THE BOOK ‘FIXED INCOME ANALYTICS'

XVI Российский облигационный конгресс

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AgaNola
Specialised Asset Manager

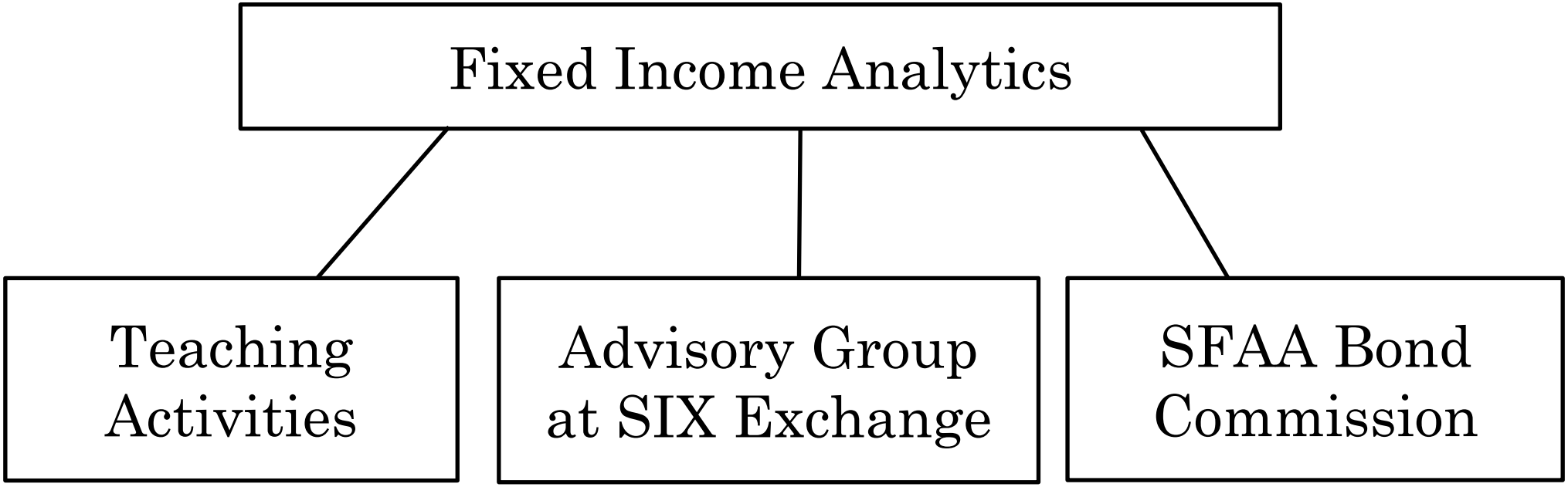
TABLE OF CONTENTS

ABOUT AGANOLA

- AgaNola is a Swiss, privately owned Specialized Asset Manager
- Leading position in convertible bonds and fixed income investments
- Strategic cooperation with Credit Suisse Asset Management
- Focus on flexible bond strategies with the option to invest in all credit markets and segments depending on their attractiveness
- Ongoing fundamental research in areas of specialization
- AgaNola supported book project

