



TO: Pension Committee

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DATE: May 31, 2011 for June 10, 2011

AGENDA ITEM:

ITEM IDENTIFICATION:

Consultation Draft for Discussion: University of Toronto Pension Master Trust Investment Volatility Risk and Return Targets

JURISDICTIONAL INFORMATION:

The Pension Committee is responsible for the Statement of Investment Policies and Goals for the pension fund master trust and any amendments thereto. The Statement will include, without limitation: return objectives, normal risk tolerance, asset allocation, and benchmarks for the evaluation of performance.

PREVIOUS ACTION TAKEN:

The Pension Committee received a copy of the University of Toronto Pension Master Trust Investment Policy and a presentation on the process of setting the targets along with the results of the 2007 asset-liability study.

HIGHLIGHTS:

The current investment risk and return targets for the pension master trust are:

- a return volatility risk target of 10% annual standard deviation over 10 years;
- a real return target of at least 4%, net of investment fees and expenses;
- the risk target overrides and constrains the return target. (That is, the risk target is of greater priority than the return target).
- a lower tolerance for downside risk.

The attached paper reviews the current targets, considers the appetite for risk, examines modeling of the U of T pension plan that produces various risk/return target combinations, analyzes the likelihood of various future outcomes, and recommends investment targets for the pension master trust going forward. It includes results of focus group meetings facilitated by Cambridge Associates and results of the asset-liability study prepared by Aon Hewitt for investment return targets of 1.3% (an attainable least risk portfolio), 2.0%, 3.0%, 4.0%, 5.0%, and 4.9% (the Reference Portfolio).

In brief, the results of the asset-liability study validate the decisions from the 2007 study. This study indicates that:

- A 4% real return target is still attainable within the 10% risk target.
- In fact, with a 10% risk target, this modeling suggests that it may be possible to expect an annualized real return of 5% over the next 10 years.
- While a 4% real return is still achievable, it will require more risk to attain, 8.7% at this time, as compared to about 7.2% in 2007

Comparison between the current 4% real return target and the lower investment return targets in the 1.3% to 3.0% range indicates that the lower risk perceived to be associated with the lower investment return targets simply does not materialize on the downside, with the “very pessimistic” going concern funded status being very similar under all the targets tested. And the required employer contributions are much higher with the lower investment return targets. We believe these results are sufficiently definitive to enable us to eliminate the 1.3%, 2.0% and 3.0% targets from consideration.

Comparison between the current 4.0% real return target and the higher investment return targets indicates that a 5% real return target would be desirable from an outcomes perspective. However, this analysis also shows that risk levels are higher than they were in 2007. The focus groups expressed little vocal support for any strategy based on investment return targets that would be higher than those currently in place. Raising the target would be seen as taking on more risk even though the modeling suggests it would currently be achievable within the current 10% risk target.

The analysis suggests that the metrics for the current 4% real return target are quite close to those for the 5% target in many areas, but with a lower risk level. Over the past 21 years we have met the 4% real return target, both on a rolling 10 year return basis, and on the basis that one-year returns should be within 10% of that target on a nominal basis 2/3 of the time. However, we recognize that it will be more difficult to achieve a 4% real investment return target in future. Although we did have a large loss in 2009 with the 4% real return target in place, this analysis suggests that the going concern funded status at July 1, 2020 would be not be significantly different under all the targets tested at the “very pessimistic” level. Therefore, we cannot reduce this risk significantly by choosing a lower target.

It is important to note that with a 4% real return target, there is a 46% probability that special payments in 2014-15 will have to be higher than those projected in the preliminary funding and financing strategy presented to the Business Board in January 2011. However, that probability is not materially improved with the 5% real return target, and is much worse with the lower investment return targets.

Taking all of the above analysis into account along with the views of the focus groups, we believe that it makes sense to continue with the investment return target that is currently in place.

**FINANCIAL AND/OR
PLANNING IMPLICATIONS:**

RECOMMENDATION:

For discussion at the June 10, 2011 meeting of the Pension Committee and, tentatively, for consideration for approval at the September 2011 meeting of the Pension Committee.

Pension Master Trust
Investment Volatility Risk and Return Targets

Consultation Draft for Discussion
at the
Pension Committee
June 10, 2011

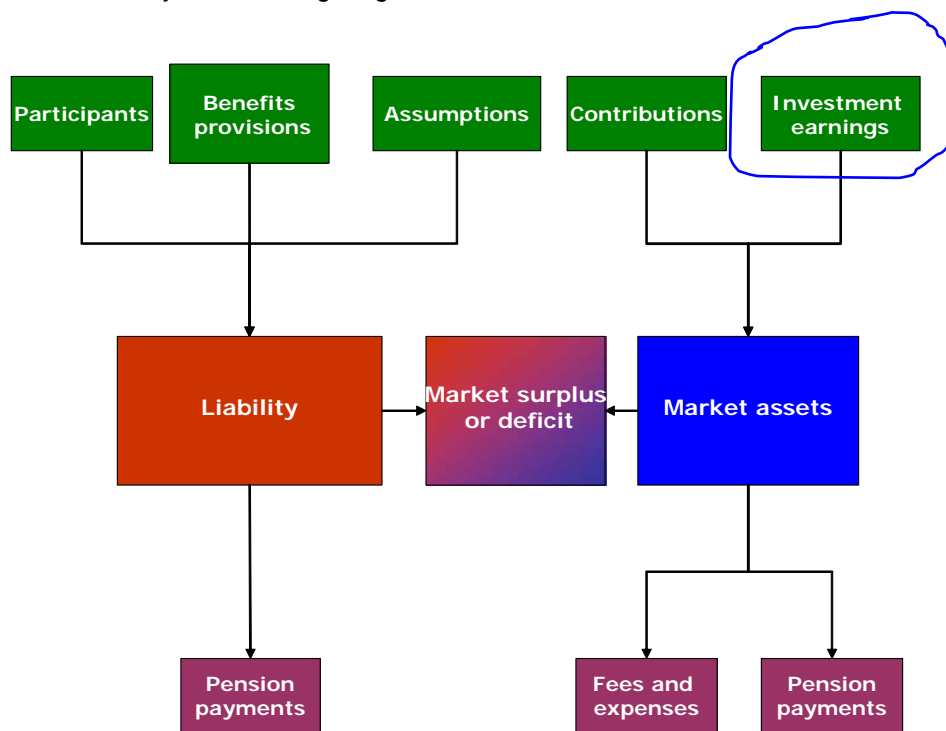
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Introduction

A defined benefit pension plan provides pension benefits to each retiring member on the basis of defined percentages applied to salary and years of pensionable service. The main objective of managing a defined benefit pension plan is to ensure that there are sufficient resources to pay for the current pensions of retired members and to ensure that there will be sufficient funds to pay for the pensions of members who will retire in the future.

The challenge for defined benefit pension plans is to find a way to reasonably estimate the current net present value of what pensions will be paid to retired members over time (the liabilities) and to set aside money now to support payment of those pensions in future (the assets), as illustrated by the following diagram:

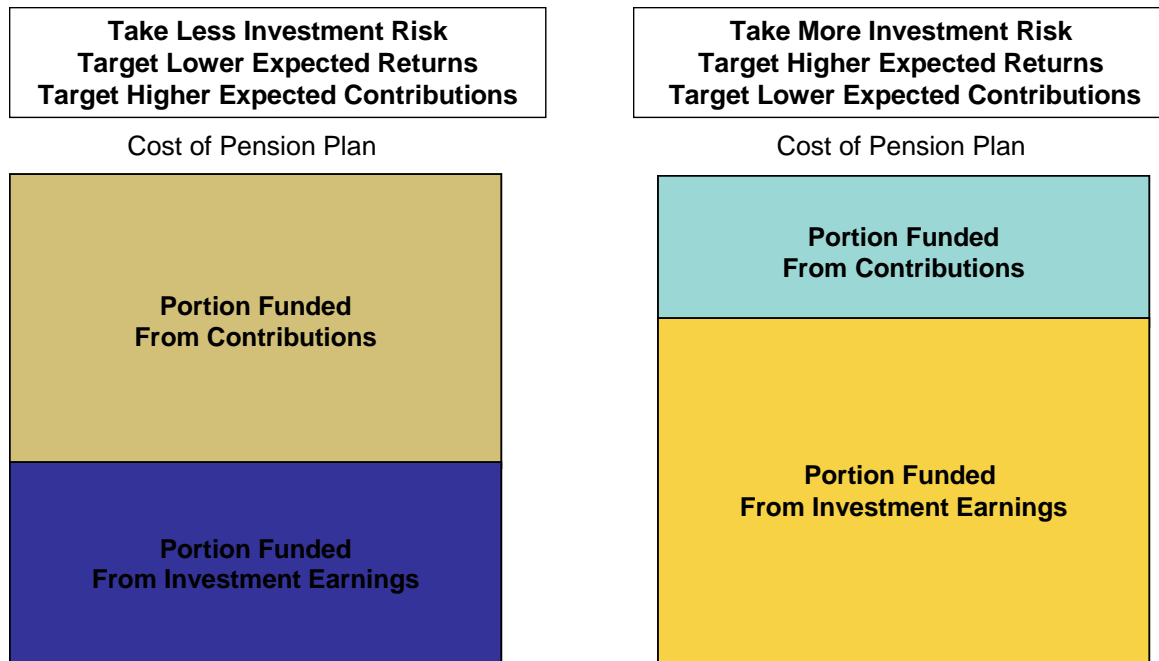


There are only two sources of funding to set aside the money needed to support those pension payments: contributions (from members and from the University) and investment earnings.

