Pension Projections

MODULE INTRODUCTION

A pension projection is a model of a pension plan over multiple periods. That is in contrast to a pension valuation which provides liabilities and assets at a single point in time.

A pension projection typically includes modeling of pension assets together with pension liabilities. However, unfunded pay as you go systems may not include any asset modeling.

In the following sections you will learn more about different modeling approaches available for pension projections, how to select assumptions, and potential ways to communicate the results of the projections.

Module Learning Objectives

After completing this module, you should be able to:

- explain why pension forecasts are necessary, the sorts of questions they seek to answer, and to whom the results of the forecast analysis should be directed.
- collect, review, and assess the sufficiency of the data elements necessary to perform a pension forecast analysis.
- select the most appropriate model for their forecast analysis and communicate the advantages and limitations of their approach.
- perform an analysis using several approaches to liability forecasting.
- explain the mechanics of forecasting different types of asset classes and perform an analysis given a variety of investment data.
- outline a variety of considerations – including plan design, regulation, restructuring activities, and standards of practice – that influence the forecast.
- communicate and illustrate the results of pension forecast analysis to a variety of audiences.

Module Sections

The Pension Projections module consists of seven sections:

Section 1: Understanding Purpose and Audience
Section 2: Data Requirements
Section 3: Model Approaches
Section 4: Liability Forecasting
Section 5: Asset Forecasting
Section 6: Model Considerations for Pension Applications
Section 7: Communication and Interpretation of Results

In addition, this module contains an End-of-Module Test and an End-of-Module Exercise.

SECTION 1: UNDERSTANDING PURPOSE AND AUDIENCE

Introduction

Section 1 provides an insight to one form of pension projections, which, roughly speaking, are based on models used to gain insight about the financial position of pension plans over one or multiple periods of time.

In this section, you will become familiar with:

- different purposes of conducting pension projections
- the intended users and stakeholders of pension projections
- how the requirements of a projection influence the modeling approach
- the expectations and decision-making process of users and stakeholders
- how projection tools and assumptions might have to change in order to accommodate the questions or feedback an actuary receives after the plan is presented

Learning Objectives

After successfully completing this section, you will be able to:

- identify the purposes of conducting a pension projection
- identify the intended users and other stakeholders and assess the goals with respect to their plan
- evaluate the requirements and the approach to conduct a pension projection
- assess the intended users (not stakeholders), their expectations, and the impact adverse scenarios may have on decision making

SECTION 2: DATA REQUIREMENTS

Introduction
Data quality is of self-evident importance in making pension projections. In practice, the data available for us in making pension projections is often less than ideal.

Professional standards applicable to actuaries practicing in Canada and the United States provide guidance in the selection, evaluation and use of data.

The standards also provide guidance regarding the disclosures concerning data-related matters that must be provided in reports on the results of pension projections.

In this section, you will become familiar with:

- the application of professional standards in Canada and the United States to the selection and use of data in a pension projection;
- how to assess the appropriateness and sufficiency of data for a pension projection;
- the potential use of sampled data or summarized/consolidated data for a pension projection;
- steps that can be taken to deal with data problems;
- why disclosures related to data that must be included in actuarial communications related to a pension projection.

Learning Objectives
Upon successful completion of this section, you will be able to:

- explain why the application of professional standards in Canada and the United States are important in the selection and use of data in a pension projection
- assess the appropriateness and sufficiency of data for a pension projection
- discuss the potential use of sampled data or summarized/consolidated data for a pension projection
- describe the steps that can be taken to deal with data problems
- explain why disclosures related to data that must be included in actuarial communications related to a pension projection

SECTION 3: MODEL APPROACHES

Introduction
What is a Model?

Models are heavily relied upon in our work. You have encountered some of them; consider the Capital Asset Pricing Model, Black-Scholes model, and the Modigliani-Miller theorem. The FSA curriculum includes information about both the models' implications and their limitations. You may have asked yourself why you have been required to learn concepts that have well-known and significant shortcomings. As it turns out, this situation – a reliance on models despite a recognition of their flaws – is intrinsic to our work.

This reliance on models is by no means limited to actuarial science. Models are of central importance to many scientific studies. There is the billiard ball model of a gas, the double-helix model of DNA, the Bohr model of an atom, the Gaussian-chain model of a polymer, Lorenz model of the atmosphere, the Lotka-Volterra model of predator-prey interaction, the Mundell-Fleming model of an open economy, and the general equilibrium model of the financial markets. Some of these you know and some not, but they are all important models.

The general concept of a model is this: a model is a representation of some part of the real world, and the model is used for "surrogative reasoning." This term simply means that conclusions reached by analyzing the model are used to guide decisions made in the real world.

In this section, you'll learn about the characteristics of models and how models are used to inform our actions.

Learning Objectives

After successfully completing this section, you will be able to:

- understand the characteristics of models and how they are used in learning
- understand different forecast methodologies
- identify the limitations of models
- assess the internal consistency of a model including assumptions and methods
- understand other model parameters and issues
- evaluate the model for purpose
- examine the strengths and weaknesses of the model for its intended purpose

SECTION 4: LIABILITY FORECASTING

Introduction
Section 4 provides an overview of methods for forecasting pension plan liabilities. The section will introduce you to:

- the various liability measurements to be projected
- the assumptions needed to perform the projection
- multiple approaches to liability projection
- In many cases you will have access to software that provides all or most of the liability forecast based on parameterized input. In other cases, you may have access to software that produces some, but not all of the needed forecast.

