1 Economic Evidence in Antitrust: Defining Markets and Measuring Market Power

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Antitrust law, policy, and practice are the product of a long and fruitful interdisciplinary collaboration between law and economics. Our chapter addresses an important aspect of that collaboration: the use courts can and should make of two bodies of knowledge in empirical industrial organization economics, as that academic discipline has evolved over the last few decades. Our examples focus on the US experience, which we know best. But we are confident that the broad considerations we discuss apply to any competition policy regime.

The first body of economic knowledge we discuss involves methods of distinguishing among alternative explanations for market outcomes or firm conduct. This is termed the problem of "identification" in empirical economics. We show how courts can apply what economists have learned about identification to the problems of defining markets and determining whether market power has been exercised. We show that the same analytic issues arise regardless of whether the evidence on these concepts is quantitative or qualitative.

The second relevant body of economic knowledge derives from the empirical economics research literature, taken as a whole. That literature demonstrates that differences among industries are important, making the industry the appropriate unit of analysis for addressing economic issues related to competition policy. A similar conclusion was reached long ago in antitrust law, when market definition became central to reasonableness analysis. But, as we explain, the research literature goes further in a way that has not yet been fully appreciated in antitrust: it suggests generalizations across closely related industries that can be exploited to help evaluate evidence and resolve cases.

We conclude by considering ways of increasing the institutional capacity of the judicial system to make use of these two bodies of economic learning. These include a possible limited role for neutral economic experts in litigation, and a role for the antitrust enforcement agencies in identifying and codifying relevant generalizations about industries from the empirical economic literature to make that learning available to courts.

1.1 Antitrust as an Interdisciplinary Collaboration

Antitrust law, more than most legal fields, looks like an outpost of economics. Competition policy decision-makers today rely extensively on economic concepts, reasoning, and

evidence. Economic terms like elasticity of demand, marginal cost, and oligopoly behavior have become part of the language of antitrust.

The importance of economics is most evident when antitrust cases are resolved in litigation. In deciding individual cases, courts routinely undertake a detailed economic inquiry into the nature of competition and the effect of challenged practices on that competition. This is most evident in merger analysis, where modern examples are numerous.[1] Economic concepts, reasoning, and evidence are central to modern antitrust analysis outside the merger context as well.[2] In enforcement agency investigations as well as antitrust litigation, the development and interpretation of evidence about industry market power and conditions of entry, and about the likely effects of a merger or business practice, are importantly exercises in applied economics.

Economic reasoning also plays an important role in framing legal rules. Perhaps the most notable example occurred in 1977 when the Supreme Court overruled the per se prohibition against nonprice vertical restraints, causing such practices to be evaluated under the rule of reason.[3] The Court emphasized that a blanket prohibition was inappropriate given that manufacturers can use such contractual restrictions to promote competition by inducing retailers to provide point-of-sale services like promotion and after-sale service, through preventing dealer free-riding.

When industrial organization economists create new tools and methodological approaches, the antitrust field pays attention. For example, as new empirical methods of detecting and measuring market power have been developed, and as advances in computerization have facilitated the collection and manipulation of data, empirical economic tools have increasingly been applied to measure market power in antitrust enforcement and litigation. Since our own experience using empirical methods in antitrust began during the mid-1980s,[4] and since we last surveyed the topic in 1992,[5] the use of such methods has grown rapidly. It is no longer a surprise to see empirical analyses presented to the antitrust enforcement agencies by outside parties during the course of an investigation, developed by enforcers to analyze a matter, or presented as part of expert economic testimony in litigation.

Just as antitrust has become infused with economics, industrial organization economics—the economics field most closely related to antitrust—has turned its attention to the legal system. Over the past few decades many of the issues and problems addressed in the research literature on industrial organization economists have been suggested or framed by antitrust cases. In one widely used undergraduate industrial organization text, for example, the index listing legal cases most involving antitrust goes on for three pages.[6] Moreover many academic economists in the industrial organization field undertake litigation-related consulting projects involving antitrust issues.

Rather than viewing antitrust law as another victory for economic imperialism, or industrial organization economics as captured by the concerns of well-heeled corporate clients with antitrust problems, we understand these developments as the natural result of a

long and successful interdisciplinary collaboration between law and economics. That deep engagement was probably inevitable. Most modern competition law regimes have economic goals, such as promoting economic efficiency or consumer welfare, in whole or substantial part.[7]

An emphasis on economic goals inevitably brings economics to bear, leading courts to frame antitrust issues in terms of economic concepts such as market power, competitive effects, entry, and efficiencies, and to interpret the detailed facts involving a particular industry and specific challenged practices through application of the logical framework supplied by economics.[8] Courts have become analytically rigorous about the effects of the challenged conduct on competition: identifying the market or markets in which competition has or will likely be harmed and the mechanism by which the challenged conduct does so. In US antitrust law the use of an economic framework was abetted by the development of the "antitrust injury" doctrine, which requires plaintiffs in many cases to explain how their injury flows from the antitrust violation they have alleged.[9] This doctrine implements the key analytical distinction from economics between protecting competition and merely protecting competitors, as it ensures that plaintiffs may not recover damages merely because they have been harmed.

Antitrust analysis also reflects the concerns of the legal system, leading judges at times to approach issues in ways that differ from how we economists might act on our own. Courts may, for example, undertake the step of defining markets even in settings where the competitive effects of business conduct can be measured directly, settings where economists might find market definition unnecessary. Economists often prefer to bring all the available information to bear, whereas courts at times adopt truncated analyses that exclude certain relevant inquiries in order to reduce the costs of administering the legal system and to specify clear and simple rules that give more guidance to courts and firms. The legal system will not fine-tune particular industries to achieve specific economic goals through regulatory determinations, as some economists have suggested. Antitrust policy properly rejects frequent suggestions that courts or regulators attempt to determine that a particular price be achieved, that a particular entrant come in, or that a particular industry structure is efficient. Rather, to the extent possible, the legal system trusts the competitive mechanism to achieve economic goals. For example, merger law does not seek to identify and create the most efficient industry structure; it merely attempts to determine whether a particular merger in an industry would harm competition.

1.2 The Empirical Problem of Identification

1.2.1 Empirical Economic Methods in Antitrust

Economic methods are valuable to antitrust because they encourage precise measurement and analysis of key economic relationships and effects.[10] In antitrust enforcement and litigation the use of economic methods helps focus the attention of decision-makers and

litigants on the connection between the economic theory of the case and the evidence. Economic methods help clarify what hypotheses are in dispute and what evidence can help test them. Economic methods also encourage analytical rigor.[11] Careful articulation of the theory can clarify thinking by laying bare key assumptions and reasoning steps, and by structuring the collection of evidence.

Our chapter addresses two facets of empirical economic methods of testing theories with evidence that have particular relevance for antitrust analysis: decision-making when information is "local" and identification. First, economic methods bring to the surface the background assumptions that underlie any particular articulation of the link between economic evidence and the theory of the case. Antitrust policy-making, whether conducted by enforcers or courts, invariably takes place under conditions of uncertainty using what we term "local" information. Information is local for the obvious reason that the record in any investigation or case is necessarily limited in scope. Litigants have neither infinite time nor infinite resources to gather information. Information is also local for a more subtle reason: inferences about economic concepts like market power or efficiencies, whether quantitative or qualitative, are never made in a vacuum. Rather, these inferences are necessarily predicated on assumptions that permit estimation of the magnitude of the effects.

Economic reasoning connecting theory and evidence lays bare those assumptions, allowing them to be recognized. This in turn facilitates evaluation of the plausibility of such assumptions and the extent to which conclusions depend on them. Accordingly, empirical economists routinely test the robustness of their conclusions to alternative assumptions, and identify the key assumptions underlying their analysis. This reasoning process has obvious application to the evaluation of economic evidence in the courtroom, and much of what goes on in the back and forth over empirical work between expert economists can also be understood this way.

The need to make decisions when information is local has another implication for investigations and litigation: it heightens the importance of using all available evidence, whether quantitative or qualitative, in antitrust decision-making. For this reason we give qualitative and quantitative evidence equal attention below when we discuss identification with respect to the market definition and market power inquiries. Moreover the need to make decisions when information is local heightens the value of relying on generalizations based on studies of related industries when reaching conclusions about industry performance and firm conduct, as we will also discuss further below.

In the remainder of this section we address a second important facet of empirical economic methods with particular relevance when evidence is analyzed in nonexperimental contexts such as antitrust: identification. We begin with a perspective on quantitative data analysis, but the conclusions we reach also apply to the analysis of qualitative evidence. Antitrust analysis, like most work in empirical social science, is best viewed generally as making inferences from evidence without the benefit of performing experiments like those that are routine in high school chemistry.

When data are analyzed in both experimental and nonexperimental contexts, the analysis must address a number of difficulties, including specification (what are the range of sensible general forms for the relationship under evaluation, including the relevant variables, the way they could interact, and the nature of errors or uncertainty?),[12] observation (how well do the measures approximate the variables they are intended to represent?), and estimation (what do the data in the sample suggest as to the range of plausible relationships among variables?). But inference in the social sciences, including economics, must also confront a distinctive problem, difficulties in identification, which are largely not issues in the experimental context of the physical sciences.[13] The identification problem arises because empirical economists can rarely perform experiments on economic actors; they must instead look carefully for settings in which nature has created an experiment for them. In planning an empirical test, economists must therefore explain why it is reasonable to interpret the data as having been created by an implicit experiment, and describe the nature of that experiment. This explanation—identification—is an important part of empirical economic analysis.

