

Shifting Public Sector DB Plans to DC

The experience so far and implications for Canada

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Executive summary

What would be the impacts and implications of converting many of Canada's major public sector pension plans from their current arrangements into individually controlled *defined contribution* (DC) plans? This is a worthwhile question to ask because several provincial-level political parties and a few policy advocates have been calling for a wholesale conversion of public sector pension plans to DC arrangements.

Fortunately there is considerable experience and evidence from other jurisdictions and a deep body of theory and literature that can help us anticipate the likely consequences of such a conversion. This paper draws from the literature and theory to anticipate issues and implications that would arise from converting major pension systems to DC. It also reviews the experience and history in other jurisdictions where large public sector pension plans have been converted to DC and in other jurisdictions that investigated converting to DC but then rejected the idea.

Finally the study models the potential quantitative impacts of converting a fairly typical large jointly sponsored public sector pension plan with primarily defined benefit (DB) pension arrangements to a DC structure. It is widely recognized within the pension industry that DC pension plans are less efficient generators of pension income than are DB arrangements or other pension design alternatives. The purpose of our modelling segment is to provide a salient demonstration of the cost and benefit implications of this reduced efficiency that is associated with DC pension plans.

Throughout the analysis we strive to keep in mind the broad array of stakeholders affected by public sector pension plans including: public sector employers and governments, employees and their dependants, taxpayers, future generations and society at large. All five of these stakeholder groups benefit from efficiency in a pension system; that is, the ability to squeeze the most benefits from a given level of contributions. The harder the money works, the easier it is for everyone involved.

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The conclusions of the study are as follows:

1. The perceived advantages to closing DB pension plans in the private sector do not translate directly into the public sector. While the shareholders of private corporations are primarily focused on profits, the shareholders of public corporations have other needs to consider.

While private corporations are able to off-load costs without being concerned about who has to pick them up, public sector employers who off-load costs in many cases are off-loading costs that have to be picked up in some other form by their shareholders, i.e., governments and ultimately taxpayers. Canadians unable to save enough directly or through workplace pensions while they are working become a burden in retirement for taxpayers.

2. Several U.S. states that have looked at converting DB plans to DC have concluded that it would cost considerably more to maintain similar benefits. Two states that had converted to DC at least partially converted back because of concerns over how little income they were producing for retirees (Nebraska and West Virginia).

A DC plan can be designed that will be better than most of those existing in Canada today, but experience and modelling show that it will still be a more expensive way of producing retirement income than a large, well-run DB plan. This would also require changes to the tax laws and most provincial pension legislation.

3. Our modelling has shown us that for an efficient \$10-billion DB plan, converting to individual-account DC arrangements to provide the same value of pension benefit would increase the ongoing cost of the plan by about 77 per cent and increase the required contribution rates accordingly. The portion of the final benefit coming from investment returns would drop from 75 per cent to 45 per cent. Using a pooled DC pension arrangement would still increase the plans costs substantially but the ongoing cost increase for the new DC plan would be reduced from 77 per cent to 26 per cent.
4. In addition to bearing perpetually increased costs for the new DC plan, the post-transition plan sponsor (often government) would face an increase in financial risk coming from the closed DB plan that would run parallel to the new DC plan for many decades. Over the first few decades, while these increased risks would be large, government could choose to bear higher costs for the closed DB plan rather than higher risks. This could be achieved by partially de-risking the closed plan's investment portfolio, but doing so would increase the cost of running the closed plan by about 38 per cent for those first few decades after the transition.
5. If the motivation for a conversion to DC is to reduce costs, then it should be noted that shifting to DC actually increases the cost of delivering a comparable pension benefit.¹
6. If the motivation for a conversion to DC is to reduce the government's exposure to the financial risks associated with sponsorship of the pension plan, then it should be noted that other plan design options are available for reducing or transferring risk that do not require sacrificing the plan's investment efficiency. Many of Canada's large public sector plans have already employed features such as joint sponsorship and/or contingency of non-core benefits in order to share and reduce risk. From this starting point, governments cannot benefit a second time by shifting again risks that have already been transferred to members. It is not clear that many Canadians appreciate this evolution.
7. If the motivation for a conversion to DC is to address an existing unfunded liability, then it should be noted that converting to DC does nothing to address the past-service unfunded liability that a plan may have accumulated. Converting to DC makes the management of a legacy-unfunded liability more risky and difficult. It also does not freeze the existing liability. In several of the cases that we examined, the past-service unfunded liability continued to grow for decades after the conversion. Ultimately, a conversion to DC will lead to a situation where the past unfunded liabilities have been extinguished and no new unfunded liabilities can be created. However, it would typically take about a century to get to that state. Extra costs and risks would be borne in the interval and the extra costs associated with the loss of investment efficiency would go on as long as the DC plan exists.

¹ See Appendix 3, sections on Nebraska or West Virginia for examples

Context and overview

In Canada and globally, some interest groups are pressing hard to convert public sector pension plans from defined benefit (DB) to defined contribution (DC).

The demands for conversion are being made in the context of what is being cast as a crisis in funding for public sector pensions that threatens current government finances and poses an unconscionable burden for future generations.²

The arguments revolve around equity, affordability and risk.

Critics argue that the pensions delivered by public sector DB pension plans are unaffordable and unfair to taxpayers, most of whom have no such retirement security of their own.

They argue that DB plans pose too much risk to current and future generations of taxpayers, risk that should be borne by the beneficiaries of the plans.

One line of argument flows from the notion that DC pensions are the norm in the private sector, and public sector employers should follow the same norm. Statistics Canada reports, however, that currently 1.4 million of Canada's private sector workers are covered by DB pension plans, while only 0.9 million are covered by DC plans.

This is a crucial debate for Canadians, and as we set out in the following pages, one in which we are all stakeholders.

This paper looks at one aspect of that debate. We test the claim that converting public sector DB plans to DC is in the best interests of taxpayers and other stakeholders by studying the experience with similar conversions in other jurisdictions, including Australia and several states in the U.S., and looking at how those lessons would apply here.

The issues under examination here are the risks and rewards for employers and employees (and by extension, with public sector employers, taxpayers). But they also include the larger but equally important context of crucial differences between the public and private sectors and what those differences mean when weighing the relative merits of different types of pension plans.³

A **defined benefit plan** is a pension plan under which an employee receives a set monthly amount upon retirement, guaranteed for life or the joint lives of the member and her or his spouse. This benefit may also include a cost-of-living increase each year during retirement. The monthly benefit is normally based on a formula that includes the participant's years of service, age at retirement (if retiring early) and, often, the highest average salary over a specified number of years.

A **defined contribution plan** is a retirement savings program under which an employer and an employee make contributions to a participant's individual account during employment with no guaranteed retirement benefit. The ultimate benefit is based exclusively on the accumulated contributions and investment earnings of the plan. Unless an annuity is purchased, any benefit payments cease when the account balance is depleted, regardless of the retiree's age or circumstances. As with any savings account, once the money is gone, it's gone.

In the simplest terms, DB plans are primarily risky to the plan sponsor at the front end (contribution rates can vary) and DC plans are risky to plan members when they pay out.

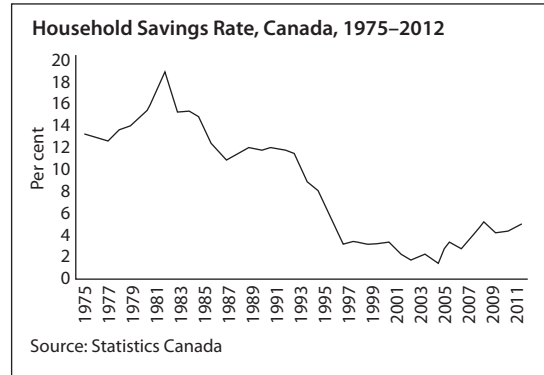
2 (Petkov 2013) (Milke and Lang 2013) et al.

3 (Statistics Canada 2014)

Public sector pensions are often part of negotiated compensation packages. Whether their design features are fair, adequate or too rich is a legitimate question for public debate, but it is beyond the scope of this paper.

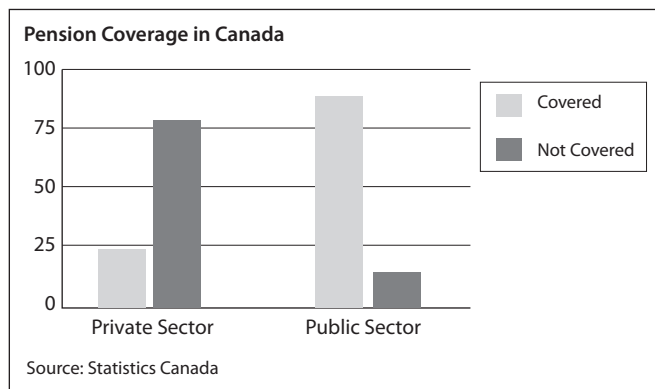
Public sector pensions are also part of a larger retirement landscape that is getting bleaker for many Canadians. Between 1986 and 2010, the proportion of the Canadian labour force covered by DB pension plans shrank from 39 per cent to 29 per cent. Virtually all of that shrinkage was in the private sector. In 2012, only 24 per cent of private sector workers had any sort of registered pension plan coverage with about half of that in DB plans. The remaining 76 per cent have the most common form of workplace pension plan in the private sector, which is no pension plan at all.

While private sector pension coverage has been falling, so too has the overall savings rate, which includes pensions and is a measure of the overall preparation Canadians are making for their future needs.



This low pension coverage rate drives Canada down in the Mercer Melbourne Pension Index, where we rank sixth out of 20 nations listed (Australia, with a mandatory workplace pension system ranks third).⁴

There is a further dichotomy in the Canadian pension world. In the public sector, 86 per cent of workers have workplace pensions of which 94 per cent are DB. This has created an environment in which the DB pension delivery system has been blamed by some critics for affordability and funding issues and for the gap between public and private sector pension coverage. As a solution, they now demand that public sector DB plans be replaced by DC plans.



This paper focuses narrowly on the implications of such a move in the hope of adding light to one facet of the crucial public debate over pension adequacy and reform.

There are many other important matters at issue in Canada's ongoing pension policy debate that we do not address here. We have not surveyed Canada's

⁴ The Australian system scores high on coverage but poorly on senior poverty rates. For more on Australia, see the appendices. In Mercer rankings, Denmark comes first, Netherlands second. The Mercer Index puts greater weight on coverage than the adequacy of benefits. (Mercer 2013)

public sector pension arrangements to catalogue the existing pension designs in use, assess their appropriateness and sustainability, or to identify plans where specific reforms would be appropriate. We have not evaluated public sector compensation arrangements and take no position on whether public sector workers in general are overcompensated or undercompensated. We do not directly address whether new national or provincial pension programs are required to help improve savings rates and pension adequacy for private sector workers. We do not review the relative merits of other pension design options such as jointly sponsored plans, multi-employer pension plans (MEPPs), union-sponsored DB plans, risk-shared plans and target-benefit plans. This paper is not a comprehensive response to all issues, nor an appeal for the status quo. It responds only to the ongoing advocacy for the conversion of public sector pension plans from their various current arrangements to DC plans.

Most large provincial and municipal level plans have already moved towards more risk sharing with plan members.

One aspect that often gets overlooked in calls for conversion to a DC model is how some public sector plans have already evolved to the point where they are no longer pure DB plans in which employers/plan sponsors carry all of the risks.

Provincial public sector pension plans have some attributes in common, but many attributes that differ. They are all pre-funded plans and are regulated by their respective provincial pension benefits legislation. Some are single-employer plans. Some cover multiple employers.

Most large provincial and municipal level plans have already moved towards more risk sharing with plan members. Some are jointly sponsored, which means that costs and the risk of unforeseen variance in those costs are shared 50/50. Some have contingent benefits that are paid only if the funding of the plan is deemed to be healthy. Inflation protection is now increasingly risk shared, i.e., not a guaranteed arrangement, in the public sector.

So while they all continue to carry the label defined benefit, many could be fairly categorized as risk-shared plans, one form of which is the target benefit model recently proposed by the federal government.⁵ Jurisdictions contemplating pension reform should certainly give consideration to a broader array of options than just the traditional DB and DC models.

Advocates of converting to DC plans usually focus on the risk to the employer or plan sponsor while ignoring or playing down what might be called public policy risks and rewards.

One example is the risk that seniors will not have saved enough during their working lives to pay for their retirement. While the public sector plans are criticized for their perceived generosity, members of these plans will be less reliant on taxpayers to meet their needs when they stop working. For those in the private sector with no pensions or only small DC benefits, future dependence on taxpayers for retirement income through GIS (for example) is a real possibility. So the primary risk to future taxpayers may not be the segment of Canadians with adequate income to look after their own needs in retirement, the risk may be the growing sector who are not so well prepared.

