

# CHICAGO PRICE THEORY

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*To Gary Becker*



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# Chicago Price Theory





# Chicago Price Theory

## *An Introduction*

### THE CHICAGO ECONOMICS TRADITION

A longstanding Chicago tradition treats economics as an empirical subject that measures, explains, and predicts how people behave. Price theory is the analytical toolkit that has been assembled over the years for the purpose of formulating the explanations and predictions, and guiding the measurement.

In the tradition of Chicago's "Economics 301," the purpose of this course is to help you master the tools in the kit so that you can use them to answer practical questions. Studying price theory at Chicago is "a process of immersion in those models so that they bec[o]me so intuitive to one's work that, in combination with new empirical investigation, they open the door to novel evaluations of market organization and government policy."<sup>1</sup>

Because price theory at Chicago has always been tethered to practical questions, this course and the course Jacob Viner taught at Chicago almost 90 years ago (Viner 1930/2013) share some remarkable similarities. The tradition draws heavily on Alfred Marshall (1890) in, among other things, viewing human behavior in the aggregate of an industry, region, or demographic group. Market analysis is essential to price theory because experience has shown that markets enable each person to do things far differently than if he or she lived in isolation. It is no accident that price theory is named after a fundamental market phenomenon: prices.

Price theory is not primarily concerned with individual behavior; models featuring individuals are provided when they offer insight about the

aggregate. None of this is to say that price theory only looks at average or representative agents. Indeed, a primary reason that markets transform human activity is that they encourage the amplification of innate differences among people. Heterogeneity can be important; as we see in the example of comparative advantage below, markets can amplify heterogeneity through returns to specialization.

Price theory has not been static, though. Gary Becker, who taught Economics 301 for many years and gives a couple of the lectures in the video series that accompanies this book, developed human capital analysis and extended price theory to deal with discrimination, crime, the family, and other “noneconomic” behaviors. Becker and Murphy revisited the topic of complementary goods, using it to examine addictions, advertising, and social interactions (Becker 1957, 1968, 1993; Becker and Murphy 1988, 1993, 2003). Most important, people and businesses are in different circumstances today than in Viner’s time—as witnessed by the decline of agricultural employment, increased life expectancy, and the rise of information technology.

## PRICE THEORY DIFFERS FROM MICROECONOMICS

Although strategic behavior, such as the interactions among sellers in a market where they are few in number, has been treated with price theory (Weyl 2018), the introductory Chicago price theory course has not emphasized it. Competition, by which we mean that buyers and sellers take prices as given and the marginal entrant earns zero profit, is emphasized in large part because for most purposes, it is a reasonable description of most markets (Pashigian and Self 2007). Moreover, the competitive framework is simple enough to make room for us to master additional aspects of tastes and technology—such as product quality, habit formation, social interactions, durable production inputs, and complementarities—that are important for practical problems. Monopoly models are used on those occasions when price-setting behavior is relevant (Friedman 1966, 34–35; Stigler 1972; Demsetz 1993, 799). More generally, price theory is stingy as to the number of variables that are declared to be important in any given application.

In emphasizing markets and competition, price theory is different from microeconomics. Both typically begin with the consumer or household, but price theory stresses how consumers react to prices, many times without reference to utility or even “rationality”; whereas microeconomics

takes care to lay down an axiomatic foundation of the utility function and individual demand functions. Price theory then quickly gets to market equilibrium, treating related subjects such as compensating differences, tax incidence, and price controls.

Microeconomics makes more intensive use of game theory, which traditionally puts somewhat more emphasis on rationality and optimizing agents. Both price and game theory model behavior as an equilibrium, but the latter typically focuses on interactions among small numbers of agents and strives to make separate predictions for each one. The rest of the market is treated as a constant.

The typical auction model of price (Klemperer 2004) is an example of the game-theoretic approach. That model has a fixed number of goods for sale in the auction, with little attention to how the goods were produced or how they would be used if not sold in the auction. The model has a fixed number of buyers and predicts how each buyer separately makes bids on the items for sale. Understanding why there are, say, two buyers rather than some other number, or what determines the seller's reservation price, is considered to be an advanced topic. With its emphasis on competitive market equilibrium, basic price theory is not concerned with bid prices but rather the ultimate transaction price, aggregate quantities produced and sold, and how they are connected with costs of various kinds, as well as how the good is situated in the consumer demand system.

The market-equilibrium approach says that the most important effects of policy, technical change, and other events are not necessarily found in the immediate proximity of the event. An ethanol subsidy example, discussed below, features a subsidy that is paid only in the market for fuel, which uses just a fraction of total corn production but has more price-sensitive demand. The market for animal feed is unsubsidized, but corn farmers' opportunity cost for selling animal feed is linked to the subsidized fuel market, so much of their gain from the subsidy comes from the increase in the equilibrium price of animal feed.

