



British North-American Committee



The need for transparency in public sector pensions

**A Comparative Study of Occupational Public Sector
Pension Schemes in US, UK & Canada**

**Sponsored by
British-North American Research Association (UK)
The Atlantic Council of the United States (US)
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Contents

The British-North American Committee.....	3
Acknowledgements	3
Executive Summary & Recommendations	4
Summary.....	4
Outstanding net liabilities.....	4
‘Annual Running Cost’ of Pensions	6
Summary Recommendations	7
Comparing Public Employee Pension Systems	8
Measuring Pension costs	10
Discount Rate	10
Description of Public Sector Pension Schemes.....	11
US	11
UK	12
Canada	12
Unfunded Liabilities.....	14
Headline Unfunded Liabilities.....	14
Current Service Cost / Contribution Rates.....	18
Why contribution rates matter	18
Methodology and Assumptions.....	18
Public Policy Considerations.....	20
Recommendations	20
Appendix: Public Sector Occupational Pension Schemes included in this study	22
Glossary.....	26
Committee Membership endorsing this paper	29

The British-North American Committee

The British-North American Committee is a group of leaders from business, labour and academia in the United Kingdom, the United States and Canada committed to harmonious, constructive relations among the three countries and their citizens. It meets regularly to discuss common concerns with invited experts and senior policymakers, and its research and publishing programme seeks to discover and disseminate potential solutions.

Implicit in the Committee's existence is recognition that the three countries share ties that go beyond economic and security questions, extending to issues of culture and habits of mind. Although the Committee has never sought to be a policy institute, its commissioning and publishing of research testifies to its members' desire to disseminate useful analysis of issues of common concern.

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Disclaimer

The views expressed in this publication are those of the BNAC members who have endorsed it (see page 29). They do not necessarily reflect the views of the BNAC membership as a whole, nor of the Atlantic Council of the United States or the British-North American Research Association, or Massey College, University of Toronto.

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Executive Summary & Recommendations

Summary

This short study compares the public sector occupational pension liabilities of the three member countries of the British North America Committee (BNAC) – US, UK and Canada. It does not deal with any other pension obligations that each Government has to its citizens, nor does it deal with the cost to the Government of any welfare safety net for retired citizens. It deals solely with the pension arrangements for retired Government employees.

The Boards of private companies have considered the rising costs of existing defined benefit provision and decided that the benefits to their companies are often outweighed by the costs and forward liabilities involved. This paper tries to provide the taxpayers of each country with information similar to that available to private Boards, so the taxpayers (and their elected representatives) are better able to weigh up the costs and benefits, and to decide on the most appropriate public sector occupational pension provision for the future.

Outstanding net liabilities

The net public employee *pension liabilities*¹ (i.e. *pension assets* less pension liabilities) of the respective Governments (as a % of GDP and in US Dollars²), based on schemes' own quoted *discount rates*³, are as follows:

¹ Italicised words in the main text are explained in the Glossary.

² UK and Canadian assets and liabilities are converted throughout this paper into US Dollars at 31 March 2009 exchange rates; \$/£ = 1.4304 and C\$/£ = 1.2560.

³ We use 'discount rate' to mean the same as 'interest rate' or 'rate of return'. See Glossary for fuller description. Market Rates are as at Aug 2008.

Table 1

	<i>Net Public Pension Liability at schemes own discount rates</i>	
<i>Country</i>	<i>% of GDP⁴</i>	<i>US Dollars (billion)</i>
US	15%	\$2,088
UK	64%	\$1,267
Canada	12%	\$151

The shape and structure of the assets and liabilities, and the analysis of their sensitivities, are set out in the main body of this paper. However, in summary, it is clear that the UK stands out as having a major, and distinctive, problem in relation to its public sector pension promises. This has been brought about because a large majority of the UK public workforce have generous, fully *index-linked final salary* pensions which are completely unfunded, whereas funded (partially or fully) public schemes are the norm in the US and Canada.

This is evident if we break down Table 1 to show assets and liabilities as well as the net liability. Table 2 illustrates:

Table 2

	<i>Public Pension Assets and Liabilities in US Dollars & Local Currency (Billions)</i>		
<i>Country</i>	<i>Liabilities</i>	<i>Assets</i>	<i>Net Liability</i>
US	\$5,455	\$3,367	\$2,088
UK - Dollars	\$1,439	\$172	\$1,267
<i>UK - Sterling</i>	<i>£1,006</i>	<i>£120</i>	<i>£886</i>
Canada - Dollars	\$408	\$257	\$151
<i>Canada – C\$</i>	<i>C\$513</i>	<i>C\$323</i>	<i>C\$190</i>

However, we have found that all three countries use *discount rates* in their pension calculations that are higher than their own (*sovereign*) *market-based interest rates*. This produces the effect of reducing headline liability calculations below what they would be under a market rate calculation.

⁴ GDP (2007): US = \$13,800bn; UK = £1,380bn; Canada = C\$1,530bn. Source IMF.

We have estimated (in Table 3) the net liability based on market interest rates. A description of the methodology we used for the ‘market rate’ calculation is set out in the main text.

