Geometric Progression

We Bring AI to Reality.

Interest Rate Bootcamp

This comprehensive course is designed for financial market practitioners who seek a deep understanding of money markets and bonds, including the practical tools for pricing, trading, and managing interest rate risk. This course will provide you with both foundational knowledge and advanced techniques in the interest rate markets space.

Participants will explore a wide range of fixed-income and floating instruments, learning to price bonds, money market securities, and inflation-linked products using Excel and / or Python. You'll dive into critical topics such as yield to maturity, credit spreads, and interest rate risk measures like duration and convexity, all reinforced through detailed, practical exercises.

Special attention will be given to the implementation of Zaronia and the nuances of bond pricing, including the SA bond pricing formula, and international conventions for accrued interest calculations. You'll also cover key elements like bootstrapping yield curves, trading on yield, and managing bond portfolios with techniques like barbell, bullet, and ladder strategies.

The course offers a practical focus, encouraging participants to bring their own laptops for exercises on pricing bonds, floating rate notes (FRNs), and interest rate derivatives. However, laptops are not mandatory as the data will be provided.

Key topics include:

- Fundamentals of bond and money market instruments, including pricing and valuation.
- Practical application of the bond pricing formula with local and international comparisons.
- Measuring and managing interest rate risk using duration, convexity, and yield curves.
- Bootstrapping the zero curve, deriving forward curves, and pricing off yield curves.
- Excel-based exercises for pricing inflation-linked bonds, FRNs, and Repos.
- Trading strategies, market conventions, and managing bond portfolios effectively.

This course offers a variety of "modules" and is typically tailored to the needs of the specific group of delegates, allowing it to be adapted for both foundational and advanced levels.

Additionally, delegates will have the option to implement the Vanilla Bond Pricing formula, FRNs, ILBs, and selected interest rate derivatives **in Python**, with all participants receiving the Python code (and spreadsheets) as part of the course materials. This section is optional and designed for those who want to further enhance their programming skills.

Please refer to the detailed agenda below for more information.

Additional Features:

- Includes Lifetime access to comprehensive electronic course materials, including insightful videos and a curated list of resources for deeper exploration.

Tutor: Mark Raffaelli

Mark is obtained his CFA Charter in 2000 and became fellow member of the Global Association of Risk Professionals (FRM) in 2001. Mark's extensive experience includes:

- Trading in Spot & Derivative Products professionally.
- Development of quantitative financial models for Surveillance, Performance Attribution, Price Validation, Price Models, Risk and Automation.
- Developments of Apps for the investment and insurance industry.
- Machine Learning and Deep Learning with Sklearn, Tensorflow & Pytorch in the Financial Markets for Banks, Asset Managers and general business.
- Time Series Analysis, Regime Change & Optimization with and without AI.
- Strategic implementation of AI.

Those who have attended Mark's courses will know about his passion and ability to cut through jargon, simplify technical issues and provide real life examples.

Level	Customised from detailed Introduction to Advanced.
Duration	It can be hosted in-house or / and online and is customised to the delegates time requirements
Suitable for	Analysts, portfolio managers, traders, and risk managers or anyone studying towards a CFA, FRM, CFQ, RPE etc. A certificate is available on request
Pre-requisites	None

Things delegates have said about this course:

- "Very good course and well presented! The content opened my eyes to the fixed income market.
- Mark presented the course in an easy to understand manner, yet he covered the complexity of all of the topics."
- "I have learned a lot from this course and it is very relevant to what I do at work. Mark made the terms much simpler and more understandable."
- "Mark has the ability to explain difficult terminology very simplistically. This, coupled with his practical market experience and enthusiasm made the course very interesting."
- "This is the only course I have attended where the bond markets have been explained in plain English that everyone can understand."
- "Mark gets 11 out of 10 for passion, energy and enthusiasm!"

Detailed Agenda

1. The Fundamentals of The Interest Rate Markets

- Brief overview of funding through Debt vs Equity.
- Features and characteristics of interest rate markets.
- Jargon of the Money Market and Bond Market.
- Getting to grips with Jibar & Libor, Sonia, Sofr, Zaronia.
- Primary Bond Issuance and Road Shows.
- Coupons and coupon setting.
- Sinking Provisions.
- Subordination & Covenants etc.
- Rating Agencies.
- Understanding Yield to maturity (Part 1).
- Discount versus Yield.