Real-life situations involve an element of strategic interaction where the players in a small-scale game understand the outside options available to them in a larger market. One approach would be to simultaneously model both the strategies and market prices. Auction models could, in principle, have endogenous production, entry, and reservation values that reflect economic activity outside the auction. But the point of theory in economics or any other field is to focus on important

variables and leave the others to the side. As noted above, a great many markets have many buyers and many sellers, and have complementarities, taxes, habits, and other variables that need attention before getting into the strategic details for specific buyers or sellers. These are the situations in which price theory is needed.

The ethanol subsidy example also demonstrates how price theory guides measurement. Empirical studies of markets over time, or comparisons across countries or industries, must consider how to summarize a seemingly complicated reality behind each observation. Price theory shows how the appropriate approach to measurement depends on the question at hand.

Putting practical questions in a market context changes the answer. Trained economists are generally aware that market analysis is why the economic incidence of, say, a tax is different from the legal liability for paying the tax. But without price theory, economics training has too little practice in market analysis and results in policy investigations that too quickly presume that, say, the corporate income tax primarily harms corporations or an earned income tax credit primarily benefits workers.

### USING *CHICAGO PRICE THEORY* TO LEARN ECONOMICS

Graduate microeconomics texts often devote more pages to game theory than competitive equilibrium, and part of their competitive analysis is dedicated to confirming that an equilibrium exists as a mathematical object. To the price theorist, the toolkit's mathematical foundations and possible abstract generalizations are an interesting subject for specialists, whereas a general economics education requires seeing how the tools have been successfully applied in the past and preparing to nimbly apply them to the next practical question that we encounter. Completing a mathematical microeconomics course will not make you good at price theory; price theory skills are obtained by practicing applications of the toolkit.

Whereas many economics courses help you master models, and leave application of those models as an advanced topic, price theory immediately engages the student with applications. The book and video series (available at <https://press.princeton.edu/titles/30205.html> or [ChicagoPriceTheory.com](http://ChicagoPriceTheory.com)) together provide three or four methods of practicing applications. First, both book and videos contain

chapter-length examples such as addictive goods, urban property pricing, learning-by-doing, the consequences of prohibition, the value of a statistical life, and occupational choice. These chapters are instances of applications of price theory that were advanced by important research papers, and sometimes spawned an entire subfield of research activity, with novel and counterintuitive results.

At Chicago, both the students and instructors over the years have gotten better at price theory as a result of engaging with the homework. If you want a formula that makes you good at price theory, this is it: practice. Know what tools are available to study markets, and with repetition notice the types of questions to which each tool is best suited, in the sense of offering a simple analysis with predictions in accordance with observation.

The Chicago homework problems are not paired with specific lectures because part of excelling at real-world applications is knowing which price-theoretic tool is the best one to use for a particular practical problem. This book therefore provides a number of sample homework questions, but only at the end of one of the three parts of the book. The video series includes about a dozen of Professor Murphy's impromptu answers to student questions about current market events.

Becker and Murphy's course has always been intensive in solving applied problems, with considerable time of the instructors and advanced star graduate students devoted to formulating and helping students solve homework questions. The drafts of the book and video are now being used at Chicago to further "flip" the Price Theory classroom so that more of the student interactions with Murphy address applied problems.<sup>2</sup> Price theory instructors not at Chicago also have the opportunity to reallocate their time away from lecturing—let this book and video series help with that—and toward developing and discussing relevant and challenging applied homework questions.

Another way to practice applications is to do some homework before you begin the course and return to them afterwards. You will be amazed at how differently you think at the end! The six questions below are good examples:

1. Is learning by working on the job cheaper than formal schooling? (See chapter 9.)
2. What is the difference between prohibiting marijuana sales and subjecting its sales to a high tax? (See chapter 12.)

3. A great many manufacturers use machines and labor in fixed proportions. Does that mean that the wage rate has little effect on the amount of labor used in manufacturing? (See chapter 7.)
4. Does the availability of e-books reduce the sales of physical books? (See chapter 11.)
5. When housing prices are above their long-run values and continue to rise, is that good evidence that home buyers or builders have unrealistic expectations about the future? (See chapter 15.)
6. Could a billion dollars in federal subsidies to farmers increase farm incomes by more than one billion? (This chapter.)

As you work through the homework questions and the applied chapters, you will practice identifying and applying the tools of price theory. But the tools are just a means to an end, which is to understand human behavior. Most of the homework questions and applied chapters in price theory are therefore real-world questions about human behavior, of the same kind that are addressed by professional economists every day at central banks, major corporations like amazon.com, and regulatory agencies like the Food and Drug Administration.