More generally, identification can be understood as clarifying the basis on which one theory can be preferred to another in nonexperimental evidence. This problem in data analysis has obvious relevance for antitrust analysis, when a court must select between alternative interpretations of industry behavior. All antitrust cases that go to trial involve a contest between at least two distinct theories explaining firm conduct, one in which the challenged behavior lessens competition and one in which it is efficient. The economic principle of identification focuses attention on the correspondence between the evidence and the competing economic theories, and thus on whether the evidence can be used to distinguish between competing theories of the case.

We illustrate these points through a close analysis of identification strategies in two areas of antitrust practice: defining markets and measuring market power. The first area focuses on identifying demand-side attributes of the industry at issue; the second on identifying supply-side attributes. Our chapter does not address the measurement of damages, the problem of inferring agreement from circumstantial evidence or the many other areas of antitrust practice where economic evidence is routinely employed.

1.2.2 Identifying Buyer Substitution in Market Definition

The empirical problem of identifying the extent of buyer substitution is ubiquitous in antitrust analysis. It is central not only to market definition, our primary example in this section, but also to the identification of unilateral effects of merger among sellers of differentiated products, an issue to which we will also refer. In both settings a key empirical question is whether demand grows less elastic when price increases are coordinated across a more extensive scope of products or locations. This is the question that determines whether the products and locations constitution an antitrust market or whether a merger would create unilateral effects by lessening localized competition.

Notwithstanding the close similarity of the economic questions addressed in these two inquiries, the types of evidence commonly relied upon to answer differ substantially. In practice, the unilateral effects inquiry gravitates toward quantitative evidence,[14] while the market definition inquiry commonly looks first and often exclusively to qualitative evidence. This difference—on its surface something of a paradox—may have a number of explanations. First, market definition may tend toward qualitative evidence because it was recognized as a central question in antitrust litigation long before quantitative evidence became important, while the unilateral effects theory became persuasive only with the development of empirical tools that allowed precise measurement of the extent of localized competition and with the widespread availability of point-of-sale scanner data for retail products (which are commonly differentiated, often by brand name).[15] Second, unilateral effects analysis may gravitate toward quantitative evidence because it can be difficult to delineate market boundaries convincingly in industries characterized by extensive product differentiation. With market shares difficult to determine (and not necessarily meaningful in any event),[16] quantitative methods generally provide more convincing evidence of competitive problems than do market shares.[17] Third, market definition may tend toward qualitative evidence because it is frequently (though improperly) assessed in a vacuum, unmoored from the theory of harm to competition. By contrast, the assessment of unilateral effects involves the direct evaluation of a competitive effects theory, and this connection is readily made evident when quantitative evidence is analyzed. In principle, there is no good reason for ignoring quantitative evidence in market definition or ignoring qualitative evidence in evaluating unilateral effects; depending on industry circumstances and the nature of the available information, either type of evidence could be the most compelling in any particular case. Accordingly our discussion will focus on the empirical economic issues at stake in identifying a market, without regard to whether the evidence is qualitative or quantitative. But we will often employ quantitative examples to illustrate methodological points, when that is how the issues can be made most clear. Our discussion of market definition is limited to settings in which the alleged harm to competition is prospective, and to those in which the theory of why competition is harmed involves cooperative rather than exclusionary conduct. Accordingly we do not consider, among other things, the *Cellophane* fallacy.

It is obvious to economists that there is an implicit economic argument underlying market definition, and that this argument is closely related to the economic and legal theory of a particular case. In a horizontal effects merger case, for example, the relevant question is whether competitive incentives of the merging firms will change following their transaction. If there is a great deal of competition for the merging firms' products from other firms, competitive incentives will change little. Market definition offers one way to get at this question, albeit an imperfect or incomplete one.[18] By contrast, courts do not always see the market definition exercise as related to the economic theory of harm. Instead, they

may think of market definition largely in a legally analytical way, as one of the things that must be proved for the reasonableness analysis in an antitrust case.

Regardless of how market definition is understood, it is often a useful component of the way antitrust doctrine is implemented in court. It requires the plaintiff in the antitrust suit to state, with reasonable specificity, what competition might be harmed by the challenged practices—by a merger, by allegedly exclusionary acts and practices, by an agreement on practices said to facilitate coordination, and so forth. Indeed market definition can be useful in this procedural sense even when market shares are not strongly probative of the magnitude of likely competitive harm. The market definition requirement also permits the defendant to rebut the idea that competition is fragile enough to be harmed, by attempting to establish a wider market.

The US merger guidelines adopt a conceptual approach to market definition that emphasizes an analysis of buyer substitution.[19] This approach is generally but not invariably followed by US courts.[20] By this methodology a candidate market does not qualify as a relevant antitrust market unless the firms participating would find it profitable to raise price for some or all of their products, at some or all of their locations, after accounting for the likely buyer response to a higher price. This analysis turns on the elasticity of candidate market demand. In particular, to first order, it would be profitable for the firms participating in the candidate market to raise price if and only if the inverse elasticity of the residual demand facing the firms[21] exceeds their Lerner Index of price–cost margin $(1/ > L)$.[22] In the event this condition is not met, because candidate market demand is too elastic, the candidate market is expanded to include demand substitutes (additional products or additional locations). The candidate market expansion continues until demand grows sufficiently less elastic as to satisfy the condition for a price increase to be profitable.

The economic problem in evaluating unilateral competitive effects of mergers among sellers of differentiated products is similar to that of market definition. In differentiated products industries, competition may be localized: buyers may view some products as closer substitutes to each other, and individual sellers may, in consequence, compete more directly with those rivals selling the closest demand substitutes. A merger of firms selling two products in localized competition may lead to higher prices for each product, since the merged firm can now recoup some of the profit it would previously have lost as a result of buyer substitution were it to raise price. Before the merger (assume here single-product firms) each firms sets price such that the inverse elasticity of its residual demand function equals its Lerner Index of price–cost margin. If the two products are in localized competition, the residual demand for one or both grows less elastic, giving the merged firm the incentive to raise one or both prices.

As should be evident, in order to define markets or assess unilateral effects, it is essential to determine the extent of buyer substitution caused by a price increase. A complete quantitative assessment would also require information about the price–cost margin.[23] But the

central economic issue at stake in market definition or unilateral competitive effects is the likely magnitude of demand substitution.

In the remainder of this section we examine strategies for identifying the magnitude of buyer substitution in the event of a price increase. We look first at how demand substitution is identified, and separated from other causes of price increases, when two common quantitative approaches are employed: estimation of demand elasticities and inference about buyer substitution from the way prices vary as firm conduct or market structure changes. We then show how the same and other approaches to identification apply when evidence as to demand substitution is qualitative.

Identification When Evidence Is Quantitative

Estimating Demand Elasticities   To focus our discussion of how buyer substitution is identified, we first sketch a hypothetical study seeking to provide evidence as to whether the retail sale of beer in Chicago constitutes an antitrust market by identifying the elasticity of beer demand in that city. The proposed study is purposely oversimplified relative to how one might be set up in practice.

The study employs monthly data on total retail revenues and total retail quantities of beer in the Chicago metropolitan area over a five-year period. Average revenue is computed from these data. Data on the average prices for soft drinks are also collected, along with data on the average unemployment rate in the region. All variables are transformed into their logarithms, and the following equation is estimated:

$$\ln(\text{quantity beer}) = \alpha + \beta \ln(\text{price beer}) + \gamma \ln(\text{price soft drinks})$$
$$+ \delta \ln(\text{unemployment rate}) + u.$$

The equation is estimated using two-stage least squares, with a time series on the logged average revenue from the retail sale of beer in Cleveland as an instrument for the price of beer in Chicago. The resulting estimate of β is interpreted as the elasticity of demand for beer in Chicago.

A number of important issues related to the probative value of evidence aside from identification are embedded even in this simple, straightforward econometric approach to developing evidence on the magnitude of buyer substitution. We will note a few, but our list is not exhaustive. Some involve observation. Beers are differentiated products, sold in a range of unit prices. In consequence, variation in average revenue, the proxy for price, could reflect variation in the market share of various brands even if no prices change. Assuming the resulting measurement error is not correlated with the other independent variables in the equation, it can be expected to lead to a downward bias in the estimate of β, toward finding little buyer substitution.[24] Also the regional unemployment rate might not be the best measure of the way changing local economic conditions affect beer demand. For example, if beer consumption is concentrated within particular demographic

groups, the aggregate unemployment rate might not reflect the financial situation of those buyers most interested in the product.

Other possible problems with this approach to learning about buyer substitution involve specification. The estimated equation does not account for advertising, by brewers or the producers of soft drinks, yet advertising may well affect demand. Nor does it allow for substitution to other beverages such as wine. Possible seasonal variation in the demand for beer is unaccounted for.[25] And the double-log specification, while convenient for interpreting coefficients (as elasticities), builds in an arbitrary assumption about the curvature of demand and the form of the error term (multiplicative not additive) that could be incorrect. These problems could lead to biased estimates of the key parameter, the coefficient β. A more subtle specification problem involves the monthly sample. A one-month reduction in the average price of beer—for example, if multiple producers place beer on sale at the same time—might lead to a different quantity response from a more permanent price reduction. If a brief price cut would expand purchases temporarily, as buyers stock up their refrigerators and pantries, the monthly demand elasticity might overstate the intermediate or long-term buyer response that might be more relevant to questions that arise in antitrust decision-making.[26]

Estimation problems could also be important. In a monthly sample, unobservable demand shocks might be serially correlated, making estimates of β appear more precise than the data actually allow. Or the prices of beer and soft drinks could be correlated, making it difficult to disentangle the demand parameter associated with either price individually.

