



教育部高校工商管理类教学指导委员会双语教学推荐教材

工商管理经典教材·核心课系列 BUSINESS ADMINISTRATION CLASSICS

# 商务统计学

## 英文版

诺琳・R・夏普 (1

普 (Norean R. Sharpe)

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保罗·F·威利曼 (

(Paul F. Velleman)

## BUSINESS STATISTICS: A FIRST COURSE



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随着我国加入 WTO,越来越多的国内企业参与到国际竞争中来,用国际上通用的语言思考、工作、交流的能力也越来越受到重视。这样一种能力也成为我国各类人才参与竞争的一种有效工具。国家教育机构、各类院校以及一些主要的教材出版单位一直在思考,如何顺应这一发展潮流,推动各层次人员通过学习来获取这种能力。双语教学就是这种背景下的一种尝试。

双语教学在我国主要指汉语和国际通用的英语教学。事实上,双语教学在我国教育界已经不是一个陌生的词汇了,以双语教学为主的科研课题也已列入国家"十五"规划的重点课题。但从另一方面来看,双语教学从其诞生的那天起就被包围在人们的赞成与反对声中。如今,依然是有人赞成有人反对,但不论是赞成居多还是反对占上,双语教学的规模和影响都在原有的基础上不断扩大,且呈大发展之势。一些率先进行双语教学的院校在实践中积累了经验,不断加以改进;一些待进入者也在模仿中学习,并静待时机成熟时加入这一行列。由于我国长期缺乏讲第二语言(包括英语)的环境,开展双语教学面临特殊的困难,因此,选用合适的教材就成为双语教学成功与否的一个重要问题。我们认为,双语教学从一开始就应该使用原版的各类学科的教材,而不是由本土教师自编的教材,从而可以避免中国式英语问题,保证语言的原汁原味。各院校除应执行国家颁布的教学大纲和课程标准外,还应根据双语教学的特点和需要,适当调整教学课时的设置、合理选择优秀的、合适的双语教材。

顺应这样一种大的教育发展趋势,中国人民大学出版社同众多国际知名的大出版公司、如麦格劳一希尔出版公司、培生教育出版公司等合作,面向大学本科生层次,遴选了一批国外最优秀的管理类原版教材,涉及专业基础课,人力资源管理、市场营销及国际化管理等专业方向课,并广泛听取有着丰富的双语一线教学经验的教师的建议和意见,对原版教材进行了适当的改编,删减了一些不适合我国国情和不适合教学的内容;另一方面,根据教育部对双语教学教材篇幅合理、定价低的要求,我们更是努力区别于目前市场上形形色色的各类英文版、英文影印版的大部头,将目标受众锁定在大学本科生层次。本套教材尤其突出了以下一些特点:

●保持英文原版教材的特色。本套双语教材根据国内教学实际需要,对原书进行了一定的改编,主要是删减了一些不适合教学以及不符合我国国情的内容,但在体系结构和内容特色方面都保持了原版教材的风貌。专家们的认真改编和审定,使本套教材既保持了学术上的完整性,又贴近中国实际;既方便教师教学,又方便学生理解和掌握。

- 突出管理类专业教材的实用性。本套教材既强调学术的基础性,又兼顾应用的广泛性; 既侧重让学生掌握基本的理论知识、专业术语和专业表达方式,又考虑到教材和管理实践的紧密结合,有助于学生形成专业的思维能力,培养实际的管理技能。
- ●体系经过精心组织。本套教材在体系架构上充分考虑到当前我国在本科教育阶段推广双语教学的进度安排,首先针对那些课程内容国际化程度较高的学科进行双语教材开发,在其专业模块内精心选择各专业教材。这种安排既有利于我国教师摸索双语教学的经验,使得双语教学贴近现实教学的需要;也有利于我们收集关于双语教学教材的建议,更好地推出后续的双语教材及教辅材料。
- ●篇幅合理,价格相对较低。为适应国内双语教学内容和课时上的实际需要, 本套教材进行了一定的删减和改编,使总体篇幅更为合理;而采取低定价,则充 分考虑到了学生实际的购买能力,从而使本套教材得以真正走近广大读者。
- ●提供强大的教学支持。依托国际大出版公司的力量,本套教材为教师提供 了配套的教辅材料,如教师手册、PowerPoint 讲义、试题库等,并配有内容极为 丰富的网络资源,从而使教学更为便利。

本套教材是在双语教学教材出版方面的一种尝试。我们在选书、改编及出版的过程中得到了国内许多高校的专家、教师的支持和指导,在此深表谢意。同时,为使我们后续推出的教材更适于教学,我们也真诚地期待广大读者提出宝贵的意见和建议。需要说明的是,尽管我们在改编的过程中已加以注意,但由于各教材的作者所处的政治、经济和文化背景不同,书中内容仍可能有不妥之处,望读者在阅读时注意比较和甄别。

**徐二明** 中国人民大学商学院

## **Preface**



e set out to write a book for business students that answers the simple question: "How can I make better decisions?" As entrepreneurs and consultants, we know that Statistics is essential to survive and thrive in today's competitive environment. As educators, we've seen a disconnect between the way Statistics is taught to business students and the way it is used in making

business decisions. In *Business Statistics: A First Course*, we try to close the gap between theory and practice by presenting statistical methods so they are both relevant and interesting to students.

