Preface

I.1. Who will gain, and what, from this book

This book has been written for undergraduate students and people needed mathematical knowledge of these widely accepted financial instruments - mortgages and annuities. The book also appeals to the educational interests of the main and most numerous category of professionals working in the financial industry. These specialists require practical knowledge and understanding of the subject for everyday operations done in the investment analytical departments.

The book material is supported by exhaustive numerical examples, tabular and graphical illustrations. Doing presentations for investment analysts, the author discovered that some advanced concepts require additional efforts for understanding, although in some instances these topics should be in the category of optional methods and concepts. So, some filtering was done and only the necessary material is included into this book. Required by logic of presentation more advanced concepts have been adjusted to a wider audience; some optional concepts were left outside the scope of this book, their absence does not jeopardize the material consistency.

Unlike most of the books on this subject, we decided to slightly extend the covered area of material, and provided very brief and popular introduction into specifics of computational algorithms for mortgages and annuities, their efficiency and software implementation issues. This is done for the following reason that we revealed during consultation and training seminars for specialists working in the industry. These people are almost without exception the end users of software systems designed for investment analysis. The questions they asked

during training sessions often indicate their practical interest to underlying computational algorithms and their implementation specific. Sometimes their questions reveal misconceptions affecting the interpretation of their analytical studies. In most situations, a short explanation was sufficient to fix these knowledge glitches. We think that this information could be helpful for many undergraduate students to understand the subject better. Of course, some teachers may consider this small section as an optional material.

On the other hand, through this material related to practical computation students may narrow the usual gap between academic knowledge and its practical application. The author himself, during the years of study, had to step over the same gap, which separates seemingly pure academic knowledge and practical applications.

I.2. Organization of the book

In Chapter 1, the presentation starts from scratch. The material requires no prior knowledge of the subject. On the mathematical side, higher school calculus is the only prerequisite for this chapter and the whole course. First, we introduce basic definitions, such as those of interest rate and its sibling notion rate of return. Then, we introduce the mathematical apparatus required for analytical studies of investments from the ground up.

In Chapter 2, we use a simplified form of equation known as IRR (internal rate of return) to derive mathematical formulas required to calculate different parameters for annuities. We present many numerical, graphical and tabular examples. Given our experience, this is an efficient approach that will allow the reader to deeply understand the subject. Examples, in our view, like a solid and convenient ladder allowing to confidently move

to another knowledge level, while introduction of only abstract theoretical concepts is similar to unsafe jumping on a vertical wall from one ledge to another. This is one of the reasons why some courses may have 60-70 % of a drop rate, when teaching material moves to another level without assuring that the previous was leant properly. Through the combination of numerical examples and gradually introduced theory students should be able to acquire comfortable understanding of annuities and their mathematical description. After completing this chapter, the reader himself will be able to derive all basic mathematical formulas for similar financial instruments.

Chapter 3 introduces mortgages. We start from the transformation of IRR equation showing how it incorporates the main specific of conventional mortgages – regular and equal payments. Once the students understand that mortgages just another subset of financial instruments whose quantitative description is based on the same mathematical foundation, IRR equation, it usually makes the rest of the material more transparent. We discovered that students understanding this specific of mortgages are very quick proceeding through the computational part of the course that considers particular mortgage parameters.

On the other hand, there is a substantial proportion of students which in fact ignored the introductory part as too theoretical, and consequently unnecessary to do the tests. Later, they just memorize mortgage formulas and use them without the understanding that actually the subject is simple if one gets the main idea that all these basic formulas have the same origin and can be derived on the fly. These students can write the tests, but they cannot analyze even slightly different financial instruments. They also lack comprehension how mortgage parameters interrelate to each other. This is why we decided to accentuate this part introducing more numerical examples and

exercises. Although this is not an absolute remedy, but the learning process is considerably more successful, and the test results are more uniform. So, the understanding that all mortgage formulas have the same origin, is important and it makes sense to consider it in more details including simple assignments.

We found that graphical presentations are helpful in understanding the subject, so we often use this learning tool throughout the book. In particular, mortgage section includes graphs of different interdependencies between the mortgage parameters, especially regarding interest and principal payments.

Chapter 4, in an accessible way, explains why mortgage equation cannot be solved with respect to interest rate, and application of numerical methods is required. We introduce some methods, and then proceed to their software implementation viewed from the perspective of users of these systems. Such an approach allows explaining why computing interest rate may require substantial computational resources and computational time. The material explains how the user should schedule the computational tasks, what execution time to expect for certain jobs compared to others. Planning of computational jobs depending on the requirements to computational resources is another subject that we consider in this introductory chapter. We recommend to use demonstrations with financial calculators, showing how different execution time can be for seemingly similar tasks. Overall, this is very useful for practical applications material. It was valued by analysts of all levels attending educational seminars.