In addition this method of assessing the magnitude of likely buyer substitution raises the distinctive social science difficulty of identification, our primary focus in this chapter. The instrumental variable technique used to identify demand in the hypothetical example operates in effect by removing variation in price where price changes are unlikely to reflect buyer substitution (removing variation unlikely to cause movements along a demand curve). In particular, the experiment created by the instrument used in the hypothetical example presumes that when beer prices in Chicago move in the same way as price changes in Cleveland, the price changes result from common production or distribution cost variation (which induce movements along a demand curve) and not from shifts in demand. If that assumption is correct, the output response to these price changes will reveal the magnitude of buyer substitution. Unfortunately, this is a suspect assumption in an advertising-intensive industry like brewing.[27] If it is incorrect, demand can appear to be more responsive to price (more elastic) than it is in fact.

This type of study of buyer substitution patterns is not exclusively employed in market definition. Demand elasticities can also be estimated in order to make inferences about the scope of localized competition and the potential for adverse unilateral effects of mergers. Defendants may argue, for example, that unilateral effects are unlikely because the cross-elasticity of demand between the products of the merger partners is low.[28] More sophisticated approaches along similar lines estimate the parameters of demand systems involving

a large set of products, and simulate the effects of merger after incorporating information (or assumptions) about marginal cost and the nature of oligopoly conduct.[29]

Relating Price to Market Structure   The likely magnitude of demand substitution in the event of a price rise is sometimes assessed quantitatively using a different type of identifying experiment, involving changes in conduct or market structure. One example of such an experiment arises if there is a cartel that was in effect for only a given time period or only in particular places. A related identifying experiment can be used if market structure differs across otherwise similar locations, or changes over time. If prices increase when the number of firms selling the products in a candidate market (or at the locations in a candidate market, or in the times or locations of the cartel) decline, then it may be reasonable to infer that a hypothetical monopolist of those products would find it profitable to raise price at locations where the number of firms has not decreased.

   This approach was employed in the *Staples* litigation to analyze market definition and the likelihood of unilateral competitive effects of merger.[30] The market definition question in that case was whether consumable office supplies sold through office superstores should be deemed a market, or whether to expand that candidate market to include other distribution channels such as discount mass merchandisers and warehouse club stores. Analysis of the data by the FTC's econometric witness showed that prices were higher in locations and at times with only one superstore chain present than in locations and at times with multiple superstore chains present. If so, a hypothetical monopolist of consumable office supplies sold through office superstores in locations and at times with multiple superstore chains present could profitably raise price, allowing the inference of a market limited to the superstore distribution channel.[31]

   Market success would then depend on the product being sold in multiple locations or at the same location over time, and on the nature of the market to perform an appropriate condition, as in differences of market structure from one period to the next or from one location to another. Identification then results from the assumption, which must be defended, that variation in market structure—particularly the decisions by office superstore chains on where to locate—does not reflect variation in the marginal costs of doing business in those locations (beyond factors that can be accounted for in the statistical analysis). That is, in order to identify the influence of demand on prices, the appropriate econometric practice is to use only those observable movements in market structure that correspond to exogenous supply side changes, in this case, changes in competitive incentives. In the analysis undertaken by the government in *Staples*, identification in comparisons of same-city prices over time was based on the assumption that any unobservable factors affecting cost likely changed little from quarter to quarter over a few years. This assumption was plausible on the facts of the case and was shared by both parties to the litigation. Identification in comparisons across cities was based on the measurement of all significant cost variables mentioned in merging firm documents as the basis for pricing and

location decisions. Moreover the estimates of price changes based on cross-city comparisons and same-city comparisons over time were similar, corroborating each other's identification strategy.

Other Quantitative Approaches   These two quantitative measures of buyer responses to changes in relative prices—estimation of demand elasticities and the comparison of prices across markets thought to be similar except for differences in market structure—do not exhaust the possible methodological approaches. Other quantitative possibilities suggested in the economics literature are potentially available for antitrust analysis. For example, beginning with the influential work of Berry, Levinsohn, and Pakes, a number of articles model the structure of product differentiation to attempt to measure long-run substitution behavior by buyers.[32] Other studies use information about price dispersion to study price discrimination.[33] Perhaps the largest literature concerns the strategic determination of prices in auctions.[34]

Identification When Evidence Is Qualitative   Market definition is more often conducted without these types of systematic empirical analyses than with them.[35] This should be no surprise: good data are not always available, key parameters in the estimation can be difficult to pin down (accompanied by large standard errors), and some tribunals are less comfortable than others with the problem of sorting out conflicting econometric testimony. Moreover qualitative evidence can be compelling, at times more probative than quantitative evidence. But when qualitative evidence is employed, the underlying economic logic of the identification strategy is often analogous to an approach to identification taken in the empirical economics literature with respect to quantitative evidence.

Demand Response to Price   A qualitative analogue to the estimation of demand elasticities may come from anecdotal evidence involving buyer responses. A firm's marketing executives may be able to report on the results of an experiment with a price increase,[36] or that their price increased following what they perceived as firm-specific increase in marginal cost. The executives may have an understanding of whether they lost share following a price increase, and if so, which rivals benefited the most from buyer substitution. To identify these responses as providing information about buyer substitution, there must be good reason to believe that the price or cost changes were exogenous.

Relating Price to Market Structure   A comparison of prices across markets thought to be similar except for differences in market structure similarly does not invariably require sophisticated data analysis. The court opinion in *Staples*, for example, evaluates this evidence based solely on party pricing documents, without reference to the econometric evidence in the record analyzing pricing systematically. The court found, based on the documentary evidence, that office superstore prices were higher when fewer superstore chains were competing. This conclusion was based both on comparisons across markets that varied in the

number of competing superstore chains at a given time and on comparisons within markets in which the number of superstore varied over time. The latter price comparisons, made based on the anecdotes and raw data presented in the documentary evidence, identified the influence of demand on prices (or, in this case, the lack of influence of demand on prices) under the same assumption adopted in the econometric work that any unobservable factors affecting cost likely changed little over the time period studied.

Structure of Product Differentiation   Market definition might also be based on qualitative information about the distribution of product characteristics and seller locations, and information on how much more buyers value products that are exactly what the buyer wants relative to products that are not quite what buyers are looking for. This approach would be analogous to econometric methods of inferring the distribution of the valuations buyers place on unobservable product characteristics from market shares and buyer characteristics.[37] This methodology requires that buyers differ from each other in their valuations of product characteristics, and that those differences or the basis for them be observable.

Under some circumstances this kind of analysis can be conducted without sophisticated modeling. For example, seller marketing documents may describe the geographic location of seller plants, the geographic distribution of buyers, and shipping costs. That information could be used to identify those buyers that view any pair of firms as their first and second choices, and to assess the likely profitability of a unilateral increase in price at either location following their merger. The econometric literature emphasizes the inferential problems arising from the presence of characteristics known to buyer and seller but unobservable to the analyst, as those characteristics are likely correlated with price. Accordingly, to identify the results of this kind of qualitative calculation as depicting buyer substitution patterns, it is important to have confidence that the most important product and buyer characteristics—locations in the example above—are observable.

Buyer Surveys and Bidding Records   Another method of assessing the likely response of buyers to price changes, buyer surveys, has both quantitative and qualitative analogues. One quantitative possibility might involve sampling of retail customers at shopping malls using a carefully constructed survey instrument, for example.[38] But surveys can also be informal, based on customer interviews. The latter approach was adopted by the Irish Competition Authority as the basis for market definition and unilateral effects analysis in a recent decision preventing IBM from acquiring another firm in the business recovery hotsite industry.[39] If there is some basis for concluding that the customer views are informed, representative, and account for a reasonable fraction of the relevant business, even an informal survey may provide a reliable guide to likely buyer substitution patterns. The identification problem in these survey contexts, whether the evidence is quantitative or qualitative, would be addressed with an argument as to why the reported buyer responses are reliable guides to future buyer conduct under the conditions likely then to prevail in the marketplace.

A different approach to a buyer survey of demand, of particular applicability to the analysis of unilateral competitive effects of merger, involves the examination of bidding records to identify buyer preferences and substitution possibilities. If many buyers routinely solicited bids from the same two sellers in the past, that evidence may identify localized competition between the two today, at least if product characteristics and relative prices among all sellers (including those two firms) have not changed (the identification assumption). That a particular buyer who bought from firm A in the past included firm B in a final round of bidding indicates that firm B may be its second choice—more reliably, in some circumstances, than if the buyer were simply to opine about its second choice. As with other methods of assessing buyer substitution, the identification issue is similar regardless of whether the evidence is quantitative, derived from a systematic analysis of buyer bidding records (or by comparing the records of the sellers), or qualitative, developed from an informal survey of an informed and representative group of customers.

