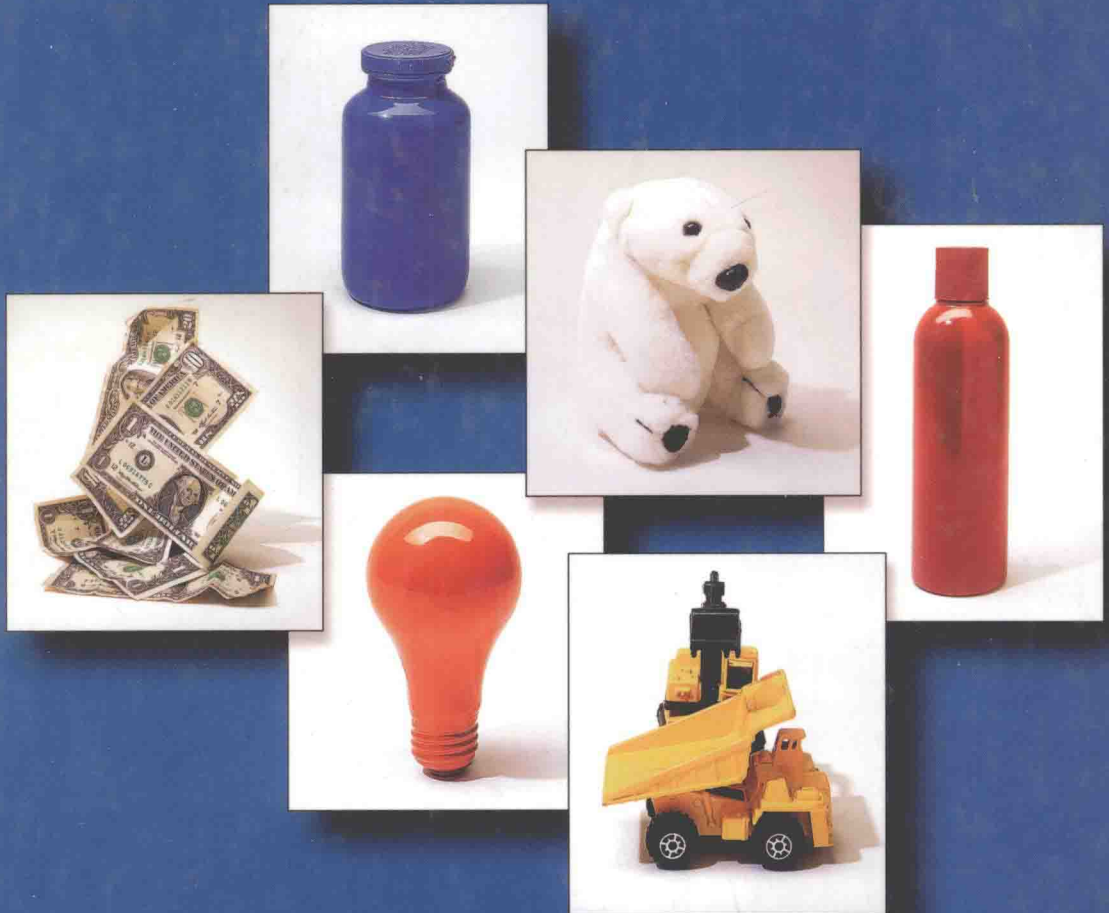


# Quantitative Business Analysis: Text and Cases



*SAMUEL E. BODILY / ROBERT L. CARRAWAY*  
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# QUANTITATIVE BUSINESS ANALYSIS

Text and Cases

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## QUANTITATIVE BUSINESS ANALYSIS: TEXT AND CASES

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To our families, for the patience and support they offer our professional lives, for the pleasure and purpose they add to the rest of our lives.

This book contains the text and cases forming the core of what has been and continues to be a highly successful MBA-level course in quantitative business analysis. The course represents an alternative to the traditional technique-driven, compartmentalized, quantitative methods course. Instead, it is a course that is

- decision and action oriented, not technique and numbers driven;
- integrated in both form and pedagogy within a business curriculum, not compartmentalized;
- managerially exciting, not methodologically dull.

It contains all of the usual topics of existing quantitative courses. Students develop the skill and the perspective to use quantitative techniques artfully to gain insight into the resolution of practical business problems. They not only master the specific techniques, but also develop the ability to garner information from commonly available sources and to recognize when a particular technique is appropriate, when additional analysis is called for, and when to end the analysis and make the decision. The most widely applicable methodologies of decision and risk analysis, probability and statistics, competitive analysis, and management science are thus integrated with personal judgment and intuition in a way that is meaningful to MBA and executive learners alike.

Two key components of the course are: (1) field-based (i.e., they actually happened) cases drawn from all functional areas of business, and (2) clearly-written, pragmatically-focused text explaining technical concepts and the strategic frameworks of quantitative analysis. The cases feature realistic, unstructured business settings wherein the methodologies of the course can be usefully and creatively applied to the decisions of the practicing manager. They thus provide vivid answers to the questions, Why is this stuff useful?