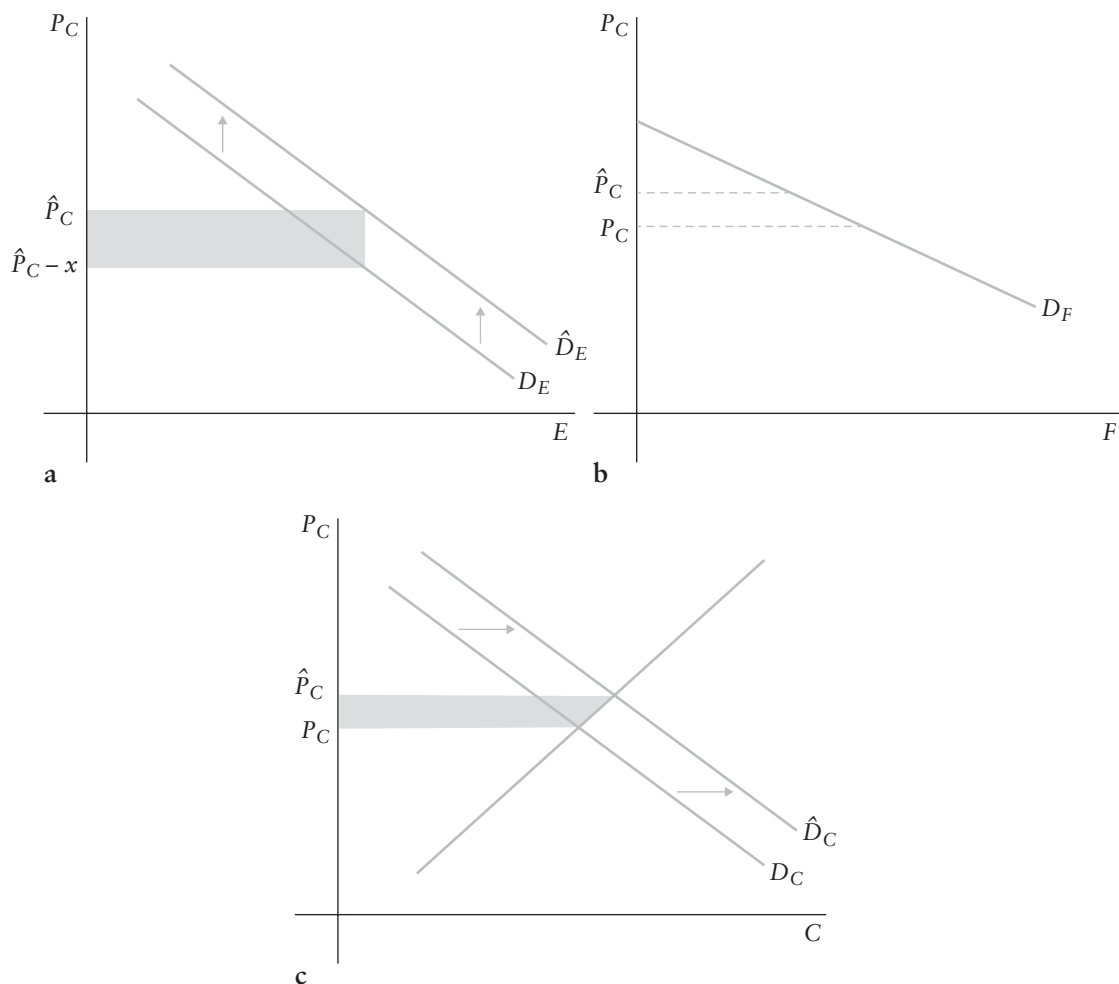
Because it is useful, price theory gets applied to a large number of practical questions. Each practitioner of price theory thereby builds a wealth of experience that pays dividends in subsequent applications. New problems are recognized for their relation to problems already solved. Perhaps this is why price theory is sometimes called “intuitive.”<sup>3</sup>

## EXAMPLE: ETHANOL FUEL SUBSIDIES

### A Market “Multiplier”

The federal government has been supporting the production of ethanol fuel with a variety of tax credits, subsidies, guarantees, and so forth. When the U.S. government started subsidizing ethanol fuel, the price of land used to grow corn—the primary ingredient in U.S. ethanol production—increased, regardless of whether the corn grown on that land actually ended up in the fuel.