5 (Department of Finance, Canada 2014)

The arguments usually presented in favour of converting public sector pensions to DC include:

- transferring risk from governments and taxpayers to employees and their dependants;
- reducing costs and lowering the volatility of costs to government and taxpayers for public sector pensions, particularly at a time when fewer private sector employees have similar pensions;
- eliminating an unfunded liability that has built up in some public sector DB funds and;
- providing plan members with greater portability of their pension assets in an age when many predict that workers will increasingly switch jobs and careers during their working lives.⁶

While these arguments reflect legitimate concerns, they are based on a simplistic and narrowly focused view of the purpose and impact of workplace pensions. The third point is also somewhat specious, since, as we will show later in this document, closing a DB plan does not eliminate an unfunded liability. In fact, the unfunded liability will almost inevitably rise over the intermediate term and this increase could be significant. In addition, the costs to fund this increasing unfunded liability can be more volatile and higher than would otherwise be the case with an ongoing pension plan open to new entrants.

As for portability, many inter-plan transfer agreements enhance mobility within the public sector and the existence of large multi-employer public sector pension plans also promotes mobility within the sector. Furthermore, in four provinces (Manitoba, Ontario, British Columbia and Quebec) DB plans now have immediate vesting, which enhances portability as well.

The risks usually referred to involve the funding levels required to ensure that the promises made in DB plans to plan members can be kept when they retire.

In the U.S., some high-profile municipal bankruptcies have been blamed on excessively generous pension plans that were grossly underfunded and poorly managed. This year celebrity investor Warren Buffett called public sector pensions a “gigantic financial tapeworm that was born when promises were made that conflicted with a willingness to fund them.”⁷

That background of highly-charged yet often irrelevant rhetoric that spills across the border makes it difficult to calmly assess the risks in Canada. And the pension landscape is far from uniform. Even in the U.S., where regulations and oversight are more lax and the problems more acute, not all pension plans, public or private sector, are in trouble. What proponents of radical surgery posit as a “crisis,” defenders of the status quo or those promoting more moderate remedies see only as funding challenges that can be overcome by adjusting contributions or other aspects of DB plans without threatening the income security of plan members.⁸

Recently, as stock markets have risen, the funding ratios of DB pension plans in the public and private sector have improved dramatically despite continuing low interest rates. Mercer

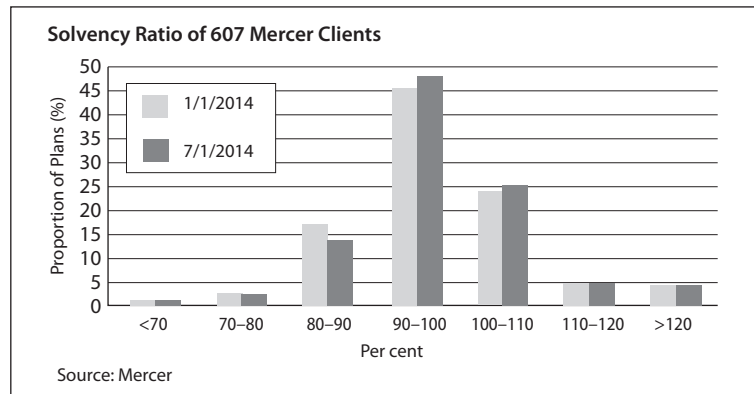
6 This argument is somewhat dated as DB and DC plans now have virtually equivalent vesting rules. As an aside, while the notion that the workforce will become increasingly mobile is now accepted wisdom in most circles, a recent study by CIBC World Markets found that job stability in Canada is now stronger than it has ever been with the percentage of Canadians who have been with the same employer for five years or more at a record high. (Tal and Exarhos 2014)

7 (Buffett 2014)

8 (Leech and McNish 2013)

reported recently that in the second quarter of 2014, its Pension Health Index for Canada stood at 105 per cent, which is down slightly from the start of the year but still near its highest level in more than a decade.⁹

So what are the risks with DB plans? The risk to employers (and employees if risks are shared) is that they will be hit with higher costs than they anticipated. That happens when actuaries find that higher contributions are required for a DB pension plan to be fully funded to meet its obligations over time



as a result of a changing investment climate, changes in life expectancy and other factors. These same factors will increase the amount of DC contributions required to maintain the pension plan retirement income objective.

When markets are buoyant and interest rates high, current costs for employers can go down, but that is rarely viewed as a problem and it has been some years since this phenomenon has been observed. If the employer can't meet its obligations, however, employees will also be at risk of not getting the defined benefits they were promised. In bankruptcy proceedings, pension plan members stand near the back of the line of creditors and often lose out (e.g., Nortel). The current reality appears to be one of continuing low interest rates for the short to intermediate term.¹⁰

In DC plans, employees carry all of the risk. Since the level of contributions is fixed, if the invested funds fail to achieve the expected returns, the benefits they can achieve will simply be less.¹¹ In a DB plan, when investments underperform, this creates an unfunded liability that has to be paid. DC plans do not have unfunded liabilities because when investments underperform, the workers benefits go down.

In the current debate, it is crucial to parse the issues and be careful with definitions.

Too often comparisons assume that all DB plans and DC plans are the same. In fact, beyond the basic DB-DC differences, a range of factors can affect how they perform that can be associated with either type of plan in the private or public sector.

9 (Mercer 2014)

10 There are obstacles beyond just market conditions to fully funding a plan. The *Income Tax Act* will not allow any surpluses in excess of 25 per cent of liabilities. Further, plan sponsors that fund a plan in excess of 100 per cent can never withdraw the capital that created that over funding. All of this discourages funding to even 100 per cent.

11 Towers Watson has maintained a Defined Contribution Retirement Index. It showed the level of benefits a worker who retired at age 60 in 2007 could expect to receive would, by 2012, take a worker until age 68 to achieve because of lower investment returns. (Towers Watson 2012)

In the private sector, DC plans are increasingly preferred by employers concerned about uncertain liabilities that DB plans can represent because of the variable investment landscape and the fact that retirees are living longer. In the private sector, these variables must be fully and immediately accounted for and can depress stock prices.

DC plans present private sector employers with fixed costs for their operation. Other than the retention issues raised by any aspect of compensation, they see little reason to consider where the risks they off-load will come to rest.

For public sector employers, or more specifically the governments that fund them, the issues are more complex. Governments have to be concerned with the welfare of all stakeholders, from plan employers concerned about affordability, to communities that need a solvent citizenry to thrive, to the coming generations of taxpayers to whom will fall the burden of looking after retirees who have not saved enough during their working lives to support themselves.

About 1.8 million Canadians, or about a third of OAS recipients, receive GIS payments. This is an indication of how little income they have saved for their own retirement.

One illustration of these offsets is that Canadians who have not been able to save enough to support themselves are subsidized by the current generation of taxpayers through the Guaranteed Income Supplement (GIS) and to some extent, the associated Old Age Security.

About 1.8 million Canadians, or about a third of OAS recipients, receive GIS payments. This is an indication of how little income they have saved for their own retirement.¹²

In addition to more responsibilities, governments have more powers than do private sector employers to make unilateral changes to existing agreements. But they also have legal and practical restraints. They will almost certainly inspire job action and legal challenges from unions and may face electoral consequences if they are seen to be abrogating agreements that were negotiated in good faith.¹³

We will examine these issues more fully in the following pages as we look at the arguments for converting public sector DB plans in the context of the usual reasons for switching and add an element that is often ignored—the risks to governments and society if seniors haven't been able to save enough in their working lives to support themselves in retirement.

We then look at the experience in jurisdictions in which public sector pensions have either switched from DB to DC or looked at the issues involved and rejected that reform.

Finally, we apply the lessons and indicators learned from the literature and apply them to a model large public sector plan to get some measure of the effects such a change from DB to DC would have on all the stakeholders.

12 (ServiceCanada 2014)

13 An example is the protests in Quebec over Bill 3. (CBC 2014)

What problem are we trying to solve?

Identifying the stakeholders, defining the terms and parsing the issues in the public sector DB vs DC debate

The starting point for analyzing the suitability of any pension plan is to define what we want to achieve. No magic formula exists to achieve adequate retirement income, there is no magic pill or free ride. Retirement is expensive and someone has to cover the costs.

In Canada we have what has been referred to as a three-legged retirement system. The three legs are government pensions, workplace pensions and personal retirement savings. From a taxpayer's perspective, however, there are only two sources for retirement income; money saved by individuals to support themselves and their dependants and money provided on a pay-as-you-go basis by taxpayers.

The more individuals can save, either through ordinary savings, tax-preferred savings accounts such as RRSPs and TFSAs,¹⁴ the Canada Pension Plan and workplace pensions, the less they require from any alternate source and the less of a burden they will be for taxpayers, now and in the future.

So the goal of any workplace pension plan—DB, DC or any other—should be to provide adequate income for retirement as efficiently as possible.

That said, there are distinct stakeholders in the pension debate who have sometimes overlapping and sometimes competing interests.

What varies greatly between the public and the private sector is what the stakes are if plans fail to meet the goal of retirement income security, who the stakeholders are and how they are affected.

Employees in the public and private sectors share the goal of securing adequate retirement income at a cost that still allows them a reasonable income during their earning years.

Employers in both sectors share the goal of keeping compensation costs as low as possible while maintaining tools for retaining workers or encouraging them to leave, as their needs change.

Where the interests of public and private sector employers diverge is in how employers serve the interests of their shareholders. In the private sector, shareholders are primarily interested in maximizing the return on their investments. Shareholders bear no responsibilities for employees or good public policy beyond those imposed by labour law and employment agreements.

Private sector employers that focus on serving their shareholders are not primarily concerned about what happens when they trim their costs and avoid risks by transferring them to either employees or the communities in which they live.

In the public sector, employers are also concerned about keeping costs low and managing risks. But their shareholders—governments, the citizens they represent and the taxpayers that support them—have much wider interests.

Employees in the public and private sectors share the goal of securing adequate retirement income at a cost that still allows them a reasonable income during their earning years.

¹⁴ Tax-preferred savings accounts have implications for all taxpayers, not just those who hold them, but that effect is beyond the scope of this paper.

So public sector employers that serve their shareholders well cannot be narrowly focused only on the cost side. The risks and retirement costs that employers—public or private—are able to off-load do not disappear. Someone else has to pick them up. In the public sector, that someone includes the same shareholders who may benefit initially from lower costs. In many cases governments that benefit from lower costs as employers will find themselves facing higher costs as providers of social services, such as GIS, for citizens who do not have adequate income to support themselves.

This duality of purpose sets public sector employers apart from private sector employers. They are stand-alone enterprises with specific services or products and have to be run efficiently as such. They are also instruments of public policy and must be managed in a way that does not undermine other public policy objectives.

So when we define stakeholders in the public sector pension debate, we quickly find that they go beyond just the employer and employees.¹⁵

For the public sector we have identified five primary stakeholders:

1. Employers/plan sponsors (which may include unions)
2. Employees/plan members and their dependants
3. Current taxpayers
4. Future generations of taxpayers
5. Society at large

What does each of these stakeholders want or need from a public sector pension plan?

The employer/plan sponsor wants low costs and low volatility of those costs. They would also like to use their pension plan as an inducement to attract and retain employees and reduce costly turnover and occasionally as a tool to encourage early retirement as conditions evolve.

Employees want low contribution rates while working and adequate and assured benefits when they retire. They want to know what their workplace pension plan will provide at retirement so that they can know how much more they need to save to provide true retirement income security. They also want to protect their purchasing power against inflation in retirement with a cost-of-living adjustment (COLA). They want to be vested as soon as possible and to be able to change jobs without giving up significant retirement benefits.

Current taxpayers would like to pay as little as possible for public sector pensions, which are part of the total compensation package their taxes support. They don't want to pay for things they cannot afford themselves. But it is also in their interest to ensure that public servants will not fall back onto tax-supported welfare programs in retirement (e.g., the Guaranteed Income Supplement or GIS). Taxpayers also want the services that public sector workers provide.

¹⁵ There clearly is a public interest in private sector employers providing adequate workplace pensions for their employees, but that issue is beyond the scope of this paper.

Future generations of taxpayers need to be protected from having to prop up growing numbers of seniors who have been unable to save enough in their earning years to support themselves in retirement. Adding public servants, who now have adequate pensions, to that list would increase this burden.

Society at large benefits from citizens of all ages who have adequate income to fully partake in the economy, adding to the vibrancy of their communities as consumers and taxpayers. Society also benefits from a large, stable, long term, patient investment pool of the type created by large-scale pension plans. The investment capital not only assists members of these plans who spend in their communities but also provides employment directly through the direct investment in businesses, development, natural resources and housing.

All five stakeholders benefit from efficiency in a pension system; that is, the ability to squeeze the most benefits from a given level of contributions. The harder the money works, the easier it is for everyone involved.

To meet the needs of the stakeholders we can articulate a set of basic principles for a desirable pension plan model. These principles would include:

1. Overall economic risk must be shared in a manner that is appropriate and fair to current and future members and employers. For example, ordinary plan members should neither be expected to be investment experts nor to understand life-cycle investing.
2. Size matters. Management efficiencies and investment opportunities that are a function of size are worthy of pursuit where there is a good alignment of interest.
3. Consistent with principles one and two, there should be a collective approach to risk and reward sharing. That is, we should put to work the “law of large numbers” to statistically minimize risk (variance).
4. Plan design should be fair to all participants, current and future, by using realistic assumptions.

Thus we can see that plans must be sustainable; affordable (for employees, employers and taxpayers); responsible (efficient and capturing economies of scale); and equitable (for current and future members, employers and taxpayers). These principles give us a framework to gauge how well existing pension plans, both DB and DC, serve the stakeholders we have identified and provide a starting point for looking at what would happen if large public sector DB plans in Canada were converted to DC.