Table 3

	<i>Net Public Pension Liability at market rates</i>	
<i>Country</i>	<i>% of GDP</i>	<i>US Dollars (billion)</i>
US	28%	\$3,869
UK	85%	\$1,683
Canada	27%	\$335

‘Annual Running Cost’ of Pensions

Public sector employers are generally required annually to calculate the full running cost of each additional year’s pension rights for their employees. This calculation is called the ‘*current service cost*’, and for almost all public pension schemes, the employer and employee together are required to make annual cash contributions to the pension fund (or direct to the Government if the scheme is unfunded) of this amount.

These costs/payments [expressed as an average percentage of the annual salary bill (payroll)] are published by each employer as the ‘*current service cost*’. Table 4 below shows the average current service cost across the three countries based on the respective Government’s assumed (or artificial) discount rate, and compared to the cost calculated at market discount rates.

Table 4

	<i>Current Service Cost of Public Pensions as % of Payroll</i>	
<i>Country</i>	<i>Governments’ assumed rates</i>	<i>Market rates</i>
US	18%	29%
UK	18%	44%
Canada	17%	37%

The values in Table 4 are startling: on these calculations, the Governments of all three countries are recording the annual cost of the pensions they provide to be about half the cost if the pension was priced at market prices. This is discussed more fully in the text.

Summary Recommendations

We make the following recommendations:

- Public Pension costs fall on taxpayers and future taxpayers, many as yet unborn. We therefore believe that transparency of costs in public bodies' reports to taxpayers should be the first aim of Governments in all three countries.
- Pension liabilities which are promised by a public body should be valued (and charged for) at sovereign market discount rates. Any other discount rate is likely to understate the true cost of pensions, and will distort reporting between unfunded and funded pension schemes. This recommendation is in line with IPSAS25⁵.
- Consideration should be given to amortising or monetising net public pension liabilities, so that intergenerational transfers between taxpayers are explicit.

⁵ International Public Sector Accounting Standards Board; Standard 25, Employee Benefits, Feb 2008.

Comparing Public Employee Pension Systems

This study compares the public sector pension occupational schemes [or plans (US & Canada)] of the US, UK, and Canada. In all three countries, the public sector employs a significant proportion of the workforce. Most of the public sector employers in all three countries offer *defined benefit pensions* (mostly based on final salary) to their employees, and in most cases these are still open to new employees, and also to new *pensions accruals* for existing employees. This contrasts with the position in occupational pension provision by the private sector in these countries, where many, if not most, defined benefit pension schemes are now closed to new entrants. Some private defined benefit pensions are also now closed to new accruals by existing employees.

The abandonment of defined benefit pensions by the private sector has occurred rapidly, and largely within the last 10 years. It has coincided with the adoption of near-‘*mark-to-market*’ accounting [FRS17 (UK), FAS158 (US), and IAS19 (International)], and has highlighted the high and rising cost of providing a longer-living workforce with high-quality pensions. The Boards of private companies have considered the rising costs of existing defined benefit pension provision, and decided that the benefits to their companies are often outweighed by the costs and forward liabilities involved. This paper tries to provide the taxpayers of each country in this study with information similar to that available to private Boards, so that the taxpayers (and their elected representatives) are better able to weigh up the costs and benefits, and to decide on the most appropriate public sector occupational pension provision for the future.

The three countries have different public employee pension structures:

- The US has a funded sector at US State level, but three large (largely unfunded) Federal schemes;
- The UK has a very large completely unfunded central system, together with a smaller funded scheme for local authorities;
- Canada has a funded sector at Provincial level. Until 2000, its Federal Schemes were unfunded; since then, most new accruals are funded at the Federal level.

For all three countries, we have used public information available as at Aug/Sep 2008, and most pension liability data relates to 2007 (or a year-end in 2007), the latest year available. We do not believe that the information we have obtained is exhaustive, but by the nature of this study, the extent to which we have omitted or failed to uncover information will mean that we have underestimated net pension liabilities. The sources are listed in the Appendix.

We have not considered any non-employment-related public sector promises to the public at large. So, for example, the UK State Pension is not included in any assessment of the UK Government's employee pension obligations; nor is the Canada Pension Plan, which is a post-retirement social security plan. It is only in its role as employer that we are considering the obligations of the public sector.

Measuring Pension costs

There are two important measures that we have studied across the three countries. The first is a stock and the second is a flow. These are equivalent to the Balance Sheet and Profit & Loss Accounts respectively in a private company. These measures are:

- The net *present value* of all accumulated pension obligations less any scheme assets. These are called the ‘net pension liabilities’.
- The annual **running cost** to the employer and employee combined of new promises incurred in a year, expressed as a percentage of salary. The actuarial name for this concept is ‘current service cost’, and is the annual pension contribution required to cover future liabilities.

The first of these tells us the scale of the outstanding promises already made (less any assets already put aside), and the second tells us about the cost of the annual promises currently being made. Current service cost must not be confused with ‘pensions in payment’, which are the payments to pensioners in the current year, representing promises accrued by pensioners over the whole of their completed career.

Pension finances are notoriously opaque, and indeed this has made the collection of data on the three countries’ public pensions difficult. Both of the values we are seeking to discover are calculated by scheme actuaries on the basis of a series of important assumptions. The most important (i.e. those which have the greatest bearing on the final values) are the discount rate; the *mortality assumptions* and the *earnings/prices growth assumptions*. In this study we have accepted the mortality and earnings/prices assumptions made for the respective schemes, as well as all the other assumptions implicit in pension valuation. The only assumption we challenge is the discount rate.

