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经济学的结构

——数学分析的方法

The Structure of Economics

A Mathematical Analysis

（第三版）

Eugene Silberberg

Wing Suen

著

上海财经大学出版社

Shanghai University of Finance & Economics Press

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PREFACE

It's safe to say that the most interesting and important developments in microeconomic theory since the publication of the second edition of this work in 1990 are in the area of choice under imperfect information. With uncertainty, the choices individuals make may reflect the problems of moral hazard and adverse selection, and the operation of the market changes as well to reflect these actions. In the third edition, therefore, we expand the scope of the text to include these new developments in economic theory. In particular, the new Chapter 15, "Contracts and Incentives," covers the recent developments in contract theory, and the new Chapter 16, "Markets with Imperfect Information," covers recent developments in information economics. Wing Suen, of the University of Hong Kong, penned these chapters. Wing was also the secret author in the second edition of Chapter 13, "Behavior Under Uncertainty," to which we have added a few examples.

To accommodate this new material, we discarded the old Chapter 19 on stability of equilibrium. We feel that this material is now less relevant to today's economics courses, both absolutely and relative to the new material. Also, since today's students are much better prepared mathematically than students were when the first edition was first published, we discarded most of the material in Chapter 2, "Review of Calculus (One Variable)," assuming that students have rudimentary knowledge of the calculus of one variable. We maintained the discussion of calculus of several variables but deleted some of the formalisms, in order to make the material accessible to students whose knowledge of that material is less than in working order. Various other changes in the traditional parts of the book include a discussion of discriminating monopoly in Chapter 4, "Profit Maximization"; a theorem and application related to complementary factors of production in Chapter 6, "Comparative Statics: The Traditional Methodology"; an extended but easier discussion of

the LeChâtelier effects in Chapter 7, "The Envelope Theorem and Duality"; and a variety of extensions and emendations throughout the text.

Although all the analysis contained herein derives from topics in microeconomics, the real subject of this book is *meta*economics rather than economics itself. That is, we concern ourselves principally with the methodology of positive economics, in particular, the way meaningful theorems are derived in economics. Paul Samuelson explained in his monumental *Foundations of Economic Analysis* (Harvard University Press, 1947) that the meaningful theorems in economics consist not in laying out various equilibrium conditions, which are rarely observable and therefore empirically sterile, but in deriving predictions that the direction of change of some decision variable in response to a change in some observable parameter must be in some particular direction. The statement that consumers equate their marginal rates of substitution to relative prices is not testable unless we can measure indifference curves. By contrast, the law of demand, which merely requires us to be able to measure the direction of change of an observable price and quantity, is a meaningful, i.e., refutable theorem. Thus in this book, in both the new chapters as well as the old, we devote ourselves almost exclusively to exploring the conditions under which models with a maximization hypothesis generate propositions that are at least in principle refutable.

Although the mathematics we use is elementary, it is extremely useful. The late G. H. Hardy wrote in his delightful essay *A Mathematician's Apology* (Cambridge University Press, 1940) that

> It is the dull and elementary parts of applied mathematics, as it is the dull and elementary parts of pure mathematics, that work for good or ill. Time may change all this. No one foresaw the applications of matrices and groups and other purely mathematical theories to modern physics, and it may be that some of the "highbrow" applied mathematics will become useful in as unexpected a way; but the evidence so far points to the conclusion that, in one subject as in the other, it is what is commonplace and dull that counts for practical life.

Moreover,

> The general conclusion, surely, stands out plainly enough. If useful knowledge is, as we agreed provisionally to say, knowledge which is likely now or in the comparatively near future, to contribute to the material comfort of mankind, so that mere intellectual satisfaction is irrelevant, then the great bulk of mathematics is useless.

But this is precisely what an economist would expect! Hardy was observing the law of diminishing marginal product in the application of mathematical tools to science. A large gain in clarity and economy of exposition can be had from the incorporation of elementary algebra and calculus. The gain from adding real analysis and topology, however, is apt to be less. And perhaps, when such arcane fields as complex analysis and algebraic topology are brought to bear on scientific analysis, their marginal product will be found to be approximately zero, fitting Hardy's definition of "useless." (It is amusing to note, though, that number theory,

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long considered one of the most useless of all mathematical inquiries, has recently found important application in modern cryptography.)

In this book we explore the insights that elementary mathematics affords the study of positive economics. We do not explore these issues to their fullest generality or mathematical rigor. Although generality and rigor are important economic goods, their production, because of the above-mentioned law of diminishing returns, entails increasing marginal costs. Thus we are usually content with intuitive, heuristic proofs of many mathematical propositions. We refer students to standard mathematics texts for rigorous discussions of various theorems we use in this book. We aimed for that unobservable margin where for the bulk of our readers, the marginal benefits of greater rigor and generality equal their respective marginal costs. By example after example we hope to convince the reader that these elementary tools yield interesting and sometimes profound insights into modern economics.

A note to students and instructors: Long experience teaching this material, and the authors' own experiences in learning it, have made it abundantly clear that mastering this material is impossible without doing the problems. So do the problems! The only true indicator of understanding is that you can explain the solution to someone else. An *Instructor's Manual* is available from McGraw-Hill.

Eugene Silberberg
Wing Suen

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