

# BUSINESS CASES — *in* — STATISTICAL DECISION MAKING

*Computer  
Based  
Applications*

LAWRENCE H. PETERS • J. BRIAN GRAY

# ***Business Cases in Statistical Decision Making***

## ***Computer Based Applications***

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# ***Preface***

This book is dedicated to students. Our experiences with them helped us understand that a course in business statistics needs to be more than formulas and problem sets. They clarified our need to demonstrate that a course in statistics is a vital part of the business curriculum. They helped us see how we could translate their needs into a teaching methodology that meets academic goals and to do so in a way that is both interesting and challenging, and which clarifies to students that statistical reasoning is a powerful business tool. We thank them for opening our minds to creating cases where the goal is not to get the right statistical result, but to make good business decisions.

We know from experience that the “hands-on” case approach helps to insure that students not only learn statistics, but retain key ideas and actually recognize how and when to apply statistical reasoning in solving problems. Some of the cases have been used successfully during mass lectures to 300 undergraduate business students to motivate discussions about problems in real business settings that require statistical analysis as part of the decision-making process. Most of the cases were assigned as group projects to a hardworking class of MBA students during the Fall 1992 Semester at the University of Alabama. Their high level of interest and involvement in solving the cases, as well as the outstanding analyses and well-written reports that they produced, convinced us that the case approach can be extremely valuable in teaching business statistics. In addition to learning a statistical computing package, these MBA students gained a great deal of experience with other computer tools (such as spreadsheets, presentation

graphics packages, and color printers) and small group dynamics. We owe these students a debt of gratitude for their useful feedback.

Our thanks go to Karen Zikos, our sales representative at Prentice Hall, for listening to our ideas, and to Valerie Ashton, our editor at Prentice Hall, for her willingness to give us the opportunity to try our ideas about using cases in business statistics courses. We are grateful for Valerie's faith in our methodology and in our ability to produce it in book form. Special thanks to Beth Solt of the Author Assistance Program at Minitab, Inc. for providing us with the Minitab Statistical Software package which was used to produce the computer output shown in our *Instructor's Guide*. We also want to thank Todd Baumgartner and Eddie Erdmann, our student assistants, for their help on this project. Their feedback from trying out the cases on various statistical software packages is greatly appreciated. We also would like to thank our families, especially Jennifer and Anne, for their support and encouragement as we worked on this labor of love.

Lawrence H. Peters

J. Brian Gray

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# ***Introduction***

All business statistics courses require students to work on “problem sets.” The goal of each problem is to have students perform a statistical computation or to apply a prescribed statistical tool to a small set of data in order to come up with “the right answer.” Such problems may or may not be given a managerial or business context which generates the numerical data students must analyze. Even in those instances in which problem sets are described in a business context, the goal, nonetheless, is to have students apply specified statistical procedures in order to come up with the correct numerical answer or statistical summary.

We believe that an emphasis on “getting the right answer” falls short of the important contribution that statistical knowledge can provide. When we ask our students to get the right answer, they fail to understand why and how statistical knowledge can be useful. They fail to understand how this knowledge can help them make better decisions in real business situations. Failing to clarify the value of statistical knowledge, therefore, can leave the student questioning the relevance of their course work in this area.

*Business Cases in Statistical Decision Making* was developed specifically in response to this issue. It addresses a current need discussed repeatedly over the past several years by leading business statistics educators at the “Making Statistics More Effective in Schools of Business” national conferences held annually since 1986. (See Easton, G. E., Roberts, H. V., and Tiao, G. C. (1988), “Making Statistics More Effective in Schools of Business,” *Journal of Business and Economic Statistics*, 6, 247-260 for a report from the first conference.) One consistently mentioned



and strongly endorsed idea resulting from these conferences is the need to engage the student's interest through the use of real business applications. These educators underscored the importance of showing students the range of real-world problems in which statistical understanding is valuable — in short, why and how statistical knowledge can be useful. Our overriding goal in preparing this case book was to help students understand how statistics can be useful for solving commonly observed managerial and business problems, thus helping students appreciate why course work in business statistics is relevant to their future professional business careers.

In contrast to “problem sets,” like those typically found at the end of each chapter in a statistics book, this discussion implies that the goal of a statistical analysis is not just to get the right answer. Rather, the goal is to correctly understand a business situation, solve a real problem, and make a good decision. To this end, students will be required to identify relevant variables, choose an appropriate analysis plan, produce correct results (remember, this is the sole goal of the typical problem set), interpret their findings and make recommendations regarding the managerial/business issues presented to them. Obviously, getting the right answer is necessary in order to meet these business objectives. But, the emphasis is on the business objective and, as such, it is hoped that students will begin to see the relevance of their study of business statistics.