Business Executive Views and Identification   Even when the evidence is primarily quantitative, the argument for identification may turn on qualitative evidence, particularly the views of business executives.[40] Experienced marketing executives may be able to explain which price changes likely result primarily from shifts in supply, whether all the significant cost-shift variables are observable, whether buyer valuations of product characteristics are observable and unchanging, and the like. For example, while we were working for one of the parties in a merger investigation over two decades ago, we sought econometrically to estimate the degree to which the potential exercise of market power for products of the parties had been disciplined by substitution to third-party products. We used a product-specific price and quantity data set. But we also asked managers to explain the changes in prices in the data set. We sought to use only the exogenous changes in prices that managers chose to implement for supply-side reasons, excluding their reactions to shifting demand conditions and to the exogenous movements of other firms.[41]

As a general rule, it is sensible to suppose that business executives have a reasonable basis for their opinions. But in principle, the reliability of those views could be tested and buttressed by asking the same kind of questions that would naturally arise were such conclusions reached by an expert economist based on an empirical study. Suppose, for example, that likely buyer substitution in the event of a price rise—a key issue in market definition and the evaluation of the unilateral effects of merger among sellers of differentiated products—is assessed not through a quantitative study of demand but through the testimony of an industry marketing executive. Like the econometrician thinking about market definition, the marketing executive concerned with pricing needs to how customers would react to a price change undertaken by the company in an effort to increase profit margins. Would customers substitute away, and if so, to which competitors' products? Would that substitution be much lessened if a particular competitor were (coincidentally or through conscious parallelism or otherwise) to raise prices at the same time? Marketing

executives very frequently think about the first two questions, perhaps less frequently about the third, and draw on a wide variety of different sources of knowledge. In assessing the marketing executive's testimony and documents, the key questions of identification turn on the executive's familiarity with this and related markets, the depth of investigation undertaken by the executive, the plausibility of the background assumptions the executive relies upon, and the clarity with which evidence was linked to the business purpose of assessing a pricing decision.

If an executive were testifying about the output effects of past increases in price, one important question would be whether his or her views are based on observations as to past supply-side shocks.[42] If past price changes were instead largely the result of shifts in demand, one might question whether the executive would have much basis for developing an informed opinion as to buyer substitution from observing buyer responses to price fluctuations.[43] Ultimately the linkage of the analysis of buyer responses to price changes that come from the supply side—cost or strategy changes at the firm or at its competitors—determines its suitability for the pricing business purpose and its suitability as evidence in an antitrust enquiry.

To see how such a conversation about identification might play out in practice with evidence in a merger case where unilateral effects are alleged, suppose that the government or other plaintiff can show that a number of customers report that products of merging firms are their first and second choices, the two firms' products have common characteristics valued by customers that distinguish them from the products of most rivals, and the two firms monitor and respond to each other's business decisions more closely than they respond to the decisions of other rivals. This qualitative and anecdotal evidence should be sufficient to draw an inference that the demand curve for one or both products will grow less elastic with merger, creating a unilateral incentive to raise price.

The merging firms could respond by undermining the probative value of the government's evidence, showing that the government's evidence misleads, by raising the same kind of problems that might undermine identification were the government's evidence quantitative. The merging firms might show, for example, that the customers are not informed and representative and that unobservable product characteristics are also important in determining buyer substitution patterns in the industry.[44] In this hypothetical litigation context, either side might supplement its position with quantitative evidence, for example, as to the magnitude of the demand cross-elasticities between the two products. But identification is no more and no less important when the evidence is anecdotal and qualitative as when the evidence is systematic and statistical.

The procedural context of antitrust lawsuits typically does not permit the multiyear data-building process sometimes needed for cutting edge academic industry studies; it must deal with the available information. Nor does it permit the scholarly tactic of selecting for study industries where data are available or where a particularly attractive identification strategy presents itself. An antitrust investigation or lawsuit is about a particular

industry, all evidentiary inferences are made conditional on background assumptions (knowledge is local), and even if the appropriate statistical technique from the academic literature is clear, the data may not be available to employ that technique within the time and resource constraints of litigation. In short, courts must decide antitrust cases reasonably expeditiously, for good public policy reasons, which sometimes constrains the amount of information and especially data available for analysis. This makes the use of multiple sources of evidence particularly valuable.

1.2.3   Identifying and Measuring Market Power

Market power—the ability of firms to raise price above the competitive level for a sustained period—is a part of the legal framework in multiple antitrust contexts. Monopoly power is an element of the monopolization offense under Sherman Act §2.[45] In addition market power is often frequently assessed under Sherman Act §1 to determine whether conduct undertaken pursuant to an agreement was reasonable. The market power inquiry may apply to a firm individually or to a number of firms as a group. Historically, in the antitrust world, market power has most commonly been identified through inference from a high market share. But direct evidence has increasingly become important as an alternative, in part because academic economists have developed a number of econometric approaches for measuring market power.[46]

It is worth emphasizing that the ultimate economic question in antitrust litigation is almost never whether a firm or set of firms have market power. The case almost invariably concerns an economic objection to the challenged conduct—an agreement among rivals, a merger, exclusionary tactics, and the like—that turns on whether the conduct has increased (in a retrospective case) or is likely to increase (in a prospective case) market power. Accordingly the economic question is not the level of market power but the change. Antitrust law at times relies upon presumptions that if the level of market power is high, various types of conduct will increase it, and if the level of market power is low, they will not. That is, in legal terms, anticompetitive effect is at times inferred from proof of market power.[47] Whether or not such inferences are justified empirically, they shift attention from the ultimate economic question of whether market power has increased. Our discussion of identification when measuring market power also focuses on levels for expositional clarity. Nonetheless, it is important not to lose sight of the ultimate question. Accordingly, when it is possible, economic methods should be used to assess changes in market power, examining a historical counterfactual without the challenged practices in a retrospective case or providing an analysis of the change in incentives in a prospective one.

As with identifying buyer substitution, quantitative methods of measuring market power through direct evidence have parallels involving the use of qualitative evidence. In this section we discuss a number of approaches to identifying market and highlight characteristic econometric issues that arise with each approach, regardless of whether the available evidence is quantitative or qualitative. We emphasize the method of identification.

A Formal Framework for Market Power Measurement   Many methods of measuring market power can be understood as growing out of a two-equation model with an industry demand function and industry quasi-supply function:

$$P = f(Q, Y, u), \tag{1.1}$$

$$P = C(Q, W, v) + h(f(\cdot), C(\cdot), Z). \tag{1.2}$$

Equation (1.1) is an inverse demand function, relating industry price P to industry output Q, a vector of observable demand-shift variables Y, and stochastic error u. In a homogeneous product industry, both P and Q are scalars. If the industry is differentiated, they have as many elements as there are products in the industry.[48]

Equation (1.2) is a quasi-supply function. It describes price as equal to industry marginal cost C, which is viewed as a function of a vector of cost-shift variables W and a stochastic error v, plus a markup, the function $h(\cdot)$. The markup function in equation (1.2) depends on marginal cost, demand, and exogenous variables Z. The models adopted in the literature typically allow perfect competition (price-taking) as a special case, by permitting the markup function to equal zero. If the markup is positive, price exceeds the competitive level. In both equations (1.1) and (1.2) we have suppressed the unknown parameters that will be estimated.

Both equations in this two equation system can provide information relevant to making inferences about market power. Incentives for exercising market power are related to the slope or elasticity of the demand function, equation (1.1). The extent to which a firm or firms have taken advantage of those incentives is related to the markup function in equation (1.2). The nature of the oligopoly interaction (e.g., static Bertrand or Cournot, or some form of coordination) is also related to the markup function, and also bears on the extent to which firms have exercised market power.

We have previously discussed issues involving the identification of demand, in connection with market definition, though will return to them briefly in this section. We will also discuss strategies for identifying parameters related to market power in equation (1.2). Before doing so, we will describe some general strategies for inferring market power related to this two-equation setup.

Estimating Quasi-Supply   The empirical economic literature employs several approaches to estimating the quasi-supply function, equation (1.2).[49] Some studies specify (1.2) as derived from a particular game-theoretic model of market power. For example, when the investigation involves unilateral market power, Bertrand (price-setting) competition is the most common assumption. The Bertrand assumption leads to prices in excess of marginal cost only if products are differentiated or if firms have increasing marginal cost functions.[50] The antitrust purpose of estimating (1.2) is to discriminate between higher costs and a higher markup as the source of higher prices.

The markup function $h(\cdot)$ can take a variety of forms, depending on various aspects of industry structure and the range of plausible ways in which firms might interact. The sim-

plest models are competition ($h(\cdot) = 0$) and monopoly ($P - h(\cdot) = MR$). For some game-theoretic models the markup function depends only on demand and cost elasticities. Other theories are more complex, potentially leading $h(\cdot)$ to depend on complex unobservables such as firms' information. A number of theories suggest that firm conduct will vary with market conditions. Accordingly some approaches allow the markup to vary with observables (variables in the vector Z), which might include, for example, measures of market concentration (like the Herfindall-Hirschman Index) or negative demand shocks (negative realizations of u), as suggested by various theories of oligopoly. But when quasi-supply during any particular time period arises as the single-period realization of a repeated game, the markup function may depend in a complex way on time preferences, information, and other variables; under such circumstances researchers tend to approximate that dependence in a simple way.

One useful generalization has structured much of the empirical literature on estimating quasi-supply: game-theoretic models of supply commonly indicate that there is more market power with less elastic industry demand. This generalization leads many empirical economists to include the term $-Qf'(\cdot)$ in the markup function, to capture the pricing incentive that lies in the difference between price and marginal revenue.[51]

Estimating Demand   Variation in the slope of the demand curve, equation (1.1), and the resulting incentive for market power, can be assessed at the individual firm level as well as at the market level. The distinction is particularly important in product differentiated industries. One approach is to estimate a multiple-price, multiple-quantity version of equation (1.1). This approach is well suited for data-rich environments in which the identification problem at issue in measuring buyer substitution can readily be solved.