The text, which has its origin in “technical notes” used for years in the course, gives the background theory and technical details necessary to perform solid, insightful quantitative analysis of business issues. It thus provides answers to the questions, What do I do now?, which are triggered by the complex issues raised in the cases.

## The Cases

Just what is a case? The answer must recognize that cases play a variety of roles in a course. They may be focused on understanding core tools and concepts, on applying methodology appropriately, on defining the limits of good practice, or on inventing new methods and adapting existing ones for the problem at hand.

Some cases in this book are highly structured, focused on a single issue, with needed data laid out. These cases can be used to develop methodology; the cases are not intended merely to present institutional information and provide practical enrichment. Such a case is more than a problem or exercise; it requires some initial assumptions, which may lead to alternative answers, and the analysis must be explained by the student in the case context.

Some of the cases are appraisal cases, where the analysis is partly or wholly done. The student will evaluate the work, applying what has been learned about good practice, and perhaps push the analysis further.

Finally, and more commonly in this book, many cases are unstructured, with multiple issues and data challenges (missing or incomplete data, choices among data, or data preparation needed). In these cases, the student must diagnose the situation, perform the analysis, and explain the use of the analysis and its limits. The intent here is not to produce apprehension, but to show that skills can be confidently applied to realistic situations. Some of the student’s fear that may arise when using cases comes from concern that there is a single right answer and that the student will be unable to find it. If students can see that many reasonable assumptions may be made (some more reasonable than others, to be sure) and that they can do a variety of analyses (some more insightful than others), they will find their own way and complement their efforts with ideas that emerge in class.

A common theme cutting across all cases, and indeed across the entire course, is the need to make real *decisions*. The cases thus avoid being academic exercises, but assume the vitality of business itself. Thus, *decision analysis* becomes an accurate descriptor of all the cases in this book and is a critical framework from which this new type of quantitative methods course hangs.

What makes a strong case? A leading characteristic is the aforementioned *decision orientation*. *Relevance* is key; students recognize that the resolution of the situation matters to them. A strong case demonstrates a *need to know* something not currently known. It involves the *practice of skills*, including new and recently acquired skills. And it requires some *internaliza-*

*tion* of concepts and the *articulation* of the reasoning process. Students will see that they are involved in situations that can be key to their careers.

In addition to these characteristics, these cases provide integration with other courses. Issues come up from other disciplines that provide bridges to other courses. If these issues are not immediately put aside in class and built upon, the course is not pigeon holed: “That’s *quant*, not management, and therefore not for me.” These cases provide many opportunities for joint class sessions, where the regular instructor can be joined by a professor of accounting, ethics, economics, finance, marketing, operations, or human resources to bring together two streams of concepts and to solidify the role of quantitative analysis in each of the business functions.

### The Text

The course’s dedication to student-centered learning places both responsibility and ownership of the learning process squarely on the shoulders of the student. The cases force the student to confront tricky issues and complex situations. The text provides a readily-available source of guidance on how to structure and resolve the issues and situations. The general flow of learning embraced by the course and supported by this book is then: analyze a case and draw on the text as the need arises. The cases challenge; the text prescribes how to address those challenges.

The text is organized as follows: Chapter 1 is an overview of the process of quantitative business analysis, using a simple but realistic example. The four major components of good analysis are introduced: *alternatives*, *assumptions*, *assessment*, and *performance*. Each of these components is the topic of one of the following four chapters, which together with Chapter 1 comprise Part 1, the core of the text.

The remaining chapters build on the four basic components of analysis, each representing a more advanced treatment of one (or more) of the components. Chapter 6 addresses the issue of how to restructure *assumptions* in a way that helps mitigate risk. Chapters 7–10 address complications arising from how to evaluate *performance*. Chapters 11–14 address issues of how to calibrate *assessments* of uncertainty in key assumptions. Chapters 15–17 address complications associated with having a large number of *alternatives* to consider (Chapter 15 also addresses complications associated with how performance is assessed, when assumptions are difficult to structure).

### Concluding remarks

The cases are organized alphabetically, not according to particular methodological approach. This organization allows flexibility in the use of the cases and preserves student responsibility to determine what should be done with each case. Of course, the cases are not to be taught in alphabetical order. The *Instructor’s Manual* describes the typical use of each case, refers to the appropriate text for each case, and provides sample course outlines. (Many of

the cases have also been used in executive education in short, non-degree programs. They would fit nicely in courses more narrowly focused in decision analysis, management science, or forecasting and regression. For short courses, any subset of these cases can be selected for custom publishing by Irwin/McGraw-Hill.)

The course based on this book assumes virtually no prerequisites. Although calculus is not needed, some algebra is assumed, but rarely getting as far, for example, as solving two equations in two unknowns. Although no prior probability or statistics is presumed, some familiarity can help the student. The principal requirements are clear thinking, the ability to conceptualize, and the ability to cut to the core of an issue.