It is important to note that there is a strong relationship between contributions and investment earnings. Since the amount that must be set aside in assets is driven by the pension liabilities, the key question on the asset side is:

How much of the pension funding should come from contributions and how much should be targeted to come from investment earnings?

The higher the investment earnings that can be generated, the lower the contributions needed to be provided, everything else remaining the same. This relationship is illustrated below.



Investment earnings are dependent on several elements:

- how much risk we are willing to take to try to achieve an acceptable level of investment earnings; understanding that the higher the investment earnings we want, generally speaking, the higher the risk of loss we are going to have to tolerate and plan for;
- what investments we make – the investment strategy, including the asset mix – to try to achieve investment earnings; and
- how investment markets are generally performing, in Canada and around the world.

The purpose of this paper is to address the first of these elements, that is, to establish return targets that are deemed appropriate for the investments of the pension plans. It is NOT the intention of this paper to establish the strategy alluded to in the second element, nor does it weigh in on the performance of the capital markets underlying the investment of the plan asset.

Managing the risks inherent in plans like the U of T pension plans is an integrated process involving the management of both investment and funding strategies. To establish the necessary risk and return targets for the plans, it is important to understand the current state of the plans' financial health and to understand the role of both investment and funding strategies.

At July 1, 2010, the U of T pension plans have going concern accrued liabilities of \$3.4 billion, market value of assets of \$2.3 billion, a market deficit of about \$1.1 billion, and a going concern funded status (market value of assets as a percentage of going concern accrued liabilities) of 68.4%. We do NOT expect to deal with this deficit through investment earnings. Rather, we are planning to deal with the deficit over a multi-year period through a funding and financing strategy (that is a strategy focusing on significantly increased contributions) featuring large early lump sum payments. For more on this strategy, which is considered preliminary at this point since it must be formally established as at July 1, 2011, please see the paper entitled ***Ensuring a Sustainable Pension Plan for the University of Toronto*** at the following web address:

<http://www.governingcouncil.utoronto.ca/AssetFactory.aspx?did=7486>)

It is important to note that given the long term nature of pension plans and the many potential contingencies, numerous assumptions are required. Moreover, actual events will almost certainly differ from those predicted. Managing to this reality requires a funding and investment strategy that addresses the current and expected future states but is also flexible enough to be adjusted and fine-tuned as future events unfold.

For investment purposes, the U of T pension plan and the OISE pension plan are combined into the pension master trust. To accomplish the tasks of this paper, we will model the U of T pension plan, which represents 97% of the assets in the pension master trust, over the next 10 years under many economic scenarios to determine whether the current risk and return targets (most recently reviewed and fine-tuned in 2007) are still appropriate for the foreseeable future. In modeling the plan, we have included the increased employer contributions projected in the preliminary funding and financing strategy . The modeling also assumes the current employee contribution formula remains the same during the projection period and that the plan's provisions remain unchanged as well.

The remainder of this paper will:

- review the current targets,
- consider the appetite for risk,
- examine modeling that produces various risk/return target combinations
- analyze the likelihood of various future outcomes and
- will recommend investment targets for the pension master trust going forward.

Current Investment Approach

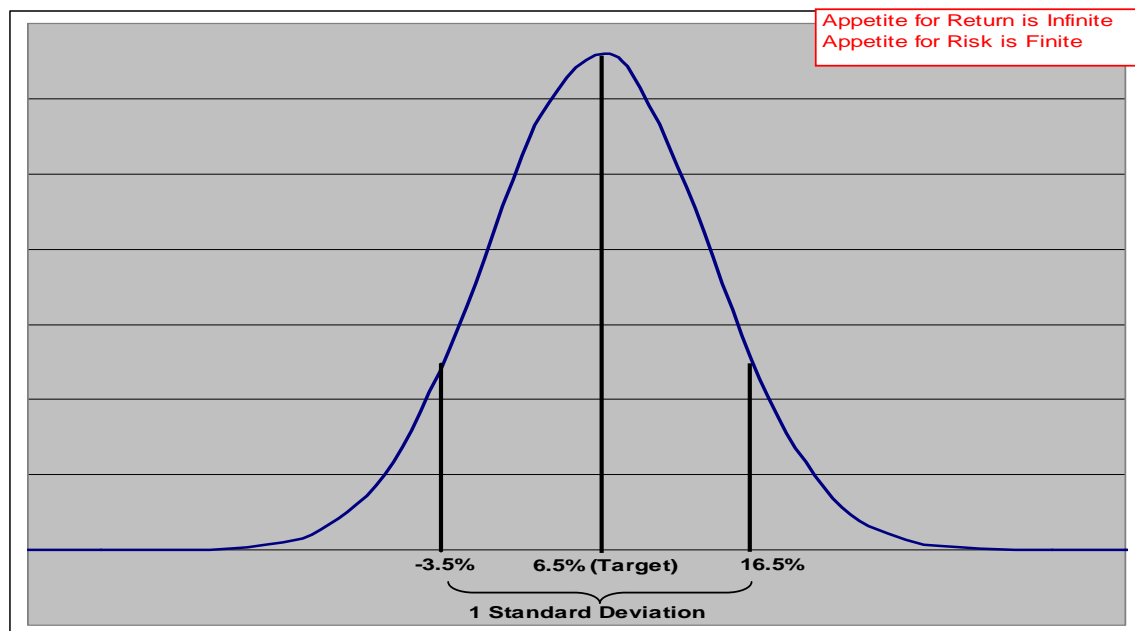
As noted earlier, the registered pension plans are invested through the unitized pension master trust which combines for investment purposes the assets of the U of T pension plan and the OISE pension plan. The master trust was created on August 1, 2000 to provide the two funds' assets with the same economies of scale, diversification and investment performance.

Current investment targets:

The current investment risk and return targets for the pension master trust are:

- a return volatility risk target of 10% annual standard deviation over 10 years;
- a real return target of at least 4%, net of investment fees and expenses;
- the risk target overrides and constrains the return target. (That is, the risk target is of greater priority than the return target).
- a lower tolerance for downside risk.

The following graph illustrates the return volatility risk target. The expected real return of 4.0% plus inflation of 2.5% results in an expected nominal return of 6.5% over a ten year period. Therefore, over a ten year period, annual nominal returns are expected to be between 16.5% and -3.5% two thirds of the time, with the remaining 1/3 expected to be outside that range, either higher or lower.



Target selection process:

Prior to 2003, the pension plan had a return target, but not a risk target. As of 2003 risk and return targets were determined through the process of preparing and assessing the results of asset liability studies. Such studies are normally conducted every 4-5 years and the results of the most recent, from 2007, are summarized below. For each portfolio selected, the table displays the return volatility risk and real return targets, the probability that required special payments would exceed \$27 million per annum¹ and the possible range of surpluses or deficits that could occur by 2011 for these portfolios under varying market conditions.

| Portfolios | Risk and Return Targets | | Probability of University Special Payments Exceeding Various Levels in 2011-2012, Assuming \$27 M Contributed 2007-2011 | | | | Surplus/Deficit Possible Outcomes in 2011 over 5,001 Scenarios Assuming \$27 M Contr. 2007-2011 | | |
|------------------------------|-------------------------|---------------|---|---------|---------|---------|---|------------|-----------|
| | Risk Target | Return Target | >\$0 | >\$27 M | >\$50 M | >\$75 M | 5th | Median | 95th |
| | | Percentile | | | | | Percentile | Percentile | |
| Liability matching portfolio | 5.0% | 1.8% | 100.0% | 100.0% | 19.4% | 3.0% | (323.0) | (407.0) | (571.0) |
| Portfolio A1 | 6.4% | 3.9% | 56.6% | 38.4% | 23.4% | 12.0% | 778.0 | (96.0) | (998.0) |
| Portfolio A2 | 7.2% | 4.1% | 53.5% | 37.4% | 24.3% | 12.9% | 952.0 | (59.0) | (1,066.0) |
| Portfolio A3 | 7.7% | 4.3% | 51.8% | 36.8% | 24.9% | 13.5% | 1,081.0 | (35.0) | (1,108.0) |
| Portfolio A4 | 8.3% | 4.5% | 50.3% | 36.5% | 25.0% | 14.4% | 1,225.0 | (5.0) | (1,153.0) |
| Portfolio A5 | 9.8% | 4.8% | 47.5% | 36.2% | 26.0% | 17.2% | 1,596.0 | 55.0 | (1,265.0) |
| Portfolio A6 | 10.5% | 5.0% | 46.7% | 35.7% | 26.4% | 17.8% | 1,776.0 | 80.0 | (1,320.0) |

As you can see from this table, the risk of having to make payments greater than \$27 million by 2011-12 was approximately the same for all portfolios at a bit more than a 1/3 chance, except for the liability matching portfolio, where the risk was 100%. The portfolio volatility of approximately 10% (9.8%) was associated with an expected real return of 4.8%, which is higher than the 4% target calculated in 2003. An expected real return target of about 4% (4.1%) was associated with a return volatility of 7.2%, which was considerably lower than the 10% calculated in 2003. In all cases, the range of possible surpluses and deficits was wide.

¹ the annual amount established in support of special payments and pension reserving as approved by the Business Board in January 2004 and funded annually in the University's operating budget.

The December 2007 report noted a number of cautions regarding the modeling. In particular, it noted (a) that the modeling focused on portfolio volatility and that volatility for an individual asset class varies over time; (b) that there are also more risks associated with investments than just return volatility, such as liquidity risk (the risk that the money will not be available when it is needed for spending) and the risk associated with the complexity of individual transactions and with asset classes as a whole; (c) that there are no mathematical models that capture all elements of risk, or that can predict what behaviours will ensue as various possible outcomes begin to unfold; and (d) that the mathematical models should be viewed as tools that help in assessing risk, but do not provide a complete and comprehensive assessment of all the risks associated with making investment choices. This is partly why the range of outcomes for a given asset mix can be so broad under different market scenarios.