2. Understanding Yield and the Vanilla Bond Pricing Formula

Delegates will price bonds in Excel using the PV method and the annuity method balancing back precisely to the JSE valuations. All examples will be performed in Excel and delegates will learn to "program" their own solutions using Excel functions. Topics discussed include:

- A detailed overview of Yield to maturity (Part 2).
- Rating agencies and their problems.
- Credit spreads, CVA and real spreads.
- Methods of deriving credit spreads.
- Calculation of the All in Price, Clean Price, Accrued Interest of vanilla bonds and zeroes.
- Broken Periods and books Closed Dates.
- The annuity formula and why it is often displayed in specifications.
- Full explanation of the Bond Pricing Formula as per the BESA \ JSE specification.
- Broken coupons.
- International comparisons of bond formulas for different countries and Accrued interest conventions e.g. 30(E)/360, Act/365 L, Act/ Act, ISMA method etc.

The formal JSE bond specification will be used as a reference.

Note: Delegates who register for the course will receive detailed documents and videos on the time value of money. This allows Mark to briefly recap the topic as it relates to pricing, giving delegates an opportunity to familiarize themselves with key terms and concepts, thus saving time on content covered in many university and professional qualifications. If needed, we can cover these topics from the ground up - such ***as time value of money, future value, present value, compounding, annuities, NACS (and its variations), the money market basis versus bond basis, continuous compounding, and more using Excel****. Please allow an additional half-day for this review if required.*

Additionally, delegates will have the option to implement the Vanilla Bond Pricing formula in Python, with all participants receiving the Python code as part of the course materials. This section is optional and designed for those who want to further enhance their programming skills.

3. Implications of the South African Bond Pricing Formulae.

- "The saw tooth effect"
- Pull to Par.
- Anomalies of the SA Bond Pricing formula.
- The problem of Accrued Interest.
- YTM vs Spot rates.
- Calculating Bond Returns and a look at historical bond returns.

4. Deriving Yield to Maturity from the All in Price

- Numerical Techniques
- Bi-section
- Newton-Raphson
- Bailey's method

Excel will be used to demonstrate these processes and delegates will learn to program the process using excel functions.

5. Types of Money Market Instruments and Bonds

- NCD's, Commercial Paper & Promissory notes.
- Some global Government Bonds.
- South African Government Bonds.
- Zero Coupon Bonds and why they are different.
- STRIPS.
- Amortising Bonds.
- Floating Rate Notes (FRNs).
- Inflation Linked Bonds.
- Asset Backed Securities & Securitisations.
- Eurobonds etc.

6. Pricing and Understanding Repos

- Understanding Repos and Buy Sell Backs.
- GC, Special and securities Lending.
- Pricing Buy Sell Backs and Repos.
- The consideration method.
- ISMA Repos (now ICMA Repos)
- Pricing Inflation linked Repos and the implications.

Delegates will perform the calculations in Excel.

7. Trading in Bonds

- The Interest rate trading environment,
- Liquidity & Depth,
- Price versus yield trading.
- Yield Quoting Convention,
- Jargon such as “Yours”, “Mine”, “Double”, Arbitrage, long \ short etc.
- Bond delta hedging.

8. Understanding Yield curves

- Understanding the Par curve.
- Applying yield curve shapes & movements.
- Traditional yield curve theory.
- Understanding par curve weaknesses.
- A detailed look at the zero curve.
- Bootstrapping the Zero curve.
- Why bootstrapping is not as simple as it looks.
- Pricing bonds off the Zero curve.
- Deriving the par rate from Zeroes.
- Deriving the forward curve.
- Pricing bonds off the Forward curve.
- Deriving the zeroes from the Forward curve.
- “Jumps” in the forward curve.

To make this section understandable to everyone, we use Piecewise Linear Interpolation to derive the respective yields. More advanced methods are used in the Interpolation section below. This section will use some multimedia animations and delegates will bootstrap curves in Excel.

9. Yield curve Interpolation

- Best fit curves versus perfect fit.
- The difference between deriving a curve from live yields to modelling what interest rates will be in the future.
- Nelson-Siegel Term structure.
- The Nelson-Siegel-Svensson model.
- Bootstrapping in reality - what to do when you have gaps.
- Getting to grips with Basis splines
- Implementing Quadratic splines, Cubic Splines and Quartic splines
- Strengths and weaknesses of the above methods.
- The JSE Monotone Preserving Interpolation.