2. THE MOTIVATION OF THE BOOK

INTRODUCTION



- First chapters of the book

www.AgaNola.com

- 3 sessions yearly

www.six-group.com

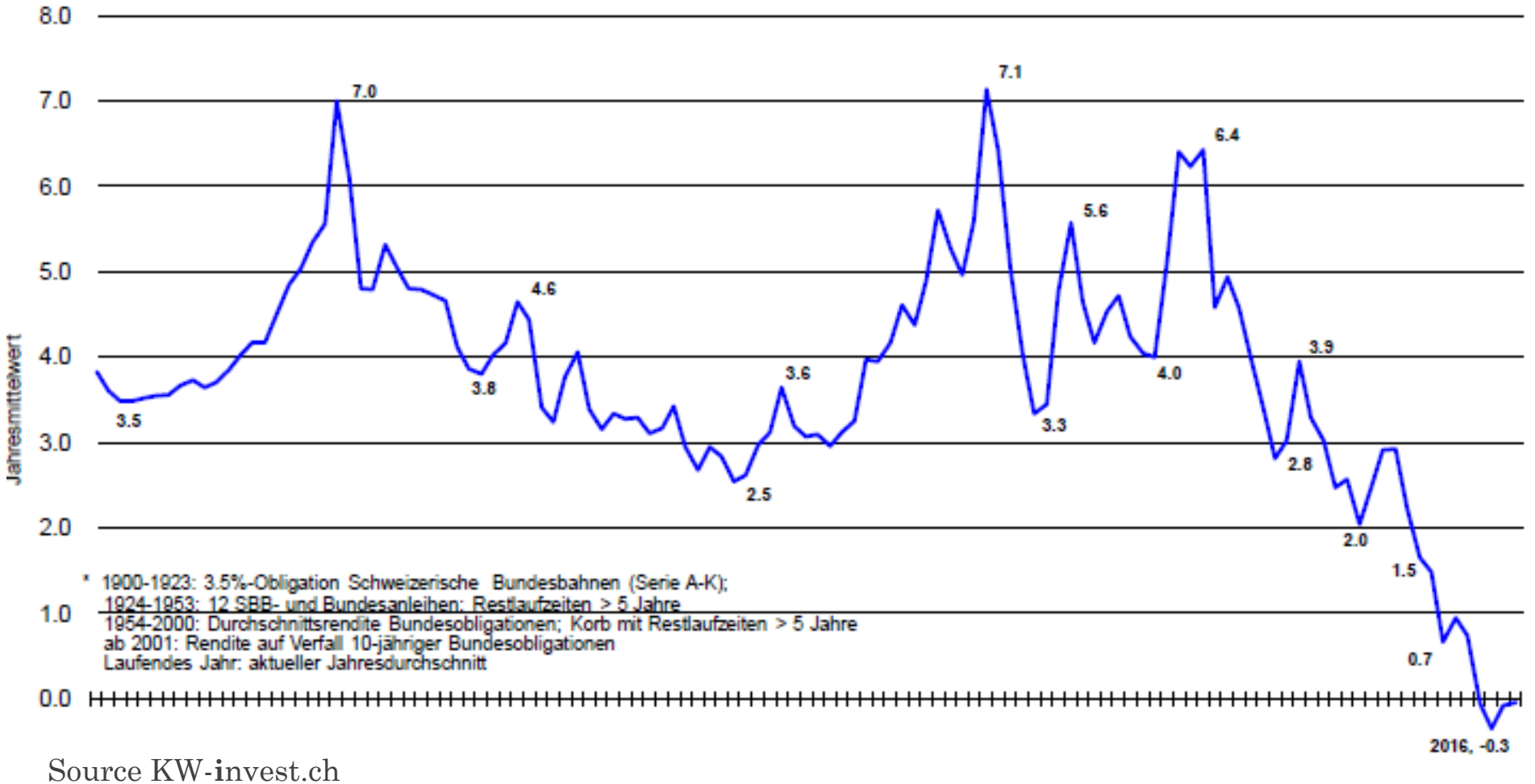
- 3 sessions yearly

www.sfaa.ch

INTRODUCTION

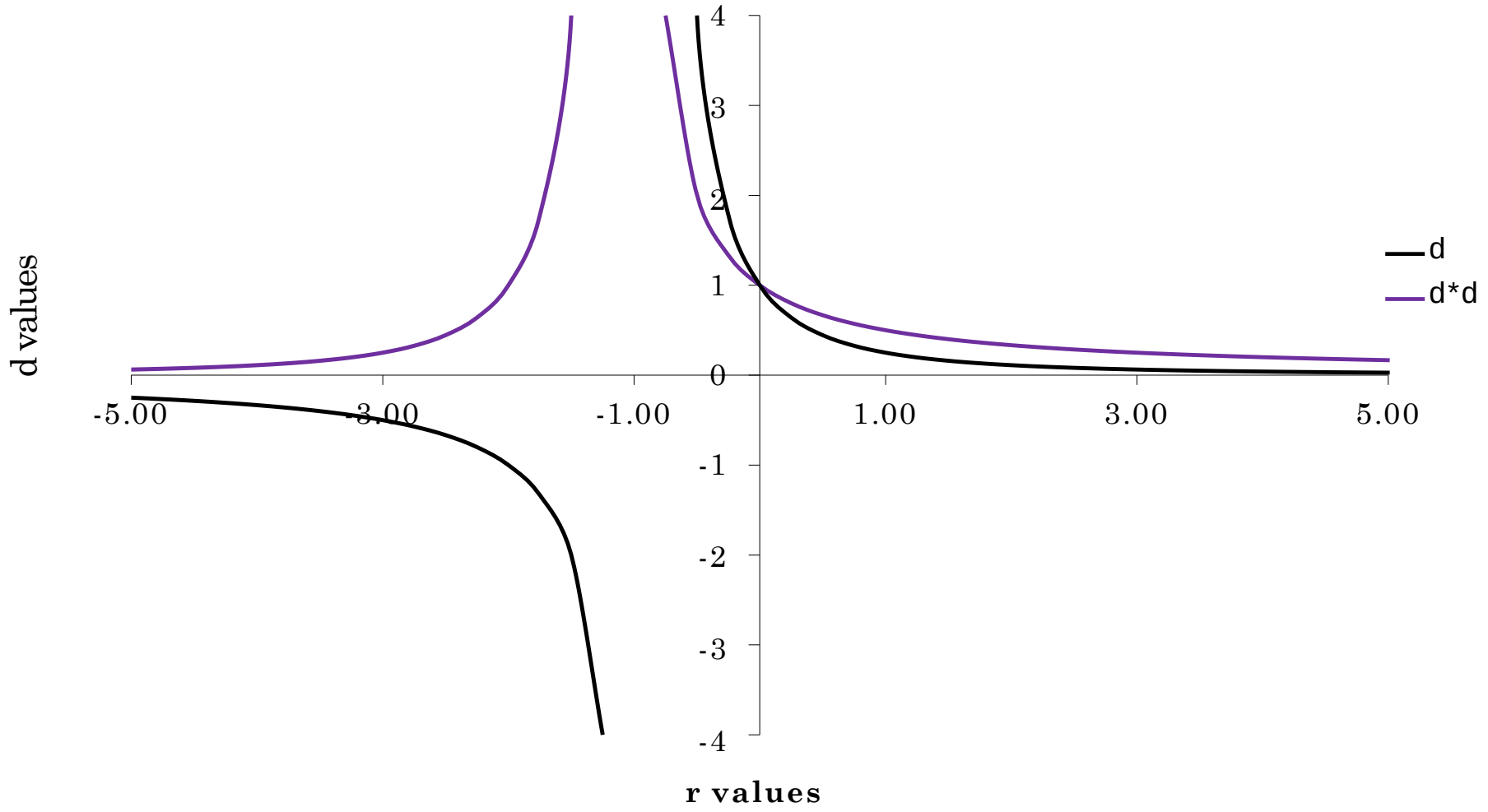
- The book
  - includes easy but not too easy examples such that the general situation is covered
  - examines the transition from a single bond to a bond portfolio
  - investigates negative interest rates

YIELDS OF THE LONG-TERM SWISS GOVERMENT



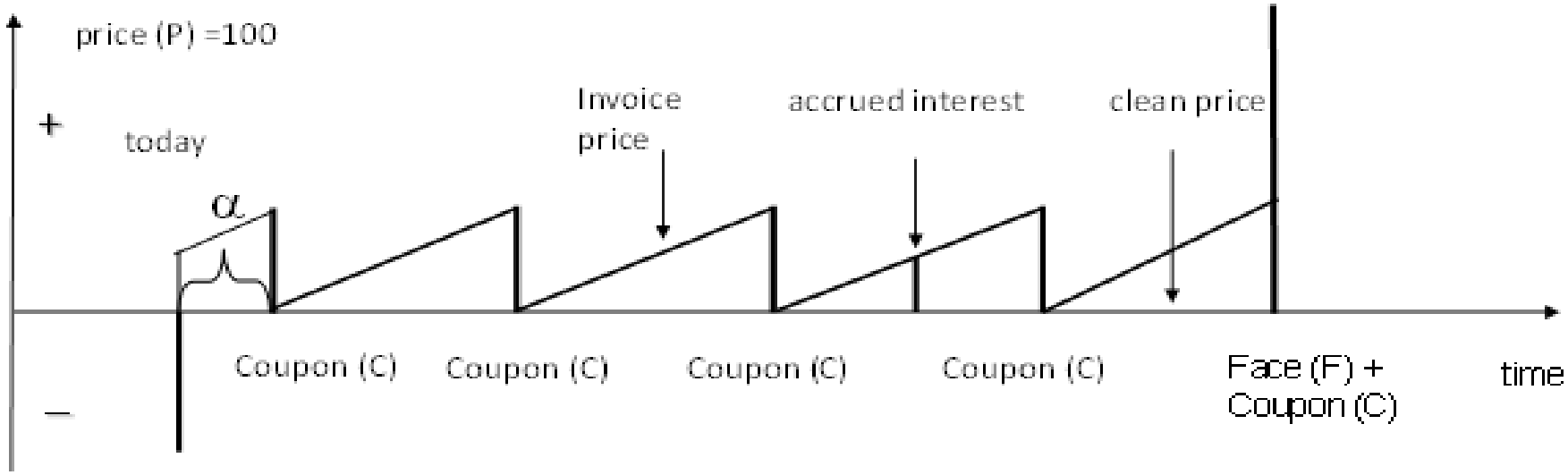
Source KW-invest.ch

DISCOUNT FACTORS



3. THE STRAIGHT BOND

STRAIGHT BOND



- A Bond is an instrument with periodic cash flows and finite life
- Invoice Price is not continuous (Zig Zag)

YIELD TO MATURITY

$$P = \frac{C}{1+r} + \ldots\ldots + \frac{F+C}{(1+r)^N} = \frac{C}{r}\left\langle 1 - \frac{1}{(1+r)^n} \right\rangle + \frac{F}{(1+r)^n}$$

- Given P, C, F and N, solve for r
- Ex ante Measure
- An arbitrage condition
- No analytic or closed solution for the general case
- Problem of multiple solution

4. THE INTERNAL RATE OF RETURN AND ITS APPROXIMATIONS

THE TRANSITION OF YTM TO IR

$$NAV(r) = \sum_{j=1}^{n} N_j P(r_j) - \sum_{j=1}^{n} \left(\sum_{k=1}^{T_j} \frac{N_j C_j}{(1+r)^k} + \frac{N_j F_j}{(1+r)^{T_j}} \right)$$

The internal rate of return IR is a solution that satisfy NAV(IR) = 0

Question: What looks the residual NAV(r) like?

THE INTERNAL RATE OF RETURN

- The calculation of IR needs in general a numerical approximation procedures
- In practice there are different approximation scheme
- A standard is missing should be discussed
- SIX and EBC recommends the Mac Duration weighted approximation

DIFFERENT APPROXMITIONS OF THE IR

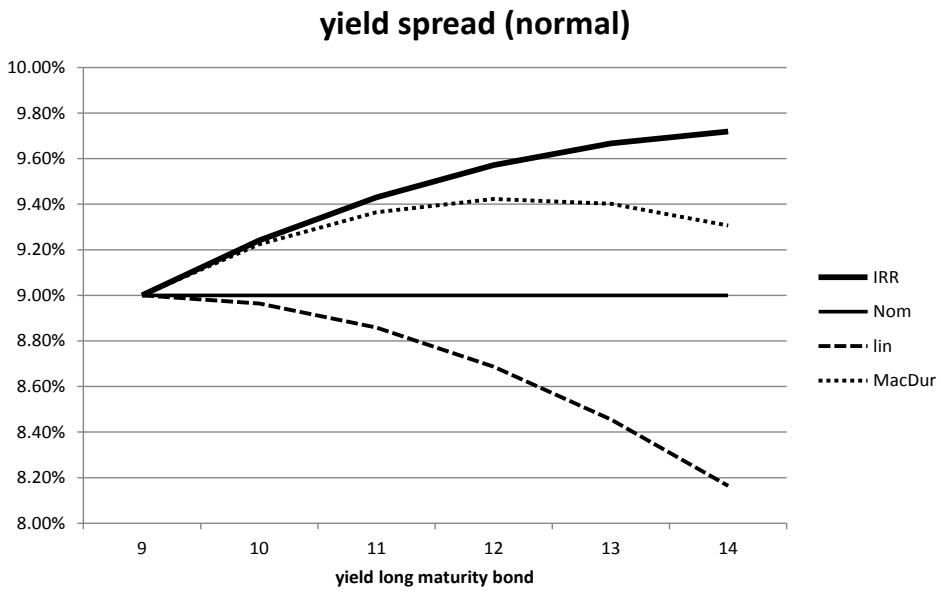
$$r_{appr} = W_1 r_1 + W_2 r_2 + \ldots + W_n r_n$$