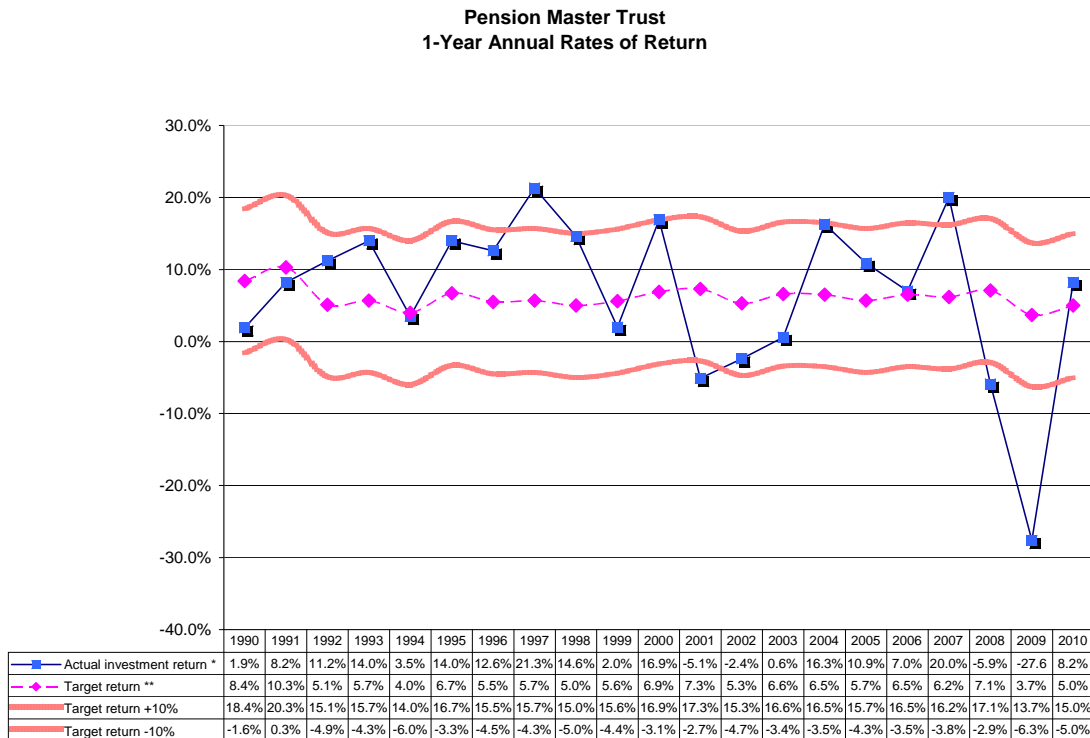
In light of these modeling limitations, the report concluded that judgment must be applied to the results obtained from modeling. The report also noted the importance of taking into account the broader environment in which the targets are being established. (Note: the pension asset liability study was conducted in Spring 2007, before the investment returns to July 1, 2007 were known and before the credit markets turmoil ensued.) Ultimately, the recommendation to the Business Board was to maintain the current targets of a 4.0% real return and a 10% standard deviation, and other qualitative refinements were added to strengthen the overall approach:

- The 10% return volatility risk target was specified as the primary target, overriding the return target in those situations where 4% real return could not be obtained without taking on more risk than the 10% permitted.
- The 4% real investment return target was established as a minimum target, except where constrained by the 10% risk target.
- A preference for lower downside risk was articulated.

These targets were approved by the Business Board in December 2007, and have been reconfirmed by the Business Board in December 2008 and December 2009. Effective with the formation of the Pension Committee, the governance authority for approval of pension investment risk and return targets has been transferred from the Business Board to the Pension Committee.

Actual investment history:

Now let us look at actual investment experience. If we look at the long-term investment history of the pension plan since 1990, and if we ascribe a +/-10% corridor to nominal returns for the entire period (the same as those in place for the master trust since 2003), we find the following: over the 21-year period, the returns for 16 (76%) of the years were within the 10% risk corridor, and those for 5 (24%) of the years were outside the risk corridor (2 above and 3 below).

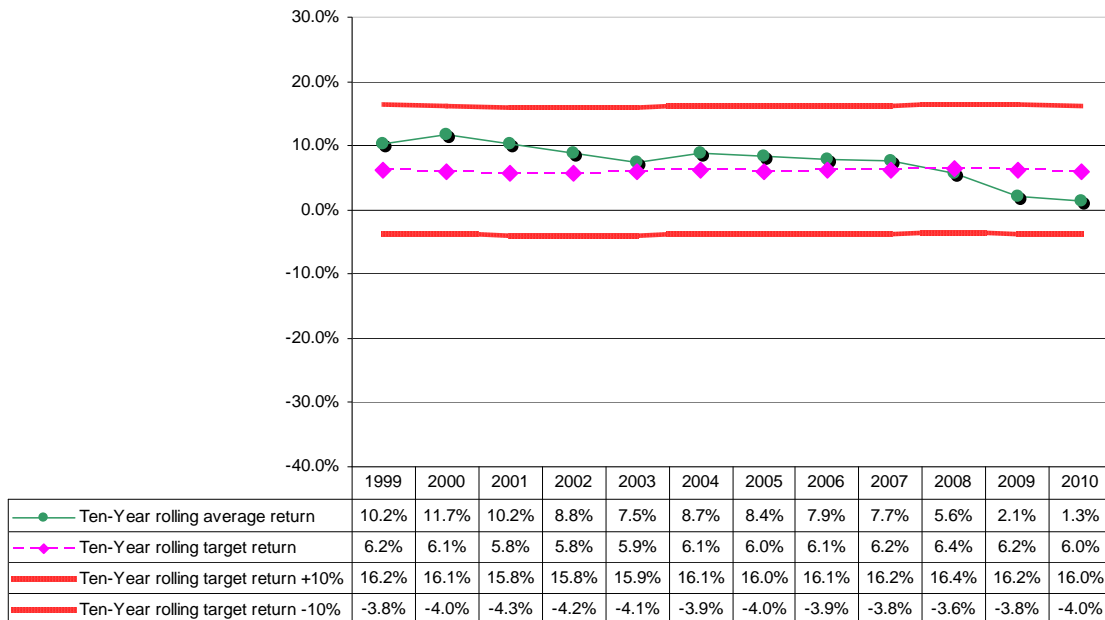


For the 19-year period from 1990 to 2008, the average annual actual nominal return was 8.2% compared to an average annual target return of 6.3%. If we include the 2009 and 2010 years, a 21-year period, the average annual actual return was 6.1% compared to the average annual target return of 6.1%. Over the period since 1990, actual returns have exactly met the University target return of CPI plus 4%.

However, if we concentrate on the more recent past, returns are more variable, as expected when a shorter period is studied. From 2004 to 2007 UTAM investment performance was excellent, outperforming the target real return and exceeding benchmarks. Results were within the target range except in 2007 when these exceeded the top of the corridor. In 2008 the market crash began and the master trust suffered a negative return of 5.9%. In 2009, the bottom fell out of the market, and the result was a negative return of 27.6%, although the 10-year return remained positive and within the corridor. During 2010, all major financial markets rebounded from the meltdown experienced in 2008 and 2009 and the one-year results were again positive.

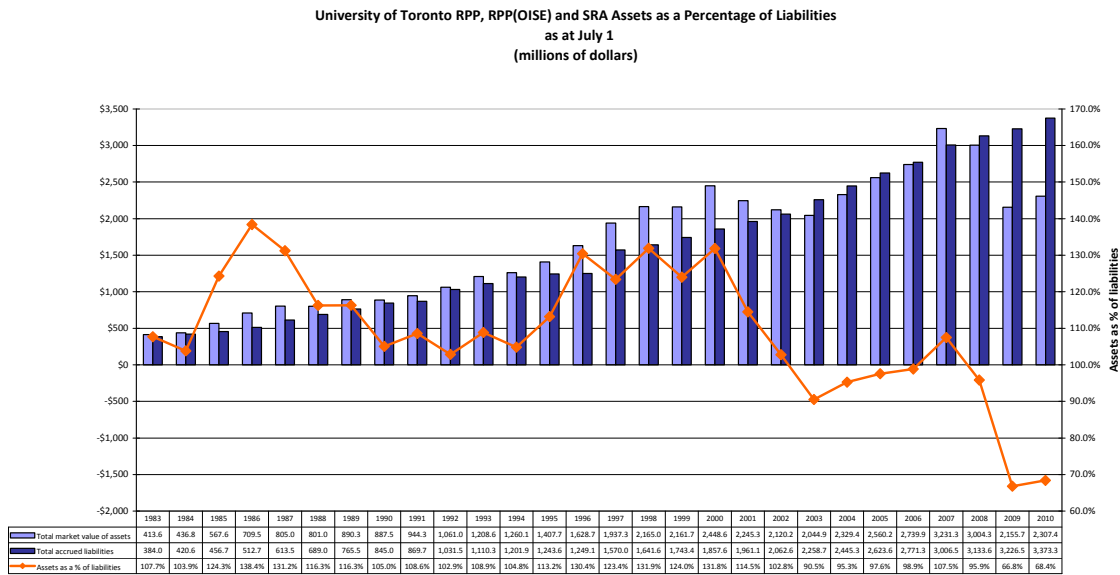
Since the investment return target has been set for 10-year periods, it is more appropriate to consider investment performance on a rolling 10-year basis rather than via a review of 1-year returns. If we look at the 10-year rolling averages, we find that for the entire period from 1990 to 2007, the actual 10-year average returns were at or above the University's target return, and that all years were within the 10% risk corridor, as shown in the following chart.