Note: This section is relatively advanced and can be run as a brief overview or as a detailed implementation using linear algebra in Excel. Additionally, delegates will have the option to implement the curves using the different interpolation methods in Python, with all participants receiving the Python code as part of the course materials.

10. Yield Curve Analysis

- Understanding the inconsistency of ratings spreads.
- Bond Spread trading.
- The I spread, G Spread, T spread and Z Spread.
- Implying the probability of default from curves.
- Parallel and non-parallel movements in the Curves.
- Interpretation of yield curve movements and term structure.
- The impact of Zaronia on Curves.
- Pricing South African Multiple Redemption Government Bonds properly.

11. A Detailed look at Measuring Interest Rate Risk

- The truth about Macaulay Duration and how it has been misinterpreted.
- Calculating the first and second derivatives of the Price / Yield function.
- Modified Duration, Delta and PV01.
- Fisher-Weil Duration.
- Derivation, explanation and practical uses of convexity.
- The Taylor series approximation.
- Interpretation and uses of duration and convexity.
- The JSE specification regarding Duration, Convexity, Delta and PV01.

Video and excel will be used to reinforce the concepts. Please note that this section uses calculus. Background reading regarding the concepts of calculus will be made available for those who are a bit rusty and want to recap the concepts.

12. Pricing Inflation Linked Bonds

- Understanding and calculating the reference CPI.
- Explanation of how CPI bonds work.
- Pricing Inflation Linked Bonds.

Delegates will perform the calculations in Excel. Delegates may choose to use Python as an alternative

13. Pricing FRN's

- Bootstrapping the Spot Curve.
- Deriving the Forward Curve and predicting coupons.
- The FRN pricing formula and its anomalies.
- FRN duration and convexity.
- Valuing Zaronia FRN's.

Delegates will price all the FRNs themselves using Excel. Delegates may choose to use Python as an alternative. Video be used to reinforce the concepts.

14. Understanding SWAPS & FRAs and how they relate to the Bond Market

- Explanation of Swaps and FRAs.
- The relationship between SWAPS, FRAs and Bonds.
- The framework of SWAP and FRA valuation.
- The Swap Curve and why it is so important.
- Overnight Index Swaps and Zaronia.
- Basis SWAPS.
- MTM of SWAPS
- Some exotic Swap strategies to take advantage of yields curve shifts.
- The Negative Swap Spread.

Delegates will price SWAPS and FRA's using Excel. Delegates may choose to use Python as an alternative.

15. Interest Rate Forwards and Futures

- Cost of Carry, Bond Forwards and the relationship with Repos.
- Bond Futures.
- Understanding Short Term Interest Rate contracts (STIRS).
- Pricing STIRS.
- The Convexity effect.
- Understanding bond contracts.
- The impact of Zaronia on Interest rate Futures.

Note, this section assumes delegates are familiar with how the futures market works. We can add a core refresher on the futures market if required.

16. Bond Indices

- Global bond Indices and how they work.
- Inflation Indices and Credit indices.
- Explanation of the BEASSA total Return indices (ALBI, GOVI etc)
- A detailed decomposition of the BEASSA Indices.
- Tracking the index and it's challenges.

17. Bond Portfolio fundamentals

- Mathematics of Bond Portfolio Management.
- Reinvestment Risk.
- Bond Portfolio duration, convexity, PV01 and delta of the portfolio.
- Weighting & Replication.
- Barbell's, Ladders and Bullets.
- Yield curve shifts.
- Delta neutral portfolios.
- "The saw tooth effect" on Portfolios.

18. Bond Portfolio Management Techniques

- Duration Matching and matching Primary risk factors
- Semi active management
- Immunisation and Asset Liability Matching with bonds
- Immunisation with SWAPS
- Traditional Active Bond portfolio management strategies.

19. Optional - Interest Rate Modelling

- A recap of working in continuous time.
- A Mathematics and Statistics primer
  - A brief recap of random variables and probability distributions
  - Geometric Brownian Motion and Ito Calculus.
  - Stochastic Calculus for interest rates
- The Vasicek Model.
- The Merton Model.
- The Cox-Ingersoll-Ross Model.
- The Ho and Lee Model.
- The Hull-White Model.
- The Black -Derman-Toy Model
- The multifactor Heath-Jarrow-Morton model.

It's important to note that this section is advanced and requires a solid understanding of mathematics and statistics. It is typically included upon request and tailored to the specific needs of the audience.