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经济学精选教材·英文影印版

ECONOMETRICS: A MODERN INTRODUCTION

计量经济学：现代方法（上）

〔美〕Michael P. Murray 著

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丛书序言

经过一段时间的精心酝酿和准备，由北京大学出版社出版的国外引进版的经济学精选教材系列终于与读者见面了。

目前入选该系列的教材共有四本：一本是经济学导论，William Baumol 和 Alan Blinder 的“*Economics: Priniciples and Policy*”（第 9 版）；一本是微观经济学教材，Waltder Nicholson 的“*Microeconomic Theory: Basic Principles and Extensions*”（第 9 版），另加两本宏观经济学教材，Reoger Farmer 的“*Macroeconomics*”（第 2 版）和 Richard Froyen 的“*Macroeconomics: Theories and Polices*”。除第一本为经济学初学者入门教材外，后三本均属于中级水平的教材，面向的读者对象为大学经济学专业的本科生和 MBA 学生。

Baumol 和 Blinder 合写经济学可谓珠联璧合。Baumol 是当代最著名的微观经济理论大师之一，在他半个世纪的研究生涯中不断有新理论面世，是名副其实的“常青树”；Blinder 则是著名的宏观经济学家，擅长财政和货币政策研究，长期参与美国宏观经济学政策的辩论，曾做过克林顿的总统经济顾问。由这两位大家合写一本同时强调理论与政策含义的经济学导论自然是再合适不过了。我一直认为，经济学最直观和最精深的智慧都在经济学导论中，千万别小瞧了它，应该反复研读。在阅读此书时，读者要特别注意那些紧密结合现实世界问题的经济学分析，从这些分析中你才能真正体会到经济学是一种让人学会思考的有力工具。

Nicholson 的中级微观堪称这方面的经典教材：它初版于 1972 年，每隔几年修订一次，到现在已是第 9 版。如此长盛不衰的教材并不多见。我在美国斯坦福大学读书时做过本科生微观课的助教，教授选定的教学参考书中就有这本书，当时是第 7 版。此书最大的特点是它的严谨性，注重每一个理论的模型背景与数学推导。它没有其他同类教材那么多生动活泼的例子，而是一板一眼用图例和数学公式说明经济学的道理。每章后都附有一些相关学术论文，作者对每篇文献还做了一些简要的评论，似乎希望有兴趣者找到原始文献加以研读，所以此书的难度应该在中级教材之上。美国学生可能不太喜欢这种板着面孔说事的风格，但我觉得中国学生会非常适应。我建议最好将此书与别的“图文并茂”的微观教材结合起来阅读，收获会更大一些。

两本宏观教材虽非出自名家之手，但仍然不失为优秀的教科书，有许多可圈可点之处。Farmer 的宏观经济学包含了一本标准的中级宏观经济学教材所应涉及的内容，如古典总供给与总需求理论、IS-LM 曲线和新凯恩斯总供给理论，另外还专门介绍了理性预期理论和近年来兴盛起来的内生增长理论。全书叙述简明、清晰，可读性强。作者充分利用当今的网络技术，为读者提供了许多网站链接，以进一步了解某些重要知识。相比之下，Froyen 更注重宏观经济学的发展与演化，为那些感兴趣于思想史的读者提供了一条清晰的理论发展脉路。近年来的宏观经济学发展非常强调与微观经济学相统一的方法论基础，但不同思想学派的特征在当今的宏观理论中仍然表现得十分明显。而要深入了解这些学派的发展和主要特征，Froyen 的书很值得一读。这两本书因各有侧重，最好将它们结合起来学习。

大家也许注意到，这些国外教材在国内已出过不少种类，比如经济学导论教材，就先后出版过著名经济学家萨缪尔森、斯蒂格利茨和曼昆的三本经济学原理，其他微观和宏观的国外教材

也是品种繁多。那为什么我们还需要继续去影印或翻译同类经济学教材呢？我想，经济学教材可以看做是一种差异化产品，它们之间有替代性，但替代性不是完全的，就像不同品牌的汽车和笔记本电脑一样，可以满足不同偏好的消费者的需求。最关键的一点是，读者可以通过研读和比较不同“品牌”的教材获得关于经济学更全面、更丰富的理解和知识。我觉得经济学的精妙之处很难从一本书里获得，对初学者尤其如此。