**Pension Master Trust
Ten-Year Rolling Average Return**



Pension Funded Status:

The funded status of the pension plans (assets as a percentage of accrued liabilities) reflects all of the components indicated in the earlier diagram on page 3. As one of only two sources of funds for the pension plan, investment earnings are a significant factor affecting the funded status of the pension plan. The following chart shows the going concern funded status of the U of T pension plans from 1983 to the present.



As you can see from the chart above, both the accrued liabilities and the market value of assets of the pension plans have grown significantly over the past 28 years. The going concern funded status has fluctuated. It was more than 100% (indicating the presence of a market surplus) for the period from 1983 to 2002. It fell to 90.5% (indicating a market deficit) in 2003, reflecting that market downturn, rose again to 107.5% in 2007, and then fell to 66.8% in 2009, reflecting the financial and economic crisis. At July 1, 2010 it was 68.4%, reflecting a large market deficit.

Funded status is important both in providing information on the financial health of the pension plan, and in triggering legislative and regulatory requirements around contributions. Our evaluation of the various investment risk and return targets will consider their potential impact on future funded status and on required employer contributions (assuming the current employee contribution formula remains unchanged) to illustrate the uncertainties represented by various return volatility risk targets.

The Appetite for Volatility Risk

A number of steps have been taken to review and recommend real investment return targets and return volatility risk levels going forward. There have been focus groups with a wide range of university stakeholders along with quantitative work undertaken by Aon Hewitt. Each will be discussed in turn.

In the context of pensions, “risk” has several potential meanings: the likelihood that investments will not achieve their target return; that investments will suffer an actual loss; that pension contributions will have to be increased; or that changes in the contributions fluctuate outside an acceptable range. Risk is the price that is paid for a target return level. One important thing to know about risk is that you can’t make money without taking risk. Risk management is not an exercise to extinguish risk. The goal of risk management is to ensure the balance between risk and reward is in proportion. It is important to understand that only part of an effective risk management program is quantitative. The challenge is to decide:

- what kinds of risk we can live with (the source of risk and how much to mitigate),
- how much risk we are able to tolerate,
- how to quantify risk,
- how to express and explain it in a way that stakeholders understand.

There is no universally accepted measure of risk for all pension plans. Some plan sponsors may define risk as the year-over-year volatility of certain financial metrics. Others may define risk as the results if the worst case scenario is realized.

Similarly, there is no universally accepted timeframe for risk management. For those plan sponsors with little budget flexibility, the timeframe may be short (e.g. one or two years). For those with greater budget flexibility, a longer time frame may be appropriate.

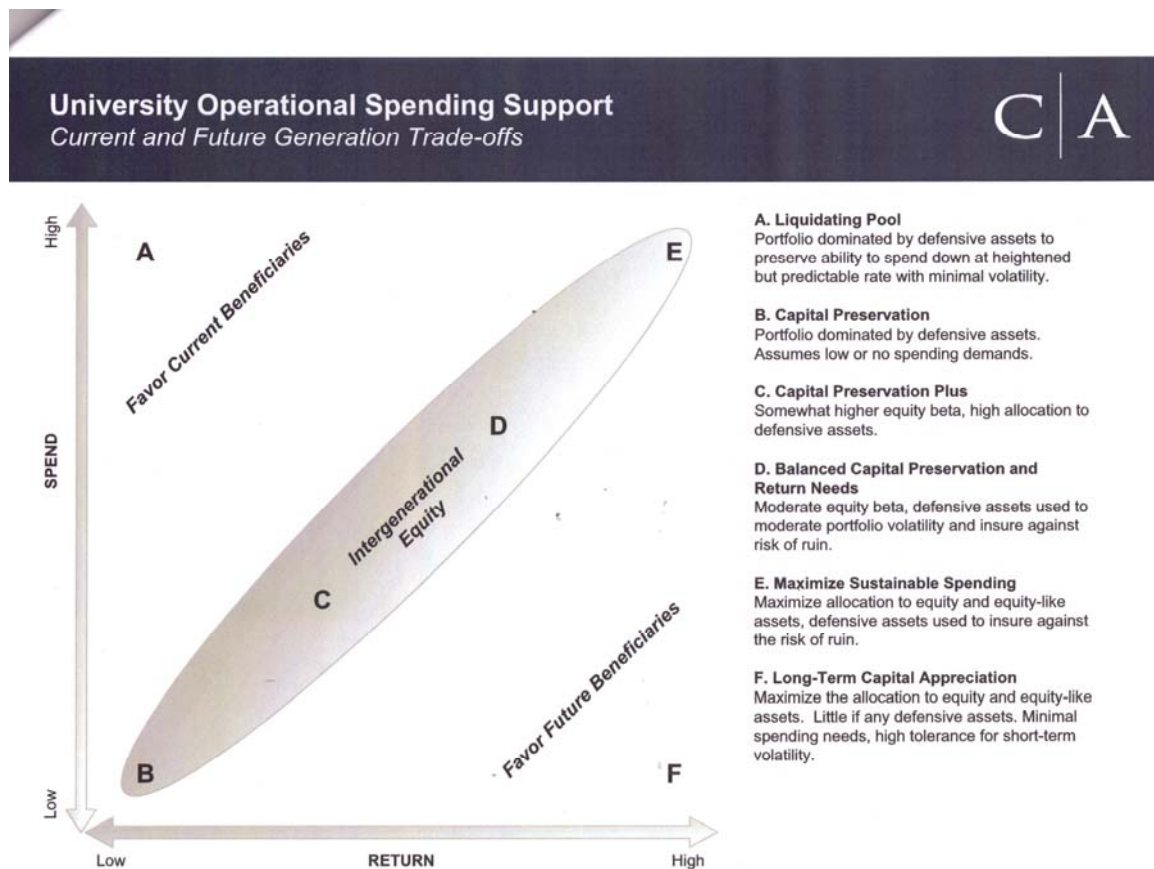
Additionally, defining risk in a pension plan is often a function of the size of the plan’s obligations in relation to the budget of the plan sponsor. The appetite for risk is usually greater for plans that are small in comparison to the operations of the plan sponsor. Appetite for risk decreases as the size of the obligations increases as a percentage of the plan sponsor’s operations.

Furthermore, the current funded status of a plan has an impact on the risk appetite of plan sponsors.

To explore the appetite for volatility risk, four focus groups were held with a wide range of university stakeholders (including principals, deans, governors and members of the senior administration) to get their views of the desired return target and an acceptable volatility risk level. Cambridge Associates facilitated these thoughtful discussions. The groups discussed the conflicting objectives:

- Desire to maximize long-term returns.
- Desire to minimize the adverse effects on operations resulting from pension.
- Desire to maximize the level of pension benefits.
- Desire to grow pension assets to keep pace with inflation.

The focus groups debated the optimal trade-offs for the University of Toronto and completed surveys in which they were required to choose between these conflicting objectives. As part of the session, they considered the following chart, presented without numbers associated with the portfolios and debated where they believed the University should be positioned with respect to investment risk and return.



There was a thorough discussion of the trade-offs amongst the conflicting objectives that needed to be made under the various scenarios presented here. The general view that emerged was one of comfort with the “D” range. There were some who favoured the “E” range for its growth, but most felt that it represented more volatility than they would like to see. A few favoured the “B” to “C” range, but most felt that the resulting investment earnings would be too low, resulting in costs that would be too high.

At the end of each session, participants were asked to complete the survey. A total of 40 surveys were completed and submitted. The Cambridge Associates report provided the following very relevant commentary on the discussion around pensions which is reproduced here in its entirety, in italics.

“..It was acknowledged in all four sessions that the pension plays a vital role in the life of the University. It helps draw highly talented faculty and staff to the University, and promote their retention. Important, it is also part of what one participant called “the moral obligation” the University has to its former employees.

Issues affecting the balance between current and future beneficiaries were noted, with an understanding that, by its very nature, the pension must be able to meet both a set of current obligations to retirees as well as a set of future obligations to those not yet retired.

As a result of current low interest rates and the market upheavals of 2008/09, the pension is currently under funded. Since the Province of Ontario will require the University to set forth a plan for bringing the pension to fully funded basis, we discussed the following three options:

- Employees increase their contributions.*
- The University reallocates resources away from its academic programming in order to fully fund the pension.*
- UTAM seeks higher investment returns, with a resulting increase in risk.*

In all the sessions, there was little vocal support for option three, and acknowledgement that the second option could weaken the core mission of the University.

In the surveys, the participants were asked a set of questions to gauge their sense of how to balance the short-term and longer-term funding needs of the pension. When asked their preference for increasing employee contributions versus decreasing future benefits, an overwhelming 80% of participants “somewhat preferred” or “strongly preferred” increasing contributions. Additionally, 60% of all participants somewhat or strongly preferred to receive lower pay now rather than lower benefits at retirement as compared to only 10% who preferred lower future benefits (30% had no opinion).

Conclusion

In managing both the pension and the endowments, a set of competing objectives must be considered that requires a careful balance to be struck between current and future needs. Current conditions in the financial markets do not make this challenge an easy one to meet. It is a hopeful sign, however, that key stakeholders in the University community were generous in giving their time to discuss the complexity of the trade-offs involved, and that they found that discussion helpful in shaping their own views .”

We concluded from these discussions that we should not seek higher investment returns to solve the University’s pension deficit problem, and subsequently designed the funding and financing strategy referenced in the previous section, which assumed the current real investment return target of at least 4%. Nevertheless, while recognizing the preferences expressed in the focus groups, in considering investment targets for the future we have modeled a wide range of targets that include both lower and higher targets than the current real investment return target of at least 4%, to generate a full range of information for decision-making.