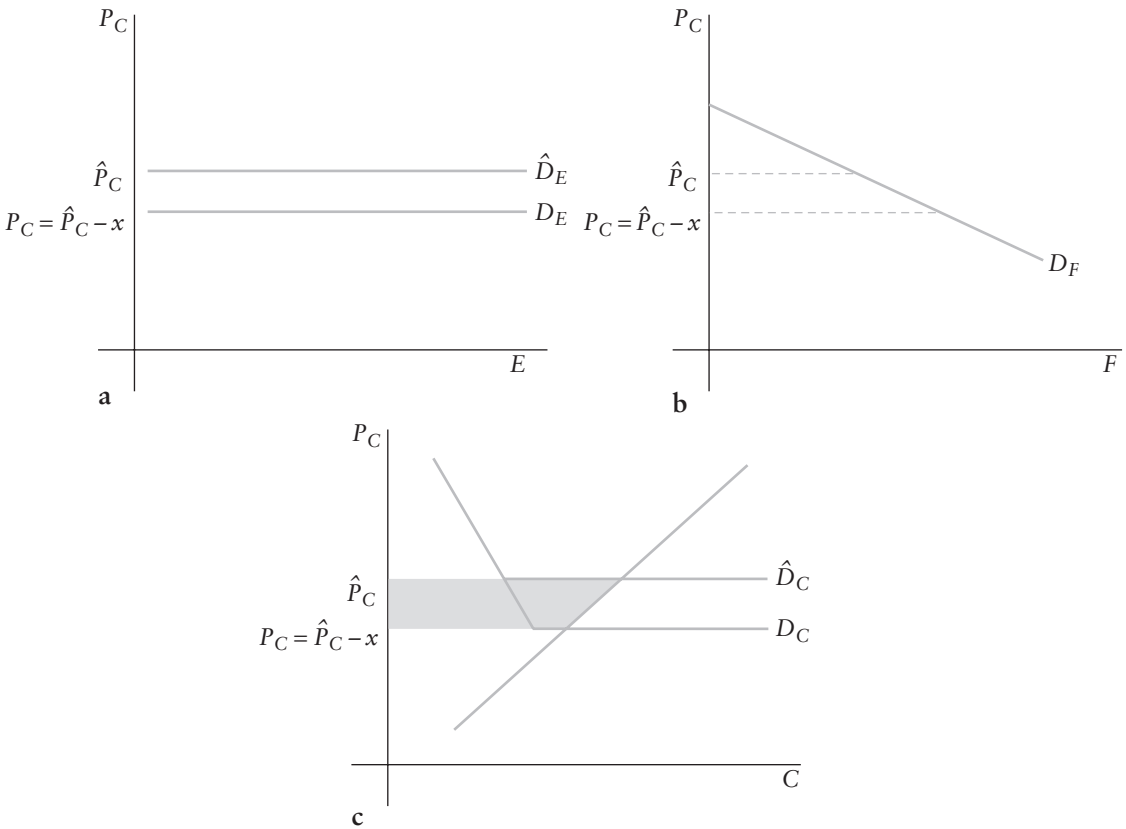
Given that U.S. ethanol is primarily produced with corn, is it possible that corn farmers benefit by more than \$1 billion for each \$1 billion that the federal treasury spends on that support? In other words, let’s use price theory to examine the incidence of ethanol fuel subsidies.



**Figures I-1a, I-1b, and I-1c:** Can farmers gain more from an ethanol subsidy than the amount the government pays?

Take a simple model in which corn,  $C$ , is used to make either ethanol fuel,  $E$ , or animal feed,  $F$ . We will consider demand curves  $D_E$ ,  $D_F$ , and  $D_C$ , shown in Figures I-1a, I-1b, and I-1c, respectively;  $D_C$ , the market demand curve for corn, is found by adding the demands for ethanol and animal feed. A subsidy of the amount  $x$  per unit corn used in ethanol serves to increase the demand for ethanol by  $x$  units in the price dimension to  $\hat{D}_E$ . Horizontally adding the new ethanol demand curve with the stable feed demand curve, we get a new overall corn demand curve  $\hat{D}_C$ . Supply and demand for corn determine the equilibrium price of corn, which is the same regardless of how it is used. An example of our market is shown in Figures I-1a–c.





**Figures I-2a, I-2b, and I-2c:** In a market where demand for ethanol is more elastic than the demand for feed, the benefit of the ethanol subsidy to corn farmers can exceed the amount the government spends on the subsidy.

The result of the subsidy is that more corn is sold overall, and for a higher price ( $\hat{P}_C$  rather than  $P_C$ ). Less corn is sold for animal feed, because that demand curve is stable and the price is higher. The extra corn sales go to ethanol because the subsidy amount  $x$  more than offsets the price increase.

Our question, posed from the perspective of the figure, is whether the producer-surplus trapezoid in the market for corn (see Figure I-1c) can be larger than the subsidy-expenditure rectangle in the market for ethanol (see Figure I-1a).

Consider a case in which the demand for ethanol fuel is perfectly elastic (Figure I-2a) and the demand for feed is strictly decreasing (Figure I-2b). The overall demand curve is flat when the price is below what the ethanol market will bear (Figure I-2c). At prices above that, all corn is sold for