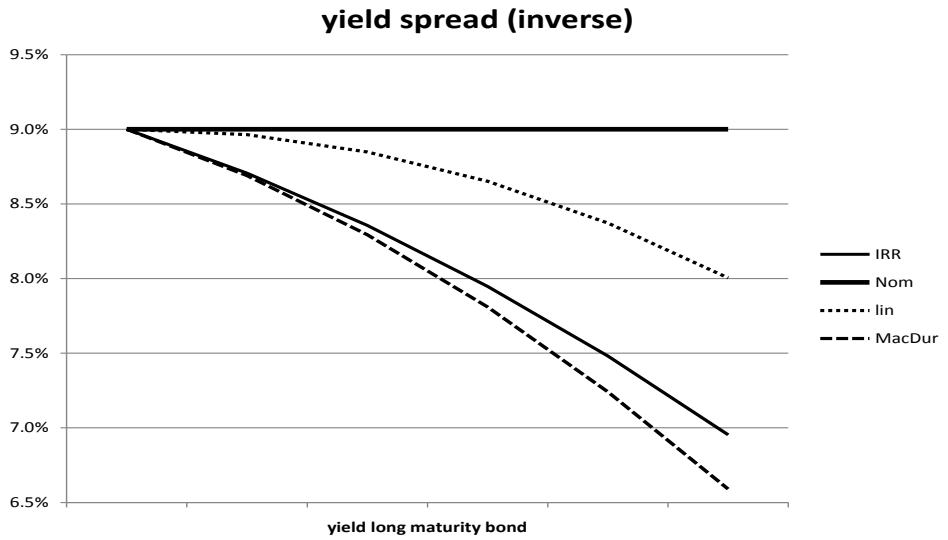
$$w_j = \frac{N_j}{\sum_{i=1}^{n} N_i}, 1 \leq j \leq n, \text{ Nominal weighting}$$

$$\hat{w}_j = \frac{N_j \bullet P(r_j)}{\sum_{i=1}^{n} N_i \bullet P(r_i)}, 1 \leq j \leq n, \text{ Price weighting}$$

$$\tilde{w}_j = \frac{N_j P_j D^j}{\sum_{i=1}^{n} N_i P_i D^i}, 1 \leq j \leq n, \text{ Mac Dur or Mod Dur weighting}$$

FIRST NUMERICAL RESULTS





FIRST THEORETICAL RESULTS

Formal Series indicates:

Result 1: By replacing IR by r_{lin}, r_{mac}, resp. $NAV(r_{mac})$ is better that $NAV(r_{lin})$, i.e.,

$$NAV(r_{mac}) = O((r_{mac})^2)$$

$$NAV(r_{lin}) = O(r_{lin})$$

FIRST THEORETICAL RESULTS

Result 2:

$$r_{mod} \leq r_{mac} \leq IR$$

- Section 3.4 (page 55) in the book

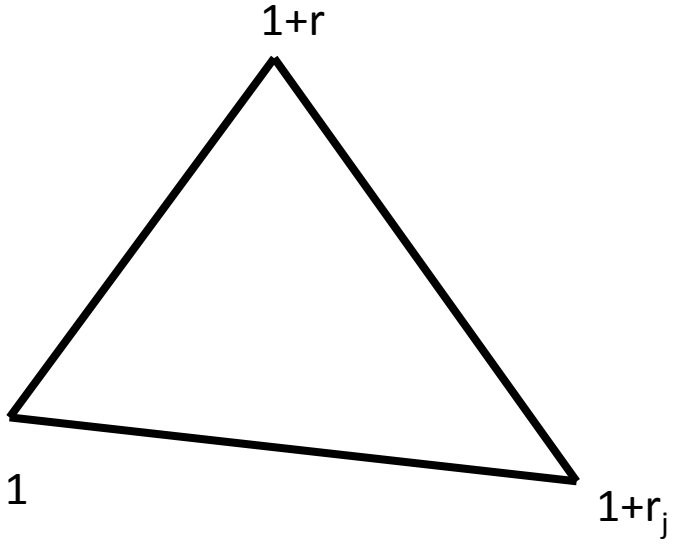


ILLUSTRATION 1 (MONEY MARKET)

$$P_1(r_1) = \frac{F_1 + C_1}{1 + r_1}, \; P_2(r_2) = \frac{C_2}{1 + r_2} + \frac{F_2 + C_2}{(1 + r_2)^2} \quad , \; r_2 > -1$$

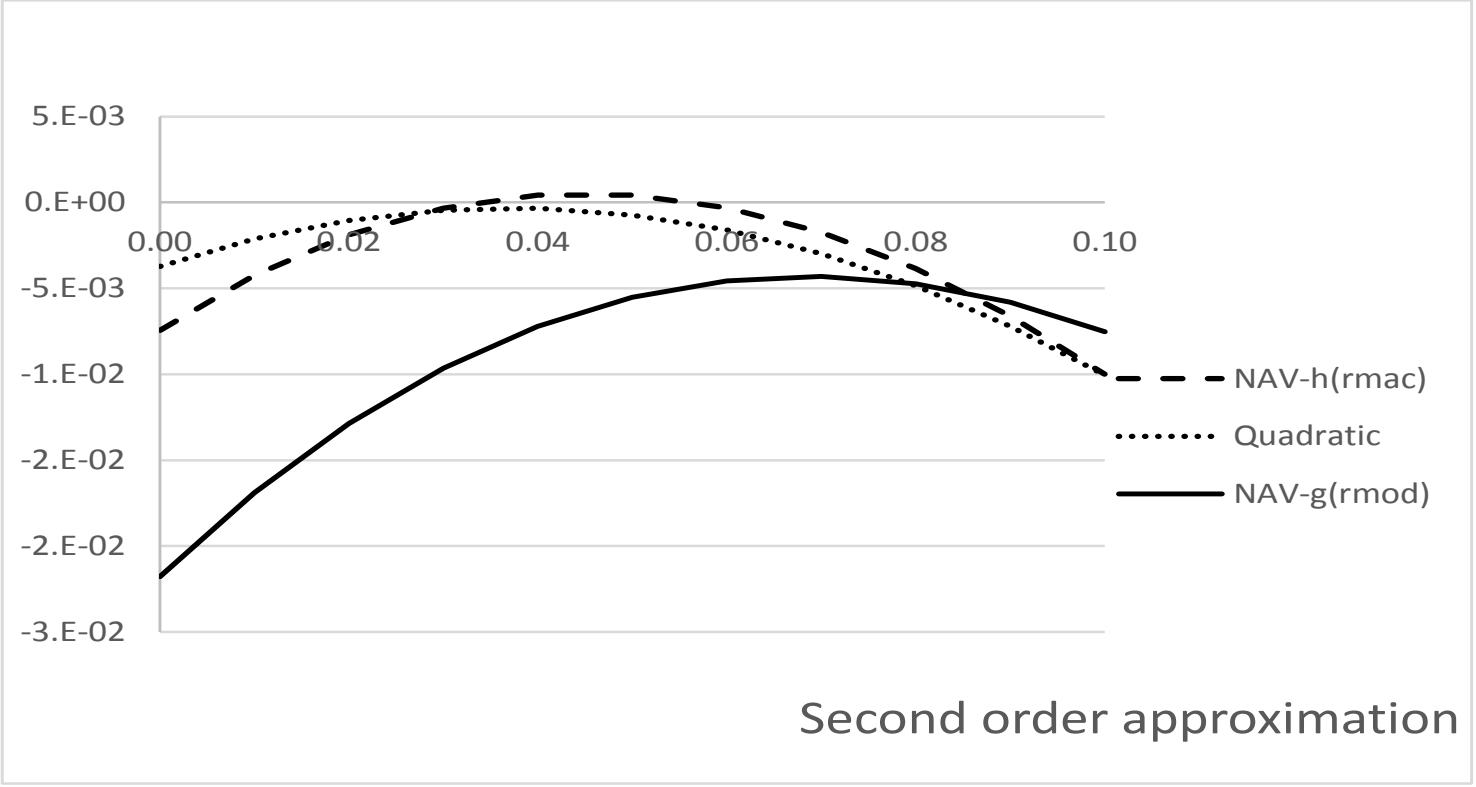
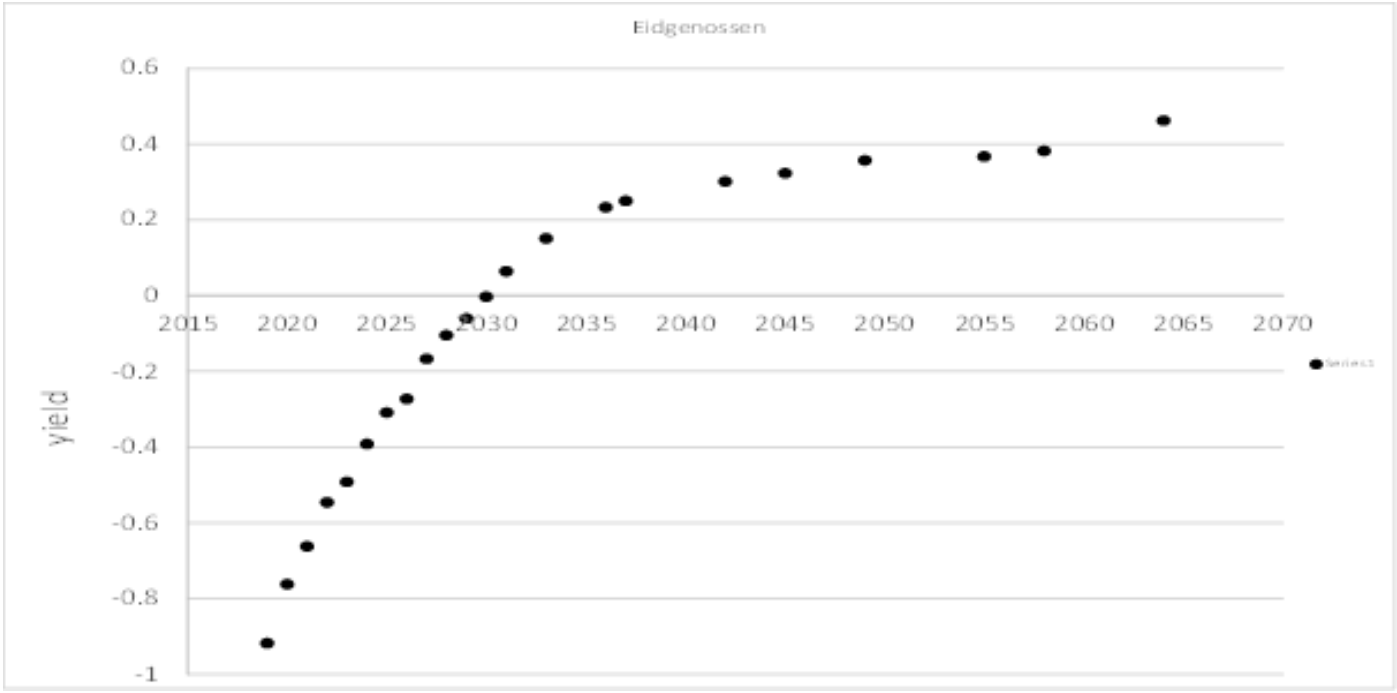