Discount Rate

The discount rate (or interest rate – the meaning is the same) is important for a simple mathematical reason that boils down to this: if I promise you \$1,000 in 30 years’ time, how much is that promise worth (i.e. will cost me) today? The answer depends on the interest rate at which I can invest money today for the full 30 years. The importance of this rate for calculating the cost and value of a pension cannot be underestimated. As an example, if the interest rate is 1% p.a., the cost today would be \$742; if the interest rate is 5% p.a., the cost today would be \$231, and if the interest rate is 10% p.a., the cost today would be \$57.

Exactly the same effect applies to the cost of pensions: the interest rate that the actuary assumes affects both the outstanding liabilities and the current service cost in a

comparable way. The higher the assumed interest rate, the lower the liabilities and the lower the current service cost (i.e. the cost of new pension promises).

Previous studies⁶ have highlighted these twin effects of an elevated discount rate for UK public sector pensions. In the UK, most of the public employee pension liabilities are unfunded; the only exception is the Local Government Pension Scheme.

For unfunded schemes, this means that there are no scheme assets on which returns can be made; therefore the appropriate discount rate is the borrowing cost of the employer. By spending the pension contributions in the year in which they were received, rather than investing them in pension assets, the employers is reducing the borrowing (or increasing the debt repayment) that they would otherwise have undertaken. This argues for using market sovereign interest rate (US Treasuries; UK Gilts; Canadian Government Bonds) for calculating pension costs and liabilities.

In a newly-issued accounting standard, the International Public Sector Accounting Standards Board (IPSAB)⁷ has specified the market sovereign (or *risk-free*) rate to be the appropriate rate for public pension schemes' discount rate.

Description of Public Sector Pension Schemes

US

The US public sector can be split into three levels: **Federal**, **State** and **Municipal**. Given the constraints on our resources, it has been possible to consider only Federal and State pension schemes, and isolated, large, Municipal funds. The omission of most Municipal funds will therefore mean that we are likely to underestimate the scale of public pension sector in the US, and therefore also underestimate the true headline net liability.

There are three main **Federal** plans: the Civil Service Retirement System (**CSRS**) for employees who started pre-1984, the Federal Employee Retirement System (**FERS**), for those starting employment post-1984, and the Military Retirement Fund (**MRF**). In addition the healthcare fund for the military (**MERHCF**) has also been included, given the large liability which this has accrued. The two civilian Federal plans are unfunded – the Military plan is largely unfunded, but Congress has voted to fully fund it with US Treasury Bonds by 2026.

We have studied 88 **US State** pension plans. We have knowingly omitted only three States for which we could find no available information. Each State generally has a

⁶ See Sir Humphrey's Legacy, Neil Record, Institute of Economic Affairs, London, 2006, for a fuller description.

⁷ IPSAS25 *op. cit.*

central scheme for the various forms of public employees, but some also have a separate scheme for teachers (and occasionally university employees), where these are not taken into consideration under the central schemes. In exceptional circumstances, **Municipal** or individual **City** schemes have been incorporated into the study if it has been felt that they were substantial enough for inclusion. We have generally not included post-retirement healthcare costs – these remain a large potential liability of most public employers. For those healthcare schemes that we have looked at, there appears generally to be very low funding ratios.

All the plans included are listed in the Appendix.

UK

The UK has six large public pension schemes, and numerous smaller ones. The five largest **unfunded schemes**, accounting for 96% of outstanding unfunded liabilities, are the **NHS**, the **Teachers**, the **Civil Service**, the **Police** and the **Armed Forces**. The sixth scheme, which is funded, is the centrally guaranteed, but locally administered, **Local Government Pension Scheme (LGPS)**. These schemes cover together about 6.4m employees, or about 25% of the UK labour force.

There is a group of quasi-public sector funds, all funded, which we have excluded from this study since by formal National Accounts definitions they are not part of the public sector. This group includes the Universities' Fund, Royal Mail, the Railways Fund, the BBC, the Bank of England and several former nationalised industries such as Coal and British Telecom, to whom partial State pension guarantees are outstanding. However, all of these entities will look to the Government to provide funding of last resort should there be shortfalls in funding, and a full evaluation of the Government's employer's pension obligations would include these schemes. On current valuations, these schemes do show substantial deficits, so the issue is not insignificant.

Canada

The Canadian public sector can also be split into three levels: **Federal**, **Provincial** and **Territorial**. Again for reasons of resources, and the fact that Territorial liabilities are relatively small, we will only include Federal and Provincial pension schemes in this study.

We have studied three **Federal** pension schemes - the **Public (or Civil) Service**, the **Military** and the **Police**. This list is not exhaustive but we believe it does account for the majority of federal liabilities. However, Canada does also publish consolidated Federal public service pension liabilities in the annual Public Accounts of Canada; and these give sufficient information for most of the Federal information that we need. The Public

Accounts' disclosures on public service pensions are extensive and helpful – a level of transparency not matched in the UK central Government and the US Federal disclosures.

The **Provincial** pension schemes are, like those of the US States, mainly divided into general Provincial employees and teachers. Of these, the teachers' pension plans account for by far the largest proportion of the liabilities. As with the US States, there are some smaller Provincial plans which we have also included. The full list of 30 Provincial plans and three Federal plans are listed in the Appendix.

