

A woman's silhouette is shown from the back, looking at a display of sunglasses on shelves. The shelves are arranged in a grid, with four sunglasses on each shelf. The sunglasses have various colors and styles, including brown, orange, green, and blue lenses. The background is a bright, uniform light color.

INTERMEDIATE MICROECONOMICS

NINTH EDITION

HAL R. VARIAN

Intermediate Microeconomics

A Modern Approach

Ninth Edition

Intermediate Microeconomics

A Modern Approach

Ninth Edition

Hal R. Varian

University of California at Berkeley



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To Carol

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PREFACE

The success of the first eight editions of *Intermediate Microeconomics* has pleased me very much. It has confirmed my belief that the market would welcome an analytic approach to microeconomics at the undergraduate level.

My aim in writing the original text was to present a treatment of the methods of microeconomics that would allow students to apply these tools on their own and not just passively absorb the predigested cases described in the text. I have found that the best way to do this is to emphasize the fundamental conceptual foundations of microeconomics and to provide concrete examples of their application rather than to attempt to provide an encyclopedia of terminology and anecdote.

A challenge in pursuing this approach arises from the lack of mathematical prerequisites for economics courses at many colleges and universities. The lack of calculus and problem-solving experience in general makes it difficult to present some of the analytical methods of economics. However, it is not impossible. One can go a long way with a few simple facts about linear demand and supply functions, and some elementary algebra. It is perfectly possible to be analytical without being excessively mathematical.

The distinction is worth emphasizing. An analytical approach to economics is one that uses rigorous, logical reasoning. This does not necessarily require the use of advanced mathematical methods. The language of mathematics certainly helps to ensure a rigorous analysis and using it is undoubtedly the best way to proceed when possible, but it may not be appropriate for all students.

Many undergraduate majors in economics are students who *should* know calculus, but don't—at least, not very well. For this reason I have kept calculus out of the main body of the text. However, I have provided complete calculus appendices to many of the chapters. This means that the calculus methods are there for the students who can handle them, but they do not pose a barrier to understanding for the others.

I think that this approach manages to convey the idea that calculus is not just a footnote to the argument of the text, but is instead a deeper way to examine the same issues that one can also explore verbally and graphically. Many arguments are much simpler with a little mathematics, and all economics students should learn that. In many cases I've found that with a little motivation, and a few nice economic examples, students become quite enthusiastic about looking at things from an analytic perspective.

For students who are comfortable with calculus, I also offer a version of the text that incorporates the material in the chapter appendices into the body of chapters.

There are several other innovations in this text. First, the chapters are generally very short. I've tried to make most of them roughly “lecture size,” so that they can be read in one sitting. I have followed the standard order of discussing first consumer theory and then producer theory, but I've spent a bit more time on consumer theory than is normally the case. This is not because I think that consumer theory is necessarily the most important part of microeconomics; rather, I have found that this is the material that students find the most mysterious, so I wanted to provide a more detailed treatment of it.

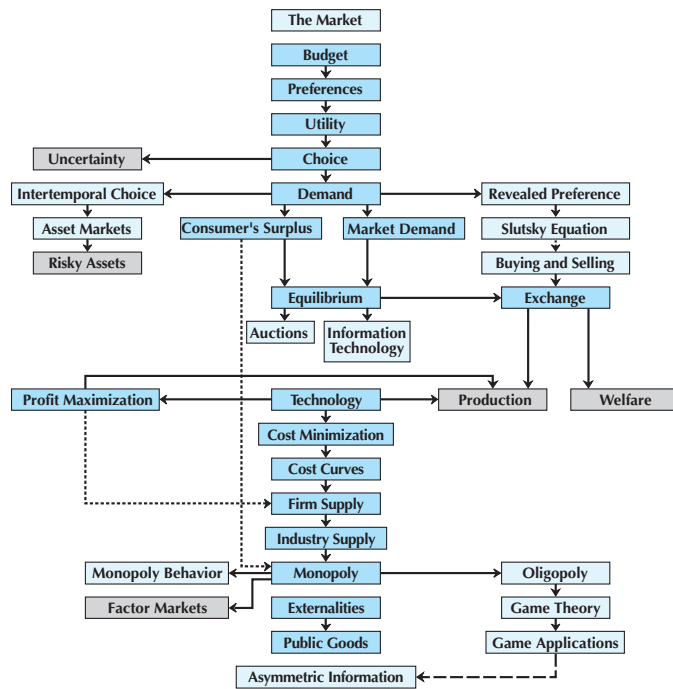
Second, I've tried to put in a lot of examples of how to use the theories described here. In most books, students look at a lot of diagrams of shifting curves, but they don't see much algebra, or much calculation of any sort for that matter. But it is the algebra that is used to solve problems in practice. Graphs can provide insight, but the real power of economic analysis comes in calculating quantitative answers to economic problems. Every economics student should be able to translate an economic story into an equation or a numerical example, but all too often the development of this skill is neglected. For this reason I have also provided a workbook that I feel is an integral accompaniment to this book. The workbook was written with my colleague Theodore Bergstrom, and we have put a lot of effort into generating interesting and instructive problems. We think that it provides an important aid to the student of microeconomics.