Another approach is to estimate the slope of the residual demand curve facing a particular firm or a small number of firms.[52] A residual demand function can be defined for a firm or a candidate market. It is derived from the structural demand function by substituting best response functions for the output of rivals, thus projecting rival output on demand and cost-shift variables. Its elasticity reflects the response of a firm to cost variation after accounting for two economic forces: buyer substitution (the parameters of demand) and rival reactions (incorporated through the determinants of rival best responses). If a firm's (or group of firms) residual demand function is perfectly elastic, it does not exercise market power. It cannot raise price on its own, and the combination of buyer substitution and output expansion of rivals would make any such effort ineffective. But a downward-sloping residual demand function indicates that the firm (or group) has the ability to raise price by reducing output, and thus can exercise market power.

In econometric terms, the elasticity of a firm's residual demand is identified by a movement in an exogenous variable affecting the supply of firm and no other. The intuition is that a higher marginal cost for the firm of interest (and that firm alone) gives the firm an incentive to raise price, but price will not rise in fact unless the firm also has the ability to increase price after accounting for the expected response of buyers and all rivals (none of

which experienced a similar cost increase, so none of which have an incentive to raise price on their own).

The empirical literature has made progress in two very different areas in estimating residual demand functions. One is in product differentiated industries. Here the largest advantage of the residual demand curve approach is that it economizes on identifying variation. The source of single-firm market power is differentiation. In other words, there is little distinction between what is learned about market power from estimating the residual demand curve and what is learned from estimating structural demand curves.

The empirical literature has also made progress where a single firm's residual demand curve is sloped because the supply curves of other firms rise steeply. This approach has been deployed in studies of wholesale electricity markets, for example. In those markets observable measures of the height and slope of other firms' supply curve are available. For example, the capacity of other firms' plants, the capacity of their most efficient plants, and so on, are in some data sets. A firm competing against only capacity-constrained rivals will face the industry demand elasticity and thus generally have more market power than a firm whose competitors might expand if price were to rise. The literature has taken advantage of that feature in estimating residual demand curves. Empirical economists have also estimated residual demand curves in the intermediate case of a firm facing only competitors whose more efficient plants are at capacity.[53]

Direct Measurement of Accounting Margins   Another approach to measuring market power is an alternative to statistical estimation: to attempt to measure directly the departure of price from an accounting estimate of marginal cost. The common measure is the Lerner Index, defined as $L = (P - C)/P$. L is related to the markup function $h(\cdot)$ discussed above. In the special case of perfect competition, both $h(\cdot)$ and L are zero. Let the elasticity of industry demand be denoted ε in absolute value. In homogeneous good industries, the magnitude of market power is often taken to equal the product $L\varepsilon$. This expression calibrates the Lerner Index by recognizing that a high value for L is unlikely if industry demand is relatively elastic, and that a low value of L does not reflect much success in raising price toward the monopoly level if industry demand is relatively inelastic.

Cost-based measures of market power such as the Lerner Index will be more meaningful when market power arises mainly from product differentiation (in which case the nature of oligopoly conduct is relatively unimportant in explaining markup), from static noncooperative behavior (e.g., Cournot quantity-setting behavior) when the demand function is steep, or when the industry is behaving close to perfect competition or monopoly. They will be least meaningful when conduct is coordinated in ways that lead markups to vary over time (unless changes in $L\varepsilon$ can be correlated with the economic determinants of successful coordination).[54]

Inference about Oligopoly Conduct   With an estimate of both L and ε, it may be possible to make inferences about the nature of firm behavior of relevance to antitrust analysis. For

example, it may be possible to test the hypothesis that firm supply is close to the monopoly level, close to perfect competition, close to Bertrand supply, and so on.[55] For this purpose the estimate of the Lerner index can either come from cost data or, more typically in the literature, can come from an estimate of firms' supply behavior. For an industry that might be collusive, the literature has tested the hypothesis that behavior is closer to the monopoly level in some time periods but not in others (Bresnahan 1987; Porter 1983) because that is the implication of oligopoly supergame theory.

This method of inference depends on a wide range of assumptions. First, it incorporates an estimate of the demand elasticity, and thus depends in part on the probative value of the evidence as to buyer substitution from which that elasticity estimate derives. Second, any implementation must address a number of practical problems.[56] Third, the Lerner Index can be difficult to measure because of well-known problems in the measurement of marginal cost. These include conceptual difficulties in relating accounting measures to economic concepts. For example, accountants define cost categories for audit purposes that do not necessarily track economist's concepts; that present difficulties in the accounting treatment of depreciation, that may not capture opportunity costs in accounting data, and that show average variable costs not equal to marginal cost where the marginal cost curve is not horizontal.[57] Indeed the academic literature in empirical industrial organization economics commonly treats the level of marginal cost as unobservable even when some of its determinants, like input prices and scale, can be observed.[58]

1.2.4   Identification Issues

We focus our discussion of identification of market power on the problem of determining the nature of firm conduct when marginal cost is not observable. This is the problem of identifying the markup function in equation (1.2). We emphasize the possibility that marginal cost is not observable because that is the dominant perspective in the empirical economics literature. As with our discussion of identifying the magnitude of buyer substitution, we treat quantitative and qualitative evidence analogously.

Rotations in Demand   To identify firm conduct in equation (1.2) when marginal cost is unobservable, empirical economists often identify oligopoly conduct from the response of price to rotations in demand (or changes in demand elasticity produced by that rotation).[59] If price rises as demand grows less elastic, industry conduct is not competitive. Less elastic demand creates room for firms to exercise market power, if they possess it.

This insight is perhaps most familiar as a method of inferring market power from anecdotal evidence, when price discrimination (as defined by economists) is viewed as evidence of market power.[60] Qualitative information could also be used to make this inference: if firm marketing executives routinely refer to value-of-service pricing rather than cost-based or competitor-based pricing, they may well be taking advantage of less elastic buyer demand to raise price.

The econometric literature on implementing this approach to measuring market power emphasizes the importance of distinguishing price increases arising when firms take advantage of less elastic demand—which reflect market power—from price increases that result from increases in cost.[61] This identification problem also arises when the evidence is qualitative. Price increases for certain customers, at certain times, or in certain markets could come about because firms hit capacity constraints or input costs are high, even if higher costs happen to be correlated with less elastic demand. This possibility must be accounted for in order to infer market power from price increases in markets in which demand grows less elastic.

Variation in Observable Cost Components   Even when firm or industry marginal cost is difficult to observe, some of its major determinants, such as key input prices, may be observable. Under such circumstances movements in price that remain after accounting for variation in factors likely affecting cost may be used to make inferences about market power. This approach identifies market power from observing price rises not likely explained by cost increases.

This type of reasoning has been adopted in antitrust cases, using anecdotal evidence. One example comes from *American Tobacco*,[62] a midtwentieth century case in which the Supreme Court upheld a jury finding that the leading tobacco firms had conspired to monopolize by fixing cigarette prices and excluded competition. The conclusion relied in part on evidence that cigarette prices rose during the Great Depression, a time when the costs of tobacco leaf were unusually low and manufacturing costs were declining. Tobacco leaf and cigarette manufacturing costs were implicitly treated as observable factors affecting cigarette costs but not affecting the costs of producing demand substitutes.

The early antitrust decision in *Addyston Pipe*[63] illustrates the inference of market power through a similar comparison made across markets rather than over time. The six defendants in the case manufactured cast iron pipe, which they sold to local gas and water utilities in procurement auctions. The firms divided markets: they agreed on which firm would enter the lowest bid in procurements in certain ''reserved'' cities. But cities more than 500 miles from the firms' foundries (''free'' cities) were not allocated to any individual seller. Prices were higher in the reserved cities than the free cities, even though costs were lower in the reserved cities, allowing the inference that the firms had exercised market power. The econometric evidence presented by the FTC in *Staples*, discussed above, provides an example of how systematic empirical evidence can be used to make a similar comparison.

In the kind of comparisons undertaken in *American Tobacco* or *Addyston*, whether with anecdotal evidence as in those cases or through a systematic empirical study as in *Staples*, the identification problem of ruling out cost increases as the explanation for price increases, so it is sometimes framed as an omitted variable issue or a measurement error problem. In *Addyston*, for example, what if certain important costs were greater in the re-

served cities but not observed by the court? This possibility is not entirely far-fetched. According to the court, defendants claimed that prices in at least one reserved city were higher because specifications were detailed and precise, requiring custom production rather than use of stock on hand. Hence it is possible that custom production was on average more likely to be required in reserved than free cities. Or suppose that reserved cities tended to have a different geology than free cities, requiring pipe manufacturers to employ more costly manufacturing techniques. This could also mean that input costs were greater in reserved cities for a reason not observed by the court. In the tobacco example, the cost of a key input was declining, and manufacturing costs were falling, but what if distribution costs were instead increasing? Not surprisingly, measurement error and omitted variable issues like these were central to the econometric argument between the parties in *Staples*.[64]

Comparison with the Conduct of Competitive Firms   Another way to interpret the methods of identifying market power employed in *American Tobacco* and *Addyston Pipe* is to view what the courts did as comparing the way firms behaved with the way competitive firms would likely behave. If there is a difference, the firms likely exercised market power. The essence of the identification problem does not change with this change in perspective, as a perfectly competitive industry would raise price only if marginal costs increased.