Unfunded Liabilities

Headline Unfunded Liabilities

In order to examine the *unfunded liabilities* of each scheme under consideration in the US and Canada (and the UK Local Government Pension Scheme), two values were collected from the most recent Annual Financial Reports: **the market value of the assets** and the outstanding **liability**, the difference between these being the **unfunded liability**. The aggregate results of this exercise are shown in Table 1 in the Summary.

We then examined how the liability was affected by changes to the discount rate. The discount rate is the rate of return used to calculate the liability.

In each scheme the discount rate assumption made by each scheme actuary to reach this figure was different, so each assumed rate was recorded separately for each scheme. Each fund also made a related inflation assumption (for future salary and pension increases), which can also vary, if not quite so widely.

The subtraction of the inflation assumption from the discount rate assumption gives us the **real discount rate** assumption. We compared this assumed real discount rate to the market discount rate in each country.

To be able to calculate the effect of changes in the real discount rate assumption on the size of pension liabilities, we needed an average *duration*⁸ of the liabilities, a measure of the money-weighted average maturity of the cash flows. Duration also conveniently roughly corresponds to the elasticity of the liabilities with respect to interest rates.

After studying the information available on the duration of the average public sector pension scheme, we have chosen to use 20 years as a standard duration for this study across all three countries. A duration of 20 years means that for every 1% change in the discount rate, there is approximately a 20% change in the liabilities⁹.

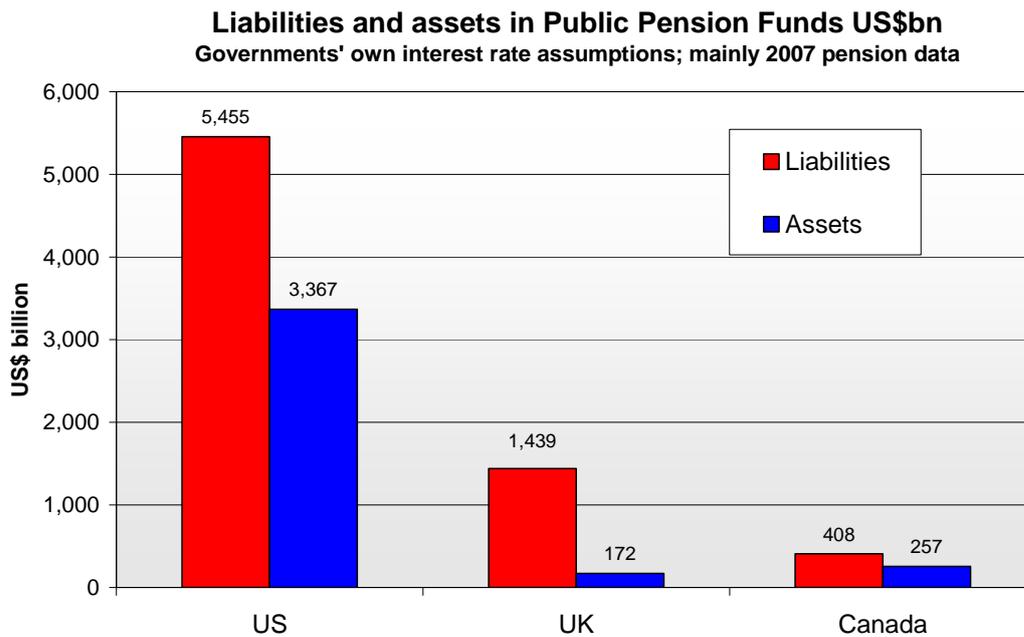
In order to be able to calculate changing duration with interest rates and the real interest rate yield curve, we built a model of future cash flows in a stylised public pension scheme. Thus rather than simply applying the market real interest rate at the time at which the study is being carried out, each cash flow should be discounted separately at the real interest appropriate to the maturity at which the cash flow is to be received. In the UK this market real interest rate curve can be derived from the *index-linked Gilt* market, in the US from *Treasury Inflation-Protected Securities (TIPS)*, and in Canada from Federal

⁸ For more on duration in this context, see *Sir Humphrey's Legacy*, op cit.

⁹ We assume 20 years' duration at the Governments' assumed discount rates. When we use lower (market) discount rates, duration rises. This is known as 'convexity' in bond financial theory.