作为在20世纪80年代求学的我非常羡慕现在的大学生，他们的选择可以如此之多，而我们那时，西方经济学教材寥寥无几，记忆中国外的就只有高鸿业先生翻译的萨缪尔森的《经济学》三册本，虽然是精品，值得反复揣摩，我也从被迫的精读中获益巨大，但总是期待有同类的教科书可一并参读。

经济学精选教材系列是一个开放的系列，这次初选四本，以后将根据教材的供需状况陆续增加。我相信，这套经济学系列教材将为经济学爱好者提供丰盛的知识大餐。

周黎安

2005年6月于北京大学

关于本书

适用对象

本书适用本科生和研究生的计量经济学课程。

内容简介

本书覆盖了计量经济学的所有重要内容。全书采用了循序渐进的方式激发学生学习计量经济学的兴趣，注重使学生在学习之初便学会像计量经济学家那样去思考。因此，本书在开始便引入了蒙特卡罗模拟，以使学生自己发现什么是最优估计量。全书结合经济学理论，给出了计量经济学应用的大量实例，包括恩格尔曲线、菲利浦斯曲线、理性预期假设的检验等经典例子。上册包括线性回归模型的重要内容，如估计量的选择、模型设定、假设检验、异方差扰动项及自回归扰动项等，适用于一学期的计量经济学课程。

作者简介

迈克尔·P. 默里(Michael P. Murray)，Bates 学院(Bates College)经济学系查尔斯·富兰克林·菲利普斯(Charles Franklin Phillips)讲座教授，曾在加州大学圣地亚哥分校(UCSD)、杜克大学(Duke University)等学校任教。默里教授的主要研究领域为贫困问题，就美国的转移支付和不发达国家的产业区位政策等有大量著述，讲授城市经济学、公共经济学、发展经济学、微观经济理论和计量经济学等课程。默里教授现任 *Journal of Economic Education* 编委，并曾担任世界银行、美国海军和兰德公司顾问。

本书特色

■不同于传统教材以最小二乘法开始教学的做法，本书从一个蒙特卡罗模拟练习开始，一方面避免了因学生不理解样本分布而带来的问题；另一方面，通过将学生的注意力集中在重复样本的估计量的差异，使学生从学习之初即像计量经济学家那样思考。在介绍异方差、变量误差和一致性等问题时，本书再次引入了蒙特卡罗方法。在本书的配套网站上可以获得相应的程序以及蒙特卡罗模拟的指南，使学生能够自行建立蒙特卡罗模型并得出结果。

■“回归的经典成就”(Regression's Great Hits)专栏提供了一系列学生可以模仿的计量分析，这些经典的实例包括学生熟悉的恩格尔曲线的建立、CAPM 模型的检验、对理性预期假设的支持等，从而帮助学生在计量经济学和经济学理论之间建立清晰的联系，完成从理论经济学到计量经济学的跳跃，并阐释了计量经济学的技术如何能够获得实用的、意义深远的或者有趣的结论，向学生展示了计量经济学研究如何能够丰富经济学的重要知识。

■本书在正文中应用了大量的现实数据，全书以经济行为为前提，以理论量化经济关系，关注理论在现实生活中的应用。

■本书内容丰富，既可用作入门教材，亦可用作具备经济学和统计学背景的学生的高级教材，可供教师根据不同教学目的灵活取舍。

教辅材料说明

本书配有以下教辅资料：

1. 教师手册：含章节概述、教学心得和习题答案

2. PPT

3. 11 个“网络扩展”模块

4. 105 个数据集，每个数据集都具有四种形式：EViews，Stata，Excel 和 ASCII

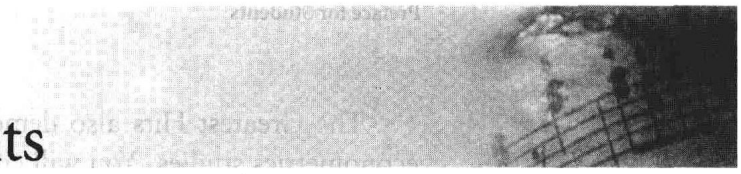
5. 6 个蒙特卡罗模拟程序

欲获得本书相关教辅材料的教师，请填写并反馈本书后面所附的《教学支持说明》，Pearson 出版公司将提供相应教辅材料。

出版声明

本书是对国外原版教材的删节后影印，由于各个国家政治、经济、文化背景的不同，对原作者所持观点，还请广大读者在阅读过程中加以分析和鉴别。

Preface for Students



This textbook introduces you to the theory and uses of econometrics. Without econometrics, economics would be a rather vague science. For example, economic theory will tell us that a 10% tuition subsidy plan will increase college enrollments, but it won't tell us by how much. Econometrics gives us more specific information. Econometrics tells us that college enrollments will rise, say, 15%, plus or minus 3%, if students get a 10% tuition subsidy.

