12</sup> DB plans in Canada are evaluated according to two evaluation methodologies: solvency, where it is assumed that the plan is terminated at the moment of evaluation; and going-concern, where continuation of the plan is assumed and earnings are projected to retirement for each worker. For the same period the median funding ratio using the going-concern method was 96%. Note that plan sponsors have to file with the regulator only every three years, except if the plan is in financial distress, in which case yearly evaluations can be required.

<sup>13</sup> Note that, contrary to the Selody (2007) data, these numbers are per plan and not weighted by assets.

<sup>14</sup> Admittedly, one could argue here that DB plan sponsors are doing their “homework”. This view can be supported by the recent increase in DB plan contributions as compiled by Statistics Canada. Between 2001 and 2005 annual contributions have almost doubled from C\$20 to C\$38 billion.

there was an important gap between the funding status of the plan as assessed by the PBGC (84%) and the actual availability of assets at the time of bankruptcy (45%). Second, in Canada, there is uncertainty about ownership of plan surpluses. While theory implicitly assumes that ownership of plan surplus is with the sponsor (the upside of providing insurance to workers), this is not necessarily the case in practice. In 2000 the Supreme Court of Canada, in the Monsanto case, ordered that any plan surplus be (at least) partially distributed to members. However, the ruling did not determine surplus ownership for all cases, and hence created uncertainty. One implication of this is that plan sponsors have an even further reduced incentive to fully fund their plans.

#### **4. Empirical studies**

While theoretical issues of underfunding of DB pension plans, with or without benefit insurance, have been analyzed in some detail, the number of empirical assessments is rather small.

Niehaus (1990) supports his model on moral hazard in benefit levels with an empirical analysis. He finds that plans which benefited from the introduction of the PBGC have significantly increased the level of benefits over the period of introduction of the insurance, compared to a control group – multi-employer plans – that were not covered. However, characteristics of multi-employer plans might be quite different from single-employer ones, thereby introducing bias in the

estimation. One would rather obtain a control group with essentially identical plan characteristics, e.g. plans from other jurisdictions. Since the PBGC was introduced at the federal level for all single-employer DB plans, such comparisons can only be made before and after the introduction of the insurance.

The situation in Canada, with Ontario the only Province with a guarantee, can potentially be exploited for future research. Two approaches come to mind. First, a more comprehensive sample could be built comparing plans across jurisdictions over time including information on funding status, investment behaviour, benefit characteristics, etc. Second, a difference-in-difference analysis *à la* Niehaus (1990), but with a more closely matched control group, could be carried out around the period of introduction of the PBGF in Ontario. One could expect more precise estimates on the effect of benefit insurance, both along the moral hazard and adverse selection lines. Such work would benefit not only the Canadian reform discussion but could give insights for other similarly administrated funds such as those in the U.K and the U.S.

This special institutional setting has so far been exploited in one article. Nielson and Chan (2006) study a panel of aggregate data on Canadian pension plans. Their dependent variables are number of plans and plan assets. They find that Ontario DB plans have significantly higher levels of assets per plan member than other provinces. Unfortunately, the aggregated data available to the authors does

not contain any information on plan liabilities. They are thus not able to assess the funding status of plans and specifically the effects of benefit insurance.

To my knowledge no empirical study has, as yet, addressed the issue of adverse selection induced by benefit guarantee insurance. However, several authors point out the potential problems of an insurance premium that does not reflect risk. Both Wilcox (2006) and Brown (2008) suggest that rates charged to plan sponsors do not adequately reflect risk. While rates are not constant across plans, as assumed in some of the theoretical work, they are usually a function of the degree of underfunding. Brown suggests that premium rates should take into account the creditworthiness of plan sponsors. Note that the Ontario PBGF, similar to its American counterpart, has variable rates that depend on the degree of underfunding but does not take into account creditworthiness.

## **5. Conclusion**

The funding situation of defined benefit pension plans may pose a threat to the retirement income of many current and future pension receivers. Even though the number of DB plans is decreasing, many workers still rely on this type of plan for their retirement. Reforms are thus called for and might be costly. One way to address the potential consequences of DB plan underfunding is through benefit guarantee mechanisms, such as the PBGC in the US and the PBGF in Ontario.<sup>15</sup>

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<sup>15</sup> As mentioned above, proper regulation of plans is a complement to benefit insurance.

In this paper I have outlined the current status of the theoretical literature on the issue. I highlight that underfunding of DB plans is a likely equilibrium outcome even in the absence of pension benefit guarantee mechanisms. I discussed the consequences of these insurance schemes. Both moral hazard and adverse selection considerations arise: i) the degree of underfunding might be accentuated; ii) plan sponsors have an incentive to invest in overly risky assets and increase the level of benefits in difficult financial situations; and iii) well funded plans might convert their DB to DC plans.

Empirical analyses of these theoretical predictions are scarce. While the problem of underfunding is commonly reported, few studies have looked at the effects of benefit insurance. Canada has a unique situation in that only Ontario has such an insurance scheme, while the other provinces (and the federal authorities) do not. This makes it possible to compare plan behaviour over time across different institutional settings or, even more promisingly, to estimate the effects of insurance via a difference-in-difference methodology. In general, more empirical work is needed to assess these effects more precisely to better inform the ongoing discussion on policy reform.



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