Asset-Liability Modeling

An Aon Hewitt asset-liability modeling study was conducted in Winter/Spring 2011 and focused on the U of T pension plan, which represents 97% of the assets in the pension master trust. It concentrated on investment risk and return volatility targets after inflation and net of investment fees and expenses. It took account of the preliminary funding and financing strategy presented to the Business Board in January 2011 (see page 5), which assumed that the University of Toronto would be successful in meeting the Ontario government's requirements for acceptance to its temporary solvency relief program and reflected the use of letters of credit based on our understanding of their use. The additional employer contributions predicted in that modeling, and their timing, are reflected in the asset/liability study. Aon Hewitt followed a process that:

- valued the liabilities;
- identified several portfolios on the efficient frontier (which represents the highest expected return that can be achieved at a specific level of risk) and calculated their expected return volatility risk and real return targets for each portfolio;
- assessed the possible range of outcomes under a wide range of economic conditions by running Monte Carlo simulations, utilizing market based, forward looking consensus assumptions based on the yield curve, for each of those portfolios over a ten-year period. Numerous metrics were produced to aid in assessing the various risk and return targets under consideration.

Valuation of Liabilities:

Liabilities should be valued as inputs to finding the efficient frontier and thus identifying portfolios for consideration. A particular challenge with the modeling in 2011 was that the pension plan is currently experiencing a significant deficit. Although the funding and financing strategy was designed with the objective of funding that deficit over time, and although that strategy has been imbedded in the modeling, the presence of the deficit at the starting point of the study can easily influence results. Traditionally, pension liabilities and contributions have generally been measured based on:

- a discount rate determined by the expected long term rate of return on plan assets;
- benefits calculated including projected pay increases,
- a cost method that keeps contributions level at a fixed rate of pay, and
- smoothed asset values which moderate large gains and losses in plan assets.

However, for the purpose of selecting candidate portfolios, it made sense to calculate liabilities based on:

- a discount rate determined by the current applicable yield curve,
- benefits calculated excluding projected pay increases, on a cost method that measures the accrued benefits, and
- market value of assets.

This methodology does a better job of reflecting the current realities inherent in financial markets and thus produces more meaningful risk metrics resulting in more appropriate candidate portfolios. The resulting value, known as the *economic value of liabilities*, was used as the starting point for the next step, the identification of portfolios for analysis.

Identification of Portfolios (Efficient Frontier Analysis):

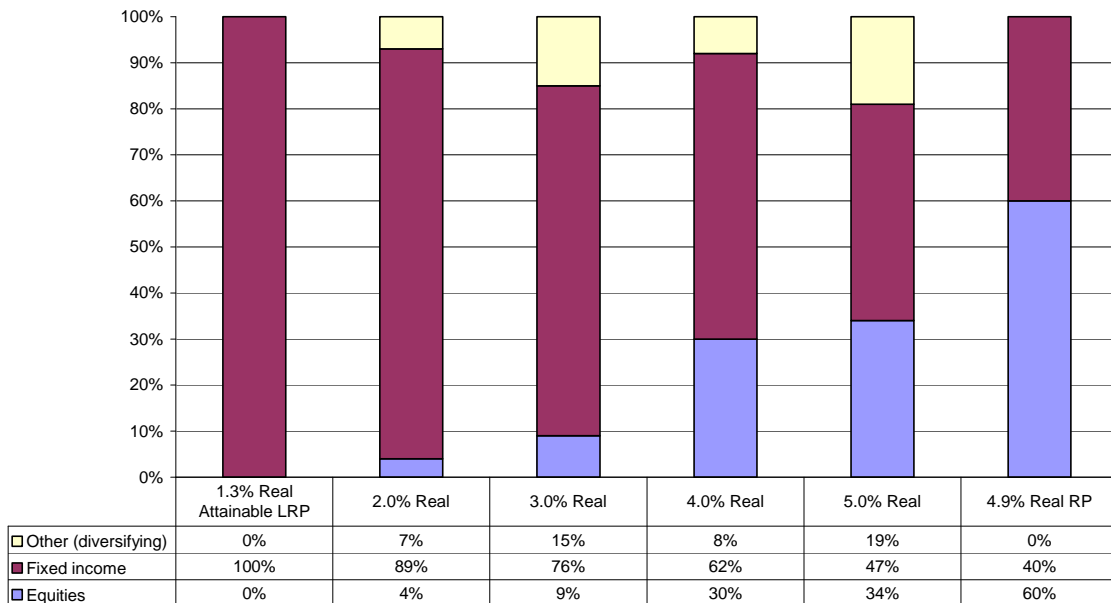
Once the economic value of the liabilities has been determined, the next step is to construct an efficient frontier that generates investment portfolios and their associated risk and return targets for further analysis. The objective is to identify portfolios with the highest level of return for a given unit of risk.. Although asset allocation is a necessary input to the exercise, the objective in this study is NOT to recommend asset allocation, but simply to generate asset allocations in order to produce risk and return targets for consideration.

Asset mixes which are inputs to the efficient frontier analysis, must be grounded in the real world. The U of T pension fund contains non-trivial allocations to hedge funds and private investments which, in many cases, must be held for several years into the future. Therefore, there is no point in generating theoretical portfolios that do not have these components. As a result, the efficient frontier analysis conducted by Aon Hewitt included the following:

- Alternative asset classes included : real estate; infrastructure; private equity; hedge funds; and commodities.
- Other constraints included a minimum private equity allocation of 10% reflecting the private equity actually existing in the pension fund; a maximum alternative allocation of 42.5% reflecting desire for a public markets presence, both from an equity and a fixed income standpoint, a minimum equity allocation of 20% also reflecting a view that any diversified portfolio should include some equities; and a maximum real return bond allocation of 50%, reflecting the reality that real return bonds are in limited supply in the Canadian bond marketplace.
- An attainable least risk portfolio (LRP) was also modeled. The constraint applied to this portfolio was a cap on real return bonds since they are in limited supply, as noted above. Without that constraint, a theoretical least risk portfolio would assume almost full investment in real return bonds (a position that would be virtually impossible to implement in a reasonable amount of time).
- Portfolios were sought with specific real return targets of 2.0%, 3.0%, 4.0% and 5.0%.
- The Reference Portfolio (RP), the University's defined reference portfolio, representing a simple, passively invested alternative to the current investment strategy, was also selected.

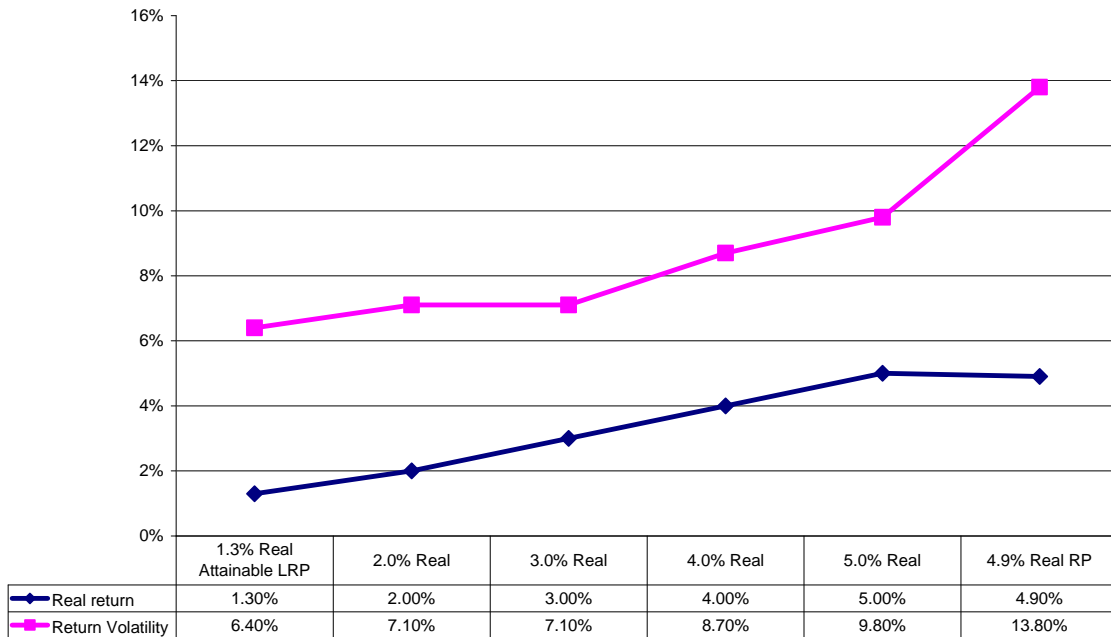
The following graph shows the asset mix assumptions for each of the portfolios under consideration. (Again, it must be stressed that these asset mix scenarios are only presented for purposes of generating risk and return targets and do not in any way, attempt to suggest or predict what asset mix should actually be implemented).

**University of Toronto Pension Plan
Asset Mix Assumptions for Portfolios Under Consideration**



It is important to note that the 4% and 5% portfolios are on the same efficient frontier. The 1.3%, 2.0% and 3.0% portfolios are not. They do not have the constraint of a minimum of 20% equity, because adding equities to the asset mix pushes returns higher than the targets for these portfolios. They also do not reflect the maximum constraint on real return bonds that is built into the higher return portfolios. The Reference Portfolio is a pre-fixed portfolio that was included for comparison, not one selected through the efficient frontier process. A return volatility risk target was calculated for each portfolio. The following chart shows the risk and return targets.

University of Toronto Pension Plan Risk and Return Targets



This graph tells us that the real return target increases as risk increases, but that the relationship is not completely linear. All of the portfolios have a return volatility risk of less than 10% with the exception of the Reference Portfolio at 13.8%. Between 1.3% and 5%, the return volatility ranges from 6.4% to 9.8%. The current 4% real return target has a return volatility of 8.7%, (up somewhat from the 7.2% return volatility calculated for a 4.1% real investment return target in 2007).