Future generations of taxpayers need to be protected from having to prop up growing numbers of seniors who have been unable to save enough in their earning years to support themselves in retirement.

Applying principles: A risk/benefit analysis for stakeholders

The most common reason given for preferring DC plans to DB is that they reduce the risks for employers/plan sponsors and transfer them to employees. Private firms want to focus on their primary business without worrying about risks they feel they can't control. Pension plans carry a number of important risks; however, these need to be examined individually to see how they are affected by the choice between DB and DC or some variant. Some of these risks are also interrelated and should not be viewed in isolation.

There are risks for employers/plan sponsors but also for employees and as we have discussed, for all five identified groups of stakeholders. There are also important benefits against which those risks have to be assessed.

DB and DC plans handle and are affected by these risks in different ways.

The risks include:

- **Investment risk**—This includes the volatility of investment returns and the broader risk of low investment income. Investments provide most of the income for either a DB or a DC plan. If returns are lower than expected in a DB plan, the employer/plan sponsor and or plan members may have to increase contributions to ensure that the plan's obligations over time can be met. In a DC plan, lower investment returns simply produce lower income in retirement or a delay in retirement, assuming the member can control the timing.
- **Expense risk**—Expenses erode income, so the higher the expenses, the less money remains to produce income. Expenses include the cost of managing investments and the administration of the plan. Generally speaking, the lower the expenses, the better.
- **Inflation risk**—If benefits are not adjusted to reflect increases in the cost of living then the effective purchasing power of the pension erodes over time.
- **Interest rate**—If the plan or worker buys a life annuity and interest rates are low at the time of purchase then the cost of a life annuity will be higher and the resulting income lower. Higher interest rates would lower the cost of the annuity and produce higher income.
- **Longevity risk**—If the plan or worker does not buy a life annuity, the risk to the employee is that they will live longer than the life expectancy for which the plan or the individual's savings account was designed. DB pension plans also face longevity risk if all pensioners in the plan live longer than assumed in the pricing of the plan, but any individual in the plan is able to pool their longevity risk with the other plan members in their cohort.
- **The risk of failure**—In the private sector this refers to the situation where a sponsor becomes insolvent while leaving an unfunded liability in the DB plan. In a public sector DB plan, it is less likely that the plan sponsor (the government) will actually become insolvent, although it has happened in the U.S. Future governments can, through legislation, however, reduce benefits to resolve their budget problems. Whether through insolvency or legislation, the reduction in benefits may occur during an economic downturn, forcing older plan members to draw on other retirement income (e.g., a personal RRSP) at a time when interest rates are low and therefore the costs of annuities are high. This unfortunate double impact of an economic downturn will also face all DC participants.

Benefits on which DB and DC plans need to be assessed include:

- Adequate retirement income that benefits employees, their dependants and their communities.
- Retirement savings that provide money for investment in the economy, either short term or for long-term projects.

How risks affect pension income

In private sector DB plans, employers/plan sponsors assume the *investment risk* as long as the employer/plan sponsor is not bankrupt and the plan is meant to be fully funded. In the private sector, the risk to plan members grows when employers/plan sponsors fail to make the actuarially required contributions. In the public sector, there is little chance the employer will fail, but governments can pass legislation to reduce benefits to solve funding problems, although this is rarely done. In jointly sponsored plans, which include many public sector pension plans, the investment risk is shared 50/50 with the workers. Other public sector plans have shared-risk components that automatically freeze or reduce benefits if the plan is underfunded.

In DC plans, the investment risk falls to the employee/plan member. In DC plans, the risk is that the savings plans will not produce sufficient retirement income. What we see from experience in other jurisdictions is that DC plans not only transfer investment risk from plan sponsors to plan members, they also increase the risk that the income generated from workplace pensions will not produce sufficient retirement income for a variety of reasons detailed farther on.

This potential retirement income shortfall is the mechanism through which stakeholders beyond the plan sponsor and plan member have a stake in the pension debate, since these retirees will be more dependent on broader public support systems.

Investment risk may be considered the bottom line in terms of income replacement, but it is not a simple measure of how well a particular investment or group of investments perform.

One of the cardinal differences between DC and DB plans as they are usually constituted¹⁶ is that DC plan members take control of most of the investment decisions affecting their personal savings accounts.

This can lead to a wide range of investment returns. A 2011 Texas study that looked at converting DB plans to DC found that in any DC plan with a self-directed component, just 8 per cent of members would do better than under the existing DB plan and 92 per cent would do worse. Two-thirds would do significantly worse, receiving 60 per cent or less of the current DB benefit.¹⁷

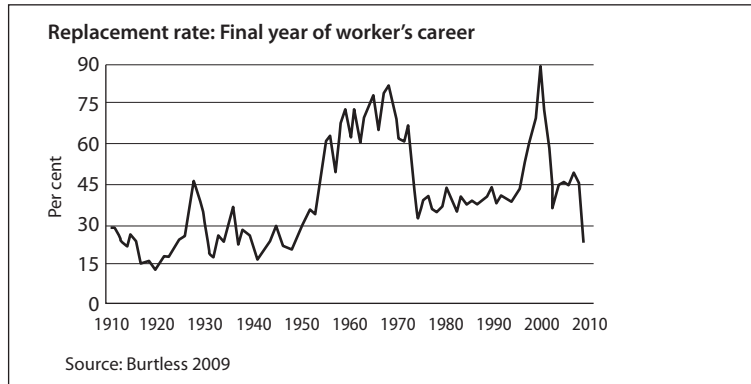
In jointly sponsored plans...the investment risk is shared 50/50 with the workers. Other public sector plans have shared-risk components that automatically freeze or reduce benefits if the plan is underfunded.

¹⁶ In Canada, the *Income Tax Act* includes in its definition of defined contribution plans the distinction that they have individual savings accounts. It may be possible to produce a more efficient DC plan but as long as they rely on individual investment decisions made by plan members, the evidence so far is that they will for most plan members still fall short of the returns they could have achieved through a large DB plan. The elements identified as necessary for a best practices DC plan include: A focus on producing retirement income rather than savings, mandatory participation, adequate contribution rates, a limited set of professionally managed, pooled investments, adequate education and advice for participants, and annuitized benefits with little or no borrowing from the plan. (McGee 2013)

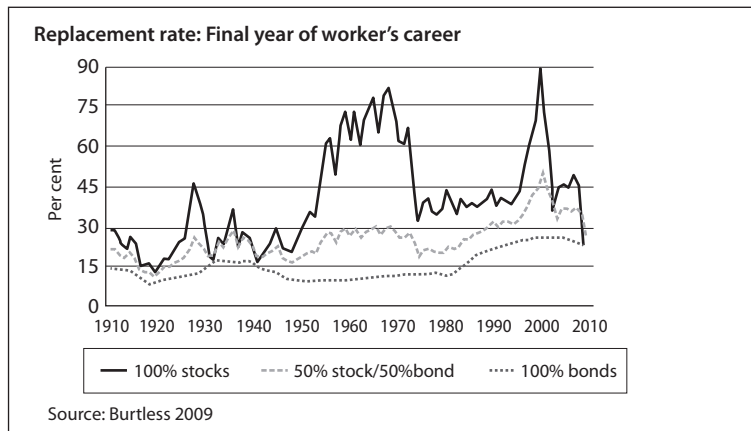
¹⁷ (Teacher Retirement System of Texas 2011)

This is partly due to a lack of financial expertise on the part of individual investors versus the professional management available to large-scale DB funds. It is also a function of some of the other risks that play against individual investors that try to match the returns achieved by large institutional investors.¹⁸

In DC plans, the investment risk, which is now the responsibility of the individual plan member, is illustrated in the table on page 15, which shows the replacement rate for the final year's salary from an annuity obtained from personal account savings of workers who contribute four per cent of annual salary over a 40-year career.



Workers can decrease the investment risk by choosing less volatile assets such as government bonds. That reduces volatility but limits returns and produces lower replacement rates as seen in the following figure. It shows the replacement rate for the final year's salary from an annuity obtained from personal account savings of workers who invest in different portfolios and contribute four per cent of annual salary over a 40-year career.



There are methods to mitigate the investment risk. The employer/sponsor may suggest a number of investment options. (Interestingly, the more options that are provided, the higher the probability the worker will choose the default option).¹⁹ Or, the worker can hire an investment advisor. In a way, however, this only shifts the investment risk over to the expense risk. Individuals can easily

18 (Morneau 2012)

19 (Tapia and Yermo 2007)

lose three per cent of their gross rate of return to the investment advisor or fund manager (referred to as the management expense ratio or MER). If funds earn in the neighbourhood of five per cent per annum and inflation runs close to two per cent (not unusual assumptions for today) then such a worker receives no real rate of return at all. Further analysis of the impact of investment fees can be seen in the following table, which tracks the impact of investment expense ratios and shows how profoundly they can affect the aggregate pension benefits and working income replacement ratios of retired plan members. The data assume an annual contribution to a plan of \$10,000 over 40 years for a worker making \$50,000 per year.

Impact of Investment Expense Ratios on Pension Adequacy

Expense Ratio	0%	0.4%	1.50%	3%	5%
Accumulated Value After 40 Years	\$777,000	\$707,000	\$551,000	\$400,000	\$272,000
Annual Pension Payout	\$45,000	\$41,000	\$32,000	\$23,000	\$16,000
Replacement Ratio	90%	82%	64%	46%	32%

(Arthurs 2008, p 184)

On a macro-economic basis, one result of this investment risk is that DC plans produce counter-cyclic retirement patterns. That is, when the economy is soft and employers would like workers to retire to lower costs, workers will have deflated DC asset values that may encourage them to keep working. Similarly, when times are good and DC balances are high, workers will choose to retire just when we need them to meet the higher demand for labour.

Workers also tend not to shift their investment portfolio mix as they approach retirement. The literature tells us that one should move out of a strong equity portfolio to more of a bond portfolio as one nears retirement. This is seldom actually seen when individual workers manage their own investments. The impact can be significant.

Many individual account holders lost 20 to 30 per cent of their equity investment values between summer of 2008 and spring of 2009. Work by the OECD shows that the market crash of 2008 could have led to a drop in replacement ratios of almost 10 percentage points.²⁰ For example, an American who retired at age 65 in 2007 would have enjoyed a replacement ratio of 24 per cent. A year later, a 65-year-old retiree could expect a replacement ratio of only 15 per cent (or 37 per cent less pension income in retirement, assuming DC contributions of five per cent over 40 years and a fixed portfolio of 40 per cent domestic government bonds and 60 per cent in domestic equities).²¹

Another important factor is longevity risk, which can affect investment decisions and limit the returns on investment available for individual investors.

Life expectancy as an average for a large group, such as a cohort of pensioners in a DB plan, can be accurately estimated. That same value is very difficult for an individual to estimate. So in planning for retirement, individuals cannot know how far their benefits will have to stretch.

²⁰ (OECD 2009)

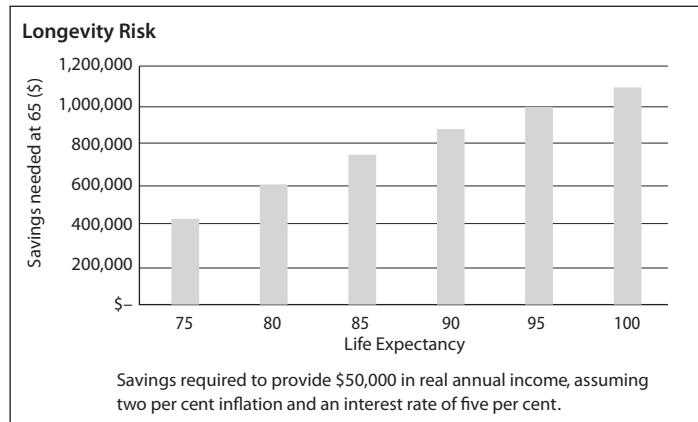
²¹ (OECD 2009)

Individuals, either with their own savings or as part of a DC plan with individual savings accounts, face two potentially bad outcomes: over saving by setting aside funds to cover retirement years they won't live to enjoy or not saving enough, running out of income and becoming dependent on government welfare.

In DB plans, individual longevity risk can be pooled among the retired members of the plan. That means that funds need only be large enough to cover the average life expectancy. Further, it means that investments do not have to become as conservative or as liquid, which generally result in lower returns, as individual members grow older.

The longevity risk can be transferred to an insurance company by buying a life annuity. In this way, the insurance company promises to pay benefits for the unknown lifetime of the worker.

This is a difficult decision to make, however, when interest rates are low as they are now. The lower the interest rates, the higher the price that will be charged for an annuity. Annuities also have to provide a profit for the insurance companies that sell them.



In DB plans, individual longevity risk can be pooled among the retired members of the plan. That means that funds need only be large enough to cover the average life expectancy.

Thus, buying an annuity raises the interest rate risk and also the expense risk.

Further, many workers cannot get a true market-value annuity in today's marketplace. To control potential adverse selection, insurers assume that if a worker voluntarily applies to purchase an annuity then that worker must be in five-star health and expecting a long life and the annuity is priced accordingly. Few workers have five-star life expectancy, but they get painted with the one-size-fits-all brush so they in effect overpay for their annuity.