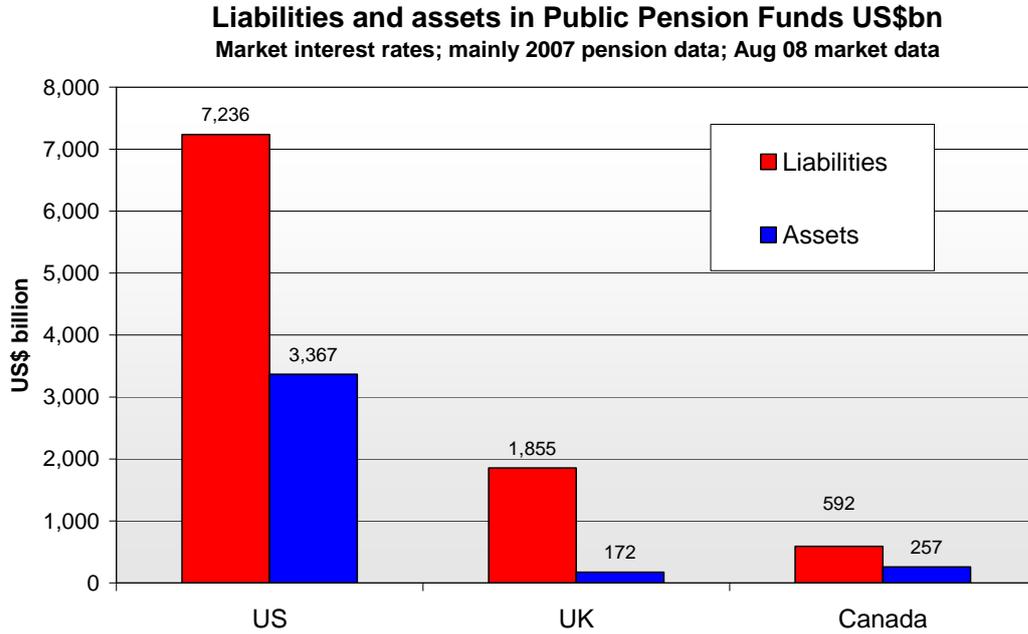
government *Real Return Bonds*. Reapplying this curve to the model cash flows will give us the most accurate estimate of the effect of using market interest rates. Graph 1 shows (for reference) liabilities and assets as reported by the respective Governments at their assumed discount rates for the aggregate pension schemes listed in the Appendix (these are the same data as Table 2).

Graph 1



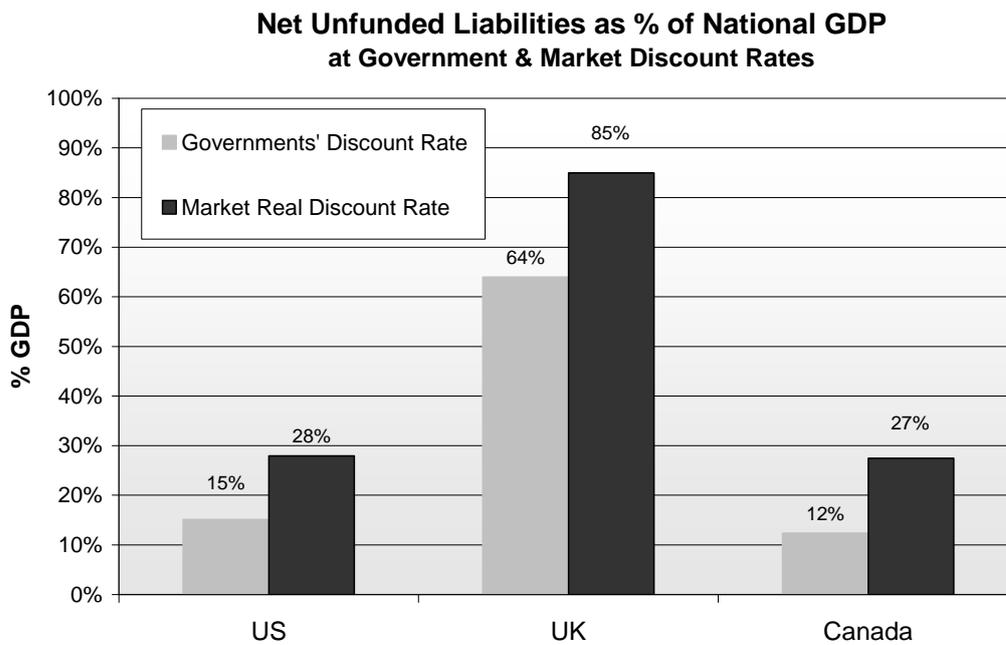
By contrast, Graph 2 shows the same pension schemes, but this time valued at August 2008 market real interest rates.

Graph 2



We can distil these gross values to net liabilities (=liabilities – assets), and express them as a percentage of each countries' respective GDP. Graph 3 illustrates (and reflects the same data as Table 1 & Table 3).

Graph 3



In summary, the UK stands out from the US and Canada as having a much larger net liability, brought about by a combination of large and generous public pension schemes covering a significant proportion of the workforce (25% - higher than in both US and Canada), and no funding in all but one of the schemes.

Current Service Cost / Contribution Rates

Why contribution rates matter

So far we have concentrated only on the headline unfunded liabilities, but these large values (particularly in the UK) may create headlines, but are not in themselves an incentive for public sector employers and employees to renegotiate the terms of their pension schemes. The liabilities accrued in the past cannot be alleviated without the government breaking its established promises to pensioners.

However, for all the public pension schemes which are open today (which is the vast majority), promises are being made (i.e. pensions are being earned) which will result in increased pension liability. The public (as taxpayers) and policy-makers need to know what the promises being made today will cost. Unlike outstanding liabilities (which cannot be reduced without expropriation), current-year promises can be re-negotiated.

Some background may help to fill in the picture of how and by whom these contribution rates are set and paid. For example, in the UK, the UK Treasury funds the employers' budgets (say the NHS), and the NHS trusts (the employers) pay employer contributions back to the UK Treasury (along with a contribution from employees (which have also come from the UK Treasury)), which in return for these contributions, takes responsibility for the payment of future pensions. Governments are also responsible for setting the contribution rates (for both employer and employee) at what they believe should cover the value of the pension accrued each year. If they do not adequately price these schemes through realistic calculation of these contributions, the employer and employee, and also the taxpayer, will remain ignorant of the true cost of the pensions that are being offered.