The data that inform a business decision have a story to tell, and the role of Statistics is to help us hear that story clearly. Like other textbooks, *Business Statistics: A First Course* teaches how to select and perform inferential tests and highlights definitions and formulas. But, unlike other textbooks, *Business Statistics: A First Course* also teaches the "why" and insists that results be reported in the context of business decisions. Students will come away knowing how to use statistics to make better business decisions and how to effectively communicate both their analysis and recommendations.

Business Statistics: A First Course is written with the understanding that today Statistics is practiced with technology. This insight informs everything from our choice of forms for equations to our extensive use of real data. But more important, understanding the value of technology allows us to focus on teaching statistical thinking rather than calculation. The questions that motivate each of our hundreds of examples are not "how do you find the answer?" but "how do you think about the answer, and how does it help you make a better decision?"

Our focus on statistical thinking ties the chapters of the book together. An introductory Business Statistics course covers an overwhelming number of new terms, concepts, and methods. But they have a central core: how we can understand more about the world and make better decisions by understanding what the data tell us. From this perspective, students can see that the many ways to draw inferences from data are several applications of the same core concepts.

#### Our Goal: Read This Book!

The best textbook in the world is of little value if students don't read it. Here are some of the ways we made *Business Statistics: A First Course* more approachable:

- **Readability.** You'll see immediately that this book doesn't read like other Statistics texts. We strive for a conversational, approachable style, and we introduce anecdotes to maintain interest. In class tests, instructors report their amazement that students are voluntarily reading ahead of their assignments. Students write to tell us (to their amazement) that they actually enjoyed the book.
- Focus on assumptions and conditions. More than any other textbook, Business Statistics: A First Course emphasizes the need to verify assumptions to use statistical procedures. We reiterate this focus throughout the examples and exercises. We make every effort to provide students with templates that reinforce the practice of checking these assumptions and conditions, rather than rushing through the computations of a real-life problem.
- Emphasis on graphing and exploring data. Our consistent emphasis on the importance of displaying data is evident through all chapters. Examples always include data displays and often illustrate the value of examining data visually, and the Exercises reinforce this. When we graph data, we are able to see structures, or patterns, that we can't see otherwise. These patterns often raise new questions and guide our statistical analysis and case analysis process. Emphasizing graphics throughout the book helps students see that the structures we look for in graphs help illuminate sophisticated concepts. In addition, we also show some data as Excel® screenshots, so students can become familiar with the Excel environment.
- Consistency. We work hard to avoid the "do as we say, not as we do" trap. Having taught the importance of plotting data and checking assumptions and conditions, we are careful to model that behavior throughout the book. (Check the Exercises in the chapter on multiple regression and you'll find us still requiring and demonstrating the plots and checks that were introduced in the early chapters.) This consistency helps reinforce these fundamental principles.
- The need to read. Students who plan just to skim the book may find that important concepts, definitions, and sample solutions are not always set aside in boxes. This book needs to be read, so we've tried to make the reading experience enjoyable.

### Coverage

The topics covered in a Business Statistics course are generally consistent and mandated by our students' needs in their studies and in their future professions. But the *order* of these topics and the relative emphasis given to each is not well established. In *Business Statistics: A First Course*, you may encounter some topics sooner or later than you expected. Although we have written many chapters specifically so they can be taught in a different order, we urge you to consider the order we have chosen.

We've been guided in the order of topics by the fundamental principle that this should be a coherent course in which concepts and methods fit together to give students a new understanding of how reasoning with data can uncover new and important truths. We have tried to ensure that each new topic fits into the growing structure of understanding that we hope students will build. For example, we teach inference concepts with proportions first and then with means. Students have a wider experience with proportions, seeing them in polls and advertising. And by starting with proportions, we can teach inference with the Normal model and then introduce inference for means with the Student's t distribution.