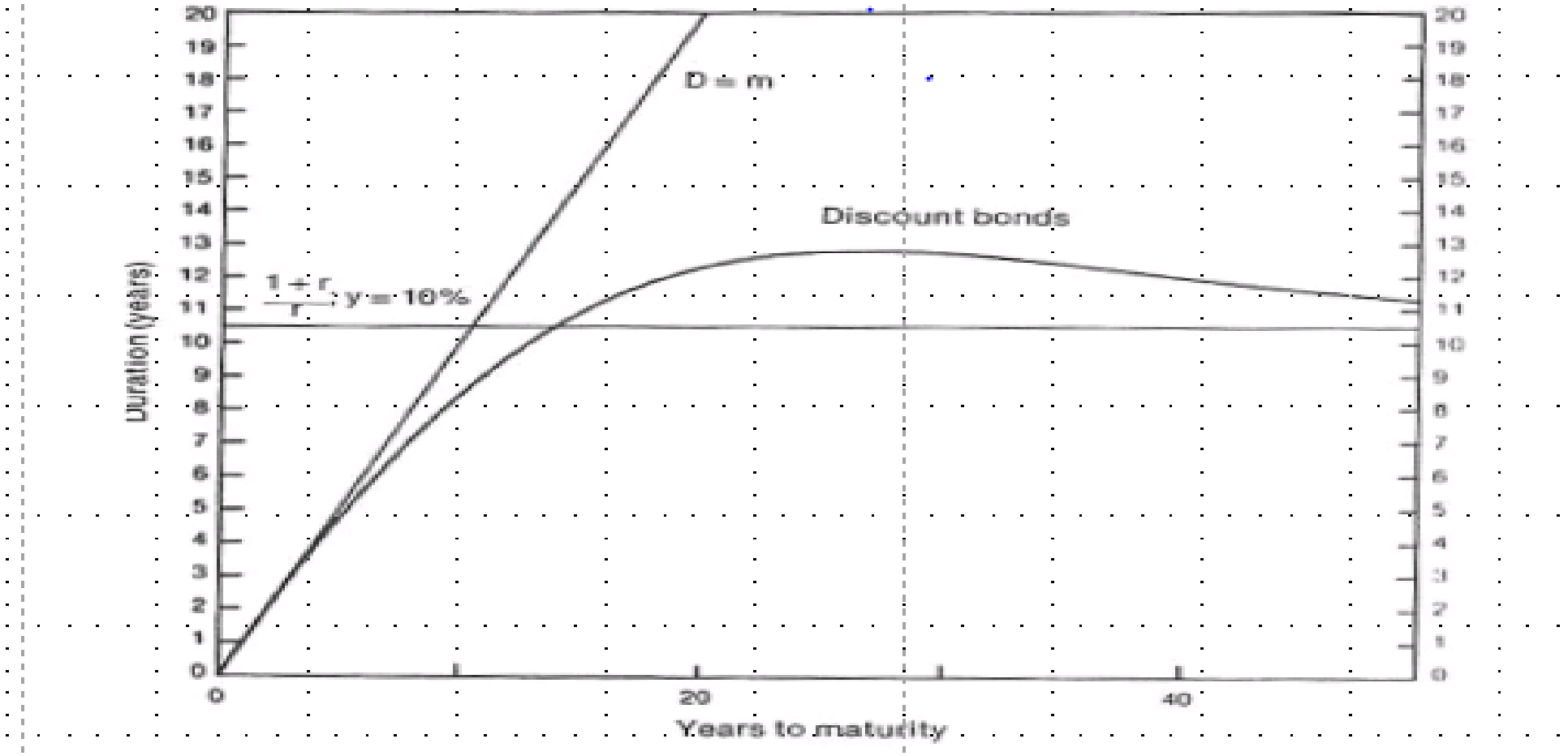
ILLUSTRATION 2 (SWISS GOVERNMENT)



- Negative interest at the short end of the yield curve
- IRR is unknown, but approximations are easy to calculate

5. THE MACAULAY DURATION

MAC DURATION FOR T TOWARDS INFINITY



Fabozzi, Frank j. Pollack, Iriving, The Handbook of Fixed Income Securities

MAC DURATION FOR T TOWARDS INFINITY

Closed formula

$$D_{mac}(C,r,T) = \frac{C\left((1+\frac{1}{r})\left[(1+r)^{T}-1\right]-T\right)+FTr}{C\left((1+r)^{T}-1\right)+Fr}$$

We apply L'Hopital's rule twice to (r > 0)

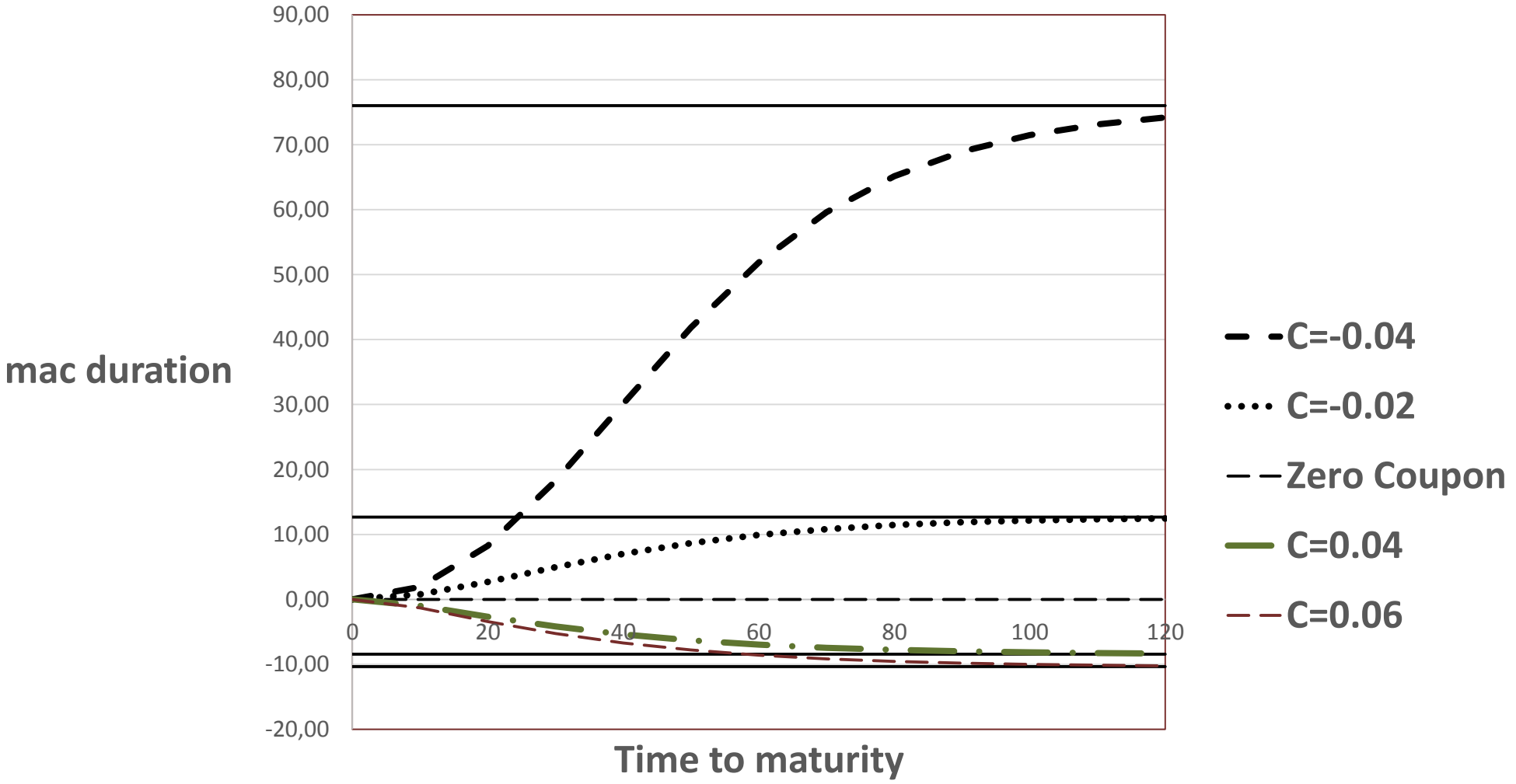
$$\lim_{T\to\infty} \frac{C(1+\frac{1}{r})\left[(1+r)^{T}-1\right]-CT+FTr}{C\left((1+r)^{T}-1\right)+Fr}$$