Outcomes under Varying Market Scenarios (Monte Carlo Simulations):

The next step was to run 5,000 different market scenarios for each portfolio over the 10-year period to July 1, 2020 to determine the range of outcomes for each portfolio under different market conditions. To do this, Aon Hewitt utilizes the Barrie and Hibbert's economic scenario generator. This is an industry standard model used by the majority of insurers and investment banks in the U.K. It is arbitrage-free (i.e. no free lunch), it exhibits "fat tails" (extreme events that are much more likely than in models based on the normal distribution), and it exhibits time-variation in correlations and volatilities (in that correlations and volatilities are not constant over time). It projects returns on asset classes in both public and private markets as well as bond yields, exchange rates and inflation. It produces 5,000 forward-looking scenarios based on Aon Hewitt's capital market assumptions as of September 30, 2010, which have the following characteristics:

- The return assumptions are "best estimates" of annualized returns. These are annualized median returns, meaning that there is a 50/50 chance that actual returns will be above or below the assumptions.
- The assumptions are long-term assumptions, based on a 10-year projection period, and they are updated on a quarterly basis.
- The assumptions are developed globally based on market consensus and forward market information contained in various economic indicators. Data sources include the Bank of England, The Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters, Consensus Economics, The Institutional Brokers' Estimate System (I/B/ES), the Investment Property Databank (IPD), and research produced by a range of prominent investment banks and research institutes.
- The assumptions and the scenarios are calibrated to current market conditions.
- The assumptions are net of fees.
- No allowance is made for managers outperforming the market. The exceptions to this are infrastructure, private equity and hedge fund assumptions where, due to the nature of the asset classes, potential manager out performance needs to be incorporated.
- All foreign asset classes are developed on an unhedged basis.

Specific outcomes must also be selected for testing against the 5,000 market scenarios. Two ways of assessing risk that are commonly used for pension plans, as noted earlier, are those that estimate impact on plan funded status, and those that estimate the impact on funding strategy. We will look at both and will consider how they should be weighted in assessing the investment targets for the U of T pension plans. The following sets of market scenarios are presented:

Very Optimistic: this outcome is BETTER than 95% of the outcomes produced.

Expected: this is the median outcome.

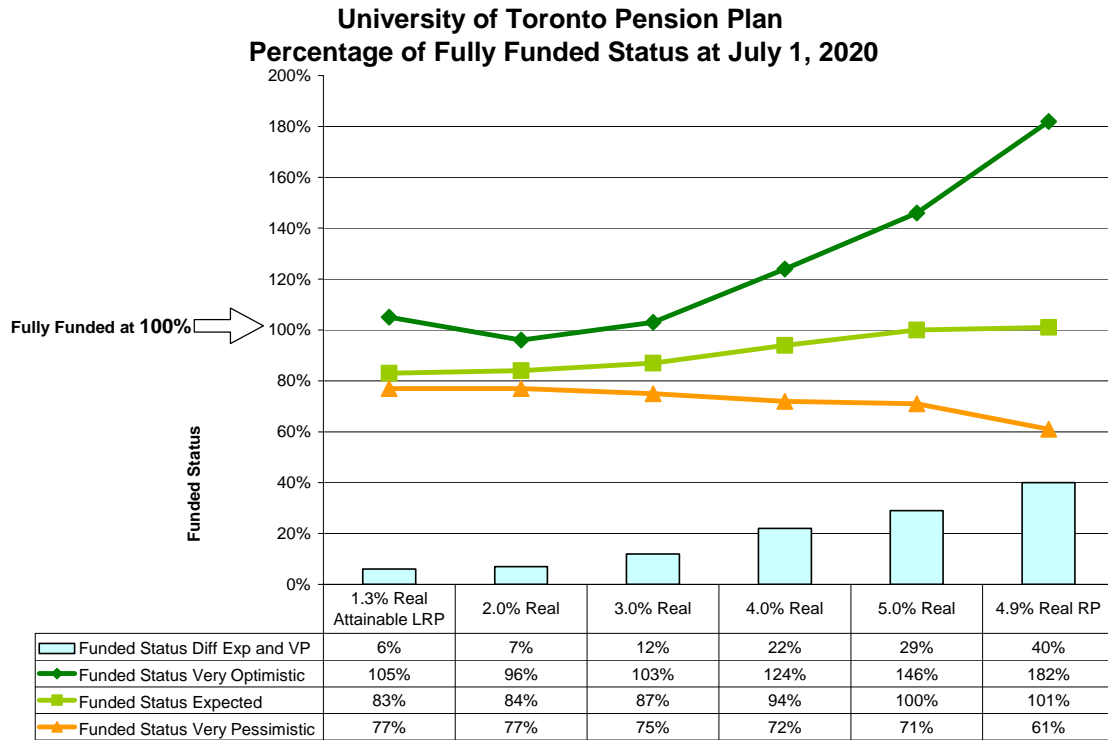
Very Pessimistic: this outcome is WORSE than 95% of the outcomes produced.

The going concern funding status analysis considers what might be the range of going concern funded status outcomes for the various investment targets, under the 5,000 varying market scenarios.

The funding strategy analysis considers the employer contributions that may be required under the various investment targets, under the 5,000 varying market scenarios. It assesses how much employer contributions may have to change in absolute dollars and in comparison to the preliminary funding and financing strategy that was presented to the Business Board in January 2011.

As you evaluate the funding strategy analysis it is important to remember that, as noted earlier, it assumes the current employee contribution formula continues and does not attribute to employees any of the contribution fluctuations attributable to the various scenarios. It is also important to note that the lower investment return targets reflect a much higher level of contributions over the period from 2011-2020 than do the higher return targets. These differences in contribution requirements will be evaluated later on in this report

At July 1, 2010 the going concern funded status for the U of T pension plan was 67% (68.4% across all three pension plans and the pension reserve). The next chart shows the extent to which the going concern funded status for the U of T pension plan might improve (or not) by July 1, 2020. In reviewing these percentages, it is important to note that the lower investment return targets reflect a much higher level of contributions over the period from 2011-2020 than do the higher return targets.



The above chart shows that, for the 2% to 5% real return range, funded status increases with investment return target at both the “very optimistic” and “expected” levels, and that funded status decreases, albeit slightly, at the “very pessimistic” level as the investment return target increases. The Reference Portfolio has both a lower “very pessimistic” and a higher “very optimistic” funded status than the 5% portfolio.

At the “very pessimistic” level, there is little difference between the various targets, with a range from 77% for the 1.3% portfolio down to 71% for the 5% portfolio. This is a fluctuation of only 6% across a wide range of investment targets, suggesting that in a very poor investment climate, the choice of a lower target does not provide any material protection against investment losses. The Reference Portfolio is an outlier with a 61% level, 10 percentage points lower than the 71% for the 5% portfolio. However, the gap between the portfolios is quite different, showing the greater potential fluctuation between “very pessimistic” and “expected” levels. This gap widens from 6% for the 1.3% portfolio to 29% for the 5% portfolio.

This tells us that there is little to choose between the various portfolios under very poor economic scenarios, that there is a wider gap between “very pessimistic” and

“expected” results as the investment return target increases and that almost all of this fluctuation is on the upside.

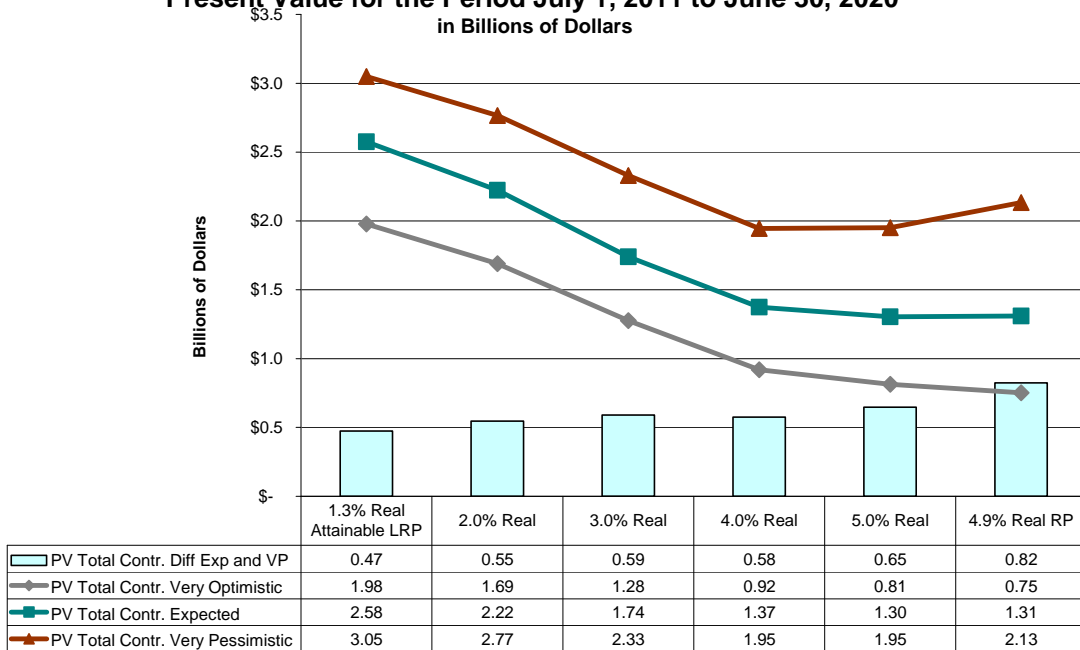
The exception to this is the Reference Portfolio, which exhibits a worse downside, a better upside and significantly greater fluctuation between the “very pessimistic” and “expected” levels than the other portfolios.