We have seen in the headline unfunded liabilities that the implicit discount rate assumptions for each of the countries were over-optimistic in comparison to the market real rate, and the same is of course true in the calculation of public sector pension scheme contribution rates, the true annual cost of which escalates at lower discount rate assumptions.

Methodology and Assumptions

We applied the following methodology to calculating the effect on contribution rates of respective Government's interest rate assumptions:

- We built a contributions model based on a stylised final salary pension scheme
- We calibrated this model for each country and sector so that at the stated (assumed) real interest rates that each sector reported on average, the model calculated the average contribution rates that were reported by each sector. [A 'sector' is 'US State Funds' or 'UK unfunded' or similar.]

- We then changed the real interest rates to market rates as at Aug 2008, and recalculated the contributions required. We checked the elasticity of contributions with respect to the discount rate with any other external verifying information we had.

We present below the summary table (Table 5) to show the calculation for all the sectors we have studied.

Table 5

Comparison of Pension Contribution Rates as % of Payroll by discount rate Government assumptions & Market real discount rates		
Country / System	Current Contribution Rate at Government discount rates	Recalculated Contribution Rate at market risk-free discount rates
UK	17.8%	44.0%
US State	14.3%	32.5%
US Federal Civilian	13.6%	17.0%
US Federal Military	26.5%	36.0%
Canada Provincial	14.1%	27.5%
Canada Federal	20.1%	45.5%

In summary, Governments across all three countries have chosen higher discount rates than their own risk-free rates to value their pension liabilities, and to calculate the contributions required to pay for them.

For well funded schemes, there is an argument, although hotly debated in the actuarial profession, that funds with higher-returning risky assets can afford to choose higher discount rates to calculate liabilities. For unfunded schemes, such as most UK and the Federal US schemes, this argument fails. There is no case in logic to value unfunded liabilities promised by a sovereign borrower at any other discount rate than their own. The choice of high (“optimistic” in the case of funded schemes) discount rates has distorted the perception of the value of public pensions in the eyes of employer, taxpayer and employee, and this has had a damaging effect on the signalling that is so necessary for effective resource allocation in a market economy. We make recommendations below.

Public Policy Considerations

Unfunded public pension liabilities represent a transfer of value (spending power) from a future generation of taxpayers to the current generation of public employees (and by implication, a transfer to the current generation of taxpayers). This decision is made by the current generation, but paid for by future generations.

There is constant electoral pressure to minimise the current tax burden for the electorate, but to make promises of future public expenditure. In the case of public employee pensions, these promises benefit only a small proportion of the electorate, and so it is very important that the promises are known and understood by those who will have to pay for them, and (ideally) paid for at the time of the promise, rather than, say, thirty years' later, when the promise matures.

There is a secondary transfer, which has arisen from the generosity of public pensions in relation to private pensions (particularly in the UK because of the scale of the public pension schemes), which is the transfer of value between the current generation of taxpayers to the current generation of public employees. This latter issue [a particular feature of unfunded pensions (“pensions apartheid¹⁰”)] is becoming a significant political issue in the UK.

The public employee pension schemes in all three countries studies suffer from a strong element of wishful thinking in their choice of discount rate to calculate liabilities¹¹. Funded (or partially funded) schemes can argue that it is valid to use an estimate of the expected rate of return on the assets to calculate the liability, although history has generally proved these rates to be too optimistic. Indeed, this leeway might have encouraged pension funds to hold riskier assets than they would otherwise have done so to justify a higher discount rate. But this reasoning does not apply to unfunded schemes, which do not have any assets to invest. With unfunded schemes, the implicit return is the interest cost saved by the reduction in public borrowing arising from the diversion of pension contributions to current Government spending, rather than investing in assets. This return is the same as the Sovereign market rate, since all three Governments' securities represent the benchmark risk-free rate.

Recommendations

In view of the above, we make three recommendations.

¹⁰ See, for example, *The Pensions Apartheid: The problem, the cost and the tough choices that need to be made*, Corin Taylor, Institute of Directors, London, Jan 2009

¹¹ This has also been a feature of the (funded) private pension systems; although more recently much tougher accounting and reporting standards are being imposed, and as a result, the consequences of years of underfunding are becoming painfully obvious, and many schemes are being closed.

- The first is that Governments make much more effort to inform taxpayers what promises are being made in their name. Most pension scheme Annual Reports are written with the employee or pensioner in mind – we find that little information digestible by the layman is contained in these reports. So we call for much greater transparency in detailing both the running cost of public employee pensions, and any net liability.
- In furtherance of this objective, we believe that central Government, and all lower tiers of Government, should conform to the latest international public sector accounting standards on post-retirement benefits. In particular, we believe that they should adopt sovereign market discount rates both to calculate the running costs of pensions, and to compute the outstanding net liabilities.
- Finally, for two reasons, we think that Governments should consider very carefully whether they should continue to accrue unfunded pension liabilities. The first reason is we observe that employee pension liabilities are rarely fully costed by the generation that grants them, and that they are poorly understood by the later generations that have to pay them. Funded schemes' running costs have to be paid in the period in which the promise is made, and in most Governmental budgeting systems, this will act as a firm control of the size of the promises made.

