Chapter 1 : Numerical Methods in Finance and Economics A MATLAB-Based Introduction_2 ppt

A state-of-the-art introduction to the powerful mathematical andstatistical tools used in the field of finance The use of mathematical models and numerical techniques is apractice employed by a growing number of applied mathematiciansworking on applications in finance.

An example of a firm with a technical specialty is Kochis Fitz in San Francisco, which built a substantial practice around its expertise in executive stock options. We f ind most advisory firms to be generalists. They are generalists in terms of both their service offerings and their market, much as a local general practitioner might treat routine family ailments. In smaller com- munities, advisers become generalists mainly because there often is not enough opportunity to create market segmentation or specialize in a product or service area. The challenge of being a generalistâ€"especially when there is an opportunity to create a finer focusâ€"is the risk of diluting your resources. Advisers are conditioned to think that diversification is good. They preach this concept to clients all the time, and they apply it in their investment allocation strategy. But why does one diver- sify? Diversification is a way to manage risk. Are you going to grow your business by deploying only a defensive approach? What will be your offensive strategy, the plan that propels the business forward? Recent research into the financial-advisory community reveals the degree to which these strategy differentiators are being deployed see Figure 2. These are the theoretical concepts on which you would base your real choices. For example, in a strategic-planning process we facilitated for an advisory firm client, the owners came up with more than forty possible strategic choices. As part of this process, we matched up the specific choices with the differentiators described above. Here are some examples: But to apply these finite resources to all forty choicesâ€"or even all eight on this illustra- tive listâ€"would be ineffective, and perhaps impossible. What are the implications for! This is just a short list of issues that must be addressed when you pick a strategic differentiator. Each question begs more questions, and each answer requires a review of what resources you need to make the strategy succeed. Any diversion of resources away from this strategic choice into another choice would result in dilution. With dilution comes low return. With focus and commitment, your prac- tice can gain traction and momentum toward its vision. That is why so many advisers hedge their strategic betsâ€"again, the idea of diversification. But assuming you have evaluated your choices, looked at your existing client base, considered the competitors in that area, and conceived of a message that will resonate with the market, your probabilities of success are higher than if you had no conscious strategic positioning. With a long-term vision and a strategy to dif- ferentiate your firm in the market, you can confidently commitâ€"and recommitâ€"the resources required to win new clients and prospects while you continue to harvest income from existing clients. Any of these eight differentiators could drive your positioning. For each differentiator, an advisory firm may have multiple strategic choices. When individuals do direct mailings, conduct seminars, get a radio program, write articles, or commit to clients that they will personally be managing the relationship, their personal reputation becomes their strategic differentiator. Their strategic choices are the use of direct mail, seminars, radio programs, published articles, or personalized ser- vice. Eventually advisers realize the limitations of this approach, particularly the inability to grow without becoming overwhelmed. The most logical progression for most of these practices is into either a niche or a specialty approach. If you look at your current client list, could you build either a niche business or a specialty business from the foundation you have? Do you have a group of clients who either draw on a specific expertise or might represent a named market? Try the niche, or named-market differentiator, for starters: Is there a common thread that runs through the group? If you can combine a niche with a specialty as a unique proposi- tion, for example, you then can build your marketing and client- service efforts around these concepts. With a concentration of effort, you could then pursue a strategy to become dominant in that seg- ment of the market. Sources of referral would begin to recognize you as a specialist in that market and, as a result, put you at the top of the list when the need for expertise in your niche or specialty arises. Advisers tend