In addition, these statistics educators pointed to the case method as the ideal way to provide college students with such an understanding. There would appear to be endless numbers of important issues, problems and decisions in business situations that are best resolved by appropriately analyzing and interpreting data. These issues, problems and decisions are, in turn, best taught by presenting students with a description of a business situation and then involving them in the thought process that produces an educated and sound business decision. The case method is ideally suited for such problems.

In all areas of business, many key issues, problems and decisions involve the identification and examination of additional information (*i.e.*, data), beyond that found in the written case. Issues related to choosing the most appropriate channels for advertising, for choosing the least expensive but most effective business solution, for selecting personnel for an important job, for identifying key new business strategies, for deciding how

scarce resources are best spent, and so forth all involve identifying and collecting appropriate information and then using that information properly in order to arrive at an effective solution.

We designed this case book to give students an opportunity to work on a set of representative real-world business problems that require the identification and appropriate use of additional information. These cases specifically require students to “go to the data” as a basis for defining the problem, developing alternative courses of action and/or suggesting meaningful solutions. We think that such a process not only makes the cases more “life-like,” but, in addition, teaches students several additional important lessons along the way. For example:

1. Students should begin to appreciate (maybe for the first time) how simple statistical procedures can be applied to solve “life-like” problems. There is a reason for having to take statistics courses — appropriately used and interpreted, statistical analysis increases our ability to make and implement better managerial and business decisions. Statistical reasoning is one of the most important tools that a business person can have. It’s better to learn that lesson now, before being faced with that first real decision to be made and ending up falling back on intuition when a good analytical solution is possible.
2. Students should begin to appreciate the importance of keeping relevant information for making business decisions and, if need be, as a basis for defending those decisions to others (*e.g.*, their supervisors, their customers, governmental agencies, or courts).
3. As a more specific example of the second point, students will have the opportunity to work with, and see the value of, computerized data files. Such experience, even in the limited context provided by this case book, is important given the growing recognition for the value of computerized information systems in modern organizations.
4. Students will receive hands-on experience using the computer as a tool for solving business problems. Without argument, such experience is regarded as a valuable part of the modern business curriculum. Learning how to use the computer as a tool for decision making and problem solving, as opposed to learning how to

program, requires practice — practice not aimed at making the computer do things, but practice aimed at having the computer help students think through problems and make better decisions.

5. Students will receive the benefit of learning how to use a statistical software package (chosen by their instructor). Becoming familiar with a business statistical software package is the first step in making the computer fulfill its promise of helping to make better managerial and business decisions. Basic familiarity with software, regardless of the particular program used, will increase the comfort level of students for working with statistical packages in general, and hopefully pique students' interest in their use in the future.

Combined with learning how to “think statistically” and seeing how statistics can be an important business tool, the use of PC's and statistical software will start students on the way to developing relevant computer literacy skills that can be applied in many work settings. Use of the present case book, thus, has the ambitious goal of helping to provide students with a working knowledge of statistics — of both tools for thinking about business problems and of using the computer for applying that knowledge to solve everyday business problems. We will put students “behind the desk” in a life-like business setting, present them with “real-world” issues, and give them a chance to put their understanding to work.

## CASES

We have chosen a number of specific “data-relevant” business issues around which to develop computer-based cases. They were chosen with three goals in mind.

1. We have chosen case topics to reflect a wide range of scenarios over several functional business areas — management, marketing, advertising, production and operations management, human resource strategy and the like. While written to reflect a wide range of functional business areas, we have attempted to write cases that do not require a great deal of prior functional expertise in those areas. More importantly, we have attempted to choose topics that typify the real-world problems that are faced by real-world managers

all the time — correctly interpreting data, choosing between costly alternatives, determining the quantity and price of goods to go into a business proposal, choosing a new strategy from data that reflect both positive and negative consequences, and so forth. We wanted to represent the kind of issues, problems and decisions that students can be expected to be involved with — business problems that require people to use good judgment and make a good decision.

2. We wanted to insure that the cases, as a set, sample a broad range of statistical procedures. Most of these statistical procedures should be covered in entry-level business statistics classes. Instructors should have no trouble identifying cases that match the specific topic coverage of their course using the cross-tabulation of cases with statistical methods included in the Instructor's Guide. Students will note that data from several of these cases can be analyzed using more than one statistical procedure — for example, one could analyze some data sets using analysis of variance or by using regression analysis. In all such instances, even though the analysis might be different, be assured that the “correct decision” is the same!
3. We wanted to emphasize that many business decisions do not require a Ph. D. in statistics in order to arrive at a good business solution. Many times, all that's needed is for someone to “statistically summarize” the data in a simple, meaningful manner. Thus, you'll see several cases that are focused specifically on descriptive summarizations of data sets, portraying those statistical summaries graphically (*e.g.*, using histograms or boxplots), and accurately interpreting these results and displays. It is our belief that many of the “data-relevant” problems students will face in the business world will require little more than a strong background in descriptive statistics. Helping students be good at what's most commonly required seems like a good investment in their development! In other instances, where a more advanced statistical understanding is required, basic statistical summaries and graphs are still very useful and will help students make sense of the results of more complex statistical analyses.

