# ILA-LFMC Sample Study Manual

You have downloaded a sample of our ILA-LFMC detailed study manual. The full version covers the entire syllabus and is included with the course.

Each portion of the detailed study manual is available in PDF with a clickable table of contents. Each reading (and sub-chapters if applicable) are also bookmarked in the PDF for ease of navigation in your favorite desktop, tablet, or smartphone PDF viewer.

Though not shown in the sample material, we also offer a highly condensed version of the detailed study manual (the “condensed outline” mentioned in the product description). The condensed outline is in the same format as the detailed study manual.

If you have additional questions about the detailed study manual or any aspect of the exam, please email us.

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**The Infinite Actuary's**

Detailed Study Manual for SOA Exam

# ILA Life Financial Management (Canada)

## Introduction to ILA-LFM-C

The ILA-LFM material is challenging to learn, and the exam is challenging to pass. There is a great deal of material, some of which is difficult. There, unfortunately, are lots of ideas that require some memorization.

Unlike the material in some of the preliminary SOA exams, the ILA-LFM material will be important for many of you to learn in order to effectively do your job. The syllabus is updated annually (sometimes more often) to reflect industry changes that impact the world of financial management.

But don't worry! People actually *do* pass this exam—many of them on their first attempt. Effectively using this study manual with our online seminar will help you focus on the most important concepts needed to pass.

## About this Study Manual

If you start early enough (3-4 months before the exam), we highly recommend reading the source material at least once yourself. As you go through the material, we recommend reviewing this study manual to focus on the most exam-relevant topics. Some of the readings are very difficult to absorb on the first attempt. **The study manual will help you pick out important information more quickly.**

This study manual is organized in exactly the same order as the study schedule included with the online seminar, which is not necessarily the same order as the official syllabus. The layout of the seminar follows the SOA syllabus because it reflects what we believe is the most logical order for learning the material start to finish:

A. Canadian Financial Reporting and Valuation Pre-IFRS 17
B. Canadian Financial Reporting and Valuation Under IFRS 17
C. Canadian Insurance Taxation
D. U.S. Regulatory Regimes
E. Capital and Surplus Management
F. Corporate Financial Management

**We strongly recommend pushing through the material at an even, steady pace so that you get through the entire course 1.5-2 months prior to the exam date.** At that time, you can return to any other part of the course you need to revisit.

You will be surprised at how much easier the material is on the second pass. Remember, this is more of a marathon than a sprint. It's an endurance test that requires a multi-month commitment to learning the exam curriculum.

## Using this Study Manual with the Online Seminar

This study manual is just one component of our ILA-LFM online seminar, which also includes video lessons and condensed outlines for all of the syllabus material, practice problems, commentary on previous SOA exams, and flash cards.

This manual is specific to the Canadian syllabus and covers all readings on the Canadian syllabus.

The advantage of an all-in-one package like the one we offer is that everything is integrated. You can think of this study manual as a highly detailed foundation for the video lessons, which focus more on the "10,000 foot" view of each reading and provide illustrative examples with our commentary. Some things are just easier to explain verbally, after all.

Some students prefer to go through the videos as they go through the material, while others prefer to get through the material on their own first, then use the videos for review. Do whatever feels the most natural for you.

## Good Luck

If you study regularly and put in the time, you will be amazed at how much material you can pack into your head by exam day—especially if you prioritize concept learning over memorization. That said, a good deal of memorization is needed. Use the condensed lesson handouts and flash cards as a guide for that.

And remember one of the most important features of our online seminar is customer support. Our course forum is a great place to post questions about any of the material because it gives other students a chance to answer and see answers. You can also email me anytime with any questions.