MAC DURATION FOR T TOWARDS INFINITY

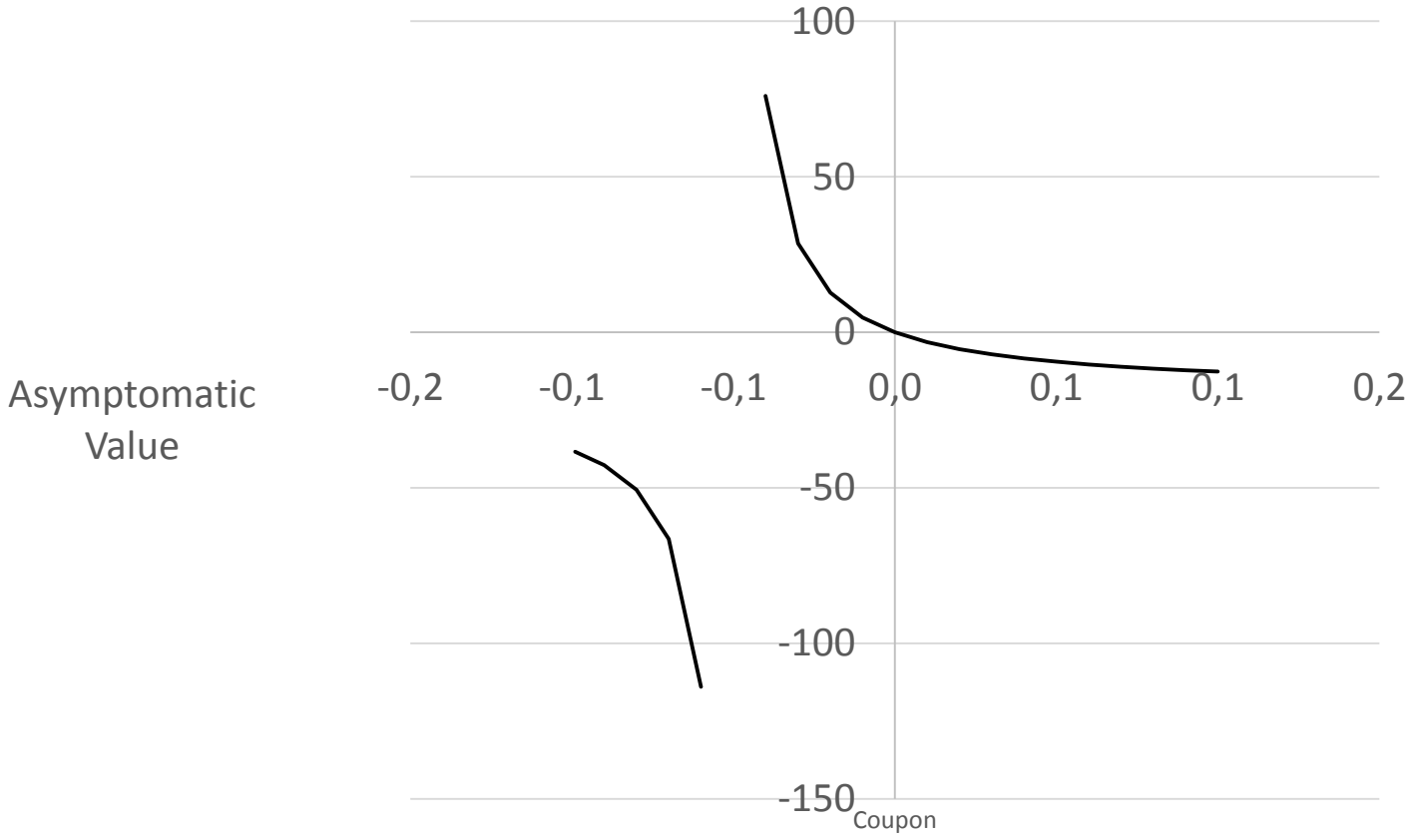
$$\lim_{T \to \infty} \frac{C(1+\frac{1}{r})(1+r)^T \ln(1+r) - C + Fr}{C\left((1+r)^T \ln(1+r)\right)} =$$

$$\lim_{T \to \infty} \frac{C(1+\frac{1}{r})\left((1+r)^T (\ln(1+r))^2\right)}{C\left((1+r)^T (\ln(1+r))^2\right)} = 1 + \frac{1}{r}$$