This alternative interpretation is worth highlighting because it has been employed in the empirical economic literature. For example, a similar approach has long been a staple of cartel detection using qualitative methods. According to one story, the infamous electrical equipment cartel involving General Electric and Westinghouse, uncovered around 1960, was discovered by a journalist who noticed that the unsuccessful bidders in one procurement had submitted bids that were identical to the last digit.[65] This pricing pattern was consistent with a bid-rigging scheme—the firms had presumably chosen their bids to avoid undercutting the colluding firm that had been selected to win that particular procurement—and hard to rationalize with competition.

A comparable strategy for identifying market power has been adopted in the empirical economics literature to detect price-fixing in auction markets. Those studies look at the way firms form bids in markets or at times thought to be competitive—at the factors that affect bidding strategies—and compare the results with the way bids are formed in markets where market power might be exercised.[66] The competitive benchmark might be identified empirically, through analysis of the bidding strategies actually adopted by firms thought to behave in a competitive manner. Firms that respond to factors like variation in costs or the determinants of buyer willingness to pay differently in the test markets than in the control markets would be identified as likely exercising market power. For example, Porter and Zona (1999) used this method to identify a partial bid-rigging conspiracy among sellers of school milk in Ohio. They found that members of the bid-rigging cartel behaved differently, along several dimensions of behavior, when the nearest competitors to any

particular school district were other members of the cartel than when there was a nearby nonparticipant. Alternatively, the competitive benchmark might be identified based on a theoretical model of how competitive firms would act. For example, firms that do not raise their bids when their costs go up, or firms that systematically raise their bids when a rival lowers its bid, might be thought not to be acting the way a competitor would. Either way, this strategy for identifying market power requires a great deal of confidence in the competitive benchmark, and confidence that cost differences across bidders (that might affect how aggressively they would bid) are accounted for.

Another antitrust application of the idea that price formation inconsistent with competition can be used to identify market power comes in the analysis of the coordinated effects of merger. In a market in which coordination is imperfect and incomplete—as coordinated oligopoly conduct would be expected to be, given difficulties firms subject to the antitrust laws have in communicating and making side payments—one firm, termed the maverick, may constrain the effectiveness of coordinated pricing when its rivals would be willing to coordinate more completely (as by raising the industry price closer to the monopoly level). Coordinated effects analysis is often concerned with identifying the maverick and analyzing the effects of the merger on its incentives to prevent more effective coordination.[67] To infer a maverick's identity its marketplace behavior, that behavior must be compared with a competitive benchmark, much as is done in the auction literature on identifying bid-rigging. For example, if industry prices change in response to pricing decisions by one firm but not those of its rivals (or to the determinants of such decisions, such as firm-specific costs facing one firm but not those of its rivals), the firm that appears to be constraining industry pricing is a likely maverick.[68]

Unusual Movements in Price   Another way to identify market power when cost is unobservable to isolate changes in price that cannot be explained by observable factors influencing cost and demand, and that are so large or unusual in their distribution as to have no plausible interpretation other than variation in quasi-supply (equation 1.2) resulting from changes in conduct. Again, identification of market power in essence turns on ruling out alternative, cost-based explanations for the price changes.

This strategy was adopted by Porter (1983) to identify coordinated conduct among nineteenth-century railroads. Porter found occasional short-term declines in price that could not be explained as the result of declines in demand in a competitive market, and could not be explained by reductions in the observable determinants of cost. Rather, he concluded, they were consistent with a model in which firms occasionally engage in price wars, set off by unexpected declines in market demand, in order to deter cheating that would undermine cooperative pricing during other periods. He identified these periods econometrically by showing that multiple pricing regimes (one during high price periods and one during price wars) fit the unexplained variation in price (the error) better than

did a single price regime.[69] Any single large price decline could reflect random chance, but multiple declines otherwise unexplained could reasonably be attributed to shifts in seller conduct.[70]

One could imagine exploiting the same ideas about the properties of unexplained price changes to identify market power in a industry experiencing occasional price wars, with qualitative instead of quantitative evidence. If industry participants routinely respond to low prices not by pointing to lower costs but instead by complaining about pricing break-downs and calling for improved pricing discipline, and if such comments in the trade press are commonly followed by increasing prices shortly thereafter, that evidence could suggest that the participants see themselves as engaged in coordinated pricing punctuated by occasional price wars.

1.3   The Nature and Significance of Industry Differences

A large empirical literature in industrial organization economics has systematically studied market power, entry barriers, collusion, and other topics relevant to antitrust. In the previous section we reviewed a number of the methodologies empirical economists have employed for studying buyer substitution and market power. Most of this work does not have antitrust policy formation as its primary goal.[71] Almost all of this work studies a single industry or a group of closely related industries, such as inherently local businesses observed in a number of different cities or counties. This literature offers a great deal of support to the basic antitrust paradigm of applying a general economic framework to analyze a particular industry in which harm to competition is alleged. The empirical economic literature itself uses the same paradigm by employing different subsets of the same broad, general body of economic and econometric tools to analyze particular industries. In this section we review what has been learned about the nature and significance of industry differences. We describe the failure of the research effort to identify broad empirical generalizations across all industries. We also describe the successful and ongoing (if less well known in antitrust circles) effort to identify generalizations across closely related industries that can be exploited in antitrust to help evaluate evidence and resolve cases.

One important finding of the economics literature is of substantial variation across industries in features most relevant to antitrust. Studies of market power find more of it in some industries than others, and some studies find more market power for some products in the same product differentiated markets than for others.[72] Studies of entry similarly find that the conditions of entry vary across industries.[73] At the broadest level the empirical economic literature therefore demonstrates that there are important industry differences in the economic concepts that matter most to antitrust analysis. This confirms the importance of an industry-specific fact-based antitrust enquiry into such matters as market definition, market power, and entry barriers.

1.3.1 Unsuccessful Efforts to Generalize Broadly across Industries

From both an academic and a policy perspective, an obvious question arises. Can economists reach a more detailed and specific answer than ''it varies across industries?'' Could economists, instead, systematically predict which industries are more likely to depart from competition? From an academic perspective, this would involve learning the underlying causes of why certain industries have more market power (higher entry barriers, etc.) than others. From an antitrust policy perspective, this would support the more rapid identification of industries in which a detailed enquiry was likely to find market power (entry barriers, etc.) It could also lead to the development of useful policy rules of thumb, ''safe harbors,'' presumptions, and other abbreviated enquiries.

In industrial organization economics there flourished until the early 1970s a large-scale, sustained effort that attempted to provide a detailed and specific set of answers to these important questions. That effort was called the structure-conduct performance (SCP) approach. It sought to establish a set of presumptions to identify which markets have market power and entry barriers by looking for simple, easily observed indicia. One extensively explored hypothesis was that capital-intensive, R&D intensive, or advertising-intensive industries might be those with high entry barriers. That hypothesis was never convincingly demonstrated, however, in large part because it looked only to information about firms' costs, oblivious to what we now know: that entry barriers have roots in strategic interaction as well as in costs.[74] Another SCP hypothesis, explored with equal fervor, attempted to connect firm or industry market power reliably with market concentration. That hypothesis too was not convincingly demonstrated. Here a large part of the SCP approach's difficulties derived from the use of accounting profit as the indicator of poor industry performance resulting from the exercise of market power.

The SCP methods ultimately failed because the empirical methods used to establish both hypotheses were subject to fatal identification critiques from Chicago school economists, a school of industrial organization economics that flourished until the mid-1970s. These economists explained that instead of measuring only market power and barriers to entry, structure-conduct performance methods also left open the possibility of another interpretation. Under that alternative view all industries have free entry and perform competitively, but there is a wide range in the productive efficiency of firms within capital-intensive, advertising-intensive, and R&D-intensive industries.[75] Firms could have large market shares and be profitable because they had achieved low costs or other efficiencies rather than because they exploited market power. The Chicago identification argument has carried the day, and empirical structure-conduct performance methods have largely been discarded in economics. In consequence modern studies relating price to market concentration, perhaps the only area in which descendants of empirical structure-conduct performance methods are pursued today, are generally limited to the examination of related industries, rather than seeking broad generalizations across the economy.[76]

The structure-conduct performance project in industrial organization economics proceeded in parallel with a related legal project. The legal project, characteristic of antitrust's post–World War II structural era, sought to develop and broad legal rules to be applied to all industries, framed around measures of market concentration.[77] The legal project was unsuccessful for two reasons. First, it eventually became clear that the rules that were adopted served to deter much efficient, pro-competitive conduct. Second, reliance only on structural measures to detect market power also became clearly problematic. The Chicago school of antitrust analysis, an intellectual movement that has dominated the antitrust field in the United States since the mid- to late 1970s and confusingly shares a name and some participants with the earlier Chicago school of industrial organization economics, played a major role in raising discomfort with structural era legal rules. These antitrust commentators created a number of case studies of leading antitrust decisions that showed how the challenged conduct could alternatively be interpreted as efficient and pro-competitive.[78]

The doctrines of antitrust's structural era came under pressure from both this legal critique and from the economic critique of the parallel structure-conduct performance project in empirical industrial organization economics. In consequence, after the mid-1970s, many if not most antitrust rules were modified, and some were overruled. Antitrust doctrine generally moved away from bright line rules and toward open-ended reasonableness standards. For example, per se rules against vertical nonprice restraints and maximum resale price maintenance have been overruled, the per se prohibition against horizontal price-fixing has been narrowed, and the structural presumption in merger analysis, once a near–per se prohibition against all but the smallest horizontal mergers, has eroded.