Econometrics combines data, economic theory, and statistical theory to quantify economic relationships. What is the price elasticity of the demand for cocaine? How much does college financial aid reduce families' saving? How steep is the Phillips curve that relates unemployment rates to changes in the rate of inflation? These are questions that can be answered by using econometrics.

Econometrics also provides tools for testing economic theories. Is the Phillips curve stable, or does it shift when economic policy changes? Is the Cobb–Douglas production function a reasonable representation of the U.S. economy? Does a college education increase lifetime earnings? These are questions for econometricians.

Econometrics also provides tools for forecasting future economic events. What will the GDP be in 2010? What will the unemployment rate be next year? How many cigarettes will R. J. Reynolds sell next year? These, too, are questions for econometricians.

Your background in economic theory and in statistics has prepared you to use econometrics. As you might expect, because economic theory and statistics are both abstract studies, econometrics also requires abstract thinking. But, in the end, econometrics, like economic theory, is not about abstractions; it is about economic behavior.

To keep economic behavior in the foreground as we march through the abstract terrain of econometrics, this text includes Regression's Greatest Hits, an econometric Top 40 that recounts the details of profound, practical, and sometimes amusing real-world econometric studies. You will find the Belgian household expenditure data that Ernst Engel relied on, in 1857, to formulate Engel's Law, which states that food expenditure absorbs a smaller share of consumers' incomes as income rises. You will see the econometric results that supported the Rational Expectations Revolution in macroeconomics. You will see studies of the demands for rye, wheat, cocaine, and watermelons. You will learn how economists measure labor-market discrimination against minorities and women. Economic growth, violence by college students, capital punishment, infant mortality, and health care policy are all subject to econometric study, and all appear in the Greatest Hits feature.

The Greatest Hits also demonstrate the critical thinking skills employed in econometrics studies. You will come to understand the limits of what economists learn. Because all empirical knowledge is conditional, what we think is true today may be contradicted by new data tomorrow. Econometrics will provide you with the ability to assess how much credence to give to economists' latest findings. Sometimes the findings are robust, and worthy of considerable confidence. Sometimes the findings are fragile, and deserve considerable skepticism. Understanding both economic theory and econometrics allows you to make such judgments for yourself, and thereby better understand the economic world in which we live.

Preface for Teachers

Why this textbook, when there are so many others available? Three features set this text apart from other recent econometrics texts: (i) starting out with the Monte Carlo approach to estimators; (ii) the applied perspective offered by the Greatest Hits feature; and (iii) the multitude of real-world data employed throughout the text. These features are discussed briefly here, and in depth in the following sections.

The book begins with a Monte Carlo exercise that shows students how to compare their own estimators of the slope of a line through the origin. The teacher's manual shows how you can, on the first day of class, get students to devise for themselves several estimators for this slope. By focusing students' attention on how estimators perform across repeated samples, the exercise conditions students to think like econometricians right from the start. The exercise also sets the stage for a very accessible development of the Gauss–Markov Theorem.

The Greatest Hits feature contains exemplary econometric analyses from historical and modern examples. The Greatest Hits feature explores these studies to a depth greater than that usually afforded by a typical textbook example. The additional insight allows students to more fully understand the connection between econometrics and the economic phenomena that they learn about in other economics courses. Many of the Greatest Hits are accompanied by the original data used in the chosen study. For example, Ernst Engel's 1857 study linking food expenditure and income appears among the Greatest Hits, and the Belgian budget data Engel used are available on this textbook's companion Web site (**www.aw-bc.com/murray**).

The book relies heavily on real-world data. The Greatest Hits, the in-text examples, and the 292 end-of-chapter problems span a wide range of economic analyses, and almost all are accompanied by data sets that the students can use to investigate further. In all, the book's companion Web site, **www.aw-bc.com/murray**, contains 105 data sets associated with Greatest Hits, in-chapter examples, and end-of-chapter problems.