Let us now turn to the funding strategy analysis. In evaluating these figures it is important to remember, as noted earlier, that the preliminary funding and financing strategy that was presented to the Business Board in January 2011 is reflected in this analysis. It assumes that the current employee contribution formula continues and does not assign to employees any of the fluctuations in contributions. It estimated special payment contributions as follows:

- For the period July 1, 2011 to June 30, 2014 \$63 million per annum (\$55 million into the U of T pension plan and \$5 million into the OISE pension plan);
- For the period beginning July 1, 2014, \$104 million per annum, of which \$33 million per annum was to be addressed through letters of credit, leaving \$71 million per annum flowing into the pension plans (\$66 million into the U of T pension plan and \$5M into the OISE pension plan).
- Two large lump sum payments of \$150 million in each of 2010-11 and 2013-14.

We considered the impact on total employer contributions over the 10-year period to July 1, 2020 of the various investment return targets. The following chart shows how the total employer contributions (present valued at a discount rate of 6%), both current service and special payments, could fluctuate over the 10 year period at the “very optimistic”, “expected” and “very pessimistic” levels.

**University of Toronto Pension Plan
Total Employer Contributions
Present Value for the Period July 1, 2011 to June 30, 2020
in Billions of Dollars**



The above chart shows that the amount of total employer contributions required over the period varies widely depending upon the choice of investment return target and upon market conditions. At the “very pessimistic” level the present value of total contributions ranges from \$3.05 billion for the 1.3% portfolio down to \$1.95 billion at the 5% portfolio, a spread of \$1.1 billion. At the “expected” level, the range is from \$2.58 billion down to \$1.3 billion, a spread of \$1.28 billion. The difference between the “expected” and “very pessimistic” levels varies from \$470 million for the 1.3% portfolio up to \$650 million for the 5% portfolio. The difference is \$570 million for the 4% portfolio.

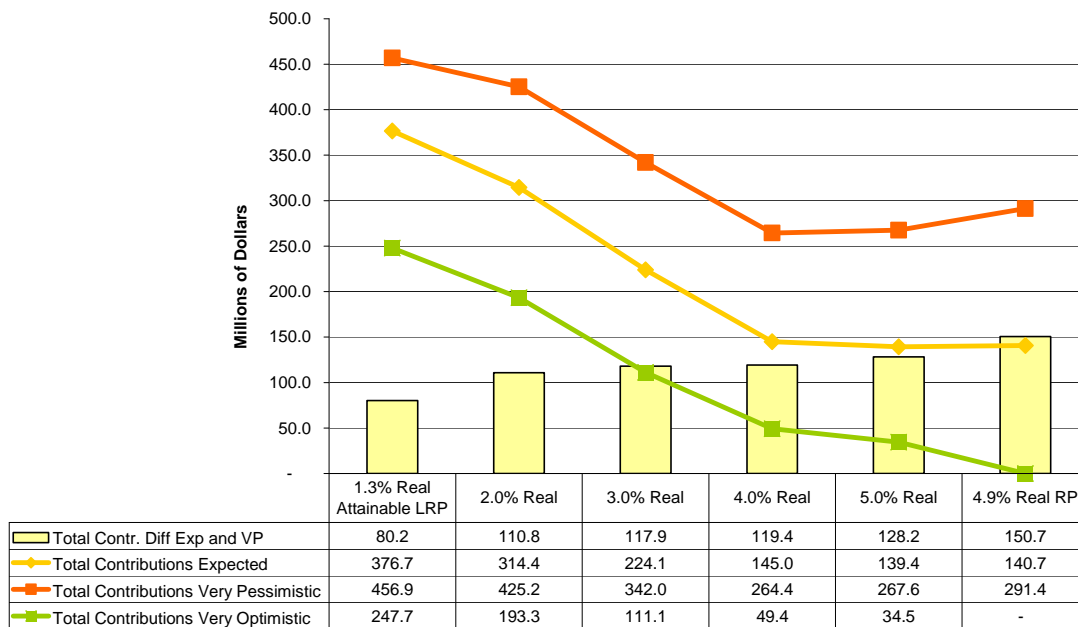
However, when we looked at going concern funded status, we saw that there was only marginal variation between the outcomes expected for the various investment targets at the “very pessimistic” level. Therefore, we may conclude that increasing the investment target:

- Does not materially impact the going concern funded status at the “very pessimistic” level (a range of 6% from 77% for the 1.3% portfolio to 71% for the 5% portfolio);
- Reduces the present value of total contributions at the “very pessimistic” level by up to \$1.1 billion (range from \$3.05 billion for 1.3% portfolio to \$1.95 billion for 5% portfolio).
- Reduces the present value of total contributions at the “expected” level by up to \$1.28 billion (range from \$2.58 billion for 1.3% portfolio to \$1.3 billion for 5% portfolio);

In summary, at the “very pessimistic” level, an investment return target of 1.3% results in only a 6% higher funded status, but will be expected to cost \$1.1 billion more in total contributions over the 10-year period when compared with a 5% investment return target.

We also looked at what might be the total required contributions for the 2014–15 year. This is a very important year from the perspective of the funding and financing strategy. Provided that the Ontario government agrees, at July 1, 2014 the University will begin solvency special payments in addition to going concern special payments, for a period of ten years. The following chart shows the total contributions for the 2014–15 year, both current service and special payments combined, for the “very optimistic”, “expected”, and “very pessimistic” levels, and shows the difference between the “very pessimistic” and “expected” levels.

**University of Toronto Pension Plan
Total Employer Contributions 2014-15
Millions of Dollars**

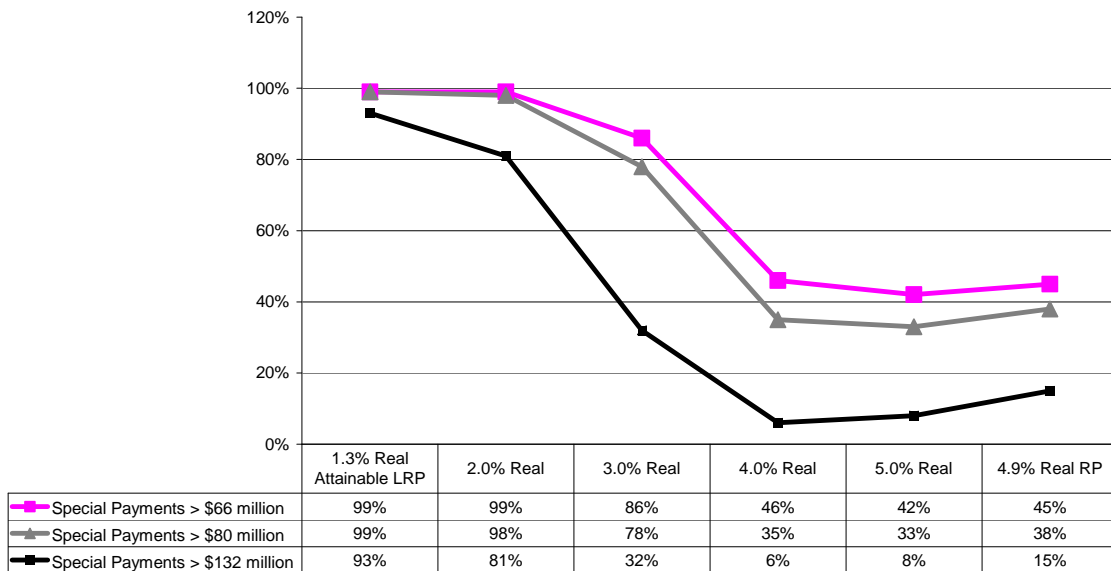


The above chart shows that total employer contributions for 2014–15 ranging from \$376.7 million for the 1.3% portfolio to \$139.4 million at the 5% portfolio, at the “expected” level, a difference of \$237.3 million. If we compare the difference between the “very pessimistic” and “expected” levels, we see fluctuation from \$80.2 million for the 1.3% portfolio to \$128.2 million for the 5% portfolio. The Reference Portfolio is again an outlier, with contributions of \$140.7 million at the “expected” level but with a fluctuation between the “expected” and “very pessimistic” levels of \$150.7 million.

For 2014–15, even at the very pessimistic level, a higher investment return target results in lower total contribution levels.

This analysis also considered the probability that the employer special payments projected in the preliminary funding and financing strategy described earlier in the paper will have to be revised upward. The following chart estimates the probability that the employer special payments for the U of T pension plan will exceed the \$66 million per year estimated under the funding and financing strategy. We also tested the probability that employer special payments greater than \$80 million per year and \$132 million per year would be required in 2014–15.