Some Chicago school antitrust commentators have sought to replace the discarded structural era bright line rules with new ones, reflecting a new set of broad, economywide presumptions in favor of interpreting most conduct as reflecting efficiencies achieved in competitive markets.[79] While these efforts have achieved some success,[80] on the whole, antitrust law examines much more firm conduct under a reasonableness standard today than was true a generation ago.[81] We suspect that most economists think that this leads to better antitrust policy formation (at least if the higher costs of running the legal system to decide cases under reasonableness standards are ignored).

Leading developments in the post-Chicago evolution of antitrust generally continue to push doctrine away from bright line rules and toward an economic-based reasonableness analysis. These include use of the "raising rivals' costs" framework for evaluating exclusionary conduct,[82] recognition of the possibility of unilateral competitive effects of mergers among sellers of differentiated products,[83] establishment of the possibility that predatory pricing could be a rational strategy,[84] attention to understanding how a merger affects the incentives of the "maverick" seller when evaluating coordinated competitive effects,[85] the use of direct evidence of market power to trump evidence of low market shares in exclusion cases,[86] and the evaluation of the potential loss of research and development

competition in innovation markets.[87] The main post-Chicago development going the other way, toward bright line rules, is the application of truncated or structured legal rules to condemn the conduct of a monopolist who excludes a rival without an adequate business justification, without need for direct proof of harm to competition.[88]

In the adversarial context of competition policy implementation, the choice between bright line rules and unstructured standards presents a decision-theoretic trade-off.[89] Bright line rules, including antitrust's per se rules, promise to lower transactions costs. They give guidance to firms seeking to comply with the law and to generalist judges seeking to apply it. They do so by limiting what must be shown to prove or disprove an offense—for example, by excluding certain arguments that a litigant might wish to proffer and in consequence excluding evidence related to those arguments—thereby also promising to reduce the transactions costs of litigation. But these advantages come at the price of greater errors in classifying firm conduct, either false convictions (finding violations when the conduct was pro-competitive) or false acquittals (failing to find a violation when the conduct harmed competition). By contrast, unstructured standards, including reasonableness tests, promise to make fewer errors by allowing courts to review all relevant evidence and arguments. But they may achieve this benefit at the price of reducing guidance to courts and firms, and raising transactions costs of litigation.

The advantages of reasonableness analysis were particularly apparent in the wake of economic criticisms of the bright line doctrinal rules that were characteristic of antitrust's structural era. The effort by some Chicago school antitrust commentators to convince courts instead to codify bright line doctrinal rules based on a new set of broad presumptions, more accepting of a wide range of firm conduct, may have been stalled by the inability of Chicago school economists to convince the economics profession that new presumptions had deep empirical economic support. Chicago school antitrust scholars listened to Chicago school economists explain that "structure-conduct performance methods cannot show market power," but formulated policy recommendations as though the lesson had been the overstatement "there is little or no market power in the economy."

1.3.2 Limited Generalizations across Related Industries

Since the late 1970s, mainstream industrial organization economics have adopted the industry case study methodology previously employed fruitfully by Chicago school economists in the preceding era, but now with improved empirical methods. The "new empirical industrial organization" emphasized the creation of empirical tools that could be adapted to analyze individual industries, for purposes that included the identification and measurement of market power.[90] The large and varied literature that resulted has identified market power in many industries, thereby undermining the possibility of an empirical basis for broad bright line antitrust rules raising high bars to antitrust challenges across the board.[91] At the same time, theoretical industrial organization economists, deploying the game-

theoretic tools through which microeconomics has been reconstructed since the 1970s, have shown that a wide range of business conduct that Chicago school economists view as consistent with the competitive model could be understood as competitive under some conditions but as reflecting the exercise or creation of market power under others. This theoretical development has also militated against the project undertaken by Chicago school antitrust commentators of identifying broad presumptions that could be codified in antitrust rules.

The application of reasonableness standards in antitrust decision-making and the modern empirical literature in industrial organization economics have an important commonality: both treat the industry as the appropriate unit of observation. Both fields recognize that a one-size-fits-all approach to analyzing business conduct won't do, since so much variation in outcomes arises from factors specific to each individual industry. Empirical investigation of game-theoretic models of competition in a variety of industries shows that some of these factors are strategic. The most plausible competitive or efficiency theory of any particular industry's structure and business practices is as likely to be idiosyncratic to that industry as the most plausible strategic theory with market power. In addition the probative value of various types of evidence as to market power, entry, efficiencies, and the like, including the relative availability and usefulness of qualitative and quantitative evidence, often differs from one industry to the next.

This perspective does not mean that each industry must be analyzed afresh, without reference to what is known about other industries. Both antitrust law and industrial organization economics have come to recognize that related industries often are sufficiently similar to provide useful guidance. Many of the same legal and economic questions arise, for example, in understanding firm behavior in markets in which products are sold at retail, in markets for basic metals with cyclical demand, in markets for high-tech products sold in aftermarkets, and in any number of similar categories. One key challenge for both antitrust analysis and empirical industrial organization economics going forward is to exploit similarities among related industries. Focused inquiry involving the industry besides the firms under study is not recognized in antitrust to the extent it is understood in economics.

For instance, it is widely recognized that product-differentiated industries as a class present certain common behaviors and analytical problems, but few economists would argue that any particular product-differentiated industry could be analyzed for market power, competitive effects, or demand substitution without industry-specific analysis. What the research literature has done is identify a set of industries in which broadly the same tool kit can be used to examine market power. Within this set of industries, an enquiry that looks only at demand substitution to address market definition and identify market power, ignoring supply-side factors like costs and strategic conduct, is in general likely to be largely right.[92]

Another example of the value of information about related industries comes from the large literature on pharmaceutical markets studying the entry of generic drugs in competition with previously patent-protected brand-name drugs.[93] This literature establishes a presumption about the relevant product market in a merger, such as between the brand-name producer and the first generic entrant. In particular, if that merger occurs around the time that a drug goes off patent, the relevant product market for the merger analysis is likely to be exactly this drug, not including other drugs in the same therapeutic category, making the transaction a merger to monopoly. Similarly the literature establishes a presumption that the likely competitive effects of such a merger are to prevent price declines in the form of cheaper generics. These presumptions could be overcome in the detailed review of facts surrounding a particular merger, of course. However, the generalizations from an academic literature that has looked at differences in market outcomes in many pharmaceutical markets when drugs go off patent should be treated as a legitimate and potentially persuasive basis for reaching conclusions in any particular investigation.

Another example, taken from the *Microsoft* litigation, illustrates how a presumption, reasonably derived from a generalization across related industries, can be rebutted. In his testimony for Microsoft, Richard Schmalensee relied upon generalizations from the software industry as a whole to inform his views about market power and entry in operating systems, the particular software category that Microsoft was accused of monopolizing. Schmalensee testified that "[c]ompetition in the software industry is based on sequential races for the leadership of categories such as word processing, spreadsheets, personal financial software, games, operating systems and utilities." Although there may be some switching costs, "the history and reality of the microcomputer industry" show that superior alternatives, for which consumers are willing abandon their investment in the products of the category leader, "come often." Indeed "[h]istory has shown that when faced with a superior alternative, software users switch and do so in droves." Accordingly, Schmalensee concluded, Microsoft's success and high share in the operating-system category does not mean it has monopoly power. "Rather, like other firms in this industry, it is in a constant struggle for competitive survival," including its struggle "to maintain its leadership in operating systems."[94]

As these excerpts suggest, Schmalensee recognized, correctly, that many software markets can be characterized by leapfrog competition, in which the winner obtains a high share for a time, only to be supplanted when a superior product comes along. He applied this generalization about software markets to the particular software category, operating systems, that was the subject of the monopolization litigation. In short, Schmalensee did what we suggest: he used what he learned about related industries to focus the inquiry about operating systems software. Based on how competition often works in software markets generally, it was reasonable to approach this case initially as Schmalensee did, by adopting a presumption that competition works similarly in operating systems software. The government actually adopted a version of the same presumption in its theory of com-

petitive harm, which posited the possibility of leapfrog competition in the operating system market if new Internet technologies, such as Netscape's browser or Sun's Java, were to come into widespread use.

But along with the court, we think the presumption as used by Schmalensee was rebutted by the evidence presented by the Justice Department and state plaintiffs demonstrating that operating systems in the period at issue were a monopoly. Microsoft's leading position in operating systems was buttressed by the so-called applications barrier to entry that gives consumers reason to prefer the dominant operating system, Microsoft's Windows, even if they would prefer another operating system if all or most applications programs available for Windows were rewritten for that operating system. When Microsoft took steps to impede the success of a new technology (Netscape's Internet browser combined with Sun's Java programming langauge) that had the potential for reducing the applications barrier to entry, those acts allowed Microsoft to maintain its operating systems monopoly.

Our point here is not to reargue the *Microsoft* case. It is to show how a generalization taken from the experiences of related industries can create a presumption about how competition works in the industry under study—and to show that the presumption can be rebutted with industry-specific evidence to explain why it does not apply in the specific case under review.

1.4   Design of Institutions for Antitrust Decision-Making

Antitrust decision-making relies centrally upon economic reasoning and upon economic evidence. Economic reasoning in antitrust decision-making puts a premium on ensuring that decision-makers are capable of that task.