My goal in writing this textbook is to engage students in econometrics by showing them how the skills they learn in this course have been applied in the real world, and to encourage them to use their knowledge similarly.

Why Begin with Monte Carlo?

What are the advantages of beginning with a Monte Carlo approach? Ordinary least squares (OLS) is the usual starting point for econometrics textbooks. Finding a "best fitting" line is an intuitively plausible goal, and the OLS estimator does serve admirably in many analyses. However, starting with OLS has two pedagogical disadvantages. First, the "sum of squared residuals" is a within-sample

property of estimators, rather than a sampling property. In 1998, in the *American Economic Review*, Peter Kennedy wrote:

> Contrary to the belief of most econometrics instructors, upon completion of introductory statistics courses, the vast majority of students do not understand the basic logic of classical statistics as captured in the sampling distribution concept.*

Students who do not understand the sampling distribution notion are not yet ready to study econometrics. The study of OLS is at odds with gaining such an understanding. Students are better served by starting with an exercise that highlights sampling distributions rather than with OLS, which ignores them.

Kennedy prefers to begin his classes with a series of problems that ask the students to "explain how to do a Monte Carlo study." I share a similar viewpoint, and thus ask students to begin thinking about Monte Carlo results in Chapter 2. Moreover, this book uses a Monte Carlo exercise that fascinates students because it compares the students' own estimators. (A horse race is always more interesting when your horse is running.) Wondering how his or her own favorite estimator is faring focuses each student's attention on which estimator is performing best when the estimators are used over and over again in repeated samples.

The second pedagogical disadvantage of the OLS strategy is that students are unlikely to uncover it on their own. The OLS estimator is typically given to students by their teachers. Wouldn't students be more invested in the outcomes if they could begin their class by designing their own estimators? Wouldn't the students be more interested if their first analysis in econometrics compared their own estimators? That is the approach this book takes. While devising estimators for the slope and intercept of a straight line is too daunting for most students, a simpler, related problem that students *can* solve asks students to devise an estimator for the slope of a straight line through the origin, beginning by grappling with the cases that have first one, and then two, data points.

For ten years, my students, working with their classmates, have collectively come up with four intuitively plausible estimators for the slope of a line through the origin (all of which are linear, and each of which is BLUE for a suitable data-generating process). I work through this exercise with them on the first day of class, and students feel energized and excited about econometrics at the end of the lecture. With four intuitively plausible estimators in hand, our discussion naturally turns to how we can choose among them. With minimal direction, we find ourselves reviewing the intuitions of mean absolute error, mean square error, unbiasedness, and efficiency.

I initially invite the students to vote for their favorite estimator, but most students quickly realize that this is not an ideal way to find a best estimator. Because

*Peter Kennedy, "Teaching Undergraduates Econometrics: A Suggestion for Fundamental Change," *American Economic Review*, 88, no. 2 (May 1998): 487–492.

mean absolute error, mean square error, unbiasedness, and efficiency are all across-sample properties of estimators, a Monte Carlo examination of the students' estimators, in which each estimator is used in many samples, is a well-received strategy for choosing among the estimators. This strategy highlights the sampling distribution concept. The students can see whether their estimator or someone else's performs better when used repeatedly.

The Monte Carlo exercise has another important benefit. In order to conduct a Monte Carlo exercise, students have to make assumptions about the data-generating process. Curiously, students usually make the Gauss–Markov Assumptions when confronted with a series of choices about their DGP. A computer program, available on this book's companion Web site (**www.aw-bc.com/murray**), leads students through the choices they must make to build their Monte Carlo models, and then presents them with the Monte Carlo results. At the end of this exercise, students are keenly aware that they have been looking across samples to assess their estimators, and they are aware that their results might well depend critically on their assumptions—that is, on the Gauss–Markov Assumptions.

Chapter 2 describes this computer program, but in practice, these lessons are most effectively conveyed by working through the computer exercise in class or lab. This Monte Carlo exercise almost always results in a clear winner among the estimators on the basis of mean square error or mean absolute error. What is not clear at the end of the Monte Carlo exercise is whether any of the estimators are unbiased—sampling error muddies the water.

