Book Review for *Mathematical Interest Theory* by J. Daniel and L. F. Vaaler

Reviewer: Susan Staples

Mathematical Interest Theory provides an introduction to interest theory, which deals with various loan and savings models, bonds and stocks, and interpretations of yield rates. The material is presented at a level sufficient to meet the requirements of Exam FM (Financial Mathematics) administered by the Society of Actuaries (SOA). Students pursuing an actuarial career as well as those seeking a mathematically based finances course stand to benefit from this informative, up-to-date, and, above all, skillfully written treatise.

For a number of years, only two books, *The Theory of Interest,* by S. G. Kellision (2nd Edition 1991) and *Mathematics of Investment and Credit,* (3rd Edition 2004) by S. A. Broverman, have official SOA sanction as texts for interest theory. Daniel and Vaaler retain much of the infrastructure of Kellison's text, and this review will mainly be concerned with a comparison between their book and Kellison's.

The mathematical presentation is superior in Daniel and Vaaler's book, with clearer motivation, a more conceptual approach, and more complete coverage. This is evident right from Chapter 1. In the introductory material there on the standard accumulation function $a(t)$ and discount function $v(t)$, *Mathematical Interest Theory* describes how to handle a general time interval $[t_1,t_2]$, highlights the related general formula in this case, and addresses common misconceptions associated with this setting. In contrast, Kellison only considers the use of these functions on the time frame $[0,t]$. Students using Kellison's book often express frustration that the text presents only specific cases of formulas, while the exercises call for nowhere mentioned generalized forms. As an example, the book presents the formula for the present value of a continuous annuity only in the setting where growth is governed by compound interest, yet the corresponding exercise (Chapter 4 #25) calls for the never discussed general integral formula. Daniel and Vaaler's text provides the full presentation of this material in Section 4.6. *Mathematical Interest Theory* also consistently offers a greater variety of worked examples in the text, and at a higher level. The value of clearer explanations and expanded example offerings cannot be underestimated for students of this subject.

In addition to increased clarity and completeness, Daniel and Vaaler's work also improves the readability and organization of the text. To this end, the authors place key formulas, facts and algorithms in boxes and new terms are printed in bold as they are introduced. Many of the examples include descriptive titles, for instance, "Finding $a(t)$ from δ_t" or "Finding a bond's yield rate," to help students skimming the book to quickly find relevant material. Furthermore, redesigned exercises feature more applied financial questions and a reduced emphasis on algebraic identity manipulations. Suggested writing activities for each chapter also introduce each homework set.

Mathematical Interest Theory further distinguishes itself from Kellison's text by incorporating present-day calculator usage and by presenting additional financial notions. Kellison still queries students regarding their "pocket calculator" with questions like "Does the calculator have exponential and logarithmic functions?" and the text remains reliant on the use of interest rate tables. In contrast, *Mathematical Interest Theory* presents a brief introduction to the BA-II Plus calculator in Chapter 0 and includes step-

by-step instruction throughout the book on relevant calculator algorithms. Students will duly appreciate this detailed practical information, since the FM exam allows and expects the utilization of such calculators. Special topics Daniel and Vaaler treat beyond the scope of Kellison's text include options, futures, swaps, and the no-arbitrage model. The authors present historical remarks on these financial concepts together with a discussion of how these topics relate to current news headlines.

Instructors and students of interest theory owe Daniel and Vaaler a debt of gratitude for their fine efforts. Assuming reason prevails, *Mathematical Interest Theory* will receive official SOA approval in a timely manner. Indeed, their investment of time and energy deserves no less interest.

Personal Information about the reviewer: Susan Staples, a native New Englander, is a complex analyst having received her PhD from University of Michigan in 1988. With her family she has explored over 50 Texas state parks as well as shared favorite New Hampshire destinations with her husband and native-born Texan children.
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