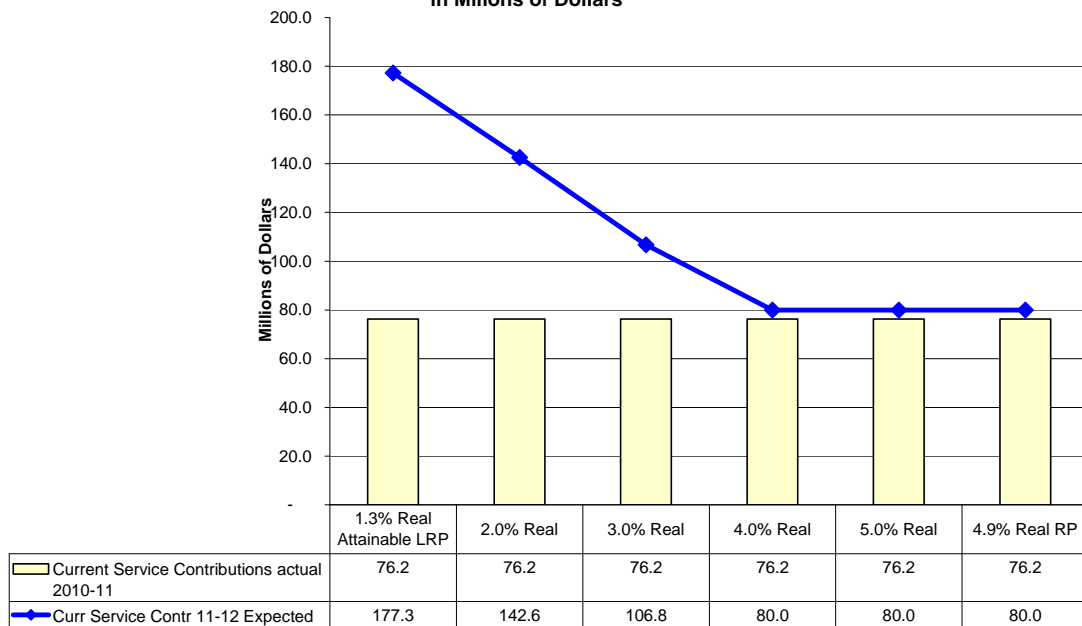
**University of Toronto Pension Plan
Probability of Employer Special Payments Higher than
Funding and Financing Strategy in 2014-15**



The above chart shows that it is virtually certain that employer special payments higher than \$132 million per year will be required for the 1.3% and 2.0% real investment return targets. At the 3% real investment return target, there is still a high probability of employer special payments of more than \$80 million per year and almost a 1 in 3 chance of employer special payment greater than \$132 million per year. At the 4% real investment return target, the probability of employer special payments greater than \$66 million drops significantly to 46% and the chance of having to pay more than \$132 million drops to 6%. The probabilities at the 5% level are only marginally different from those at the 4% level. The Reference Portfolio is again an outlier with higher probabilities than the 5% portfolio.

We also considered the impact on employer current service contributions. The required employer current service contributions for the U of T pension plan were \$76.2 million at July 1, 2010. The following chart shows current service contributions at July 1, 2011 under the various investment return targets at the “expected” level (the current service is not significantly affected by varying market scenarios and the “very optimistic” and “very pessimistic” levels are not sufficiently different to be given a strong weighting in selecting an investment return target).

**University of Toronto Pension Plan
Employer Current Service Contributions 2011-12
at the "Expected" Level
in Millions of Dollars**



The above chart shows that the current service contributions in 2011-12 would vary from \$177.3 million per year for the 1.3% portfolio down to \$80 million per year for the 4% and 5% portfolios (accrued liabilities discounted at a real rate of 4% for all portfolios with an expected real return of 4% and greater).

The Role of Judgment

The modeling conducted by Aon Hewitt represents state-of-the-art risk analysis. However, it is important to note that this modeling focuses on return volatility, and its resulting impact on going concern funded status and contributions, and that volatility for an individual asset class varies over time. There are also more risks associated with investments than just return volatility, such as:

- liquidity risk (the risk that the money will not be available when it is needed for spending)
- implementation risk;
- maverick risk (the risk of deviating from the group); and
- the risk associated with the complexity of individual transactions and with asset classes as a whole.

There are no mathematical models that capture all elements of risk, or that can predict what behaviours will ensue as various possible outcomes begin to unfold. (For example, if the returns are not good, we would likely change our strategy.) The mathematical models should be viewed as tools that help in assessing risk, but they do not provide a complete and comprehensive assessment of all the risks associated with making investment choices. This is partly why the range of outcomes for a given asset mix can be so broad under different market scenarios. Judgment must be applied to the results obtained from modeling and to take into account the broader environment in which the targets are being established.

Conclusions

We have considered the implications for going concern funded status and for the funding strategy of each of the investment return targets under consideration. The following table summarizes the key metrics for the U of T pension plan.

| | | Current Service Contributions 2011-12 | Plan Funded Status at July 1, 2020 | | | | Probability that Special Payments will Exceed Funding and Financing Strategy | | | |
|--------------------|-------------------------------|---------------------------------------|------------------------------------|----------|------------------|-------------|--|---------------------------------------|---------------|-----------------|
| Real Return Target | Return Volatility Risk Target | Expected | Very Optimistic | Expected | Very Pessimistic | Pessimistic | Gap between Expected & Very Pessimistic | >\$66 Million Current Prelim Strategy | >\$80 Million | > \$132 Million |
| 1.30% | 6.4% | 177.3 | 105% | 83% | 77% | 6% | | 99% | 99% | 93% |
| 2.00% | 7.1% | 142.6 | 96% | 84% | 77% | 7% | | 99% | 98% | 81% |
| 3.00% | 7.1% | 106.8 | 103% | 87% | 75% | 12% | | 86% | 78% | 32% |
| 4.00% | 8.7% | 80.0 | 124% | 94% | 72% | 22% | | 46% | 35% | 6% |
| 5.00% | 9.8% | 80.0 | 146% | 100% | 71% | 29% | | 42% | 33% | 8% |
| 4.90% | 13.8% | 80.0 | 182% | 101% | 61% | 40% | | 45% | 38% | 15% |

As noted at the beginning of the paper, the key purpose of this analysis is to determine whether the current risk and return targets, which were most recently reviewed and adjusted in 2007, are still appropriate for the foreseeable future.

In brief, the results of this study validate the decisions from the 2007 study:

- A 4% real return target is still attainable within the 10% risk target.
- In fact, with a 10% risk target, this modeling suggests that it may be possible to expect an annualized real return of 5% over the next 10 years.
- While a 4% real return is still achievable, it will require more risk to attain, 8.7% at this time as compared to about 7.2% in 2007.

Comparison between the 4% real return target and the lower investment return targets in the 1.3% to 3% range indicates that the lower investment targets require higher contributions and, except at the “very pessimistic” level, actually result in lower going concern funded status at July 1, 2020 than do the higher investment return targets.

- At the “expected” level, the going concern funded status is better and contributions are lower at the higher investment targets than at the low investment targets. Comparing the 1.3% target and the 4% target shows that the 1.3% target would require \$1.21 billion more contributions over the 10-year projection period than the 4% target and yet the going concern funded status at July 1, 2020 would be less by 11% than for the 4% target.
- At the “very pessimistic” level, the going concern funded status is marginally better at the lower targets than at the higher ones but total employer contributions are much higher. Comparing the 1.3% target and the 4% target shows that the 1.3% target would require \$1.1 billion in additional contributions while only improving the going concern funded status by 6%.

The analysis shows that the lower risk perceived to be associated with the lower investment return targets simply does not materialize on the downside, with the “very pessimistic” going concern funded status being very similar under all the targets tested. And the required employer contributions are much higher. We believe these results are sufficiently definitive to enable us to eliminate the 1.3%, 2.0% and 3.0% targets from consideration.

If we now turn to the 4% and 5% targets, we see that over a 10 year timeframe, the distribution of results is more favourable for higher return portfolios. At the “expected” level, employer contributions decrease as returns increase. The fluctuation between “expected” and “very pessimistic” levels increases as the investment return target increases, but the “very pessimistic” results remain relatively unchanged, with the higher volatility in the higher return targets tending to manifest itself on the upside.

Many of the metrics suggest that a 5% return target would be desirable from an outcomes perspective. However, this analysis also shows that risk levels are higher than they were in 2007. The focus groups expressed little vocal support for any strategy based on investment return targets that would be higher than those currently in place. Raising the target would be seen as taking on more risk even though the modeling suggests it would currently be achievable within the current 10% risk target.

The analysis indicates that the current 4% real return target is also attractive. Its metrics are quite close to those for the 5% target in many areas, but with a lower risk level (8.7% versus 9.8% for the 5% portfolio). Over the past 21 years, we have met that 4% real return target, both on a rolling 10 year return basis, and on the basis that one-year returns should be within 10% of that target on a nominal basis 2/3 of the time. We were actually within that corridor 76% of the time. However, we recognize that it will be more difficult to achieve a 4% real investment return target in future, as evidenced by a risk level of 8.7% now as compared to the 7.2% generated by the 2007 study. This is because real bond yields have fallen dramatically, making it necessary to take on more risk going forward to achieve the same level of returns. This means that we will need to invest in more equity and equity-like investments going forward since bond returns will contribute a smaller proportion of real return than they have in the past. Although we did have a large loss in 2009 with the 4% real investment return target in place, this analysis shows that the going concern funded status at July 1, 2020 would not be significantly different under all the targets tested at the “very pessimistic” level, so we cannot reduce this risk significantly by choosing a lower target.

On the downside, it is important to note that with a 4% real investment return target there is a high probability that total contributions may have to increase beyond the levels projected in the preliminary funding and financing strategy and we will have to be prepared for that eventuality. At the 4% real investment return target level, there is a 46% probability that special payments beginning in 2014–15 will have to be higher than the \$66 million per year for the U of T pension plan that we have projected in the funding and financing study. There is a 35% probability they will have to be higher than \$80 million per year but only a 6% probability that they will have to be higher than \$132 million per year. However, these probabilities are not materially improved at the 5% target and are much worse at the lower investment return targets.

Taking all of the above analysis into account along with the views of the focus groups, we believe that it makes sense to continue with the pension master trust investment return target that is currently in place.

Recommendations

It is recommended that the investment return volatility risk and real investment return targets currently in place for the pension master trust be retained. Specifically, they are:

- a return volatility risk target of a 10% annual standard deviation over 10 years;
- a real return target of at least 4%, net of investment fees and expenses;
- the risk target overrides and constrains the return target.
- a lower tolerance for downside risk.