The question of unbiasedness provides the springboard to a more formal statistical analysis of the students' estimators in Chapter 3. Students' estimators are almost always linear estimators; only occasionally do students suggest an estimator that uses medians, which are not linear. Chapter 3 notes the linearity of the students' estimators and asks when, under the Gauss–Markov Assumptions, a linear estimator of the slope of a line through the origin is unbiased. Chapter 3 also derives the variance of a linear estimator. One semester, a student of mine raised his hand at this juncture and asked, "If I minimize that variance, subject to the unbiasedness requirement, can I get an even better estimator?" Not every student leaps unaided to the Gauss–Markov Theorem, but the theorem is easy to motivate once the unbiasedness and variance results are in hand. Moreover, students grasp without great difficulty that the strategy used to get a BLUE estimator under the Gauss–Markov Assumptions could be as easily applied under alternative assumptions; from here, the path to generalized least squares is clear.

The book's Monte Carlo beginning yields three pedagogically valuable fruits: an early experience with competing estimators for a given problem, a clear understanding that econometricians choose estimators for their across-sample properties, and a confident intuition for the strategy of BLUE estimation. Typically, I cover these first three chapters of the text and a lecture-long review of statistics (the material in the book's Statistical Appendix), in four 80-minute lectures and

two lab periods. Later on, the text returns to Monte Carlo analyses to facilitate learning about heteroskedasticity, errors in variables, and consistency. Computer programs for these exercises are also on the textbook's companion Web site (**www.aw-bc.com/murray**). Another computer program that visually illustrates the power of hypothesis tests about the OLS estimator is on the Web site as well.

Regression's Greatest Hits

The Greatest Hits feature serves several purposes in the text. The abstractions needed to do economics are aesthetically appealing for some students, but most students are more interested in econometrics as a toolkit. The first Greatest Hits show students that knowledge obtained with econometrics can be both practical and profound. Early Greatest Hits include Feldstein's investigation of the effect of college financial aid on family saving and Engel's 19th century work on food expenditures and income. A later, more light-hearted Greatest Hit studies the relationship between a wine label's contents and the wine's price.

In the early chapters, the Greatest Hits help students make the leap from the theoretical economics they have studied to the econometrically convenient linear forms in which econometricians usually cast economic theories. The economic theory that students encounter before taking econometrics relies heavily on one economic variable being a function of another, $y = f(x)$, as in a demand equation or in a supply equation, with equilibrium conditions linking the functions. The linear-in-parameters function used in introductory econometrics is a special case of the functions usually found in economic theory, but one that is often unfamiliar to students when they begin their econometrics course. "Why do I care about straight lines?" is a sensible question that is best answered by examples in which straight lines are economically interesting. The Capital Asset Pricing Model and Friedman's permanent income consumption function make straight lines through the origin surprisingly interesting.

Later in the book, the Greatest Hits illustrate how new techniques have been used to obtain practical, profound, or intriguing results. Some Greatest Hits—those categorized as "Classical Favorites"—have each been cited more than 300 times since 1968. Examples include Mincer on wages; Mankiw, Romer, and Weil on growth; Phillips, and later Lucas, on the Phillips curve; and McFadden on transportation. These Greatest Hits show students how much important economic knowledge is grounded in econometric research.

A second subset of Hits—"Golden Oldies"—are equally venerable, but predate the Social Science Citation Index. Examples include Engel on the demand for rye (1861); Lehfeldt on the demand for wheat (1914); and Cobb and Douglas on the production function (1928). These Greatest Hits remind students that economics has been an empirical science for a very long time.

A third category—"Pop Tunes"—provides students with practically important or amusing results that illustrate the usefulness of the tools they are learning.

Examples include beer prices and student misbehavior, and capital punishment and murder rates.

The Greatest Hits are written for accessibility. Casual reading should enable students to glean the primary lesson of any Hit. But careful reading should yield richer understandings of both the economics and the econometrics of the Hit. Instructors can use the Greatest Hits as sidebars that illustrate why we study econometrics or as a rich addition to the students' learning.

Applying Econometrics to Real-World Data

Much of econometrics must be learned by doing econometrics. Though it is true that students cannot understand econometric applications without studying econometric theory, they cannot internalize and fully appreciate the concepts of econometric theory until they have grappled with applications. This book's Greatest Hits and its in-chapter examples show students how econometrics can be richly applied; the end-of-chapter problems charge students with applying econometrics themselves.