Finally, it is difficult to get an annuity that provides true inflation protection. One can buy variable annuities with payouts that move with market values, but market values do not correlate well with inflation. Or one can buy an annuity where the annual payout increases according to a set (constant) growth factor, but this is far from true inflation protection and this feature greatly decreases the initial monthly payout. Inflation protection is a worthy social goal, one that individual account DC plans cannot cost-effectively achieve. DB plans can provide a level of inflation protection in a cost-effective manner by making such protection contingent on the funding health of the plan.

Thus, today, the choice with individual DC accounts is either a very expensive life annuity or budgeting for retirement based on the nearly impossible task of projecting how long the income will be needed.

Workers who outlive their savings have to rely on government income supports, such as GIS. This raises societal and intergenerational transfer issues that will be discussed in more detail later.

Regardless of the assumed life expectancy, as the individual worker ages, they will have to move the portfolio into ever more conservative or liquid assets that would normally be expected to provide lower rates of return. The effect is compounded when combined with an investment horizon of 20 plus years after retirement. Further, the worker may be forced to sell assets at an inopportune moment in the market cycle. In a pooled-asset DB plan, however, while the individual worker ages one year per year, the collective group of workers does not age as rapidly as any individual, so that the portfolio can remain invested longer in higher return assets such as equities, infrastructure and private equity. Further, there should be no need for sudden forced sales.

The longevity attribute also becomes a factor for DB plans when they are closed to new members, as some have been when the plan sponsors switch to DC plans for new hires. As the remaining DB plan members age, the plan has to turn to more conservative and more liquid investments with generally lower returns. That means to keep the plan fully funded, employers/plan sponsors often have to increase contributions because the investments are doing less of the work.²² This effect is exacerbated by the loss of contributions that new members would have been making had the plan not been closed.

Size matters

Most of those arguing for a shift in the public sector from DB to DC plans would have the new DC accounts managed individually, requiring individual investment choices. While this gives more control to the individual, one of the problems with an individual account approach to retirement income security (e.g., RRSPs) is that individuals have to try to mitigate many of the retirement income risks alone. Many advantages can come from having a larger asset pool, either by being part of a very large employment group or by allowing smaller pension plans (which could include individual RRSP and TFSA accounts) to commingle their assets. Not only can you achieve savings on the expense of administration and management, but investment opportunities exist for large funds that are not available to smaller funds (e.g., infrastructure and private equity).

Further, if the commingled fund pays out the retirement income, then a large commingled plan has the advantage of the pooling of the mortality risk that results from a more accurate estimation of average life expectancy.

Work by Ambachtsheer displayed in the following table shows how important plan size is with respect to the investment expense risk.²³

Investment Fees by Size of Pension Fund

Size of Pension Fund	Investment Fees for Large-cap Equities
Individual Account	250–300 bp*
\$10 million	60 bp
\$1 billion	42 bp
\$10 billion	28–35 bp

* bp = basis points

22 (RVKuhns & Associates, Inc. 2012)

23 (Arthurs 2008, p 184 Pensions 2008)

In the same vein, a survey of 316 private sector DB plans published this year by the UK Pensions Regulator found that small DB plans (0–99 members) were paying up to four times the administrative and investment costs per member as large plans (1,000–4,999 members).²⁴

Comparing the benefits of DB vs DC

It is possible for very large DC plans to have many of the investing advantages of size. Canada does not have large DC plans on the scale of the DB plans that exist today.²⁵ But they could be formed. This could be done, for example, under the Pooled Registered Pension Plan model created by the federal government. However, even here there are likely to be costs for marketing and sales to attract members and employers to use a specific service provider's products.

DB plans provide a benefit to workers that has true meaning.

But, even if a DC plan could achieve size, there are still residual advantages to the DB plan model.

First, DB plans provide a benefit to workers that has true meaning. Workers are told that their plan will provide them with a given percentage of their final-average or career-average salary or that they will receive so many dollars per year of service once they retire.

For example, one plan might pay 1.5 per cent of the average salary of your final five years of employment for each year of service. So, you know that if you work there for 30 years, you replace 45 per cent of your salary in retirement. Another plan might pay \$1,000 per year of service. So, again, if you work with that employer for 30 years, you know that you will get \$30,000 a year in retirement. Some public sector DB plans guarantee to adjust these payments in line with the Consumer Price Index (CPI) through cost-of-living adjustments (COLAs), although the number of plans with a guaranteed COLA is declining.

Contrast this to being told that your employer will deposit \$2 per hour of work on your behalf into a Capital Accumulation Plan (this is how a DC plan works). So, if you work a 52-week year at 40 hours a week for 30 years and if your fund can earn five per cent per annum after fees (a very important assumption) you will have \$283,000 in a bank account on the day you retire.

But, what does that tell you? Will that provide you with retirement income security throughout the remainder of your life?

So, defining a retirement benefit either as a replacement ratio or a set dollar amount per year allows workers to plan for their retirement income security. Amassing some dollars in a bank account (even a large number of dollars) may not. The worker in the DC plan is still responsible for the draw-down phase with all the risk and difficulties that implies. In fact, as we are now learning, the draw-down phase of retirement planning is far more complex than the accumulation-of-assets phase.²⁶

Another issue for RRSP-type DC plans is what is often called leakage, which is what happens when money put aside for retirement is withdrawn prematurely and used for some other purpose. It

24 The mean costs were £1,054 for small plans, versus £281 for large plans. Very large plans (more than 5,000 members) had the lowest per member running cost of £182, however, due to the small sample size this was not considered to be statistically significant. (IFF Research 2014)

25 The Public Employees Pension Plan in Saskatchewan is the largest, with \$5.6 billion in assets. See appendix for details.

26 (MacDonald, et al. 2013)

sometimes happens when workers change jobs, so that the apparent portability advantage of an RRSP-type DC plan can turn into a liability in terms of providing retirement income. Cashing out to buy a home or some other property can also be done deliberately in a manner that “games” the income-security system by turning what would be income into assets that are not counted in order to qualify for low-income benefits, such as the GIS.²⁷

This is a key benefit of a DB plan. It doesn't just provide you with an accumulation account and then leave all remaining risks to you. It pays you retirement income. And it pays you this retirement income for life for the pensioner and often for the spouse. The worker does not face either the investment risk or the longevity risk to the same extent.

DC plan members may be given little advice on how to draw down their DC savings.²⁸ A poorly chosen draw-down strategy can negate the potential rewards from diligent efforts on the accumulation side. We elaborate more on this issue farther on.

The effect of switching from DB to DC in the public sector: The experience so far

Experience from other jurisdictions that have either converted DB plans to DC for public sector workers or considered converting consistently shows that the promises of cost savings and reduced liabilities are never met without significant reductions in benefits.

In 2006, Alaska closed the DB plans for teachers and state employers for new hires and replaced them with individual 401(k) type accounts. At the time Alaska closed its DB plan, its unfunded liability was projected to be \$5.7–\$6.2 billion. By spring 2014, the unfunded legacy liability had grown to about \$11.9 billion despite increased contributions by the employer.²⁹

Michigan closed its existing DB plan to new employees in 1997. At that time, it was 108 per cent funded. By 2012, that funding ratio had fallen to 60.3 per cent and the plan had an unfunded actuarial accrued liability of \$6.2 billion.

A 2011 study found that members of the Michigan DB plan that chose to switch to the DC option in 1997 were much worse off than the majority that stayed with the closed plan. The average account for those 60 or older was \$123,000, which it was estimated at the time would produce an annual income of about \$9,000. That compared poorly with the average benefit of about \$30,000 for those retiring in the DB plan at the time.

West Virginia is one of two states (the other is Nebraska) that have changed back from a DC plan to some form of DB over concerns about low benefits for employees and high administration costs. When a DC plan was set up for new hires in the West Virginia Teachers' Retirement System in 1991, about 4,500 members of the existing plan switched. By 2008, fewer than 10 per cent of those over the age of 60 had account balances greater than \$100,000. Many had less than they would have received in a single year in benefits under their former plan.

27 (Agnew 2013)

28 (Brown 2008)

29 For details and references in this section, see the appendices on other jurisdictions.

Nebraska state and county employees were covered by DC plans that were set up in the 1960s. In 2002, the DC plans were closed to new employees and replaced by Cash Balance DB plans after a study showed how poorly the DC plans performed when compared to DB plans for Nebraska teachers. The 20-year average investment return for DC plans was 6–7 per cent compared to 11 per cent for DB plans. At the same time, the DC plans had disproportionately higher administration costs.

Several states have studied a conversion of their DB plans to individually controlled DC accounts and decided against proceeding in that direction.

A study in New York City found that it would be 57–61 per cent more expensive to deliver the same benefits under a DC plan than it would with the existing DB plans.

As part of a design study in Minnesota, Mercer conducted an actuarial analysis that concluded that it would cost \$2.76 billion over the following decade to convert to a DC plan. The study also found that DC plan members would be less likely to be able to support themselves in retirement and more likely to need taxpayer-supported public assistance.

In Wisconsin, a state in which the government was able to essentially break public sector unions and had a free hand in changing retirement benefits, a 2012 study recommended against converting to DC. This was in part because the plan had been healthy and in part because some features usually associated with DC plans were already incorporated into the state DB plan, which includes an element of risk sharing that had reduced benefits to many members since the 2008 recession.

The Nevada Public Employees' Retirement System (PERS) was grappling with unfunded liabilities and in 2010 studied the effects of closing its DB plans to new members. Among the findings by the Segal Company was if the plan was closed to new members, the amortization component of contribution rates for the closed plan would need to increase by 10.44 per cent of payroll for regular employees and 11.44 per cent for police/fire employees. The study also found that as a result of lower investment returns, DC plan members would have retirement assets that were 20 per cent lower than DB plan members.

A study by the Teacher Retirement System of Texas, the sixth-largest retirement system in the U.S., also rejected a conversion from DB to DC as a solution for its funding woes. Among the key findings were that the DB plan provides benefits at a lower cost than alternative plans; the majority of members would do significantly worse investing on their own; that setting up an alternative system for new hires would not address existing liabilities; and other pension plans that moved from DB to alternative systems realized savings only through lowering benefits.

A study in New York City found that it would be 57–61 per cent more expensive to deliver the same benefits under a DC plan than it would with the existing DB plans.³⁰

Australia has achieved a massive increase in pension coverage at a reasonable cost by instituting a mandatory retirement savings program, the Superannuation Guarantee, in 1992. More than 90 per cent of men and women are covered. While successful at vastly increasing coverage, the Australian program has been less successful at reducing poverty in seniors and displays on a large scale many of the problems associated with individually controlled defined contribution savings plans.

30 (Fornia 2011)

“Despite the compulsory contributions and tax concessions, only 20 per cent of Australians are completely self-sufficient in retirement and, of this group, only half manage to stay self-sufficient with the balance eventually relying on the government age pension,” Deloitte Partner Stephen Huppert wrote recently.³¹

In Canada, the primary experience with relatively large-scale DC pension plans has been in Saskatchewan, which closed the DB plans for public employees and teachers in 1977.

While Saskatchewan has been cited by at least one prominent critic of DB plans as an example of a jurisdiction that successfully met a pension-funding crisis head on, it is not at all clear that the conversion has served any of the stakeholders we have identified particularly well.

Almost four decades after the DB plans were closed, Saskatchewan taxpayers are still facing a multi-billion-dollar unfunded liability that will cloud its outlook for another five decades. At the end of the last fiscal year, there were still 300 active members and 5,800 retired plan members and dependants receiving benefits from the DB plans.

Public servants covered by the DC plan set up to replace the closed DB plan do have access to some options that are not available to Canadians with personal RRSPs, but they also face some of the same pitfalls that can make it difficult to achieve adequate retirement income from personally managed investments.

Economic effects

The consistent finding in theory and practice that DB plans are more efficient than DC plans at producing pension income from a given level of contributions shows the advantage for DB plan members. That efficiency also has ripple effects on all other stakeholders, not just because of the higher benefit amounts that can be paid out with resulting higher tax revenues but also because of attributes of the assets in DB plans, which in Canada have created large pools of patient investment capital.

The impact of public sector pension plan assets on the Canadian economy is immense. Total pension assets in Canada were around \$1.34 trillion at the end of 2013 with more than \$900 billion in public sector plans. The scale of investable funds in pension plans not only has repercussions for plan members but also for the economy because of their size and the way they are invested. Large funds can invest in larger projects and fund managers with longer timelines are more likely to invest in large infrastructure projects.

Lawrence Schembri, deputy governor of the Bank of Canada, recently described the pension industry as second only to the banking in its importance to the Canadian financial system.³² “Pension funds contribute to financial stability because of their size and behaviour,” he said. They have long investment horizons, they invest real money as opposed to borrowing and they have the luxury of patience to withstand short-term market volatility or liquidity stresses. Because the contributions to pension funds are locked in, they are not at risk of mass withdrawals or runs during a financial crisis.

31 (Huppert 2014)

32 These comments were made on May 15, 2014 in Quebec City in a speech to the Pension Investment Association of Canada.

In Canada approximately 75 per cent of every pension dollar paid out comes from investment returns—a testament to the sound funding and best-in-class investing of the pension funds.

The funds are also strong contributors to improving corporate governance practices. They take an active role in the companies in which they invest.