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You will do several liability forecasts as part of this section based on partial output and will learn some of the mathematics behind the forecast.

Learning Objectives

After successfully completing this section, you will be able to:

- understand the various liabilities subject to projection
- understand various assumptions needed for a forecast
- understand the different approaches to liability forecasting
- identify a forecasting approach to match the business needs of the client
- Identify what is needed to develop the forecast

SECTION 5: ASSET FORECASTING

Introduction
Section 5 provides and overview of methods for forecasting a pension plan portfolio of assets and assess the appropriate data and assumptions to be used in such a forecast. These forecasts help the actuary to evaluate the possible effects of various asset allocations on measures important to the plan and its termination strategy.

Pension asset projections are a key component in projecting funding requirements and the plan's funded status. As discussed in Section 4, funding requirements differ among nations (and sometimes among government entities within a nation) and among types of plans (private, public, multi-employer, church, and plans for special groups).

The section will introduce you to:

- The sources of return for different asset classes
- The necessary data elements to project a portfolio of assets
- How to select appropriate assumptions to be used for an asset forecast
- How to Incorporate changes in cash flows in and out of assets

At the end of the section, you will perform an asset portfolio forecast with provided data and assumptions using:

- Monte Carlo simulations
- Simplified forecasts

Learning Objectives

After successfully completing this section, you will be able to:

- discuss the purposes of asset projections
- use the formula for the estimated market value of assets
- name and discuss a variety of equity or stock investments
- define asset classes and describe their underlying rates of return
- compare and contrast growth and value stocks
- explain credit fixed income investments
- define and discuss the importance of diversification
- explain the importance of stochastic models

SECTION 6: MODEL CONSIDERATIONS FOR PENSION APPLICATIONS

Introduction

At this point in the module, you will have studied and applied all the building blocks of pension plan forecasting.

- reviewing the audience and purpose of analysis
- gathering and reviewing data
- establishing your general approach to building your model
- reviewing and comprehending the plan liabilities and investments

We now turn to the practical, real-world application of forecasting. This is where, as a pension actuary, you will bring together your actuarial training and your knowledge of your client and their plan to properly simulate decision-useful outcomes for the organization.

Section 6 will begin by examining broad categories of pension plan designs. We will then move on to the regulatory—or governmental—rules that dictate how plans are funded and accounted for, as well as providing some real-world application in the Canadian and U.S. pension markets. We will discuss corporate, benefit, and policy decisions such as liability transfer exercises and investment glidepath implementation. Finally, we will close by examining a risk management framework in the context of the Actuarial Standards of Practice (ASOPs) issued by the Actuarial Standards Board and CIA standards that apply in Canada.

Learning Objectives

After successfully competing this section, you will be able to:

- analyze different types of pension plan designs and features
- evaluate various governmental rules and policies given a hypothetical regulatory framework
- evaluate risk-sharing and liability transfer exercises
- assess the components of dynamic rebalancing
- analyze a forecast study in the context of actuarial standards of practice in U.S. and Canada

SECTION 7: COMMUNICATION AND INTERPRETATION OF RESULTS

Introduction
In Section 7 we look at illustrating projection results under the following three ways in which assumptions can be set.

1. Single set of demographic and economic assumptions specified for the assignment;
2. Multiple sets of demographic and economic assumptions specified for the assignment; and
3. Multiple sets of demographic and economic assumptions generated randomly by a model for the assignment (a.k.a. stochastic modeling).

Projecting results under a single set of demographic and economic assumptions may be the most common projection assignment for the actuary. With this type of projection, the most important metric to the principal is usually specified. The principal usually has questions that he or she hopes the projection will answer. Common questions are:

- "What will my required plan contribution be over the next x plan years?"
- "What will my financial statement expense be over the next x plan years?"
- "What happens to the plan's funded status over the next x years if investment returns are lower than expected and general interest rates stay low?"

There are myriad questions that a plan sponsor could ask. The challenge to the actuary is to answer the question(s) clearly, accurately and cost-effectively. Section 3.15 of US ASOP No. 4 states that the actuary should use professional judgment to establish a balance between the degree of refinement of methodology [in an assignment] and materiality [that such refinement generates]. That certainly applies to performing the projection as well as communicating the results[1].

[1](2019, December 1). Proposed Revision of ASOP No. 4 - Measuring Pension Obligations and Determining Pension Plan Costs or Contributions (Second Exposure Draft) - Actuarial Standards Board. http://www.actuarialstandardsboard.org/asops/measuring-pension-obligations-and-determining-pension-plan-costs-or-contributions-second-exposure-draft/

Learning Objectives

After successfully competing this section, you will be able to:

- understand disclosures required by relevant ASOP/CSOP
- communicate results from various stakeholder perspectives, including an emphasis on the purpose of the projection
- produce graphical results that provide intended users a clear understanding of the pension projection outcome
- explain the limitations of models, the accuracy of projections and how the selection of projection assumptions affected the projection results