to avoid becoming so narrowly focused because they fear they will miss other opportunities. Why not make the call yourself? Caryn Spain introduced us to the critical concept of perspective. Perspective in this context refers to the points of view you should evaluate before deciding on your strategic positioning. For most advisory firms, there are four critical perspectives: Here are some exercises to consider: Write down the names of your top twenty to thirty clientsâ€"not just the most profitable ones but also those you enjoy most and who also happen to be among your top revenue generators. Then list the characteristics of these clients, such as age, occupation or preoccupation, geography, net worth and income, spe- cial interests and special issues, and how they became your client. See if you can identify a common thread in this client base. Your goal is to discover what you need to focus on to replicate this client base many times over. An effective means of doing this is to deploy the client- audit process described in chapter 3. What might the results tell you about the products and services you should be developing and offer- ing to serve their needs? Write down the names of five to ten of your top competitors. So by identifying the top firms serving clients in your market, you begin your competitive market research. Go to their websites; clip their ads; ask their clients and your prospects about them. Your objective is to discover what differentiates them and makes them strong, what compelling strengths do they offer as an advisory firm? What are they known for? Or should we try to find a way to differentiate from them? The mantra at industry conferences used to be that advisers should build their businesses around their core competencies. By assessing your strengths and weaknesses, you can identify the gaps in your practice-management and service offerings. Ask yourself the difficult questions about your depth, expertise, responsiveness, talent, and even your motivation and interests. Your personal definition of success. This exercise is an absolute must. Most of the well-regarded gurus on practice managementâ€" Dan Sullivan of Strategic Coach, and Bill Bachrach, for instanceâ€" preach this concept. What is personally fulfilling to you? Owning and operating a larger business? The ability to spend more time away from the busi- ness? What would the parent company define as success, and how would this influence your strategy? This busi- ness model has many interesting nuances because Boston law firms have the unique advantage of being able to offer trust services and manage money under a special state charter that does not require them to be registered. The creation of a registered investment- advisory firm is a form of brand extension that allows the law firm to expand its offering into wealth management and provide investment and planning advice to nontrust clients both within Massachusetts and in the other markets that this large law firm serves. One manage- ment challenge for NPFA is to be sure that its business strategy takes into account the expectations of its owners, the partners in the law firm. Beyond this, the lawyers must have clear parameters in their interaction with the trust side of the firm. When it was independent, its leaders could make decisions about investments in the business, client selection, expansion into markets, and what it regarded as acceptable returns to the shareholders. Now the firm must be responsive to the own- ers who acquired it. Although some may chafe under such expec- tations, in reality, these parameters give Sand Hill a discipline in management it may not have had while it was independently owned. As you examine your strategic choices from these four perspectives, your priorities begin to take shape. It will also help you to take some things off the table that have been a distraction, like the addition of new business lines, the addition of staff members who do not really serve your core clients, or even the acceptance of certain clients. Your strategy for your business, then, will be one that! But an approach that considers your choices from these four critical perspectives will allow you to have a four-dimensional view of what your business needs to look like in the future. Many of the same advisers, however, have not gotten past the thinking stage into the action stage. As a result, they have not transformed strategic choices into measurable results. But the desire to serve wealthier clients is not in itself a suf- ficient differentiator. This approach keeps clients from judging the firm solely on investment performance and underscores the value it delivers beyond invest- ment selection. To make this approach work, the firm needed to define the client-service experience, which included how it was going to report to the clients. The owners also had to make the internal commitment to applying this process to all of their clients to ensure consistency in their process and protocols. Individual jobs were redefined to support it. Technology was

designed to enhance it. The marketing came naturally, as an outgrowth of a clearly defined process, and the firm has become known and differentiated itself in its marketplace for this specialty. This is a good example of strategic positioning. Define Your Focus The process of considering all the possibilities of what you could possibly do with your business is both exhilarating and exhausting. After determining the priorities that will define your business in the future, you need to further refine your vision by answering these important questions: Which clients will we serve and why? Which products and services will we offer and why? How do we deliver those products and services to those clients in a way that makes us unique? Each of these questions requires an answer before you can pro- ceed. Where will you focus geographically? What size businesses will you target? On which industries will you focus? At what stage in their life cycle is it best to reach out to them? Family and money dynamics!

Chapter 2 : Paolo Brandimarte

Numerical Methods in Finance and Economics STATISTICS IN PRACTICE Advisory Editor Peter Bloomfield North Carolina State University, USA Founding Editor Vic Barnett Nottingham Trent University, UK.