The funds also provide a stable source of employment in the financial sector, with approximately 10,000 professionals employed and a payroll of \$1.5 billion plus \$2 billion in fees paid to other supporting jobs.

Finally, Canadian public sector pension plans are a well-known Canadian brand globally in the investment world, participating in some of the largest deals in recent years. In Canada approximately 75 per cent of every pension dollar paid out comes from investment returns—a testament to the sound funding and best-in-class investing of the pension funds (i.e., only 25 per cent of benefits come from contributions). More on that later.

Human resources considerations

Pension plans are an important tool in the total compensation package to attract and retain good employees. DC plans historically were seen as more attractive for some employees, especially younger ones, because of the notion of individual control and superior portability. But DB plans now have shorter vesting provisions (with immediate vesting in four provinces) and have more identifiable benefits for employers and employees so this is no longer a DC advantage.

This is particularly true for public sector workers in DB plans. Most public sector workers, even if they change employers within a sector, will have full transferability of benefit accruals. The separation of the pension plan from the employer is one of the successes of the public sector model and addresses an issue that private sector employers have not been able to solve.

As detailed previously, DB plans offer employees increased confidence that they will have the income they need in retirement relative to DC plans. They also offer a clearer framework for employees to understand their needs for savings beyond their workplace pension to obtain the level of income they hope to have in retirement.

They also offer employees and employers a way to make their savings for retirement work harder since, as has been amply demonstrated, DB plans historically have produced more income from a given level of contributions.

For employers DB plans offer both a tool to enhance their ability to retain employees in whom they have invested significant amounts in training and a mechanism for trimming their payroll through early retirement if the need arises.

From a human resources perspective, employers with DC plans may be buffeted more by business cycles. Employees may hang on to their jobs longer or leave earlier in a manner that is counter to the best interests of the employer during booms and busts. Employees may be tempted to leave at the very time employers have a greater need for their labour. Conversely, hidden pensioners (i.e., unproductive workers who have postponed retirement because of inadequate pensions) may also be an issue. Employee morale may also be hurt if employers switch from a DB plan to a DC plan if employees deem it to be inferior, which may in turn affect productivity.

An American study looked at 82 publicly-traded companies that announced freezes or closings in 2003–2007 to see if the expectations about closing their DB plans were realized. They found that

no share-value increase could be documented and speculated that the negative human resources issues may have offset any financial advantage gained by closing their DB plans. It seems reasonable to expect the same issues would be at play in the Canadian public sector, even though the metric of stock price isn't available.³³

Applying the lessons:

What would the conversion of DB plans to DC look like in Canada and what would the fallout be?

“If you look at the DC plans that are out there now, they are likely to produce less benefit per dollar contributed than you would get out of a DB plan, and in that sense they are less efficient... they are small, offer less investment choices, and you have the wrong people making the investment decisions.”³⁴

Bob Baldwin, a consultant specializing in pension policy and former advisor to the Ontario Expert Commission on Pensions

Other sections of this study have expanded on these themes. What this section intends to do is to put some actual numbers to these arguments. What would it cost to run a large DB plan versus a typical DC plan? What would it cost to run a large DB plan versus a large, more efficient DC plan?

Baldwin alludes to the advantages of DB plans in terms of being bigger and earning higher investment returns. In a 2008 paper, Almeida and Fornia analyzed three sources of efficiencies in large DB plans and provided estimates on the impact these factors would have on the effectiveness of DB versus DC plans.³⁵ They point out the longevity advantage of a DB plan in its ability to calculate how long retirement benefits will be needed (see a complete section on this topic, earlier). Because of the pooling of the longevity risk, large plans can base the payout duration on the average life expectancy for the entire DB population. In an individual plan, the retiree must cover more than their expected lifetime to avoid running out of money. That means less income can be withdrawn monthly. Almeida and Fornia estimate that this factor gives DB plans a 15 per cent advantage.

While the average age of a large DB plan does rise with the general aging of the membership, it does not rise one year for every calendar year as it does for an individual. And while a DB plan's demographics can shift gradually, in contrast to an individual account, it is an ongoing entity with a long-time horizon. Thus, there is no need to move to cash or more liquid assets that will pay lower expected rates of return as the individual ages. This asset advantage gives DB plans a further five per cent advantage.

33 (McFarland, Pang and Warshawsky 2009)

34 (Baldwin n.d.)

35 (Almeida and Fornia 2008)

Finally, most large DB plans have their own in-house investment departments or can negotiate low investment fees in the open market. They can invest in a wider array of assets including infrastructure. This gives DB plans another 26 per cent advantage. In total, Almeida and Fornia estimate a 46 per cent advantage in favour of DB plans versus small DC plans for producing benefits out of a given level of contributions.

...most large DB plans have their own in-house investment departments or can negotiate low investment fees in the open market.

In our modelling, we use two sets of effective return-rate assumptions to bracket the plausible range for efficiency losses likely to be incurred when moving from a DB arrangement to a DC plan. For

the low end of our DC efficiency range we rely on the investment rates of return net of all factors outlined by Almeida and Fornia. For the low end in this case study, we cut the expected rate of return on our funds by a full 46 per cent. Thus, if the expected rate of return for our fund was 6.5 per cent the model run would use a net rate of return of 3.5 per cent ($6.5 * (1-0.46)$).

To set the upper end of our investment return bracket we assume an efficiency equal to 80 per cent of DB efficiency, as opposed to the 46 per cent of DB efficiency employed above. Thus an expected 6.5 per cent rate would be cut to 5.2 per cent. Some advocates of DC use the term DC quite broadly to include pooled professionally-managed arrangements, with no individual investment discretion and even possibly with mandatory automatic annuitization. While there is no question that such modifications would improve the efficiency of a

DC arrangement, there comes a point at which the modified arrangement is no longer a DC plan. We do not believe that it is possible to approach 100 per cent of DB efficiency with a modified DC plan that could still sensibly be described as DC. Our 80 per cent number envisions a plan that has a pooled and professionally-managed fund, but lacks automatic mandatory annuitization. It would still suffer from the lack of longevity risk pooling (a 15 per cent efficiency loss according to Almeida and Fornia). It would compete with DB arrangements on investment management sophistication and cost, but only up to the point of retirement. Much of the investment returns that drive DB pension plans come from returns made during the individual's period of retirement. In existing pooled DC arrangements, at retirement the amount accumulated in an individual's account is turned over to the individual, and the benefits of low-cost professional management are lost for the subsequent period of individual's retirement. By one estimate, 60 cents of every dollar of retirement income is earned after retirement.³⁶ For this reason we feel that placing the upper bracket for DC efficiency at 80 per cent is being generous to the DC concept.

We have constructed as an example a generic large multi-employer public sector pension plan using typical features from some of Canada's large provincial-level public sector pension plans. It has assets of \$10 billion and is funded 50/50 by employers and plan members so that any contribution rate increases that may be required to support the basic pension benefit are shared 50/50 between employee and employer contribution rates. The plan is fully funded (exactly 100 per cent) at its latest valuation. The fact that the pension benefit costs are shared 50/50 would be particularly important in a plan that is less than 100 per cent funded when it is closed. When a plan is underfunded but ongoing and the costs are split 50/50, then the unfunded liability is paid 50 per cent by increased employer contributions and 50 per cent by increased employee contributions. But once the plan is closed there are no further employee contributions available.

In our generic example inflation adjustments are paid on a contingent basis so plan participants carry this risk entirely.

³⁶ (Por 2014)

The total risk sharing for a plan of this design would typically work out to about 36 per cent of risk being borne by the employers and about 64 per cent by the plan members. Members carry a larger share of the risk because the indexation component is contingent and not guaranteed. Fully indexed pension inflation protection for a plan of this sort would account for 28 per cent of the plans contingent liabilities and the risk for this component is borne by the members. The basic non-indexed pension would account for 72 per cent of the plan's liabilities and the risks associated with that component are split 50/50 between the employers and the members.

We presume, as is almost universally the case, that after conversion, a new DC plan would run in parallel with a residual DB plan that would remain to fulfill the pension promises made to current plan members for their service prior to the conversion.

The more gradual approach to managing the transition would be to open a new DC plan for new employees only and to keep the DB plan running for existing employees who would keep contributing and keep accruing service and benefits under the old DB plan. The DC plan would start small and grow gradually over the decades. The DB plan would run on for about another century but would become increasingly impaired over time by the loss of contributions related to new younger members.

The more abrupt approach would be to start the new DC plan for all future service (existing employees and new employees) and to close the DB plan to future service. In this case the DC plan would grow much more quickly. The DB plan would have no new contributions and would be driven entirely by its investment returns. Since the past-service pension promises (basic pension benefit) were not contingent, any actuarial losses for the closed DB plan would have to be made up by the plan's sponsor or through benefit reductions where permitted.

Future financial effects of the conversion on the government would come from the new DC arrangement and from the ongoing residual DB plan. We examine these two sets of potential effects separately. The analysis focuses on the more abrupt transition approach (closing the plan to future service).

The alternative approach of closing the DB plan to future members would raise the same issues, but in a more drawn-out way. For example, in both transition approaches the DB plan gets starved for contributions and must rely entirely on its investment returns plus sponsor top-ups when required. With closing the plan to future service this happens immediately, but with a closed-to-future-employees approach it develops over several decades.

Our analysis focuses on the contribution rates that would be required to deliver a DC pension benefit of comparable value to the status quo DB plan benefit.

We focus our attention on the ongoing long-term cost of the plan, ignoring any temporary amortization components in the contribution rates.

We also focus our analysis on the basic pension (non-indexed). This is because the inflation arrangement is assumed to be a contingent benefit so that the risk is borne entirely by the members.

The literature generally identifies four efficiency disadvantages that individually managed, individual account DC plans incur relative to large DB plans:

1. The loss of longevity risk pooling introduces extra costs for annuitization, or to over fund in an attempt to self insure against longevity.
2. As the individual matures the investment portfolio should be gradually de-risked (a glide path) to reflect the individual's changing risk tolerance. This portfolio shift reduces expected return.

3. Individual accounts have higher management costs than do large pooled accounts.
4. Amateur individual investors predictably make mistakes that cause their actual returns to be below the passive returns for the relevant index.

Drawing on the work of Almeida and Fornia we assume that the effective return on investment of an individual accounts DC arrangement would be 54 per cent of the return expected for the current highly pooled and efficient DB arrangement.

We recognize as well that a more efficient, pooled DC structure could be adopted for the new DC plan (no individual accounts and no individual investment options). We assume investment efficiency of 80 per cent of DB efficiency for this arrangement on grounds that it addresses some of the losses noted above.

We also assume here that the existing 50/50 cost sharing for the basic pension contribution rates would carry over smoothly to the contribution rates for the new DC plan. That is a big and perhaps implausible, simplifying assumption. Public sector plans have benefited from having negotiated pension arrangements. A shift to DC arrangements would presumably have to repudiate the existing agreements and unilaterally impose the new arrangements legislatively. Under those circumstances the change would be a major labour relations and political issue. How this scenario would play out in practice is not at all clear.

Comparative cost for a new DC plan producing the same benefit as the DB plan

The contribution rates presented in the following table are integrated rates for our generic plan. The contribution rates specified in the table reflect the cost of producing an equivalent pension benefit. They apply as shown on earnings above the year's maximum pensionable earnings (YMPE). For earnings below the YMPE the contributions would be three per cent less than the numbers shown.

	Status Quo Valuation Assumption(%)	Pooled DC Plan, 20% Investment Efficiency Loss(%)	Individual Accounts DC Plan, 46% Investment Efficiency Loss(%)
Nominal Investment Return	6.50	5.20	3.50
Required Long-term Contribution Rate (Entry Age Normal Cost, integrated)	15.75	19.86	27.85
Relative to final pension payouts:			
Employer Contributions	12.50	16.00	22.50
Employee Contributions	12.50	16.00	22.50
Investment Returns	75.00	68.00	55.00

The above table was produced by running a valuation model for the generic plan using multiple investment return assumptions. It suggests that if the current DB arrangement were to be replaced by an individual accounts DC arrangement, the basic pension contribution rate would have to increase from 15.75 per cent to 27.85 per cent to deliver a similar retirement income to the current plan. That represents a permanent 77 per cent increase in the expected contribution costs for the employer and for the employees (assuming that employees would still be sharing costs).

Another perspective on the same information is provided in the bottom row of the table. Currently 25 per cent of the pension benefits being paid could be considered as a refund, or flow-back, of the employer and employee contributions (without interest). The other 75 per cent of the pension comes from investment returns.

In the individual accounts DC scenario the portion coming from investment returns would drop to 55 per cent, and the portion coming from returned contributions would rise from 25 per cent to 45 per cent. This change reflects the loss of investment efficiency, resulting in lower net investment returns and a higher required contribution rate.

Analysis of the closed DB plan

From the employer/government perspective, closing a residual DB plan to future service could hurt the plan in three ways:

1. If an unfunded liability in the DB plan existed at the time of conversion, the shift to a new DC plan would do nothing to address it. The closed DB plan would be left with no contribution revenues and no contributors with whom to share the cost of addressing the unfunded liability. The sponsor of the closed DB plan (presumably that would be the government following a unilateral repudiation of the risk-sharing arrangements built into the current agreement) would bear sole responsibility for the plan's liabilities.