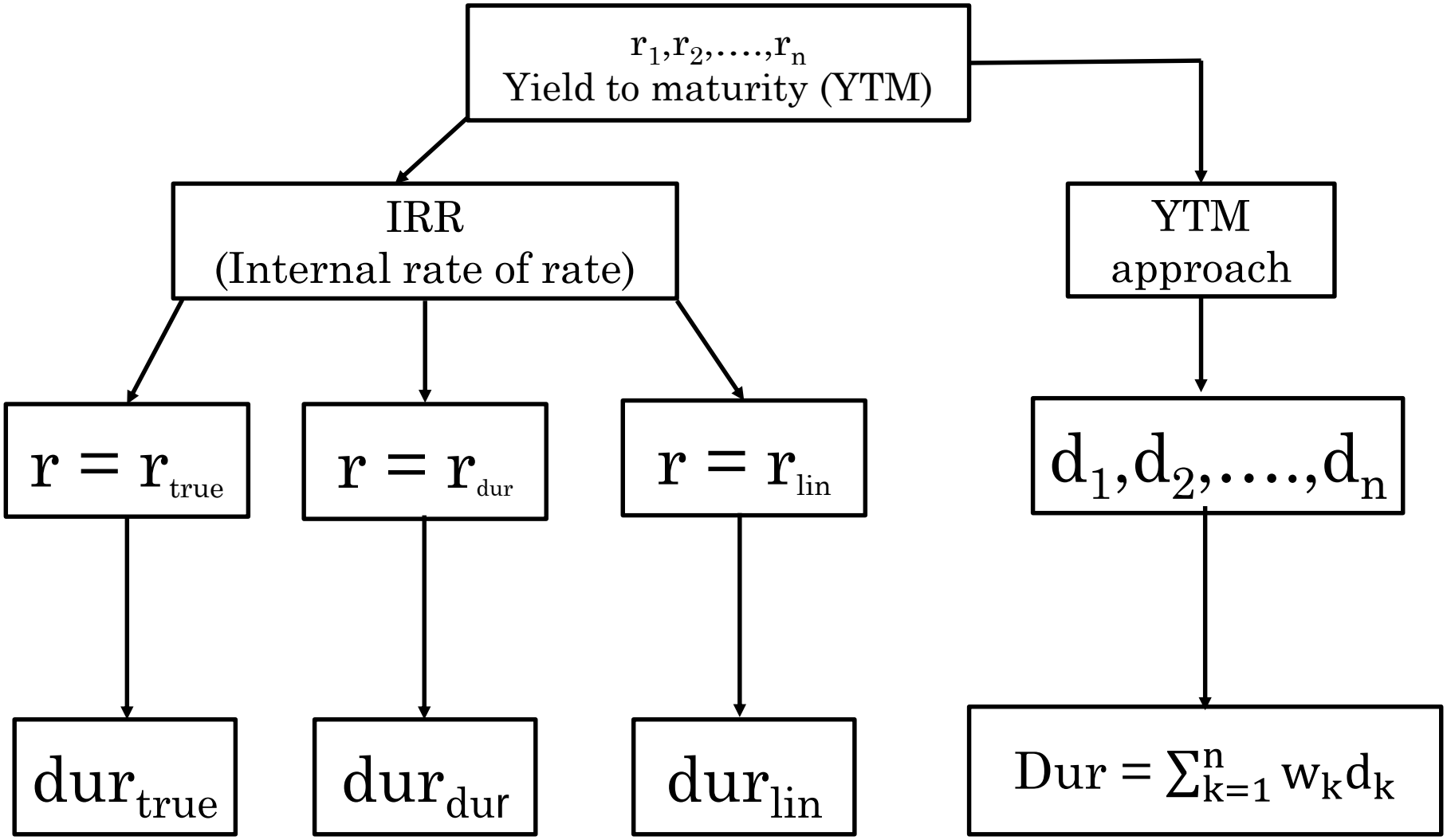
ASYMPTOTE FOR INTEREST RATE NEGATIVE



ASYMPTOTE FOR INTEREST RATE NEGATIVE



MAC DURATION FOR A PORTFOLIO



A NUMERICAL EXAMPLE

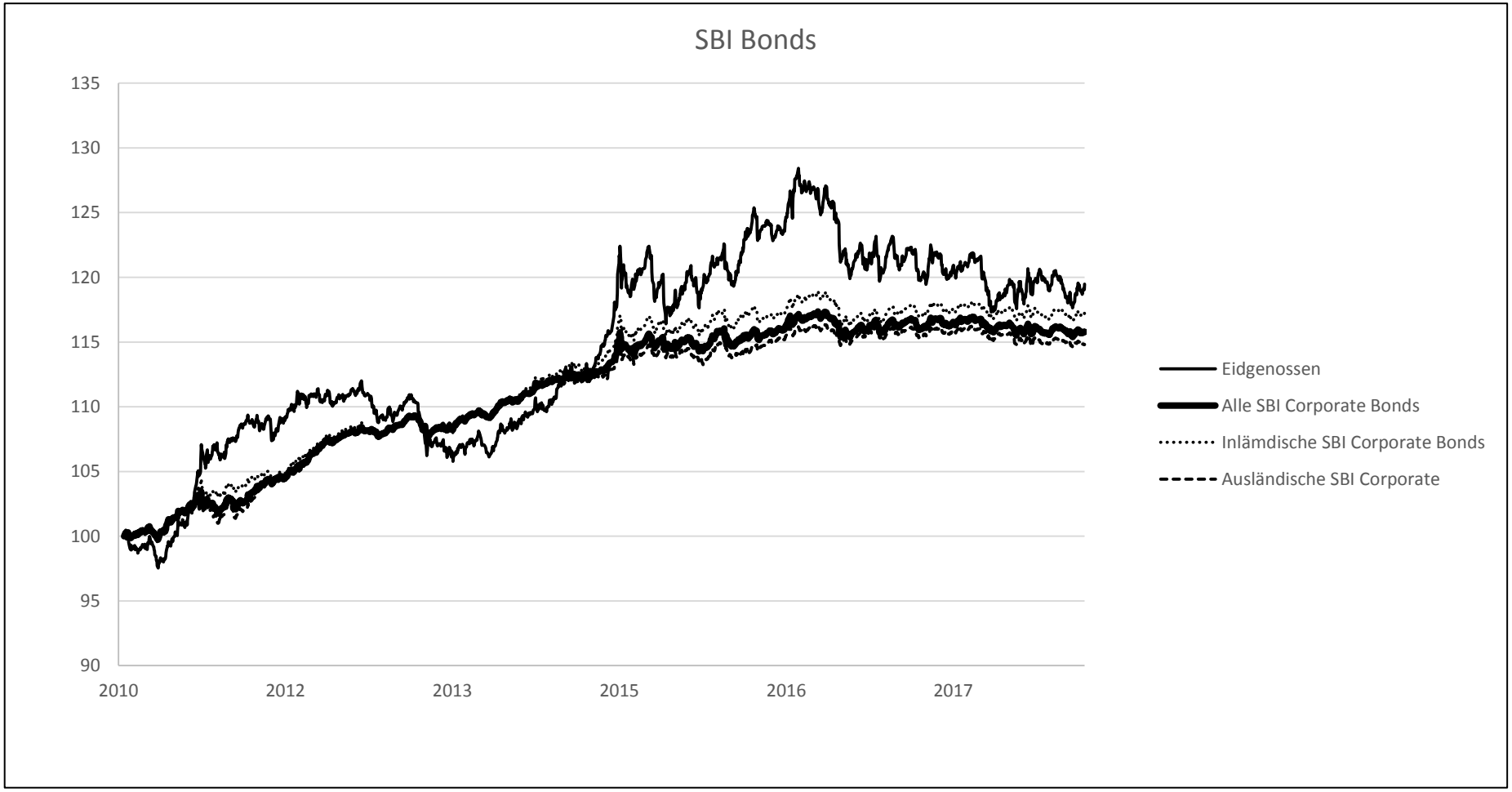
Straight Bond with a constant to maturity T = 7 years

	Coupon	
Interest	**4%**	**2%**
0.04	**6.242137**	**6.569376**
0.02	**6.294218**	**6.601431**

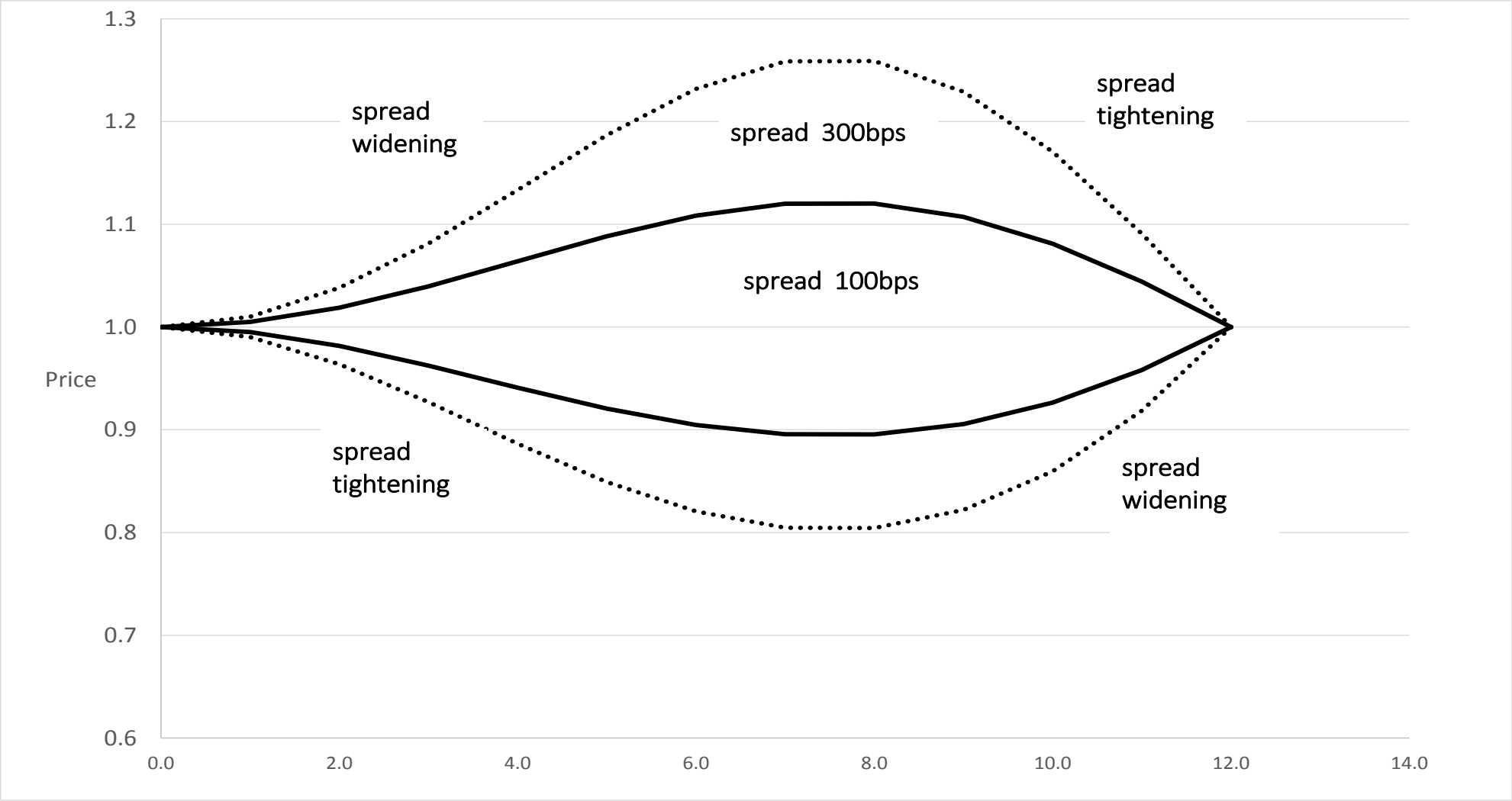
SOME REMARKS ON CREDIT

- Fundamental Property of Modified Duration is not reflected by Credit Spreads: Credit Risk is increased when yields increase.
- Cannot be concluded from the discount factors
- Further concept: Under the flat concept Spread Duration is equal to the Modified Duration for straight bonds.