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# Yield Curves Explained

**Source: TIA exclusive**

*Instructor's note: a lot of students coming off of prelim exams get confused with the concept of yield curves and discount rates. This short TIA exclusive supplementary lesson hopes to shed some light and clear up frequently misunderstood notions about this concept. Please note that this is not directly on the exam, but it will help with understanding other lessons (e.g. CIA interest rate scenarios, various CF discounting topics etc).*

## Introduction

A yield curve is made up of the prevailing government bonds on the market as of **a particular point in time**. There are 2 types of yield curves: par curves and spot curves:

Par curve:

- Gives the yield to maturity (YTM) for (coupon-paying) bonds at each maturity: the single discount rate that you would use to discount all of the bond's cash flows to get today's market price
- Because there usually aren't bonds on the market at every maturity (e.g., there's not likely to be a bond with exactly 4.5 years to maturity, and another with exactly 13.5 years to maturity, and so on)
- The par curve is constructed by using whatever maturities are available in the market, and then using some mathematical technique to interpolate (or extrapolate) to get the remaining YTMs
- Common referred to curve by media and market watchers

Spot curve:

- The spot curve gives a yield that is used to discount a single cash flow at a given maturity
- It gives the YTM for zero-coupon (as opposed to coupon-paying) bonds
- Often used to calculate fair value of a bond

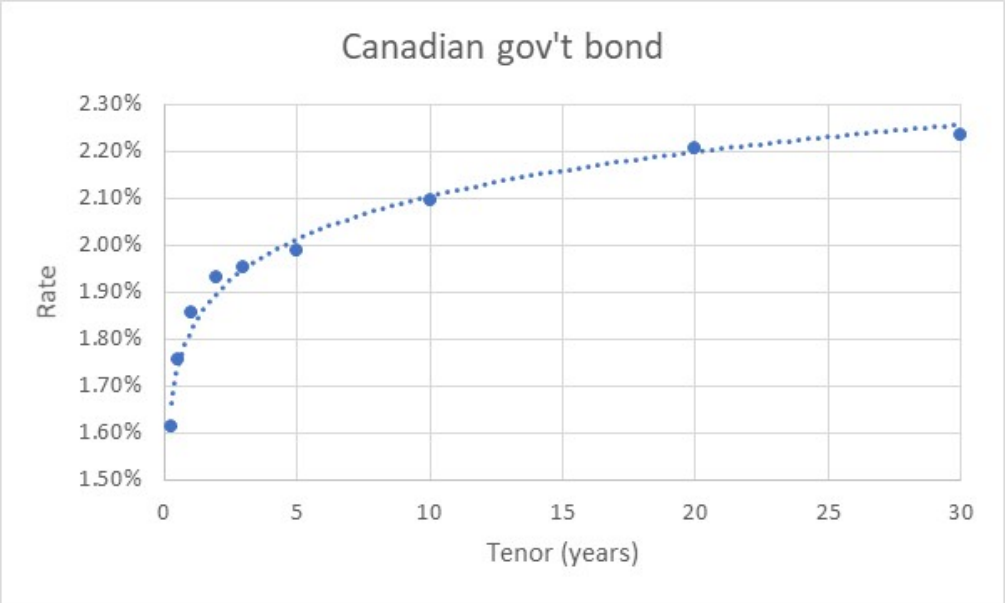
Par rate is a sequence of spot rates for the available maturities. As a result, the par rate will always be less than the spot rates for every maturity.

*Instructor's note: for simplicity, we will assume all yield curve discussed is a spot curve for the remainder of this supplementary lesson.*

## Yield curves and discounting

Here are the Canadian government bond rates as of Jan 2019:

| Tenor | 3 month | 6 month | 12 month | 2 year | 3 year | 5 year | 10 year | 20 year | 30 year |
|---|---|---|---|---|---|---|---|---|---|
| Rate | 1.615% | 1.755% | 1.856% | 1.931% | 1.954% | 1.989% | 2.095% | 2.207% | 2.236% |




The rates form a curve (i.e. the yield curve)

With this yield curve information, you can use it to discount CFs. The most simple and straight-forward way to derive the rates for discounting CFs is to convert (bootstrap) the spot rates into forward rates, by using this general formula:

$$(1 + f(t,r))^r = \frac{(1 + S(t+r))^{(t+r)}}{(1 + S(t))^t}$$

Where:

- $f(t,r)$ = r-year forward rate at time t
- $S(t+r)$ = spot rate at time (t+r)
- $S(t)$ = spot rate at time t

For example, the 1 year forward rate at time 1:

$$(1 + f(1,1))^1 = \frac{(1 + S(2))^2}{(1 + S(1))^1}$$

$$f(1,1) = \frac{(1 + 1.931\%)^2}{(1 + 1.856\%)^1} = 2.006\%$$

In other words, 2.006% is the one year interest rate from year 1 to year 2.

Example:

There is a CF of 1,000 in year 2. Calculate it's PV at time 0, using:

(i) Forward rates
(ii) Spot rates

Solution:

(i) PV @ time 0 = $\frac{1{,}000}{(1+f(0,1))\times(1+f(1,1))} = \frac{1{,}000}{(1+1.856\%)\times(1+2.006\%)} = 962.47$

(ii) PV @ time 0 = $\frac{1{,}000}{(1+S(0,2))^2} = \frac{1{,}000}{(1+1.931\%)^2} = 962.47$

Breaking it down into Lehman's terms, (i) is discounting the 1,000 one year at a time (i.e. from year 2 back to year 1, and from year 1 back to year 0), while (ii) is discounting the 1,000 from year 2 directly back to year 0. The reason why they're the same is because of the no arbitrage principle.

## Applications in valuation

In this exam, the most common applications/occurrences of yield curves is in CALM. Due to the nature of the reinvestment strategies, it is inaccurate to rely on the yield curve information as of the valuation date, but instead, we need to project future yield curves. For example, for CALM prescribed scenarios 3-6, you are given the definition of the short term (12 month) and long term (20 year) rates. From those rates, you need to build the rest of the yield curve (using linear interpolation should be suffice for the purposes of this exam, unless you are given a specific relationship for the other tenors).

However, keep in mind that the yield curve is always as of a particular point in time. If the point in time changes, then the yield curve information is no longer valid. This is applicable in many valuation situations where revaluation or reinvestment occurs. For example, if an asset matures in 5 years from my valuation date and I want to reinvest the proceeds in a 10 year bond, it is inappropriate to assume that the bond will earn 2.095% (the 10 year spot rate above), since I can't accurately use today's yield curve information, 5 years from now. This is where the CALM prescribed scenarios come into play and provide a definition of how to **project** the yield curve X years from the valuation date.

For example, if we assume that the ST Ult Rf-low = 1.3% and LT Ult Rf-low = 3.2%, then for CALM prescribed scenario 3:

Short-term rate (i.e. 12 month tenor) at time 5 = 50% × (80% × 1.856% + 20% × 1.3%) = 0.872%

Long-term rate (i.e. 20 year tenor) at time 5 = 75% × (80% × 2.207% + 20% × 3.2%) = 1.804%

Using these 2 rates, you can then build the yield curve using linear interpolation or some other definition. The chart below is the complete yield curve using linear interpolation from the ST and LT rates:

| Tenor | 3 month | 6 month | 12 month | 2 year | 3 year | 5 year | 10 year | 20 year | 30 year |
|---|---|---|---|---|---|---|---|---|---|
| Rate | 0.836% | 0.848% | 0.872% | 0.921% | 0.970% | 1.069% | 1.314% | 1.804% | 2.295% |

So if my asset matures in 5 years, then reinvesting its proceeds into a 10 year bond at time 5, would yield a return of 1.314%.

## CALM vs LICAT

The key methodological differences between the CALM and LICAT interest rate scenarios are that (i) LICAT provides specific definitions for the tenors on the yield curve (vs CALM where you're allowed to use straight forward linear interpolation) and (ii) the LICAT interest rate scenarios are as of the valuation date only (vs CALM where you need to project future yield curves).