Third, I believe that the treatment of the topics in this book is more accurate than is usually the case in intermediate micro texts. It is true that I've sometimes chosen special cases to analyze when the general case is too difficult, but I've tried to be honest about that when I did it. In general, I've tried to spell out every step of each argument in detail. I believe that the discussion I've provided is not only more complete and more

accurate than usual, but this attention to detail also makes the arguments easier to understand than the loose discussion presented in many other books.

There Are Many Paths to Economic Enlightenment

There is more material in this book than can comfortably be taught in one semester, so it is worthwhile picking and choosing carefully the material that you want to study. If you start on page 1 and proceed through the chapters in order, you will run out of time long before you reach the end of the book. The modular structure of the book allows the instructor a great deal of freedom in choosing how to present the material, and I hope that more people will take advantage of this freedom. The following chart illustrates the chapter dependencies.



The darker colored chapters are “core” chapters—they should probably be covered in every intermediate microeconomics course. The lighter-colored chapters are “optional” chapters: I cover some but not all of these every semester. The gray chapters are chapters I usually don’t cover in my course, but they could easily be covered in other courses. A solid line going from Chapter *A* to Chapter *B* means that Chapter *A* should be read before

chapter *B*. A broken line means that Chapter *B* requires knowing some material in Chapter *A*, but doesn't depend on it in a significant way.

I generally cover consumer theory and markets and then proceed directly to producer theory. Another popular path is to do exchange right after consumer theory; many instructors prefer this route and I have gone to some trouble to make sure that this path is possible.

Some people like to do producer theory before consumer theory. This is possible with this text, but if you choose this path, you will need to supplement the textbook treatment. The material on isoquants, for example, assumes that the students have already seen indifference curves.

Much of the material on public goods, externalities, law, and information can be introduced earlier in the course. I've arranged the material so that it is quite easy to put it pretty much wherever you desire.

Similarly, the material on public goods can be introduced as an illustration of Edgeworth box analysis. Externalities can be introduced right after the discussion of cost curves, and topics from the information chapter can be introduced almost anywhere after students are familiar with the approach of economic analysis.

Changes for the Ninth Edition

I have added a new chapter on measurement which describes some of the issues involved in estimating economic relationships. The idea is to introduce the student to some basic concepts from econometrics and try to bridge the theoretical treatment in the book with the practical problems encountered in practice.

I have offered some new examples drawn from Silicon Valley firms such as Apple, eBay, Google, Yahoo, and others. I discuss topics such as the complementarity between the iPod and iTunes, the positive feedback associated with companies such as Facebook, and the ad auction models used by Google, Microsoft, and Yahoo. I believe that these are fresh and interesting examples of economics in action.

I've also added an extended discussion of mechanism design issues, including two-sided matching markets and the Vickrey-Clarke-Groves mechanisms. This field, which was once primarily theoretical in nature, has now taken on considerable practical importance.

The Test Bank and Workbook

The workbook, *Workouts in Intermediate Microeconomics*, is an integral part of the course. It contains hundreds of fill-in-the-blank exercises that lead the students through the steps of actually applying the tools they have learned in the textbook. In addition to the exercises, *Workouts* contains a collection of short multiple-choice quizzes based on the workbook problems in each chapter. Answers to the quizzes are also included in *Workouts*.

These quizzes give a quick way for the student to review the material he or she has learned by working the problems in the workbook.

But there is more . . . instructors who have adopted *Workouts* for their course can make use of the *Test Bank* offered with the textbook. The *Test Bank* contains several alternative versions of each *Workouts* quiz. The questions in these quizzes use different numerical values but the same internal logic. They can be used to provide additional problems for students to work on, or to give quizzes to be taken in class. Grading is quick and reliable because the quizzes are multiple choice and can be graded electronically.

In our course, we tell the students to work through all the quiz questions for each chapter, either by themselves or with a study group. Then during the term we have a short in-class quiz every other week or so, using the alternative versions from the *Test Bank*. These are essentially the *Workouts* quizzes with different numbers. Hence, students who have done their homework find it easy to do well on the quizzes.

We firmly believe that you can't learn economics without working some problems. The quizzes provided in *Workouts* and in the *Test Bank* make the learning process much easier for both the student and the teacher.

A hard copy of the *Test Bank* is available from the publisher, as is the textbook's *Instructor's Manual*, which includes my teaching suggestions and lecture notes for each chapter of the textbook, and solutions to the exercises in *Workouts*.

A number of other useful ancillaries are also available with this textbook. These include a comprehensive set of PowerPoint slides, as well as the Norton Economic News Service, which alerts students to economic news related to specific material in the textbook. For information on these and other ancillaries, please visit the homepage for the book at <http://www.wwnorton.com/varian>.

The Production of the Book

The entire book was typeset by the author using T_EX, the wonderful typesetting system designed by Donald Knuth. I worked on a Linux system and using GNU *emacs* for editing, *rcs* for version control and the T_EX Live system for processing. I used *makeindex* for the index, and Trevor Darrell's *psfig* software for inserting the diagrams.