Deterministic and Monte Carlo Methods 4. The recurring keyword, and the most important thing to me, was useful. The book had, and has, no ambition of being a very advanced research book. The basic motivation behind this second edition is the same behind the first one: See also the excerpt from the preface t o the first edition. However, there are a few new things here: The title mentions both Finance and Economics, rather than just Finance. To avoid any misunderstanding, it should be made quite clear that this is essentially a book for students and practitioners working in Finance. Nevertheless, it can be useful to Ph. In the last four years, I have been giving a course on numerical methods within a Ph. From the point of view of my students in such a course, the present book has many deficiencies: For instance, it does not cover ordinary differential equations and it does not deal with computing equilibria or rational expectations models; furthermore, practically all of the examples deal with option pricing or portfolio management. Nevertheless, given my experience, I believe that they can benefit from a more detailed and elementary treatment of the basics, supported by simple examples. Moreover, I believe that students in Economics should also get lK. The book has been reorganized in order to ease its use within standard courses on numerical methods for financial engineering. In the first edition, optimization applications were dealt with extensively, in chapters preceding those related to option pricing. This was a result of my personal background, which is mainly Computer Science and Operations Research, but it did not fit very well with the common use of a book on computational finance. In the present edition, advanced optimization applications are left to the last chapters, so they do not get into the way of most financial engineering students. The book consists of twelve chapters and three appendices. Chapter 2 is an overview of financial theory. It is aimed at students in Engineering, Mathematics, or Operations Research, who may be interested in the book, but have little or no financial background. Chapter 3 is devoted to the basics of classical numerical methods. In some sense, this is complementary to chapter 2 and it is aimed at people with a background in Economics, who typically are not exposed t o numerical analysis. To keep the book to a reasonable size, a few classical topics were omitted because of their limited role in the following chapters. In particular, I do not cover computation of eigenvalues and eigenvectors and ordinary differential equations. Chapter 4 is devoted to numerical integration, both by quadrature formulas and Monte Carlo methods. In the first edition, quadrature formulas were dealt with in the chapter on numerical analysis, and Monte Carlo was the subject of a separate chapter. I preferred giving a unified treatment of these two approaches, as this helps understanding their respective strengths and weaknesses, both for option pricing and scenario generation in stochastic optimization. Regarding Monte Carlo as a tool for integration rather than simulation is also helpful to properly frame the application of low-discrepancy sequences which is also known under the more appealing name of quasi-Monte Carlo simulation. There is some new material on Gaussian quadrature, an extensive treatment of variance reduction methods, and some application to vanilla options to illustrate simple but concrete applications immediately, leaving more complex cases to chapter 8. Chapter 5 deals with basic finite difference schemes for partial differential equations. In this simplified framework we may understand the difference between explicit and implicit methods, as well as the issues related to convergence and numerical stability. With respect to the first edition, I have added an outline of the Alternating Direction Implicit method to solve the two-dimensional heat equation, which is useful background for pricing multidimensional options. This chapter can be safely skipped by students interested in the option pricing applications described in chapters 7, 8, and 9. However, it may be useful to students in Economics. It is also necessary background for the relatively advanced optimization models and methods which are covered in chapters 10, 11, and Chapter 7 is a new chapter which is devoted to binomial and trinomial lattices, which were not treated extensively in the first edition. The main issues here are proper implementation and memory

management. We also deal briefly with the estimation of option sensitivities the Greeks by Monte Carlo methods. Emphasis is on European-style options; pricing American options by Monte Carlo methods is a more advanced topic which must be analyzed within an appropriate framework, which is done in chapter The main reason for including this chapter is pricing American options by Monte Carlo simulation, which was not covered in the first edition but is gaining more and more importance. I have decided to deal with this topic within an appropriate framework, which is dynamic stochastic optimization. In this chapter we just cover the essentials, which means discretetime and finite-horizon dynamic programs. Nevertheless, we try to offer a reasonably firm understanding of these topics, both because of their importance in Economics and because understanding dynamic programming is helpful in understanding stochastic programming with recourse, which is the subject of the next chapter. This is becoming a standard topic for people in Operations Research, whereas people in Economics are much more familiar with dynamic programming. There are good reasons for this state of the matter, but from a methodological point of view I believe that it is very xx PREFACE important to compare this approach with dynamic programming; from a practical point of view, stochastic programming has an interesting potential both for dynamic portfolio management and for option hedging in incomplete markets. Chapter 12 also deals with the relatively exotic topic of non-convex optimization. The main aim here is introducing mixed-integer programming, which can be used for portfolio management when practically relevant constraints call for the introduction of logical decision variables. We also deal, very shortly, with global optimization, i. We also outline heuristic principles such as local search and genetic algorithms. They are useful to integrate simulation and optimization and are often used in computational economics. The appendix on probability and statistics is just a refresher which is offered for the sake of convenience. The third appendix on AMPL is new, and it reflects the increased role of algebraic languages to describe complex optimization models. AMPL is a modeling system offering access to a wide array of optimization solvers. The choice of AMPL is just based on personal taste and the fact that a demo version is available on the web. In fact, GAMS is probably much more common for economic applications, but the concepts are actually the same. This appendix is only required for chapters 11 and Finally, there are many more pages in this second edition: Actually, I had a choice: While there is indeed some new material, I preferred the second option. Actually, the original plan of the book included two more chapters on interest-rate derivatives, as many readers complained about this lack in the first edition. While writing this increasingly long second edition, I switched to plan B, and interest-rate derivatives are just outlined in the second chapter to point out their peculiarities with respect to stock options. In fact, when planning this new edition, many reviewers warned that there was little hope to cover interest-rate derivatives thoroughly in a limited amount of pages. They require a deeper understanding of risk-neutral pricing, interest rate modeling, and market practice. I do believe that the many readers interested in this PREFACE xxi topic can use this book to build a solid basis in numerical methods, which is helpful to tackle the more advanced texts on interest-rate derivatives. Interest-rate derivatives are not the only significant omission. I could also mention implied lattices and financial econometrics. But since there are excellent books covering those topics and I see this one just as an entry point or a complement, I felt that it was more important to give a concrete understanding of the basics, including some less familiar topics. Furthermore, the heavy burden it places on the reader tends to overshadow the underlying concepts, which are the real subject of the book. Visual Basic would be a very convenient choice: It is widespread, and it does not require yet another license, since it is included in software tools that almost everyone has available. Such a choice would probably increase my royalties as well. To the very least, it can be considered a good language for fast prototyping. These considerations, as well as the introduction of new MATLAB toolboxes aimed a t financial applications, are the reasons why I am sticking to my original choice. I have received much appreciated feedback and encouragement from readers of the first edition of the book. Some pointed out typos, errors, and inaccuracies. As with the first edition, I plan to keep a web page containing the hopefully short list of errata and the hopefully long list of supplements, as well as the MATLAB code described in the book. My current URL is: An up-to-date link will be maintained both on