(Since we assume the generic plan is currently fully funded, this is not a factor in our modelling. We note, however, that in the real world, pressure to convert from DB to DC may come to bear most heavily on underfunded plans, based largely on the misunderstanding that the conversion would resolve an underfunded plan's unfunded liabilities.)

2. Closing the plan to future service would cause a maturation of the plan that would increase the actuarial cost of the plan's accrued liabilities for plans that use the unit credit actuarial methods. This increased cost would have to be covered by the sponsor.

If the plan uses entry age actuarial methods, this factor would not increase plan costs. We assume here that the generic plan is using entry age actuarial methods, so this factor does not enter into our modelling.

3. After the closure of the DB plan to future service, the sponsor (assumed to be a government post-conversion) would still have to administer the plan and the assets that have been accumulated to pay for the existing past service liabilities. If there are actuarial losses as the plan goes forward, government would bear responsibility for 100 per cent of the resulting unfunded liabilities. Relative to the current 50/50 sharing of actuarial and investment risks associated with the basic pension, this represents a substantial increase of the employer/government/taxpayer risk exposure, particularly for the first decade or two after the conversion.

One possible response to this increase in risk exposure would be to de-risk the investment portfolio correspondingly. This would reduce returns and increase costs as an alternative to

bearing higher risk. We assume for our modelling that government (sponsor) post-transition would choose to maintain its pre-transition risk exposure by de-risking the investment portfolio and bearing the consequently lower returns and higher cost.

To model this effect, we assume that the government's objective as sponsor of the closed plan would be to contain its risk exposure to no more than what its risk exposure was under the current shared-risk DB plan. If its share of the risk has increased from 50 per cent to 100 per cent due to the conversion to DC, then to offset that it should seek to cut the portfolio's risk by 50 per cent. That could be done by shifting half of the portfolio to risk-free investments, which, to match the plan's liabilities, would be long-term government bonds. The appropriate investment return assumption for modelling would then be an average of the current portfolio's expected return and the risk free-rate of return.

	Status Quo Valuation Assumption (%)	Closed to Future Service Residual DB Plan, Portfolio Half Status Quo, Half Government of Canada Long-term Bonds (%)
Nominal Investment Return	6.5	4.7
Required Long-term Contribution Rate (Entry Age Normal Cost, integrated)	15.75	21.78

Government could offset its additional risk exposure to the closed DB plan by 50 per cent de-risking the investment portfolio. To do so would create a new unfunded liability in the plan because there would be no contribution rates in effect to increase. To reduce the investment risk by 50 per cent the cost of funding the plan would increase by 38 per cent. Government could cover off that cost by either making ongoing contributions to the closed DB plan of about six per cent of salary (in addition to the contributions being made to the new DC plan), or it could make a one-time payment into the plan of about \$3.29 billion (for the sample plan, which is assumed to have both assets and liabilities of \$10 billion).

Summary of the impacts of the conversion

We have assumed the plan is a large, public sector pension plan that has negotiated a number of risk-sharing and cost-sharing features over the years. It is currently in a fully-funded actuarial position. Costs are shared 50/50 between the employer and the plan participants.

If government were to convert these arrangements to DC unilaterally, in addition to labour relations implications, it would face several adverse fiscal impacts.

For the new DC plan the cost of delivering a retirement income similar to the current arrangements would be 77 per cent higher than the status quo if individual accounts arrangements were used, or possibly only 26 per cent higher if a pooled DC arrangement were established. Of course costs could be reduced by delivering a more meagre benefit. But that could also be done (and more efficiently) within the current risk-shared DB framework.

In addition, as most other jurisdictions that have converted to DC have discovered, government would be left administering a closed DB plan that could prove to be more problematic and costly to government than the status quo. The closed DB plan would be more financially risky than the old open, risk-shared DB plan. Potentially that risk increase could be offset by de-risking the investment portfolio to reduce contribution rate volatility but doing so would add significant immediate additional costs.

Combining the extra inefficiency cost in an individual accounts DC plan of 12.1 per cent of salary (or alternatively 4.11 per cent of salary for a pooled DC plan) with the additional cost of 6 per cent of salary for de-risking the closed DB plan would yield a total of 18 per cent of salary increase for the individual accounts version (or 10 per cent of salary increase for the pooled DC version).

These numbers ignore any extra administrative costs arising from having to administer two ongoing pension plans after conversion.

Also note that in Saskatchewan, where old DB plans for provincial employees were switched to new DC plans for employment after 1977, that the old pre-1977, closed DB plans still exist and are expected to exist for another 90 years with last survivor benefits (See Appendix for details).

Finally, it bears repetition that the Canadian economy looks to the large public sector pension plans as a potential source of investments that will assist in achieving fiscal stability. To date, these large plans have invested a lot of money into the Canadian economy (at all levels) including infrastructure. Any conversion of these DB plans into DC plans will reduce these investment cash flows.

Conclusions

1. The perceived advantages to closing DB pension plans in the private sector do not translate directly into the public sector. While the shareholders of private corporations are primarily focused on profits, the shareholders of public corporations have other needs to consider.

While private corporations are able to off-load costs without being concerned about who has to pick them up, public sector employers that off-load costs in many cases are off-loading costs that have to be picked up in some other form by their shareholders, i.e., governments and ultimately taxpayers. Canadians unable to save enough directly or through workplace pensions while they are working become a burden in retirement for taxpayers.

2. Large, well-run DB plans are more efficient at producing retirement income than are DC plans. Several U.S. states that have looked at converting DB plans to DC have concluded that it would cost considerably more to maintain similar benefits. Two states that had converted to DC at least partially converted back because of concerns over how little income they were producing for retirees (Nebraska and West Virginia).

Canadians unable to save enough directly or through workplace pensions while they are working become a burden in retirement for taxpayers.

A DC plan can be designed that will be better than most of those existing in Canada today, but experience and modelling show that it will still be a more expensive way of producing retirement income than a large, well-run DB plan. This would also require changes to the tax laws and most provincial pension legislation.

3. Our modelling has shown us that for an efficient \$10-billion DB plan, converting to individual-account DC arrangements to provide the same value of pension benefit would increase the ongoing cost of the plan by about 77 per cent, and increase the required contribution rates accordingly. The portion of the final benefit coming from investment returns would drop from 75 per cent to 45 per cent. Using a pooled DC pension arrangement would still increase the plans costs substantially but the ongoing cost increase for the new DC plan would be reduced from 77 per cent to 26 per cent.

4. In addition to bearing perpetually increased costs for the new DC plan, the post-transition plan sponsor (often government) would face an increase in financial risk coming from the closed DB plan that would run parallel to the new DC plan for many decades. Over the first few decades, while these increased risks would be large, government could choose to bear higher costs for the closed DB plan rather than higher risks. This could be achieved by partially de-risking the closed plan's investment portfolio, but doing so would increase the cost of running the closed plan by about 38 per cent for those first few decades after the transition.
5. If the motivation for a conversion to DC is to reduce costs, then it should be noted that shifting to DC actually increases the cost of delivering a comparable pension benefit.
6. If the motivation for a conversion to DC is to reduce the government's exposure to the financial risks associated with sponsorship of the pension plan, then it should be noted that other plan design options are available for reducing or transferring risk that do not require sacrificing the plan's investment efficiency. Many of Canada's large public sector plans have already employed features such as joint sponsorship and/or contingency of non-core benefits in order to share and reduce risk. From this starting point, governments cannot benefit a second time by shifting again risks that have already been transferred to members. It is not clear that many Canadians appreciate this evolution.
7. If the motivation for a conversion to DC is to address an existing unfunded liability, then it should be noted that converting to DC does nothing to address the past-service unfunded liability that a plan may have accumulated. Converting to DC makes the management of a legacy unfunded liability more risky and difficult. It also does not freeze the existing liability. In several of the cases that we examined, the past-service unfunded liability continued to grow for decades after the conversion. Ultimately, a conversion to DC will lead to a situation where the past unfunded liabilities have been extinguished and no new unfunded liabilities can be created. However, it would typically take about a century to get to that state. Extra costs and risks would be borne in the interval and the extra costs associated with the loss of investment efficiency would go on as long as the DC plan exists.

Appendices—Case studies in detail

Appendix 1—Saskatchewan

Saskatchewan is alone among the provinces in Canada in having a DC plan for most public employees other than teachers.

It was led down that path in 1977 by then Minister of Finance W.A. (Wes) Robbins, a former chief administrator for the DC plan covering co-operatives (Co-operative Superannuation Society). He was a great believer in DC plans and a great salesman. He persuaded the legislature that DC was a more secure route to achieve retirement income security than the existing DB plan.

His primary argument was based on the long vesting period for DB plans that existed at that time and resulted in many shorter-term employees failing to realize the full potential of their pension contributions. The only way the proposed funding for DB plans could work, he argued, was if a large percentage of members received no benefits (i.e., left the plan before full vesting).³⁷

“I think people are beginning to realize that pension plans based on formula calculations, and most public and private pension plans are in that category, operate on a principle similar to lotteries. Few winners and many losers,” Robbins told the Saskatchewan Legislature during debates in 1977.³⁸

While Robbins focused his arguments on vesting, funding was looming as an issue in the background. Until 1977, public employees in Saskatchewan had a DB plan that was totally unfunded (pay-as-you-go). Employee contributions went into provincial general revenues and benefits were paid out of general revenues. Pension benefits could not be negotiated as part of the total remuneration package. The government set the benefits level and decided if or when cost-of-living adjustments would occur.³⁹

The legislation Robbins sponsored closed the existing DB plans to new members and led to the establishment of DC plans for most public employees over the next few years.

At the time the DB plans were closed, the Saskatchewan plans were not truly pre-funded at all.⁴⁰ The main Public Service Superannuation Plan was being operated by the province on a pay-as-you-go basis (i.e., taxpayers paid the benefits when they came due).⁴¹

Saskatchewan has been held up by at least one critic of public sector DB plans as a model for the rest of the country as a province that recognized it had a looming pension crisis and met it head on.⁴²

It is not at all clear, however, that the action taken by Saskatchewan has benefited any of the five stakeholders we identified earlier in the paper.

37 Today, Ontario, Quebec and Manitoba have immediate full vesting and British Columbia has vesting at two years and will also have full immediate vesting once Bill 38 becomes law.

38 (Legislative Assembly of Saskatchewan 1977)

39 (May, et al vs Government of Saskatchewan: Executive Summary of Memorandum of Fact and Law on Behalf of the Plaintiffs 2009)

40 (Legislative Assembly of Saskatchewan 1977)

41 (Government of Saskatchewan 2013)

42 (Milke and Lang 2013)

Almost four decades after the DB plans were closed, Saskatchewan taxpayers are still facing a multi-billion-dollar unfunded liability that will cloud its financial outlook for another five decades. Between 2008–09 and 2012–13, the DB legacy pension liabilities of the Saskatchewan government increased by more than \$1 billion, from \$5.45 billion to \$6.77 billion.⁴³ It's only now—more than three decades after the plans were closed to new members—that the province can start to project a decline in the annual drain on the provincial treasury as membership declines.⁴⁴

The two main closed DB plans are the Teachers' Superannuation Plan and the Public Service Superannuation Plan. They are still operating in parallel with the plans that replaced them.

As of the 2014 annual report of the Saskatchewan Public Service Superannuation Board, there were still 206 active employees who were part of the plan when it was closed to new members in 1977 and 5,520 retired plan members and dependants receiving benefits.⁴⁵

During bargaining in 1979, the Saskatchewan Teachers' Federation agreed to close the Teachers' Plan to new members but in later negotiations asked for a DB plan to be reinstated. The province refused a shift to being a DB plan sponsor, but said the union could run a DB plan if they wished with the government making only defined contributions.

The new Saskatchewan Teachers' Retirement Plan (STRP) took effect July 1, 1991, and runs in parallel with the old Saskatchewan Teachers' Superannuation Plan. As of June 30, 2013, there were still 748 active members and 11,481 pensioners and survivors in the old plan, which had a legacy unfunded liability of \$5.251 billion.⁴⁶

The new plan run by the Teachers' Federation is a target benefit DB plan. It starts as a career-average plan, but if investment returns are good, it moves towards a final-average plan. The COLA is totally at risk. The plan is currently paying a COLA equal to 80 per cent of CPI. As of June 30, 2013, the STRP had a slight surplus.

Saskatchewan is an example (the only example in Canada) of what a large public sector DC plan might look like.

As of March 31, 2014, the Saskatchewan Public Employees Pension Plan (PEPP) covered 79 employers and 54,000 members and managed \$6.5 billion in assets.⁴⁷

The Saskatchewan PEPP has many of the attributes that have been proposed as being part of a best-practices DC plan that could rival a DB plan for efficiently producing retirement income.⁴⁸ But it also illustrates some of the hurdles that members of DC plans have to overcome to achieve adequate retirement income, even if the funds are performing well.

PEPP is large enough to have some advantages of scale. Rather than a single fund, however, PEPP has six separately managed funds that range from a high-risk/return accelerated growth fund to low-risk, low-return short-term bond fund.⁴⁹ The funds are professionally managed with fund fees that ranged from 0.2 per cent to 0.55 per cent in 2013–14.