The second reason is that large unfunded liabilities are, as described above, an intergenerational transfer. We think that for the public sector, all intergenerational transfers should be represented by explicit Government debt. Debt is transparent, and understood by the electorate. Other liabilities are not. Hence, since pension liabilities are capable of being monetised, we recommend that they should be as far as possible, and at a pace commensurate with the budgeting process and the scale of the unfunded liabilities.

An example of 'monetising' of an unfunded liability is the US Military Pension Plan, for which Congress passed a plan in 1984 for it to move from an unfunded scheme, to a fully funded scheme by 2026. This involves not only the Military budget funding the annual running cost of the pension scheme, but also the 'catch-up', in which each year a proportion of the unfunded liability is funded by the issue to the Military Pension Plan of US Treasury Bonds, in return for payment to the US Treasury by the Military.

Appendix: Public Sector Occupational Pension Schemes included in this study

US Federal Pension Plans included in the study

Federal Type	Plan Name
Civilian	CSRS
	FERS
Military	MRF
	MERHCF

US State Pension Plans included in the study

State	Plan Name	State	Plan Name
Alabama	ERS	Kansas	KPERS
	TRS		Kentucky
Alaska	PERS	Louisiana	KTRS
	TRS		LASERS
Arizona	ASRS	Maryland	TRSL
Arkansas	APERS		SRPS
	California	ATRS	Massachusetts
CalPERS		MTRS	
CalSTRS		Michigan	MSERS
LACERA			MPSERS
LACERS			MERS
OCERS			RSCD
SDCERA			Minnesota
Colorado	PERA	TRAM	
	DERP	MSRS	
	DPSRS	Mississippi	PERS
Connecticut	CSTRS		Missouri
	Delaware	DPERS	Montana
Florida	FRS	LAGERS	
Georgia	ERS	PERS	
	TRS	TR	
Hawaii	ERS	Nebraska	NPERS
Idaho	PERSI	New Hampshire	NHRS
Illinois	SRS	New Jersey	Division of Pension & Benefits
	TRS		New Mexico
	SURS	NMERB	
	IMRF	New York	NYSLRS
	CPTF		NYSTRS
	Indiana		PERF
	Iowa	TRF	NYCTRS
IPERS		NDPERS	
		North Dakota	

US State Pension Plans included in the study (cont)

State	Plan Name
North Dakota	TFFR
Ohio	OPERS
	STRS
	SERS
	OPFPF
Oklahoma	OPERS
	TRS
Oregon	PERS
Pennsylvania	SERS
	PSERS
	PMRS
Rhode Island	ERSRI
South Carolina	SCRS
South Dakota	SDRS
Tennessee	TCRS
Texas	ERS
	TRS
	TMRS
Utah	URS
Vermont	VSRS
	VSTRS
Virginia	VRS
Washington	DRS
West Virginia	CPRB
Wisconsin	ETF
Wyoming	WRS

UK Pension Schemes included in the study

Unfunded Public Sector Pension Schemes

Armed Forces Pension Scheme

Principal Civil Service Pension Scheme (Great Britain)

Principal Civil Service Pension Scheme (Northern Ireland)

NHS Pension Scheme (England & Wales)

NHS Pension Scheme (Scotland)

House of Commons Staff Pension Scheme

House of Lords Staff Pension Scheme

Health & Personal Social Services Superannuation Scheme (Northern Ireland)

Teachers' Pension Scheme (England & Wales)

Scottish Teachers' Superannuation Scheme

Northern Ireland Teachers' Superannuation Scheme

Police Pension Scheme (administered locally by police authorities)

Firefighters' Pension Scheme (administered locally by Fire & Rescue Authorities)

UK Atomic Energy Authority Pension Scheme

Research Councils Pension Scheme

Judicial Pension Scheme

Funded Public Sector Pension Schemes

Local Government Pension Scheme

Canadian Federal Pension Plans included in the study

Civilian	Public Service
Military	Canadian Forces Superannuation Plan
Police	RMCP Plan

Canadian Provincial Pension Plans included in the study

Alberta	Alberta Teachers Retirement Fund Public Service Pension Plan Local Authorities Pension Plan Public Service Management Plan Special Forces Pension Plan Management Employees Pension Plan
British Columbia	Teachers' Pension Plan Municipal Pension Plan Public Service Pension Plan College Pension Plan
Manitoba	Civil Service Superannuation Fund Teachers' Retirement Allowances Fund
New Brunswick	Public Service Superannuation Plan Teachers' Pension Plan Provincial Court Judges Pension Plan
Newfoundland & Labrador	Teachers' Pension Plan Public Service Pension Plan Uniformed Services Plan Members of the House of Assembly Plan
Nova Scotia	Teachers' Pension Fund Public Service Superannuation Plan
Ontario	Teachers' Pension Plan Public Service Pension Plan
Prince Edward Island	Teachers' Superannuation Fund Civil Service Superannuation Fund
Quebec	RREGOP RRPE RRCE
Saskatchewan	Teachers' Superannuation Fund Public Service Superannuation Plan