Even though this book of texts and cases is software neutral, the electronic spreadsheet is assumed to be a fundamental tool available to the student. The spreadsheet is a very helpful way for instructors to provide the right amount of help to students. Spreadsheets containing data from case exhibits and, sometimes, the setup for analysis are available with the *Instructor's Manual*. They may also be downloaded from the QBA home page accessible through the Darden School's home page (<http://www.darden.virginia.edu/>) on the Internet. It will be necessary to use @Risk or Crystal Ball, and the Solver within Excel or What'sBest! to do some of the cases. Other software tools, such as TreePlan Precision Tree, or DPL, may be useful to students in the course but are not necessary.

A complete instructor's manual, with sample course outlines and an extensive teaching note for each case, is available from Irwin/McGraw-Hill. To the instructor's advantage the authors have put as much effort and time into teaching notes as the cases. Each note is the product of many teaching meetings and discussions of pedagogy.

The production of this book reaffirms our commitment to what we have been doing in our quantitative analysis course for many years. We are glad to see that others in our discipline are also interested in this approach, as evidenced by many sessions on the topic at the meetings of such professional societies as the Institute for Operations Research and Management Sciences, and the Decision Sciences Institute. We welcome the interest and hope that our experience may be found useful elsewhere.

Please provide feedback (especially about successes and failures with these cases), new case ideas, and innovative ways of teaching. Write to any of the authors at Darden Graduate Business School, University of Virginia, Box 6550, Charlottesville, VA 22906-6550, or send e-mail.

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# 1 PROACTIVE DECISION MAKING

A couple of weeks ago a real estate broker with whom you had previously worked approached you, inquiring of your interest in a 1,100-acre tract of gently rolling woodlands on the perimeter of the Washington, D.C., metropolitan area. The site was ideal for the development of a mid- to upscale residential community, and the timing of the query was ideal. Your firm, which specializes in residential land development, was just completing a moderately sized project and was seeking a new venture to take its place, particularly a project that would enhance the firm's reputation.

Preliminary investigations of Potomac Manors, as the site had become known within the firm, were encouraging. The site was zoned R3 for low-density residential housing. The zoning stipulated a minimum lot size of three acres and spelled out, among other things, specific requirements for lot dimensions, roads, septic systems, and public spaces. Your design team had arrived at a preliminary plan that carved out 300 three-acre lots, each with at least one very attractive marketing feature. The 200 acres that were not being used for lots were devoted to roads and public space. It was estimated that the lots would sell for an average price of \$150,000. It was also estimated that the development and selling costs would be \$8,000 per acre and miscellaneous expenses, such as permits and legal fees, would total \$400,000.

The property was being offered at \$23,000 per acre. The broker had allowed you two weeks to explore the opportunity and was expecting a response within the next few days. Is Potomac Manors a profitable project? Should you put forward the required \$250,000 in earnest money to secure the property or let it go back on the open market?



The Potomac Manors decision is stereotypical of the decisions managers must make. There are alternatives (to buy the property or not); there is a performance measure (profits); and there are assumptions (the linkages among the selling price, the costs, and profits; the estimation of the average selling price and the costs). In addition, the decision must be made in a timely fashion and cannot be procrastinated, for as the maxim says, “Not to decide is to decide.” This chapter will explore the various aspects of situations that make proactive decision making challenging and that make analysis valuable.

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## Routine Decisions

Many decisions in our lives are routine—which route to take from home to the office, where to invest excess money in the short term, what foods to buy at the supermarket. In each of these instances, we may quickly consider several alternatives, evaluate a measure of performance for each alternative, and make a choice. All of this is done in our head in a split second without an explicit consideration of our assumptions. Even more simply, we may apply a well-established rule of thumb or just do what we have always done, without even thinking about alternatives. Generally we are comfortable with such simplified decision processes because the consequences of the decisions are often not very significant and because over time we have implicitly considered (or experienced) the linkages between the alternatives and the performance measure and we do not feel the need to explicitly acknowledge them.

Sometimes, however, even routine decisions need more careful consideration. Changes in the situation can invalidate the tried-and-true decision rules. A new stoplight may be installed or a construction project begun on the route from home to office; the bank may impose minimum balance requirements for checking accounts; the supermarket may buy its fresh produce from a different supplier. These changes in the environment disrupt the assumptions that we have made regarding the relationship between alternative and performance. The change may be manifest in the structure of the linkages (the presence of delays due to the stoplight) and in the assessment of a key parameter (the distance from home to office because of the construction detour). As a result of such changes in assumptions, a new alternative may become more attractive and the old alternative may result in a surprise, if it were implemented. **Even in routine situations, there is a need to be aware of the assumptions that are being made and the degree of congruity between those assumptions and reality.** Small amounts of dissonance can require a review of the routine decision-making process.

Even though it is unlikely that anyone would treat the Potomac Manors project as if it were a routine decision, a simple appraisal of the profit of the project, using the estimates provided by the design team, might form the basis of the project's financial evaluation. A relevant calculation might simply be