43 (Government of Saskatchewan 2013)

44 (Milke and Lang 2013)

45 (Public Service Superannuation Board (Saskatchewan) 2014)

46 (Saskatchewan Teachers' Superannuation Commission 2014)

47 (Saskatchewan Public Employees Pension Board 2014)

48 (McGee 2013)

49 In July, 2014, PEPP announced changes to the fund line-up. The short-term bond fund is closing October 31 and a new Money Market fund is being created.

Unlike being in a DB plan, members have a choice in how their retirement contributions are invested (the above six funds). Plan members are offered and urged to take professional advice in making their choices and told that they are responsible for the consequences of that choice.

“You are responsible for the investment option(s) you choose,” the Member Booklet cautions. “While you cannot control the performance of a particular investment option, you do make decisions about the investment fund options in which you invest.”⁵⁰

They can also choose a Step Plan, which is also the default option for members who make no choice. The Step Plan apportions a member’s account into the six funds based on a ratio that changes the weighting from riskier to less risky as the member ages and nears retirement.

So PEPP members arguably have easier options than individuals with RRSPs. But they still face what may be seriously negative consequences if the choices they make result in inadequate savings when they are ready to retire.

When that time comes, they also face choices that will affect not just their own income security in retirement, but also demands on other stakeholders, including current and future taxpayers who have to support Canadians who are unable to fully support themselves.

Normal retirement age for PEPP members is 65, with early retirement possible starting at 50. At retirement, PEPP members have a choice of:

- buying a life annuity from the Saskatchewan Pension Annuity Fund;
- transferring out of PEPP to buy a prescribed Registered Retirement Income Fund or a life annuity;
- taking a PEPP Variable Pension Benefit, or
- a combination of the above.

Except for the fact that some options are identified with the PEPP plan, these options are equivalent to those available to any Canadian (i.e., a life annuity or a RRIF) who has accumulated a retirement nest egg and they carry the same risks.

As with the investment choices, plan members are warned that planning for retirement is their responsibility and they are urged to consult “your accountant, lawyer or a qualified financial planner with knowledge of the pension industry to evaluate your personal situation.”⁵¹

Again, as for any retired Canadian, there is a minimum that plan members must start withdrawing at age 71 but there is no maximum. If they wish, they can withdraw all of their savings from their Variable Pension Benefit at once. Members are warned, however, that there is no “guarantee on income levels or how long your money will last. Once the (Variable Pension Benefit) account is depleted to a zero dollar balance, the account is closed.”⁵²

This flexibility will be attractive for many plan members, but it may also lead to the early exhaustion of pension funds, either through poor planning or for what has been called red-pickup syndrome, which is the tendency of some people to use their retirement accounts for a major purchase rather than ongoing income.⁵³

50 (Saskatchewan Public Employees Pension Plan n.d.)

51 (Saskatchewan Public Employees Pension Plan n.d.)

52 (Saskatchewan Public Employees Pension Plan 2014)

53 (Levitz 2008)

Appendix 2—Australia

Australia has become a widely-cited example of how to reform a national retirement security system at reasonable cost.

On some levels, it has been highly successful. Coverage has been widely expanded and costs to government have been kept low. At the same time, the reforms in Australia illustrate issues that would stem from converting large DB plans in Canada to smaller DC accounts with greater investment control by individual members.

The reforms in Australia have succeeded in vastly increasing the percentage of Australians covered by a workplace pension, especially among women. In 1974, fewer than 20 per cent of Australian women, half the rate of men, were covered by workplace pensions. Today, more than 90 per cent of both men and women are covered, primarily because of a mandatory retirement savings program, the “Superannuation Guarantee”⁵⁴ program created in 1992.⁵⁵

At the same time, taxpayer-based spending on pensions remains relatively low.⁵⁶

Most of the taxpayer-based spending is on the Age Pension, which is an income and asset tested pension that is designed to cover 28 per cent of male total average weekly earnings for an individual or 41.3 per cent for a couple. About three quarters of Australian retirees qualify for at least a partial Age Pension and about half receive the entire amount.⁵⁷

The mandatory savings plan has made Australia a world leader in terms of coverage in providing workplace pensions, but that lead has not yet been reflected in the poverty rate for seniors. In the latest OECD ranking, Australia scored much worse than Canada, with a 39.2 poverty rate compared to the 5 per cent rate in Canada.⁵⁸

The 1992 legislation required all employers to contribute nine per cent of earnings to a retirement plan for all employees aged 18–70 who reach a minimal earnings threshold, a contribution rate that will rise to 12 per cent by 2020. Employees are not required to make a contribution, but they can through what is called salary sacrifice. Only 20 per cent of those eligible make additional contributions, however.⁵⁹

Since 2005, most employees have had the right to choose a Superannuation Fund. There are several types of funds and hundreds of individual funds and thousands of investment choices.⁶⁰

Since the introduction of the Superannuation Guarantee, many existing DB plans, including those in the public sector, were closed to new members or somehow converted.

The Superannuation Guarantee has succeeded as a mandatory savings plan. In the two decades after it was introduced, the value of retirement funds under management grew from about \$200 billion to about \$1.7 trillion.⁶¹ From 2002 to 2012, Australia had a 46 per cent increase in pension assets (as a per cent of GDP) while pension assets grew 29 per cent in the U.S.

54 Superannuation is the term used for retirement income or pension in Australia

55 (Swoboda 2014)

56 In 2009, Australia spent 3.5 per cent of GDP on old age pensions and survivor benefits, compared to 4.5 per cent for Canada and an OECD average of 7.8 per cent. (OECD 2013)

57 (National Commission of Audit 2014)

58 (OECD 2013) This comparison may be skewed somewhat by the fact that 85 per cent of retirees own their own home. (Bateman 2009)

59 (Agnew 2013)

60 (Sy 2011)

61 (Swoboda 2014) Figures in Australian dollars, which have been roughly on par with Canadian dollars.

While successful as a savings plan, however, several issues have been identified that have undermined its effectiveness in providing adequate retirement income. One is peculiar to Australia because of the way the Superannuation Guarantee interconnects with the Age Pension. The others are issues that are common to DC plans but seem more obvious in Australia because of the overwhelming predominance of DC plans, large and small.

The peculiarly Australian issue is the ability to “game” the system by drawing down superannuation benefits, which are available at age 55, to qualify for a larger Age Pension, which is available at 65.⁶² As with the OAS and GIS in Canada, the Age Pension in Australia is clawed back once income thresholds are reached.

Unlike the OAS or GIS, the Age Pension also has an asset test, although a personal home is not included in the assets.

The other issues revolve around investment decisions and the way superannuation funds are paid out.

Over 90 per cent of employed Australians have savings in a superannuation account and the total assets in these accounts now exceed Australia’s Gross Domestic Product. The 2005 legislation gave most employees the right to select a superannuation fund, which can be organized by a retail financial services company, such as a mutual fund company; by a public or private employer or industry group, which can often negotiate lower fees or enhanced services from financial services companies; or by the individuals themselves in a do-it-yourself self-managed superannuation fund serving less than five participants. Each of these funds typically gives workers a choice in how their savings are invested.

As with investors in retail funds in North America, studies have shown that investment decisions about which funds to choose and what instruments to invest in are being made by individuals who sometimes lack even the most basic of investment knowledge or skill.

In addition, the Australian Securities and Investment Commission reports that many workers making investment decisions not only did not understand how to apply the concepts of risk and return, they are often unable to distinguish good advice from bad.⁶³

Reforms have been introduced to try to protect financially illiterate or uninterested investors, including better defaults and better reporting of fees, with the hope that more transparency will lead to more competition.⁶⁴

A recent study, called Redesigning Choice and Competition in Australian Superannuation, found that the high fees and costs of private sector pension plans in Australia seriously limit investment returns for pensioners.⁶⁵ The Australian superannuation model was founded on the assumption that market competition would deliver economic efficiency in a largely private, defined contribution system. The report, commissioned by the government of Australia, shows that while total assets in the system have grown substantially through contributions, net earnings from investments were relatively low.

62 As in Canada with the increase in age eligibility for the OAS, the minimum age for drawing an Age Pension in Australia is being increased gradually from 65 to 67. In the May, 2014 Budget, the government announced a further increase to age 70 by July 1, 2035.

63 For example, while most involved in one survey understood high-risk investments involved risk, fewer than half were able to rate the risk associated with either fixed interest rate or balanced fund investments. (Australian Securities and Investments Commission 2011)

64 (Agnew 2013)

65 (Sy 2011)

The principal reason for the lower than anticipated earnings is that high costs and fees restrained the growth of the fund, despite the role that competition was expected to play in keeping costs minimal.

The report argues that competition does not produce lower costs when individual investors face complex choices, as they do in retirement planning and investing. Simply, complex choices are not functional choices at all, which means that the average investor pays the fees and costs set by the various funds.

The Australian report argues that investors need clearer options, which in turn would produce real competition that would drive costs down.

Another weakness in the Australian system is the way money is withdrawn from Superannuation funds. In 2012, almost half of the withdrawals were in the form of a lump sum. Only a tiny fraction (two per cent) were taken as annuities, the rest were in phased withdrawal products.⁶⁶

Without annuities, individual Australian retirees bear longevity and inflation risks.⁶⁷

Combined with the investment risks they face at the front end, the back-end risks add up to a high level of income uncertainty for many Australians in their retirement years.

Appendix 3—Selected U.S. jurisdictions

Alaska

In 2006, Alaska became one of two states to close DB pension plans for teachers and state employees and replace them with individual DC 401(k)-type accounts for new hires.

When he signed the bill into law, then Alaska Gov. Frank Murkowski said the objective was to stop the so-called bleeding that led to an unfunded liability then projected at \$5.7–\$6.2 billion.⁶⁸

Critics who at the time said the change would do nothing to solve the unfunded liability have turned out to be right. Since closing the pension plans to new hires, the unfunded liability has grown to about \$11.9 billion. The increase has occurred in spite of higher contributions aimed at bringing down the unfunded liability

In April 2014, the state legislature approved a plan to pay \$3 billion in the current fiscal year but also to slow payments in a manner that will leave higher costs to be dealt with in the future.⁶⁹

Since closing the DB plan to new members, contribution rates have increased. For state employees, the Actuarially Required Contribution (ARC) employer rate increased from 12.39 per cent of salary in 2006 to 22.48 per cent in 2012. For teachers, the rate increased over the same period from 24.57 per cent to 36.04 per cent.⁷⁰

Alaska is also among the minority of states that do not allow state employees to access Social Security, an important source of retirement income for most Americans.

66 (Agnew 2013)

67 (Agnew 2013)

68 (Inklebarger 2006)

69 (Forgey 2014)

70 (Herzenberg and Snuggs 2013)

A coalition of unions and other public interest groups has been campaigning to reverse the shift from DB to DC but with no success.

In a 2010 White Paper⁷¹ the coalition argued that the change from a DB to a DC model would not address the funding problem and would lead to human resource retention issues in a state that has a high cost of living relative to the lower 48 states. That would lead to higher training costs for the state as a result of employees who would gain training and experience in Alaska and then move on to jurisdictions with more lucrative pension plans.

The paper argued that many of the public servants with DC plans who stayed in Alaska would outlive their savings and find themselves on public assistance, at a further cost to taxpayers.

That cost to taxpayers would be exacerbated by the effect on the economy. Retirees with less cash would be more cautious with their spending, the report argued.

Michigan

Michigan, along with Alaska, is one of two states that brought in a mandatory DC plan for state employees. In both states, new hires are enrolled in 401(k) plans, although Michigan employees also participate in Social Security (OASDI) while those in Alaska do not.

Michigan closed its existing DB plan to new employees in April, 1997. That decision has not turned out well for either employees or the state.

In the year the DB plan closed to new employees, it was 108 per cent funded. By 2012, that funding ratio had fallen to 60.3 per cent and the plan had a unfunded actuarial accrued liability of \$6.2 billion. The funding ratio for the Reserve for Health Related benefits was 3.9 per cent.

The DB plan was funded entirely by employer contributions. In 2012, the state enacted legislation to require DB plan members to either start contributing 4 per cent of their salary to stay in the plan or to switch to a DC plan. All but 600 of 17,800 eligible workers chose to make the contribution.⁷²

That requirement was ruled unconstitutional in a case that at the time of this writing was on its way to the Michigan Supreme Court.

Members of the DB plan were given a chance to switch to the DC plan in 1997 and 5.5 per cent did so, tempted by buoyant financial markets and more portable pension assets with a shorter vesting period.⁷³

Thirteen years on, those nearing retirement who had stayed in the DB plan were doing much better than those in the DC plan, according to a 2011 report.⁷⁴ The average account for those 60 or more was \$123,000, which it was estimated at the time would produce an annual income of about \$9,000. In the DB program, the average benefit for those retiring at the time was about \$30,000.

An Asset/Liability study⁷⁵ conducted by RVKuns & Associates, Inc. in 2012 found that an aggressive investment strategy would be needed to close the funding gap over 30 years, but found also that because of the finite nature of the closed plan, it would need to be on a glide path towards a less volatile investment mix.