SPREAD VERSUS TOTAL RETURN



CREDIT BONDS



6. FIXED INCOME AS ASSET CLASS

CONTENTS OF THE CHAPTER

- Purpose of a Benchmark
- Construction of a Benchmark
- Different types of Benchmark
- Description of different Benchmark product by the different Institution
- Industry versus tailor-made benchmarks

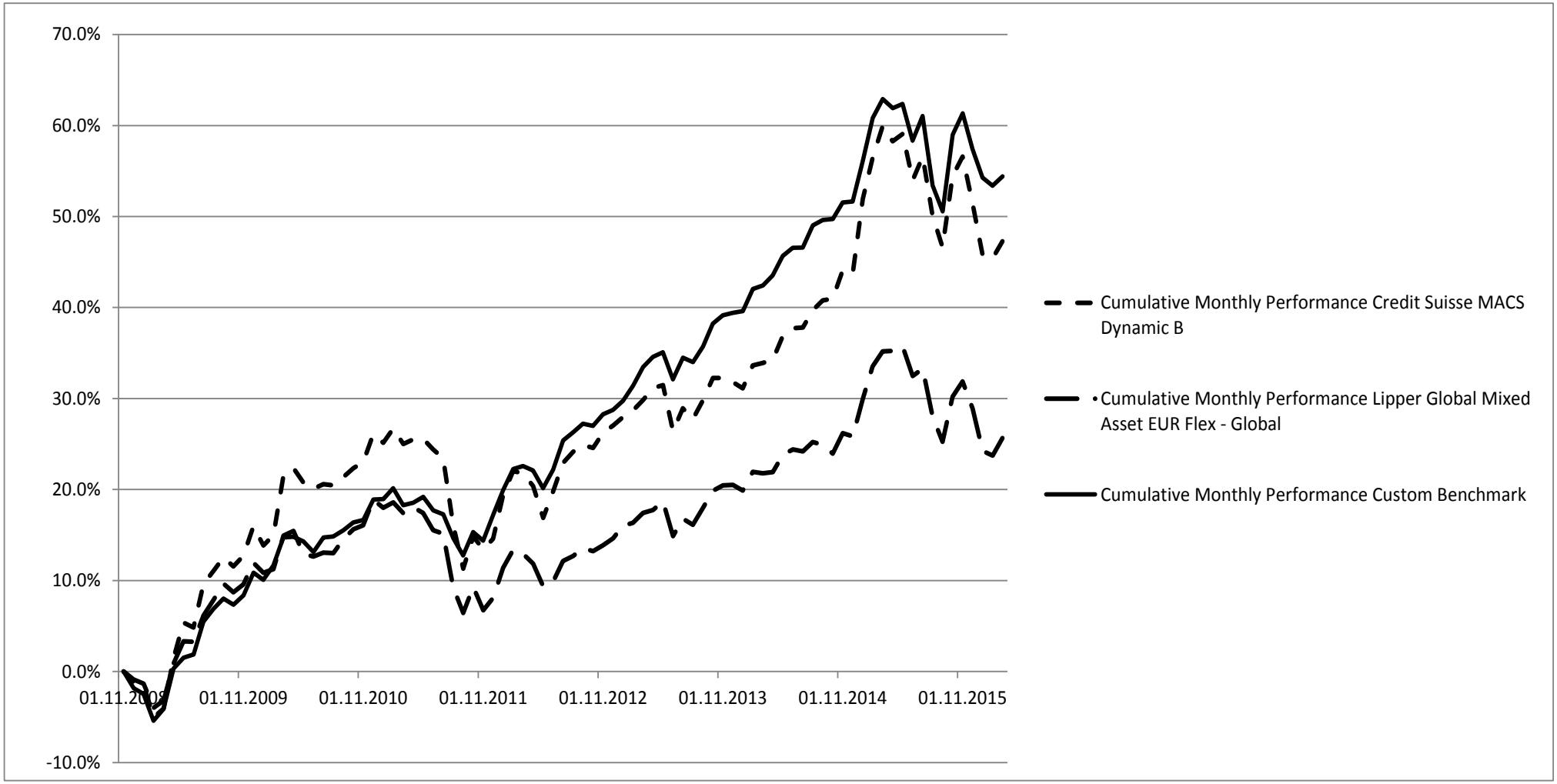
BASIC NOTIONS

Benchmark portfolios that are well known are called i**ndustry-standard benchmarks**. They provided by MSCI and FTSE for the Equity Universe and provided by J.P. Morgan, Citigroup, Barclays and Merrill Lynch for the fixed Income Universe.

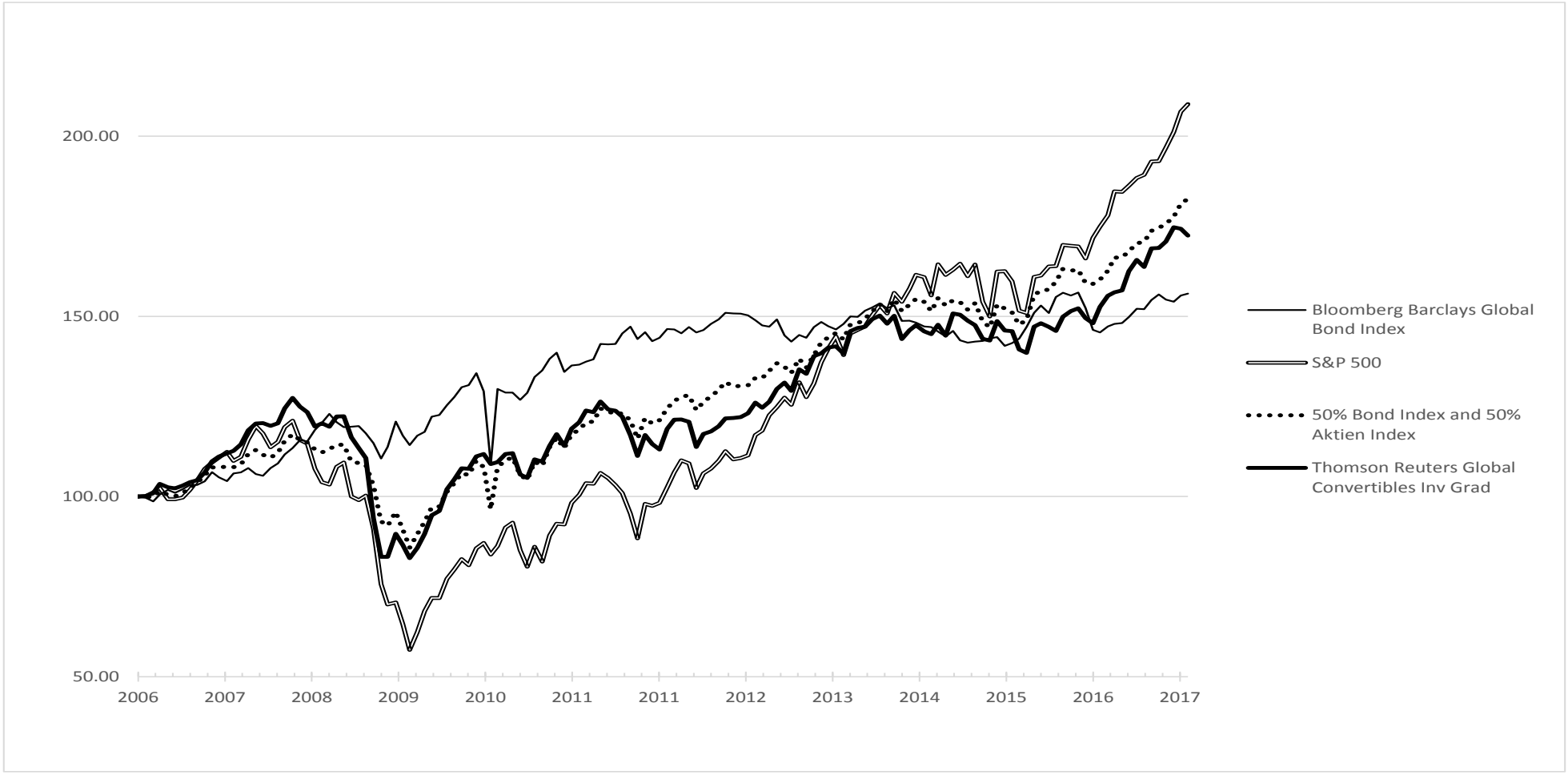
Industry-standard benchmarks allow for peer analysis and are transparent.

Benchmarks that a tailored for a specific Investment strategy or a particular client request are called **tailor-made benchmarks**.