*Instructor's closing remarks: hopefully this provides some insight on some common misconceptions on yield curves. I want to stress again that this supplementary lesson **is not explicitly on the exam**. However, having a fundamental understanding of how yield curves work in valuation and CALM is critical for this LFV-C exam. It will pave the way to a better understanding of the various valuation lessons.*

# Embedded Value Practice and Theory

Source Author: Robert Frasca and Ken LaSorella (March 2009)

## Overview of This Reading

**Embedded value (EV)** is a measure of shareholders' value in an insurer: the current value of freely distributable surplus plus the PV of the existing business's future distributable earnings

The popularity of EV has grown over time, and it's closely related to the concept of actuarial appraisal value, which will be covered in more depth in LFV-106

*The formulas in this reading present many, many opportunities for numerical exam questions, and they are best learned through the examples in the video lesson*

**Key topics for the exam include:**

- Definition of EV
- Comparisons between EV and AAV
- EV components and formulas
  - Adjusted net worth (ANW)
  - In-force business value (IBV)
  - Cost of capital (CoC)
  - Risk discount rate (RDR)
  - PV of distributable earnings (PVDE)
  - Methods for reflecting debt capital
- EV assumptions: economic vs. non-economic
- Market-consistent EV
  - Time value of financial options and guarantees (TVOG)
  - Risk-neutral assumptions
  - Comparisons between EV and MCEV
- Analysis of Movement—how to perform and define key components
  - Contribution from new business
  - Target IBV
  - Experience gains and losses

  - Changes in valuation bases or assumptions
- EV disclosure guidance and issues

## Introduction

**Embedded value (EV)** = measurement of value that shareholders own in an insurance enterprise

- Shareholder value is made up of capital, surplus, and the PV of future earnings to from the existing business
- Has evolved to embody a codified collection of rules and practices
- Uses of EV:
  - Justification for stock prices and acquisition purchase prices
  - Performance measurement for executive compensation
  - Profitability analysis for lines of business
  - Assessment of returns for capital allocation purposes
- EV is similar to actuarial appraisal value (AAV), but there are differences:
  - AAV includes contribution of future new business, while EV does not
  - AAV uses higher discount rates than EV
  - Expense assumptions in EV are more company-specific than those used in AAV, where assumptions reflect prevailing sentiment of the market
  - *More on AAV in LFV-106*

History of EV

- In the 1980s, companies in the UK started to disclose EV
- Dec 2001: Association of British Insurers develop guidelines for calculation of EV (Achieved Profits Method)
- European Embedded Value (EEV) defined in May 2004 by the CFO Forum
- Market-Consistent Embedded Value (MCEV) developed by the CFO Forum in 2008

## EV Mechanics and Formulas

**EV = Adjusted Net Worth (ANW) + In-Force Business Value (IBV)**

- **Adjusted Net Worth (ANW)**
  - ANW = Required Capital + Free Surplus
  - ANW excludes intangible assets (e.g. goodwill)
  - The entire ANW is not distributable since it includes required capital
  - ANW starts with statutory capital and surplus but adds back items like AVR and non-admitted assets because these items have realizable value
  - 2 approaches for valuing ANW
    1. Most literal approach: only FS is marked to market and tax effected (adjusted for taxes)
       * Assume assets supporting RC earn book rates of return
    2. More practical approach: entire ANW is marked to market and tax effected
       * Assume entire ANW earns a market rate of return
- **In-Force Business Value (IBV)**
  - IBV = PVBP – PV(CoC)
  - Book Profits (BP) = $\text{Surplus}_t - \text{Surplus}_{t-1} \times (1 + i_t)$
    * $i$ = after-tax rate of return on assets supporting surplus
    * BP = growth in surplus other than interest earned on surplus = statutory net income after taxes after removing investment income on surplus (required capital)
  - Required Capital (RC) = percent of regulatory risk-based capital
    * US: usually the NAIC authorized control level RBC
    * Canada: usually a % of MCCSR
    * Could also use the level of capital needed to maintain a specific rating from a rating agency capital or use economic capital
  - $\text{CoC}_t = \text{RC}_{t-1} \times (\text{RDR} - i_t)$