We introduce the concepts of association, correlation, and regression early in *Business Statistics: A First Course.* Our experience in the classroom shows that introducing students to these fundamental ideas early motivates them at the beginning of the course. Later in the semester, when we discuss inference, students recall what they have learned and find it natural and relatively easy to build on the fundamental concepts they experienced by exploring data with these methods. In an introductory course, the relative emphasis placed on topics requires planning by the instructor. Introductory Business Statistics courses often have limited time, so it can be hard to get to the important topics of multiple regression and model building with enough time to treat them thoroughly. We've been guided in our choice of what to emphasize by the GAISE (Guidelines for Assessment and Instruction in Statistics Education) Report, which resulted from extensive experience in how students best learn Statistics. Those recommendations, now officially adopted and recommended by the American Statistical Association, urge (among other detailed suggestions) that Statistics education should:

- 1. Emphasize statistical literacy and develop statistical thinking;
- 2. Use real data;
- 3. Stress conceptual understanding rather than mere knowledge of procedures;
- 4. Foster active learning;
- 5. Use technology for developing conceptual understanding and analyzing data; and
- 6. Make assessment a part of the learning process.

In this sense, this book is thoroughly modern. But to be effective, a course must fit comfortably with the instructor's preferences. There are several equally effective pathways through this material depending on the emphasis a particular instructor wants to make. We describe some alternative orders that also work comfortably with these materials.

Flexible Syllabus. Business Statistics: A First Course follows the GAISE Guidelines of the American Statistical Association. The committee that developed these guidelines was made up of innovative educators in Statistics education, including one of the authors of this textbook (Velleman). Those guidelines call for presenting students with real data early and throughout the course and emphasizing real-world decisions and understanding as the final step of any statistical analysis. Following that advice, we have placed an introductory (exploratory, non-inference) section on regression early in the text (Chapter 6).

However, we are acutely aware of the challenge that Statistics instructors face in covering essential material in a limited period of time. For that reason we offer suggested modifications that may better fit your teaching style and requirements:

- Chapter 3 (Surveys and Sampling) can be taught just before Chapter 7 (Randomness and Probability), where it would provide motivation for randomness.
- Chapter 6 (Correlation and Linear Regression [without inference]) can be taught just before Chapter 14 (Inference for Regression), where it would form a larger lesson on regression analysis through inference and can be followed immediately by Chapter 15's discussion of multiple regression.
- Chapter 8 (Random Variables and Probability Models) can be postponed until any point later in the course, or it can be omitted entirely for a more data-focused course.
- We introduce inference with proportions. We find this works better for students (who know about polls and margins of error in that context), and makes the presentation simpler. If you prefer to introduce inference with means, you can teach

<sup>1</sup> www.amstat.org/education/gaise

Chapter 11 (Confidence Intervals and Hypothesis Tests for Means) before Chapter 10 (Testing Hypotheses about Proportions). Note, however, that we teach inference for means without the assumption that the population standard deviation is known, and thus emphasize Student's *t*. That reflects the almost universal practice in real business analyses and in all statistics software. It also frees students of any concern about how big a sample should be before "switching" from *t* to Normal—with modern technology, there is no need to switch. And no statistics package or regression analysis does switch.

- Chapters 12 (Comparing Two Groups) and 13 (Inference for Counts: Chi-Square Tests) are omitted by some instructors.
- Chapter 15 introduces multiple regression, which can also be omitted.
- Chapter 16 is a brief introduction to the modern topic of data mining. It is intended as an overview and is optional.

#### **Features**

A textbook isn't just words on a page: it is many features that come together to form a big picture. The features in *Business Statistics: A First Course* provide a real-world context for concepts, help students apply these concepts, promote problem-solving, and integrate technology—all of which help students understand and see the big picture of Business Statistics.

Motivating Examples. Each chapter opens with a motivating example, often taken from the authors' consulting experiences. These companies—such as Amazon.com, Zillow.com, Keen Inc., and The Fair Isaacs Corporation—enhance and illustrate the story of each chapter and show students how and why statistical thinking is so vital to modern business decision-making. We analyze the data from those companies throughout the chapter.

Step-by-Step Guided Examples. The ability to clearly communicate statistical results is crucial to helping Statistics contribute to business decision-making. To that end, some examples in each chapter are presented as Guided Examples. A good solution is modeled in the right column while commentary appears in the left column. The overall analysis follows our innovative Plan, Do, Report template. That template begins each analysis with a clear question about a decision and ends with a report that answers that question. To emphasize the decision aspect of each example, we present the Report step as a business memo that summarizes the results in the context of the example and states a recommendation if the data are able to support one. In addition, whenever possible we include limitations of the analysis or models in the concluding memo.

Mini Case Study Projects. Each chapter includes one or two Mini Case Study Projects that use real data and ask students to investigate a question or make a decision. Students define the objective, plan the process, complete the analysis, and report a conclusion. Data\* for the Mini Case Study Projects are available on the website, formatted for various technologies.