TAILOR-MADE BENCHMARK

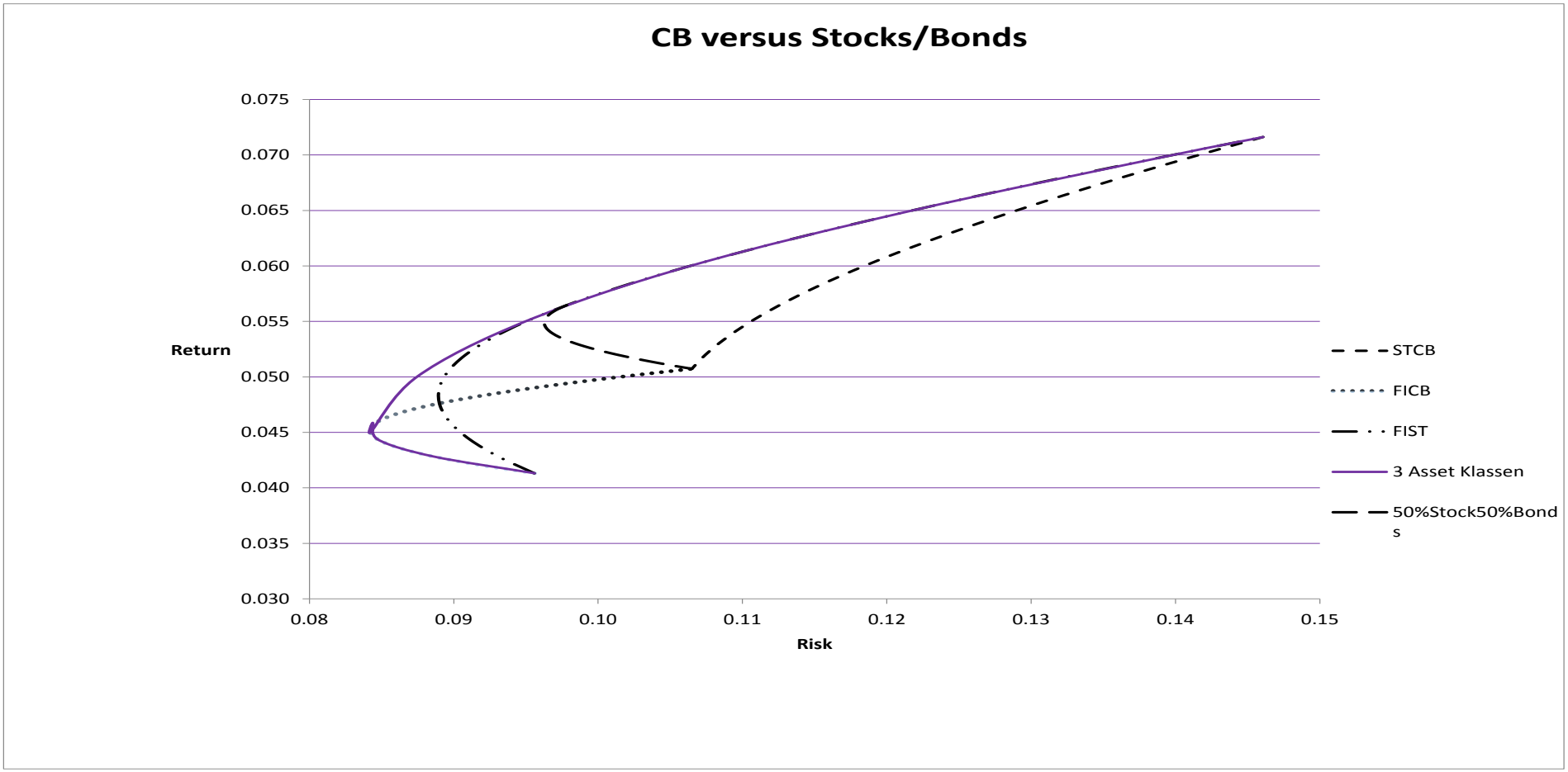


COMPARISON OF MARKETS



Source: Bloomberg

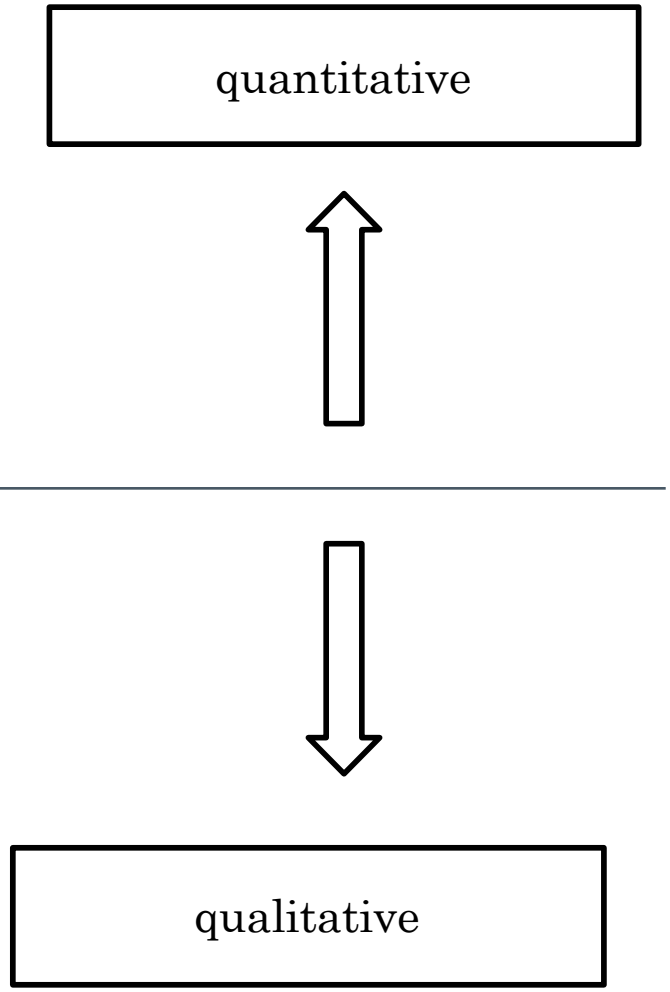
FIXED INCOME AS ASSET CLASS



OVERVIEW OF THE BOOK

1. Introduction
2. The time value of money
3. The flat yield curve concept
4. The term structure of interest

5. Spread Analysis
6. Swap Market
7. Fixed Income Benchmarks
8. Convertible



7. LITERATURE AND DISCUSSION

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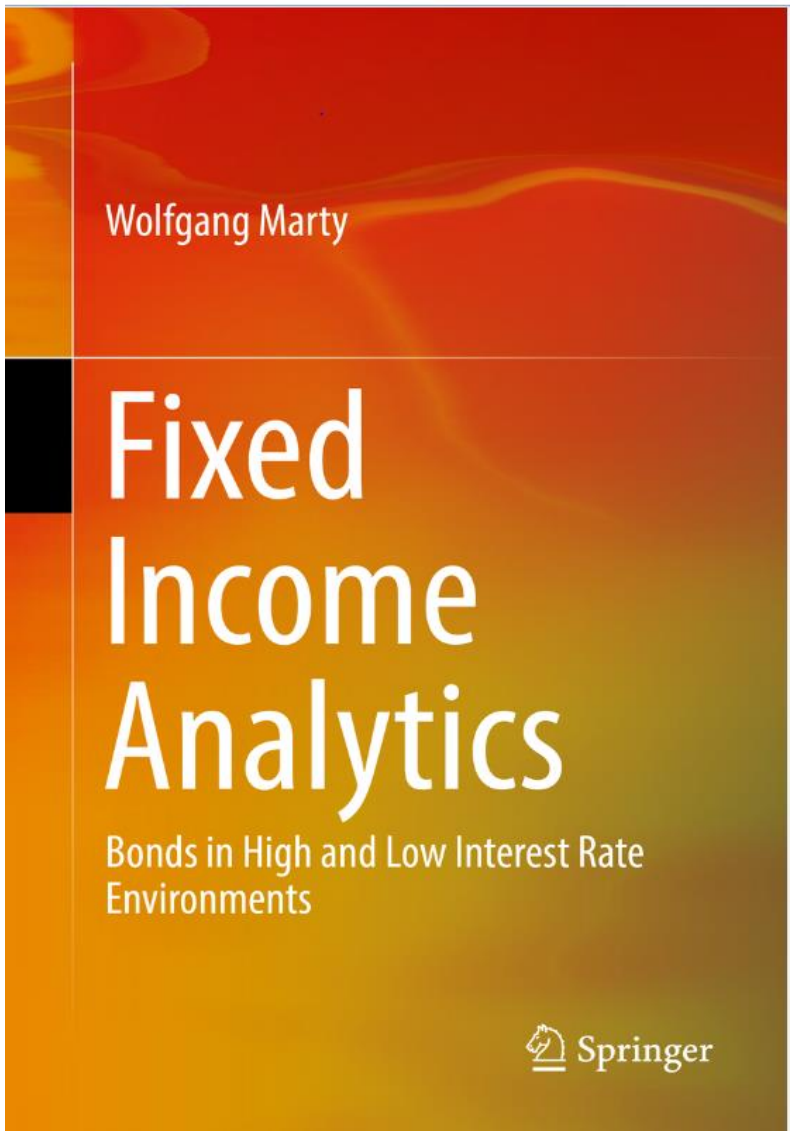
MANY THANKS FOR YOUR ATTENTATION



спасибо за внимание

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