71 (Alaska Public Pension Coalition 2010)

72 (Eggert 2013)

73 (Papke 2004)

74 (Keefe 2011)

75 (RVKuhns & Associates, Inc. 2012)

Even with the employee contributions, which have not yet been approved by the courts, the study concluded that the state would have to increase contributions by about \$50 million a year, or 10 per cent above the existing level, to reach full funding over 20 years.

Minnesota

In 2010, the state legislature mandated a study to look at alternative designs for existing public sector retirement plans

The Retirement Plan Design Study, finalized in June 2011, included an actuarial analysis of the costs associated with moving from the existing DB structure to a DC plan.⁷⁶

The report was commissioned after the sharp drop in overall funding experienced following the 2008–2009 market turmoil and recession that hurt pension plans across the U.S. and Canada.

The findings reflected those experienced elsewhere. According to the Mercer actuarial analysis, it would cost \$2.76 billion over the following decade to move to a DC plan. In the mid-term (11–20 years) the costs would be lower because of investment returns realized on the accelerated funding mandated by the need to pay off the unfunded liability of the closed DB plans over a shorter time frame.

In the long term, the costs would once again be higher, Mercer found, because the ongoing “normal cost” of the existing DB plans is less than the cost of a future replacement DC plan.

The report also looked at the issue from the perspective of providing adequate retirement income. It cited a 2010 study on public-sector compensation by the Minnesota Taxpayers Association⁷⁷ (now called the Minnesota Center for Fiscal Excellence) that found that the median 401(k) savings for a 30-year private-sector employee retiring at 60 was \$74,000. That, the state report estimated, would produce a monthly retirement income of \$340 for a term of 22 years and five months. A similar worker covered by the public-sector pension plan could expect a monthly stipend of \$1,700 for life.

The conclusion is that individual 401(k) DC plans will leave more Minnesotans employed in the public sector at risk of needing taxpayer-funded public assistance.

Subsequent to the 2011 Pension Design Study Report, the Minnesota legislature passed a bill that left the DB plan intact but:

- increased employee and employer contributions;
- increased the penalties for early retirement;
- reduced cost-of-living adjustments until funding ratios improve.

⁷⁶ (Bergstrom, Hacking and Vanek 2011)

⁷⁷ (Milanowski, Twait and Haveman 2010)

Nebraska

Until 2002, state and county employees in the Nebraska Public Employees Retirement System were covered by DC plans that were set up in the 1960s. In that year, the DC plans were closed to new members and statewide cash balance plans were established for new hires. Existing employees were given two chances to switch to the new plan, in 2003 and 2007. About a third did so each time.⁷⁸

The change to cash balance plans was made after studies comparing retirees in Nebraska school DB plans found they were achieving higher benefits with lower costs than retirees in the DC plans. The studies demonstrated that the DC plans had disproportionately high administrative costs, lower benefits and lower investment returns compared to statewide defined benefit plans. The 20-year return average (1982–2002) for the DB plans was 11 per cent, while DC plans earned 6–7 per cent.⁷⁹ Nebraska's cash balance DB plan allows the average plan member to earn a better rate of return than in the DC plan by providing professional investment management services, increasing individual member risk tolerance through investment pooling and allowing members to benefit from economies of scale.

The switch to cash balance DB plans has resulted in lower fees and administration costs and reduced the DC investment and timing risk for retiring members.⁸⁰

Nevada

Nevada has a mandatory defined benefit plan for public service employees.

The Nevada Public Employees' Retirement System (PERS) administers three cost-sharing and one multi-employer plan, covering 188 public sector employers. At the end of 2012, there were 98,512 active members and 49,548 benefit recipients and the plan had a funding ratio of 71 per cent.⁸¹

In 2010, at the request of the PERS board, the Segal Company did a projection on the effects of closing the plan to new employees, who would become part of a DC plan.⁸²

Among the findings was that closing the plan to new members would substantially increase the amortization component of the contribution rates. That would require contribution rates to increase by 10.44 per cent of payroll for regular employees and 11.44 per cent for police/fire employees.

Projected over a two-year period, that would have been an increase in combined contributions from employer and employees of \$1.2 billion.

The study also concluded that the difference between expenses and expected return would lead to a difference in net return of 1.5 per cent annually. The result would be that DC participants would have retirement assets that were 20 per cent lower than for DB participants.

A separate report on the economic impact of the Public Employees' Retirement System concluded that each dollar of taxpayer contribution supported \$6.99 in total economic output for the state.⁸³

The plan paid more than \$1 billion in pension benefits, which supported \$390 million in income for state residents other than Nevada PERS retirees.

78 (A Review of Defined Benefit, Defined Contribution, and Alternative Retirement Plans 2012) (Chambers 2011)

79 (A Review of Defined Benefit, Defined Contribution, and Alternative Retirement Plans 2012)

80 (Chambers 2011)

81 (AonHewitt 2013)

82 (The Segal Company 2010)

83 (Boivie, Ilana; Rhee, Nari; National Institute on Retirement Security 2013)

New York City

A 2011 study published by the New York City Comptroller's Office Budget and Policy Bureau modelled a comparison between a DB plan and a DC plan for 1,000 new hires for five NYC employee plans.

The study, *A Better Bang for NYC's Buck*,⁸⁴ was authored by William B. Fornia and was based on the findings of the earlier report he co-authored, *A Better Bang for the Buck*.⁸⁵

The five plans were:

- Teachers' 55/5 in the Teachers' Retirement System
- 57/5 for civilian workers in the NYC Employees' Retirement System (NYCERS) and the Board of Education Retirement System
- Sanitation 20 Year (SA) for sanitation workers in NYCERS
- Police Tier 3
- Fire Tier 3

The study found that longevity risk pooling in the city's DB plans saves 10–13 per cent of the cost of providing equivalent benefits under a DC plan; portfolio diversification in the DB plans saves 4–5 per cent and better returns from DB plans saves 21–22 per cent.

According to Fornia's analysis, the cost to deliver similar benefits was 36–38 per cent lower than it would be in a DC plan. That translates to a finding that it would be 57–61 per cent more expensive for DC plans to deliver an equivalent level of benefits to those currently provided by the DB plans.

Total Amounts Required at Retirement (Fornia 2011)

		For DB Plan	Additional Required for DC			For DC Plan
			Longevity Pooling Impact	Portfolio Diversification Impact	Superior Return Impact	
Teacher (Age 62)	Accumulation at Retirement	\$607,946	\$98,320	\$35,331	\$84,320	\$825,917
	% of Payroll	13.6%	2.1%	0.8%	4.8%	21.3%
Case Worker (Age 61)	Accumulation at Retirement	\$391,031	\$83,595	\$23,423	\$56,421	\$554,471
	% of Payroll	13.0%	2.8%	0.8%	4.5%	21.1%
Sanitation Worker (Age 53)	Accumulation at Retirement	\$496,365	\$104,969	\$33,331	\$75,941	\$710,606
	% of Payroll	16.2%	3.4%	1.1%	5.4%	26.1%
Police Officer (Age 51)	Accumulation at Retirement	\$769,299	\$122,083	\$59,828	\$123,633	\$1,074,843
	% of Payroll	21.8%	3.4%	1.7%	7.8%	34.7%
Fire Fighter (Age 52)	Accumulation at Retirement	\$779,526	\$117,356	\$58,668	\$122,429	\$1,077,979
	% of Payroll	21.4%	3.2%	1.6%	7.6%	33.8%

84 (Fornia 2011)

85 (Almeida and Fornia 2008)

As an illustration of the promise and potential difficulties of consolidating pension funds, the NYC comptroller proposed in 2011 to merge five of the city's pension plans into a single pooled fund with \$120 billion. The savings through consolidation were estimated to be at least \$1 billion annually.⁸⁶

Despite support from the mayor and several of the unions, not all of the affected unions agreed and the proposal stalled.

Texas

The Teacher Retirement System of Texas (TRS) is the sixth-largest retirement system in the U.S., with about a million current members and 350,000 benefit recipients as of August 31, 2013.

Concerns over funding prompted the state legislature to order a study of the effects of potential changes to the plan, including the conversion from a DB to a DC fund.

The Pension Benefit Design Study⁸⁷ submitted in September 2011, confirmed that changes needed to be made to address the unfunded liability of the TRS.

But it rejected converting from DB to DC as a solution.

Among the key findings:

- The DB plan provides benefits at a lower cost than alternative plans.
- The majority of TRS members would do significantly worse investing on their own in a plan with a DC component.
- Other pension plans moving from DB to alternative structures have realized savings, but by lowering benefits.
- Setting up an alternative system for new hires will not address existing liabilities.

The study modelled a DC plan based on an income replacement ratio of 68 per cent but with no COLA (so purchasing power would decline). It found to produce the same level of income replacement with a defined contribution approach would be 12–138 per cent more expensive than the existing DB plan.

If contributions were kept at the current levels, the alternative plans would produce benefits that would replace 27–59.7 per cent of pre-retirement income for a career employee retiring at age 62, compared to the 68 per cent under the existing DB plan.

The study modelling found that in any plan with a self-directed component, just 8 per cent of members would do better than under the existing plan and 92 per cent would do worse. Two-thirds would do significantly worse, receiving 60 per cent or less of the current benefit.

The study found that while reducing benefits or increasing costs, setting up a new system for new hires would not only not reduce the existing liabilities, it would significantly increase them. Closing the plan to new hires would increase the liquidity requirements as the plan matured. That would limit the range of investments, adding \$11.7 billion to the liability.

Since inception, 61.4 per cent of the TRS income has come from investments and 38.6 per cent is from member and employer contributions.

⁸⁶ (Morneau 2012)

⁸⁷ (Teacher Retirement System of Texas 2011)

West Virginia

West Virginia is one of two states (Nebraska is the other) that have changed back from a DC Plan to some form of DB over concerns about administration costs and low benefits for plan members.

In 1991, a DC plan was set up for new hires in the West Virginia system that offered a choice of mutual funds, money market funds and annuities. About 4,500 members of the existing DB plan in the West Virginia Teachers' Retirement System elected to switch to the DC plan. For most, the results were poor.

By the time school employees were able to move back to a DB plan in 2008, teachers over 60 were facing a grim retirement. Of the 1,767 employees over 60, only 105 had balances in their individual accounts of more than \$100,000.⁸⁸

The balance for many was less than they would have received in a single year as benefits under the old plan.

Not only was the DC plan failing to provide adequate income for retirees, plan managers calculated that the DB normal costs were lower than they had been under the former DC account. Without the amortization cost of unfunded liabilities, the normal cost of the state DB contribution was 4.3 per cent, 40 per cent less than the 7.5 per cent employer contribution under the DC plan.⁸⁹

In 2005, an actuary for the state retirement board calculated that returning to a DB structure could save the state an estimated \$1.2 billion over 30 years. Studies also showed higher returns from the DB plan than in the DC plan over a 10-year period from 2001–2010; DB assets earned 3.93 per cent compared to 2.32 per cent for those in the DC plan.⁹⁰

Wisconsin

In 2011, the Wisconsin legislature passed a bill that stripped public sector unions of the right to bargain for anything other than wages and further limited wage increases to the rate of inflation.

That left issues, including pensions and health care, at the sole discretion of the employer.

At the same time, the legislation eliminated mandatory union membership and required unions to bill members directly instead of through the state payroll system.

The result has been that union membership among state employees has fallen by more than half and the state has had a free hand to modify the pension system.⁹¹

After looking at the existing defined benefit plan, employees were forced to pay a higher proportion of the contributions. The plan, however, has been left virtually alone.

Gov. Scott Walker, who became a national figure by taking on public sector unions, has pointed to the fully funded pension plan in Wisconsin as a welcome legacy of previous governments in contrast to plans in other states.⁹²

88 (Levitz 2008)

89 (Keefe 2011)

90 (Olleman and Boivie 2011)

91 (Greenhouse 2014)

92 (Journal Sentinel PolitiFact Wisconsin 2013)

Even so, as part of the conservative agenda of the Republican-dominated legislature, 2011 Act 32 required the Department of Employee Trust Funds, the Secretary of the Department of Administration and the Director of the Office of State Employment Relations to consider studying the structure and benefits provided under the Wisconsin Retirement System (WRS).

The Act required the study to address setting up a defined contribution system as an option for employees; to consider the effect of allowing employees not to make required contributions; and to limit benefits for such employees to a money purchase annuity.⁹³

The study, submitted in June 2012, recommended against making any of those changes. It found that the WRS is already a financially healthy system with low cost to taxpayers. In addition, the changes proposed would likely either increase costs to provide similar benefits or reduce the benefits achievable by plan members for many of the same reasons cited in other studies and jurisdiction, including higher administration costs and lower investment returns.

It also found that many of the advantages often cited for DC plans are already incorporated into the WRS because of some unique design features.

The WRS is unusual among state public sector plans in the U.S. not just for its long history of being fully funded, but also for the risk-sharing component that has reduced benefits for many members in every year since the 2008 recession except 2013.

At retirement, members have a choice of either a formula-based annuity similar to other DB plans or a money purchase annuity. Members who leave before retirement age can take a separation benefit, allowing for some portability. Among the changes under Act 32 is a five-year service requirement for vesting in either a formula or money-purchase based annuity.⁹⁴

The WRS has \$95 billion under management and 570,000 active and retired participants.⁹⁵

93 (Conlin, Huebsch and Gracz 2012)

94 (Zimmerman 2013)

95 (Williamson 2014)

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