    * Reflects the annual risk premium that must be paid to the owners of capital backing the business (the shareholders)

  – **Risk discount rate (RDR)**

    * RDR = discount rate for all PVs in an EV calculation

    * RDR can technically vary with time, but most companies use a constant RDR

    * RDRs often vary from company to company and from LOB to LOB

    * RDR can be based on a weighted average cost of capital (WACC) or just on the cost of equity ($e$) (*see "Debt and Debt-Like Capital" below*)

  – CAPM cost of equity: $e = RF + \beta \times (RM - RF)$

    * $RF$ = risk-free rate

    * $RM$ = expected equity rate of return (e.g. S&P 500)

    * $RM - RF$ = market risk premium

    * $\beta$ = measure of relative risk (sensitivity) of a company's stock to that of the market

$$\beta = \frac{\text{Covariance(Company's Stock Return, Market Total Return)}}{\text{Variance(Market Total Return)}}$$

    * If $\beta < 1$, the company has less risk (and therefore less expected return) than the overall market

    * If $\beta < 0$, the company's stock return is negatively correlated with the market's return

#### Debt and Debt-Like Capital

In the UK and Canada, debt is not considered as part of the EV calculation $\Rightarrow$ RDR is based on cost of equity capital only

Some jurisdictions (e.g. US) do not allow conventional debt to be used to fund capital requirements (e.g. can't borrow money to back RBC)

- However, debt-like instruments (surplus notes, capital notes, or preferred shares) can be combined with equity capital to fund total capital requirement
- RDR that reflects both cost of equity capital and cost of debt

Therefore, debt can either explicitly or implicitly recognized in the EV calculation

1. **Explicit Recognition of Debt in Cost of Capital**
   - RDR = cost of equity only
   - CoC = WACC
   - Reflect debt ($D$) explicitly in the CoC formula $\Rightarrow$ assume the after-tax cost of debt = $d$

$$\begin{aligned}\text{CoC}_t &= (RC_{t-1} - D_{t-1}) \times (RDR - i_t) + D_{t-1} \times (d_t - i_t) \\ &= (RC_{t-1} - D_{t-1}) \times (e_t - i_t) + D_t \times (d_t - i_t) \\ &= \text{explicit cost of equity + explicit cost of debt}\end{aligned}$$

2. **Implicit Recognition of Debt in the RDR**
   - Rather than reflect debt explicitly, use RDR = WACC

$$\text{RDR}_{\text{WACC}} = e \times \left(\frac{E}{E+D}\right) + d \times \left(\frac{D}{E+D}\right)$$

   - $\text{CoC}_t = \text{RC}_{t-1} \times (\text{RDR}_{\text{WACC}} - i_t)$
   - WACC can be expanded to include other sources of capital like preferred stock

$$\text{RDR}_{\text{WACC}} = e \times \left(\frac{E}{E+D+P}\right) + d \times \left(\frac{D}{E+D+P}\right) + p \times \left(\frac{P}{E+D+P}\right)$$

**EV results will be the same under the 2 methods if the following conditions are true:**

1. Values for equity and debt used in WACC are fair values
2. Debt is maintained at a constant percentage of the PV of distributable Earnings (PVDE) throughout the projection period

### PV of Distributable Earnings (PVDE) and IBV

**Distributable earnings (DE)** = stat after-tax stat net income profits - increase in RC

$$\begin{aligned}\text{DE} &= BP_t + i \times RC_{t-1} + (RC_{t-1} - RC_t) \\ \text{PVDE} &= \sum \frac{BP_t - (RC_t - RC_{t-1})}{1 + RDR} \\ &= \text{PVBP + PV(Interest on RC) + PV(Change in RC)} \\ &= \text{IBV + PV(Interest on RC) + PV(Change in RC)} \\ \text{EV} &= \text{PVDE + FS}\end{aligned}$$