## COMPUTER REQUIREMENTS

Students can expect their instructor to choose cases that reflect the material being covered in class and in their text book. Most college business statistics courses require students to use a microcomputer or mainframe statistical software package — clearly that will be true if this case book is assigned. Instructors will provide needed help in using that software package. In the event that a mainframe computer package is used, it may be desirable for the instructor to upload a copy of the data files to the mainframe for easier student access. Likewise, in a networked microcomputer environment, it may be advantageous to make a copy of the data files available on the network.

The data files on the Data Disk for this case book were designed specifically to work with most popular business statistical software packages. (These cases could also be analyzed with a spreadsheet package such as Excel which has some statistical capabilities.) Each data set includes only numerical data, in ASCII (text) format. Students who encounter any problems with reading the data into their software package should see their instructor. We have tried the data files with a number of popular statistics packages (including Minitab, Systat, and Execustat) and have noted any limitations, as well as problems and their solutions, in the Instructor's Guide.

A complete description of each data set is given in the Data Description section of each case. Names and definitions for each variable (*i.e.*, for each column of data) are provided.

Finally, in some instances, cases require students to prepare graphs and/or tables describing the results. If the chosen statistical software enables students to do so, they should use it. Otherwise, students can summarize the data statistically using their statistical software and then prepare graphs and/or tables by hand or use any of the common graphics packages (*e.g.*, Harvard Graphics) that may be available to students.

## **IN CONCLUSION, ...**

We believe that both students and instructors will find these business statistics cases to be an interesting and valuable addition to their business statistics course. Our experiences with this approach have been extremely rewarding. We hope yours are, too.



# ***Amtech, Inc.***

Amtech, Inc. is in the business of selling sophisticated computerized point-of-sale cash registers, cash register printers, computer-printer software and interfaces, printer supplies, and hands-on training to commercial accounts. Amtech's owners chose their market niche to be smaller companies that appear ready for a large scale expansion of their business. Smaller companies need, and are willing to pay for, the personal attention and customization of the hardware, software and training that Amtech offers. Once committed to a particular configuration of hardware and software, these clients seldom reconsider their alternatives when expansion occurs. This is a high margin business and no client is considered too small to deserve attention. Small clients often blossom into larger businesses, and their growth typically signals the expansion of Amtech's sales as well.

The typical marketing plan is centered on identifying customer needs and then developing a plan to satisfy those needs. Amtech's first contact with potential clients demonstrates their cash registers' capabilities and the extent to which software can be customized to meet a particular client's needs. Amtech account executives emphasize the importance of customizing both their software and training to meet clients' needs as the features that distinguish Amtech from its competitors. They then request an opportunity to distribute a questionnaire to key personnel in the client organization in order to develop a customization plan that "fits" the client's needs and to make a presentation to the client based on their findings.

The questionnaire asks participants about important business issues needed to customize the software, and the backgrounds of those persons



who will use the high tech equipment in order to customize the training program. Part I of the questionnaire deals with technical business issues that reflect the nature of the client's business and business plan. For example, information is collected regarding their accounting system, the inventory monitoring, control and reordering functions, the extent to which the client wishes to create a data base of client purchases as a marketing tool, and the selection and printing of in-store coupons on the back of the sales receipt designed to elicit future purchases that complement current purchases. These business functions, among others, are discussed with the management of the organization and go into designing the software to meet client's business needs. All senior level management and headquarters' professional staff (*e.g.*, accountants) complete this part of the questionnaire.

The second part of the questionnaire is aimed at understanding the backgrounds of those persons who will use the equipment. This is important information, since the training program will have to be designed to meet the needs of those persons who will complete the questionnaire. If the typical employee has limited background in the use of computers, then a longer, more costly training program will need to be designed. On the other hand, if their background with computers is substantial, then a mere orientation to the use of this equipment might suffice. This is an important consideration from more than the training costs involved, since a great deal of evidence that exists suggests that poorly trained employees either become frustrated and quit, or if they stay, never help the company reap the full benefit of the technology it has purchased.

Wendy Cambridge began her career at Amtech less than two years ago and has risen quickly from marketing assistant to assistant account manager for some of Amtech's larger clients. She was recently given her first opportunity to co-lead a sales team for a new potential client, Grass-Roots, Inc.

Grass-Roots fits the profile of an ideal customer. They are setting up a small chain of plant and garden stores in a large Southern city and have plans to expand their company to ten additional cities over the next five years. Each store location will be surveyed to insure high levels of customer service. Operations staff will work individually with customers, from when they first walk in the store through check-out.