Glossary

<i>accrual rate</i>	Defined Benefit pension schemes include a value (the accrual rate - often $1/60^{\text{th}}$ or $1/80^{\text{th}}$), which represents the proportion of the final or career average salary earned for each year of employment to be paid as pension. Forty years employment in a $1/60^{\text{th}}$ final salary scheme will mean a pension of $40/60^{\text{ths}} = 2/3^{\text{rds}}$ final salary.
<i>contribution rates</i>	The annual payments made by employers and employees to the Government, expressed as a percentage of salary in that year, to pay (in theory) for the pensions being promised in that year.
<i>current service cost</i>	The annual cost to the Government, expressed as a percentage of salary in that year, of taking on the obligation to pay for the pensions being promised in that year.
<i>defined benefit</i>	A Defined Benefit (DB) pension scheme is one in which a promise is made by the employer as to the size of the ultimate pension that the employee receives. The size of the pension will depend on either the final few years' salary (final salary) or the average salary over the employee's career (career average scheme), although that latter is also adjusted for inflation over the career. Other contributory factors include the accrual rate and the years of service.
<i>discount rate (interest rate)</i>	The interest rate applied in a calculation of the <i>discounted</i> or <i>present value</i> . The convention is to express discount or interest rates as the un compounded annual rate of return – so a 10% interest rate will turn £100 into £110 in one year.
<i>discounted</i>	A future payment is discounted back to today by taking its <i>present value</i> . The interest rate used to calculate the present (or discounted) value is sometimes called the discount rate.
<i>duration</i>	Duration is a measure of both the average maturity of a series of payments in the future (like pension payments or payments by Gilts), and also a measure of the sensitivity of the <i>present value</i> of such a stream of payments to changes in interest rates. The duration measured in years is approximately (and conveniently) also a measure of the negative percentage change of the present value with respect to the interest rate. So if interest rates fall 1% from 3% to 2%, then for a 20-year duration stream of payments, the present value of the payment stream will rise by $1\% \times 20 = 20\%$.
<i>earnings/prices growth assumptions (or real earnings assumptions)</i>	These are assumptions, made by the pension actuary, of the future earnings growth the workforce compared to the future rise in prices. UK actuaries generally assume higher rates of real earnings growth than US or Canadian in current reports.

<i>final salary</i>	A pension whose annual payment is a defined proportion of the employee's final year's salary. A typical scheme might have an accrual rate of $1/60^{\text{th}}$, so that after 40 years, a newly retired pensioner would be paid a pension of $40/60^{\text{th}}$ of his or her final salary. Most public pensions are index-linked: in the US & Canada the link with prices often comes as a Cost of Living Adjustment (COLA), although COLAs are not automatic in some schemes. In the UK, index-linking to RPI is full and automatic.
<i>Gilts</i>	UK Government Debt. Gilts are tradeable instruments (bought and sold on the Stock Market), which can be either 'conventional' or 'index-linked'. One unit of conventional Gilts pays a fixed interest payment twice yearly, and then £100 at maturity. E.g. 6% Gilt 2028 pays £3 per £100 unit on 7 June & 7 December each year, and £100 +£3 on 7 December 2028. Index-linked Gilts pay interest and principal on the same basis, but each payment is indexed to the Retail Prices Index (RPI). Because of the mechanics of indexation, there are additional complexities in index-linked Gilts, including two types – 8-month lag and the more modern 3-month lag. Most of the UK National Debt is in the form of Gilts.
<i>index-linked</i>	Payments that are linked to the future value of a prices index (such as CPI or RPI). Such payments are inflation-protected, because they go up in line with average prices.
<i>marked-to-market</i>	The value of any assets or liabilities when valued at the market price prevailing on a particular date.
<i>mortality assumptions</i>	Mortality assumptions are the assumed pattern of age of death of the pensioner population. These are generally based on longevity models, which in turn are based on tables compiled by Government from public death records, and by insurance companies and pension funds from the records of their customers and pensioners.
<i>pension liabilities</i>	The value today (see <i>present value</i>) of the future pension payments owed by an employer (the Government) to a current, former or retired employee. Liabilities measured in this way will always be smaller than the actual amounts paid in future, as the liability calculation takes account of the interest earned between today and when the payments are due.
<i>present value</i>	The value today of a payment or stream of payments in the future. If the market interest rate is 3%, and the future payment is £100 in ten years' time, the present value is $£100/(1.03)^{10} = £74.4$. This is because if I invest £74.4 today at 3% compound, then in ten years I will have £100. More generally $PV = FV/(1+r)^n$, where PV = present value; FV = future value; r = interest rate; n = time to future payment in years.

<i>real interest rate</i>	The market rate of interest over and above inflation payable by index-linked Government debt. The rate varies continuously according to market behaviour.
<i>Real Return bonds</i>	These are the Canadian equivalent of UK index-linked Gilts (see Gilts above) and US Treasury Inflation Protected Securities.
<i>risk-free interest rate</i>	See Sovereign market interest rate.
<i>sovereign market interest rate</i>	The market interest rate that an investor would receive (and a Government would pay) for a fixed period of a loan (Government debt). Sovereign market interest rates are sometimes called 'risk-free'.
<i>Treasury inflation protected securities (TIPS)</i>	These are the US equivalent of UK index-linked Gilts (see Gilts above) and Canadian Real Return bonds.
<i>unfunded</i>	A pension scheme in which no money has been set aside to pay the pensions promised. If contributions have been received by an unfunded scheme, these are spent by the Government in the year in which they are received.

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