Wiley Web page: In some sense, crossroads may be disappointing, indeed. In this book, different paths cross, involving finance, numerical analysis, optimization theory, probability theory, Monte Carlo simulation, and partial differential equations. It is not a point of departure, because although the prerequisites are fairly low, some level of mathematical maturity on the part of the reader is assumed. It is not a point of arrival, as many relevant issues have been omitted, such as hedging exotic options and interest-rate derivatives. Hence, this is not a research monograph; it is a textbook for students. On the one hand, students in Economics usually have little background in numerical methods and lack the ability to translate algorithmic concepts into a working program; on the other hand, students in Engineering do not see the potential application of quantitative methods to finance clearly. Although there is an increasing literature on high-level mathematics applied to financial engineering, and a few books illustrating how cookbook recipes may be applied to a wide variety of problems through use of a spreadsheet, I believe there is some need for a n intermediate-level book, both interesting t o practitioners and suitable for self-study. I believe that students should: Acquire reasonably strong foundations in order to appreciate the issues behind the application of numerical methods Be able to translate and check ideas quickly in a computational environment Gain confidence in their ability to apply methods, even by carrying out the apparently pointless task of using relatively sophisticated tools to pricing a vanilla European option Be encouraged to pursue further study by tackling more advanced subjects, from both practical and theoretical perspectives The material covered in the book has been selected with these aims in mind. I am afraid the book will not please statisticians, as no econometric model is developed; however, there is a wide and excellent literature on those topics, and I tried to come up with a complementary text book. The text is interspersed with MATLAB snapshots and pieces of code, to make the material as lively as possible and of immediate use. MATLAB is a flexible high-level computing environment which allows us to implement nontrivial algorithms with a few lines of code. It has also been chosen because of its increasing potential for specific financial applications. It may be argued that the book is more successful at raising questions than at giving answers. This is a necessary evil, given the space available to cover such a wide array of topics. But if, after reading this book, students will want to read others, my job will have been accomplished. This was meant to be a crossroads, after all. Despite all of my effort, the book is likely to contain some errors and typos. I will maintain a list of errata, which will be updated, based on reader feedback. Any comment or suggestion on the book will also be appreciated.

Chapter 3 : Numerical Methods in Finance and Economics: A MATLAB-Based Introduction - PDF Free Dow

A state-of-the-art introduction to the powerful mathematical and statistical tools used in the field of finance The use of mathematical models and numerical techniques is a practice employed by a growing number of applied mathematicians working on applications in finance. Reflecting this development.

Chapter 4 : Numerical Methods in Finance and Economics : Paolo Brandimarte :

The correct application of numerical methods in finance is essential, as they directly relate to pricing methods, which in turn have a direct impact on the profit and loss distribution of a portfolio.