In all, 292 end-of-chapter problems ask students to apply their newly learned skills. The problems rely on 105 real-world data sets that are available on the book's companion Web site, **www.aw-bc.com/murray**. (Each data set is available in four formats: EViews, Stata, Excel, and comma-separated ASCII. To allow students to easily apply the methods learned in a given chapter, the data are cleaner than what researchers must usually work with.) Where possible, the data are drawn from published economics articles, so that students can see first-hand the intimate link between econometrics and new economic knowledge.

Using the Book

I expect that almost all one-term introductory courses will use Chapters 1 through 11. In this case, you would begin with students' own estimators of the slope of a line through the origin and end with generalized least squares applied to models with heteroskedastic or first-order autocorrelated disturbances. However, instructors who do not want to use Monte Carlo methods can skip Chapters 2 and 3 with little disruption. Teachers who assign a term paper in which students do original empirical work can also point students to the Chapter 12 Greatest Hit "Making Music." This hit introduces the microeconomic and macroeconomic data sets that economists work with most often.

Chapters 12 through 19 are written to be taught in almost any order, so that teachers of a semester-long introductory course can select a specialized topic to add to the foundations taught in Chapters 1 through 11. Chapter 12, which introduces consistency and asymptotic distributions, is an especially good prelude to Chapter 13 on IV estimation; otherwise, Chapters 12 through 19 are freestanding. Especially novel is Chapter 15, which introduces students to randomized and natural experiments.

Instructors who prefer to teach matrix algebra with their students will find the chapter appendices that re-present chapter material in matrix form helpful. Early appendices also develop the mechanics of matrix algebra. There is no matrix algebra in the book outside of these appendices. For additional material, teachers can turn to the Web Extensions available on this book's companion Web site. For example, chapters on maximum likelihood estimation and on the generalized method of moments are available online.

Chapters 12 through 19, coupled with the online Web Extensions, are the basis for a second semester of a course in econometrics. Instructors of advanced courses, who need to spend considerable time reviewing introductory econometrics, can select material from Chapters 12 through 19 and the Web Extensions. Advanced courses that follow immediately upon an introductory course can cover most, if not all, of Chapters 12 through 19 and the Web Extensions in a full semester.

Supplements

For the instructor an Instructor's Manual and PowerPoint presentation slides are available for download at the Instructor's Resource Center on the catalog page for *Econometrics: A Modern Introduction.*

The Instructor's Manual has been designed to provide you with support and suggestions for using this book effectively in your econometrics course. For each chapter in the text, the Instructor's Manual contains:

- Chapter overviews
- Teaching tips, which detail my strategies for helping students achieve success in each topic area
- Answers to the end-of-chapter questions and problems

The Instructor's Manual also contains several suggested pathways for organizing your course.

The Power Point presentation contains a version of my lecture notes, refined and prepared by Stephen Weinberg, who used the book as a Teaching Fellow at Harvard University. The slides also contain the figures and tables from the text.

The Companion Web site for this book can be accessed at **www.aw-bc.com/murray**. This Web site contains a wealth of supplementary material, including

- Eleven Web Extensions—fully developed discussions of the following special topics: A Medley of Regression's Greatest Hits; Using Calculus and Algebra for the Simplest Case: $n = 3$; A Matrix Approach to Consistency; X's Fixed Across Samples; and A Matrix Approach to Consistency with Stochastic Regressors; Local Average Treatment Effects; More Estimators for Systems of Equations; A

Matrix Representation of Panel Data; Multiple Cointegrating Relationships; Log-Odds and Logit Models: Using Grouped Data; Multinomial Models; Generalized Method of Moments Estimators and Identification; and Maximum Likelihood Estimation.

- 105 Data Sets—the data sets that students will use to solve the end-of-chapter problems. The data sets are available in four formats: EViews, Stata, Excel, and comma-separated ASCII.
- Selected Solutions to the end-of-chapter problems
- Six Monte Carlo Simulation Builders—Web-accessible Monte Carlo programs for assessing the small- and large-sample properties of several estimators for various DGPs, including the Gauss–Markov and heteroskedastic cases and the omitted variables case.
- The PowerPoint presentations
- Glossary Flashcards

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