What Can Go Wrong? Each chapter contains an innovative section called What Can Go Wrong? that highlights the most common statistical errors and the misconceptions people have about Statistics. The most common mistakes for the new user of statistical methods involve misusing a method, not miscalculating a statistic. Most







<sup>\*</sup> 本书所需相关数据均可从www.pearsonhighered.com/sharpe获得,或登录人大经管图书在线(www.rdjg.com.cn)从本书所在页面免费下载。

of the mistakes we discuss have been experienced by the authors in a business context rather than a classroom situation. One of our goals is to arm students with the tools to detect statistical errors and to offer practice in recognizing when Statistics is misused, whether intentional or not. In this spirit, some of our exercises probe the understanding of such errors.

By Hand. Even though we encourage the use of technology to calculate statistical quantities, we realize the pedagogical benefits of doing a calculation by hand. The *By Hand* boxes break apart the calculation of some of the simpler formulas and help the student through the calculation of a worked example.

Reality Check. We regularly remind students that Statistics is about understanding the world and making decisions with data. Results that make no sense are probably wrong, no matter how carefully we think we did the calculations. Mistakes are often easy to spot with a little thought, so we ask students to stop for a reality check before interpreting results.

Notation Alert. Throughout this book, we emphasize the importance of clear communication. Proper notation is part of the vocabulary of Statistics, but it can be daunting. Students who know that in Algebra n can stand for any variable may be surprised to learn that in Statistics n is always the sample size. Statisticians dedicate many letters and symbols for specific meanings (b, e, n, p, q, r, s, t, and z, along with many Greek letters all carry special connotations). Students learn more effectively when they are clear about the letters and symbols statisticians use.

Just Checking. To help students check their understanding of material they've just read, we ask questions at points throughout the chapter. These questions are a quick check and most involve little calculation. The answers are at the end of the exercise sets in each chapter so students can easily check themselves to be sure they understand the key ideas. The questions can also be used to motivate class discussion.

Math Boxes. In many chapters, we present the mathematical underpinnings of the statistical methods and concepts. Different students learn in different ways, and even the same student can understand the material by more than one path. By setting these proofs, derivations, and justifications apart from the narrative, we allow the student to continue to follow the logical development of the topic at hand, yet also make available the underlying mathematics for greater depth.

What Have We Learned? These chapter-ending summaries highlight new concepts, define new terms introduced in the chapter, and list the skills that the student should have acquired. Students can think of these as study guides. If they understand the concepts in the summary, know the terms, and have the skills, they're probably ready for the exam.

Ethics in Action. Students are often surprised to learn that Statistics is not just plugging numbers into formulas. Most statistical analyses require a fair amount of judgment. The best guidance for these judgments is that we make an honest and ethical attempt to learn the truth. Anything less than that can lead to poor and even dangerous decisions. The *Ethics in Action* vignettes in each chapter illustrate some of the judgments needed in statistical analyses, identify possible errors, link the issues to the American Statistical

Exercises. We've worked hard to ensure that exercises contain relevant, modern, and real-world questions. Many come from news stories; some come from recent research articles. Whenever possible, the data are on the website (always in a variety of formats) so students can explore them further. The exercises marked with a indicate

Association's Ethical Guidelines, and then propose ethically and statistically sound

alternative approaches.









ETHICS IN ACTION

that the data are provided. Sometimes, because of the size of the data set, the data are only available electronically. Throughout the book, we pair the exercises so that each odd-numbered exercise (with answer in the back of the book) is followed by an even-numbered exercise on the same Statistics topic. Exercises are roughly ordered within each chapter by both topic and by level of difficulty.

Data Sources. Most of the data used in examples and exercises are from real-world sources, and we list many sources in this edition. Whenever we can, we include references to the Internet data sources used, often in the form of URLs. As Internet users (and thus, our students) know well, URLs can "break" as websites evolve. To minimize the impact of such changes, we point as high in the address tree as is practical. Moreover, the data themselves often change as more recent values become available. The data we use are usually on the companion website, www.pearsonhighered.com/sharpe. If you seek the data—or an updated version of the data—on the Internet, we try to direct you to a good starting point.

Technology Help. In business, Statistics is practiced with computers, but not with a single software platform. Instead of emphasizing a particular Statistics program, at the end of each chapter, we summarize what students can find in the most common packages, often with annotated output. We then offer specific guidance for several of the most common packages (Excel®2007 and 2003, Minitab®, SPSS/PASW®, JMP®, and Data Desk®) to help students get started with the software of their choice. In addition, throughout the text, we also show some data as Excel screenshots, so students can become familiar with the Excel environment.

## **Index of Applications**

Note: IE = In-Text Example; BE = Boxed Example; GE = Guided Example; EIA = Ethics in Action; E = Exercises; JC = Just Checking; P = Project

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