The book design was by Nancy Dale Muldoon, with some modifications by Roy Tedoff and the author. Jack Repchek coordinated the whole effort in his capacity as editor.

Acknowledgments

Several people contributed to this project. First, I must thank my editorial assistants for the first edition, John Miller and Debra Holt. John provided

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CHAPTER 1

THE MARKET

The conventional first chapter of a microeconomics book is a discussion of the “scope and methods” of economics. Although this material can be very interesting, it hardly seems appropriate to *begin* your study of economics with such material. It is hard to appreciate such a discussion until you have seen some examples of economic analysis in action.

So instead, we will begin this book with an *example* of economic analysis. In this chapter we will examine a model of a particular market, the market for apartments. Along the way we will introduce several new ideas and tools of economics. Don’t worry if it all goes by rather quickly. This chapter is meant only to provide a quick overview of how these ideas can be used. Later on we will study them in substantially more detail.

1.1 Constructing a Model

Economics proceeds by developing **models** of social phenomena. By a model we mean a simplified representation of reality. The emphasis here is on the word “simple.” Think about how useless a map on a one-to-one

scale would be. The same is true of an economic model that attempts to describe every aspect of reality. A model's power stems from the elimination of irrelevant detail, which allows the economist to focus on the essential features of the economic reality he or she is attempting to understand.

Here we are interested in what determines the price of apartments, so we want to have a simplified description of the apartment market. There is a certain art to choosing the right simplifications in building a model. In general we want to adopt the simplest model that is capable of describing the economic situation we are examining. We can then add complications one at a time, allowing the model to become more complex and, we hope, more realistic.

The particular example we want to consider is the market for apartments in a medium-size midwestern college town. In this town there are two sorts of apartments. There are some that are adjacent to the university, and others that are farther away. The adjacent apartments are generally considered to be more desirable by students, since they allow easier access to the university. The apartments that are farther away necessitate taking a bus, or a long, cold bicycle ride, so most students would prefer a nearby apartment . . . if they can afford one.

We will think of the apartments as being located in two large rings surrounding the university. The adjacent apartments are in the inner ring, while the rest are located in the outer ring. We will focus exclusively on the market for apartments in the inner ring. The outer ring should be interpreted as where people can go who don't find one of the closer apartments. We'll suppose that there are many apartments available in the outer ring, and their price is fixed at some known level. We'll be concerned solely with the determination of the price of the inner-ring apartments and who gets to live there.

An economist would describe the distinction between the prices of the two kinds of apartments in this model by saying that the price of the outer-ring apartments is an **exogenous variable**, while the price of the inner-ring apartments is an **endogenous variable**. This means that the price of the outer-ring apartments is taken as determined by factors not discussed in this particular model, while the price of the inner-ring apartments is determined by forces described in the model.

The first simplification that we'll make in our model is that all apartments are identical in every respect except for location. Thus it will make sense to speak of "the price" of apartments, without worrying about whether the apartments have one bedroom, or two bedrooms, or whatever.

But what determines this price? What determines who will live in the inner-ring apartments and who will live farther out? What can be said about the desirability of different economic mechanisms for allocating apartments? What concepts can we use to judge the merit of different assignments of apartments to individuals? These are all questions that we want our model to address.

1.2 Optimization and Equilibrium

Whenever we try to explain the behavior of human beings we need to have a framework on which our analysis can be based. In much of economics we use a framework built on the following two simple principles.

The optimization principle: People try to choose the best patterns of consumption that they can afford.

The equilibrium principle: Prices adjust until the amount that people demand of something is equal to the amount that is supplied.

Let us consider these two principles. The first is *almost* tautological. If people are free to choose their actions, it is reasonable to assume that they try to choose things they want rather than things they don't want. Of course there are exceptions to this general principle, but they typically lie outside the domain of economic behavior.

The second notion is a bit more problematic. It is at least conceivable that at any given time peoples' demands and supplies are not compatible, and hence something must be changing. These changes may take a long time to work themselves out, and, even worse, they may induce other changes that might "destabilize" the whole system.

This kind of thing can happen ... but it usually doesn't. In the case of apartments, we typically see a fairly stable rental price from month to month. It is this *equilibrium* price that we are interested in, not in how the market gets to this equilibrium or how it might change over long periods of time.

It is worth observing that the definition used for equilibrium may be different in different models. In the case of the simple market we will examine in this chapter, the demand and supply equilibrium idea will be adequate for our needs. But in more general models we will need more general definitions of equilibrium. Typically, equilibrium will require that the economic agents' actions must be consistent with each other.

How do we use these two principles to determine the answers to the questions we raised above? It is time to introduce some economic concepts.

1.3 The Demand Curve

Suppose that we consider all of the possible renters of the apartments and ask each of them the maximum amount that he or she would be willing to pay to rent one of the apartments.

Let's start at the top. There must be someone who is willing to pay the highest price. Perhaps this person has a lot of money, perhaps he is