The institutional structure of the US courts and antitrust enforcement agencies presents a mixed picture of the sophistication of economic thinking. The enforcement agencies have a well-developed institutional capacity to obtain economic input from a professional staff of PhD economists, and antitrust lawyers in leadership roles often have developed a substantial facility with economic reasoning from their long engagement with the antitrust field.[95] Indeed many attorneys in the antitrust bar show considerable economic sophistication. But the courts do not have these advantages. Judges are generalists. Most lack experience with antitrust or economics and do not generally have the same training as professional economists.[96] Unlike agency officials, judges do not have much access to economic support. Accordingly, there is a serious discrepancy between tasks judges are called upon to do in antitrust cases—evaluating or even undertaking economic reasoning—and the capabilities of many judges to perform that task.

Moreover the litigation context in which much antitrust analysis occurs can direct the attention of a court away from the most important issues in evaluating economic evidence. The litigation setting encourages precision in the details, more so than the academic setting, where a small computational mistake, for example, would be unlikely to raise a

question about the credibility of the researcher. The litigation context can undervalue the importance of the big picture—of linking the economic evidence with a theory of the case, or measuring key economic relationships and effects using sensible methods. These problems, which could be of great significance in the academic setting, may be dismissed as merely another disagreement among experts.

Recognition of the difficulties courts face in evaluating economic evidence in antitrust cases is not new. Frank Easterbrook (1984) has termed the difficulties of making correct judgments under a reasonableness standard in any individual case the "limits of antitrust." Easterbrook's solution was to recommend that courts adopt simple and general bright line doctrinal rules in the antitrust field, rather than endorsing a wide-ranging reasonableness analysis in individual cases. We do not object, in principle, to bright line rules based on convincing economic generalizations from a substantial program of careful empirical research. But absent progress in developing such rules, we propose two other approaches to this problem that do not avoid the detailed analysis of industry evidence.

Our first proposal is that empirical economists—both academics and economists at the antitrust enforcement agencies—work to unify the tool kit used in academic work and in antitrust work and begin to create a catalog of generalizations about various industry structures—a set of stylized facts and (rebuttable) presumptions about groups of related industries. We have already provided two examples of the kind of generalizations and presumptions we have in mind. One is a presumption about the likely loss of competition from a merger involving the producer of a brand-name drug producer and the first generic entrant, which could be expressed in the form of a narrow product market. Another is the generalization that shifts in retail prices in differentiated consumer products industries resulting from horizontal merger will generally reflect the effect of the merger on the pricing constraint imposed by demand substitution, not supply-side changes in cost or the oligopoly solution concept. These kinds of generalizations would be used to structure the analysis in individual antitrust cases and suggest the kind of evidence that would be most appropriate. The antitrust agencies could assume the job of organizing conferences of empirical economists to identify the consensus view of the economics profession, and write reports to codify the resulting generalizations and presumptions, and making them available to help judges and litigants.[97]

Our second proposal involves helping judges interpret economic evidence and assess its probative value.[98] Various methods of doing so have been tried, including the use of court-appointed economic experts,[99] the use of judicial law clerks with economic expertise,[100] and direct questioning of one economic expert by another. The legal debate over options for giving courts greater access to economic expertise has mainly addressed the pros and cons of court-appointed experts. The commentary highlights the importance of finding an independent expert acceptable to the parties (particularly in fields where basic principles are in dispute), making any independent expert's views transparent to the litigants and giving the parties an opportunity to comment on those views. One concern is that otherwise,

a district court judge, having selected an independent expert, may in practice give that expert's views too much deference. Another is the difficulty finding a neutral independent expert, free from conflicts and strong ideological presumptions, who could be available at the court's convenience. Many of the best potential experts—well versed in aspects of economics most relevant to antitrust and sufficiently experienced with antitrust litigation to understand how to assist a court—have a high opportunity cost of taking on new projects and may not find it attractive to work for the court, perhaps excluding high-profile cases, unless they are able to limit the time they must commit. A third concern is that utilization of a court-appointed independent expert may add to the length and cost of litigation.

We suspect that the most pressing need for improvement in the design of institutions for antitrust decision-making is to find a way to clarify for generalist judges the nature of the dispute between economic experts for opposing parties. This observation suggests that a court-appointed economic expert would confer substantial value by undertaking a limited task: reviewing the reports of opposing experts, and writing his or her own report for the court that supplements the work of party experts by explaining where those experts disagree and why (without necessarily taking a view of his or her own on the resolution of key disputes). Party experts could be allowed to comment on the independent expert's report, but oral testimony and cross-examination of the independent expert would not be necessary.

This proposal for what might be termed a "clarifying expert" would have a number of advantages. It would give the judge help in understanding the economic arguments in the case. The limited scope for the court-appointed expert would encourage the judge to view the expert as providing help, rather than as an authority to be deferred to.[101] The limited assignment would also encourage a strong and deep pool of potential independent experts to make themselves available for consideration for the clarifying expert role. If the clarifying expert's report is made public (presumably after redacting confidential business information), that would encourage high-quality analysis by the clarifying expert, by allowing for peer review of his or her output, and encourage high-quality analysis by the party experts, by creating a public record of an independent view of their economic work.[102]

A number of important details would still have to be worked out to implement this suggestion—such as how the independent clarifying expert is selected (must the parties agree? can they wield a veto?), what materials the expert may review (just the expert reports?), how much direction the court will provide (perhaps by indicating where the judge would most benefit from clarification), and at what stage in the proceeding should a clarifying expert be involved.[103] We have sketched our proposal to encourage further deliberation about the way institutional design affects the ability of judges to undertake sound economic reasoning in antitrust litigation.[104]

Attention to the capacity of courts to apply economic reasoning is important because of the central role that judges play in shaping and implementing US antitrust policy. The success of the antitrust enforcement agencies owes much to the way decision-makers in those

institutions are able to interact with economists.[105] Courts have done so too, but only indirectly, through what judges learn from the experts in their courtroom, economic articles cited by the litigants, and the economic reasoning embedded in the doctrinal rules that they employ. Our proposals seek to bring judges even closer to how economists think and what economists know.

Notes

1. For example, *Hospital Corp. v. Federal Trade Commission*, 807 F.2d 1381 (7th Cir. 1986) (J. Posner) (upholding FTC determination that a hospital merger would likely harm competition by facilitating coordination was upheld based on a detailed review of postmerger market structure, integrating a wide range of factors beyond market concentration); *Federal Trade Commission v. Staples, Inc.*, 970 F. Supp. 1066 (DDC 1997) (enjoining a merger between office superstore chains based on evidence that head-to-head competition between the merging firms led to lower prices, regardless of the presence of warehouse club stores, mass merchandisers, or independent retail office supply stores in the area); *United States v. Waste Management, Inc.*, 743 F.2d 976 (2d Cir. 1984) (overturning lower court injunction barring a merger between two Dallas-area waste disposal firms that would result in high market concentration, since easy entry into the market made the exercise of market power unlikely).

2. For example, *United States v. Microsoft Corp.*, 253 F.3d 34 (DC Cir. 2001) (upholding lower court finding of liability against Microsoft based on detailed economic analysis of the way the exclusion of Microsoft's browser rival from access to the most important channels of distribution protected Microsoft's operating system monopoly from a significant long-term competitive threat, thus allowing it to maintain its market power); *Blomkest Fertilizer, Inc. v. Potash Corp.*, 203 F.2d 1028 (8th Cir. 2000) (relying on economic analysis of factors including market structure affecting the ability of firms to coordinate successfully to uphold award of summary judgment to defendants in a horizontal price-fixing case); *National Collegiate Athletic Association v. Board of Regents*, 468 US 85 (1984) (concluding that the association regulating college sports had effectively created a cartel by selling television rights for all college football games, and preventing schools or conferences from contracting with television networks on their own).

3. *Continental Television, Inc. v. GTE Sylvania, Inc.*, 433 US 36 (1977), overruling *United States v. Arnold, Schwinn & Co.*, 388 US 365 (1967).

4. The empirical revolution in antitrust analysis was arguably ushered in by our development of empirical methods of estimating residual demand elasticities during the mid-1980s. Baker and Bresnahan (1985, 1988).

5. Baker and Bresnahan (1992). For a more recent survey, see Baker and Rubinfeld (1999).

6. Carlton and Perloff (2005).

7. Noneconomic goals played a greater role in the United States prior to the late 1970s than they do today, but even then economic goals were important.

8. See generally, Lopatka and Page (2005).

9. The antitrust injury requirement was introduced in *Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc.*, 429 US 477 (1977) in a setting where a rival sought damages from a merger alleged to harm competition by facilitating horizontal coordination. Later decisions have extended the requirement substantially. Gavil, Kovacic, and Baker (2002, pp. 777–88). For example, in *Microsoft*, the appeals court interpreted *Brunswick* as requiring proof that the monopolist's conduct harmed competition not just competitors. *United States v. Microsoft Corp.*, 243 F.3d 34, 589–59 (DC Cir. 2001). In that case, the antitrust injury requirement was applied to an allegation of exclusionary (not collusive) conduct challenged under the Sherman Act (not the Clayton Act) by a government plaintiff (not a private plaintiff) seeking injunctive relief (not damages)—a setting far indeed from that of *Brunswick*.

10. Here we view economic methods broadly, as going beyond theoretical modeling and econometric data analysis to include experimental and simulation methods.

11. Rigorous analysis is important regardless of whether the economic theory of the case is presented informally or through a formal model. In some sense a model is always lurking in the background when an economist, attorney or judge interprets evidence. (We use the term "model" broadly to include all abstract frameworks. In appropriate circumstances a table or a verbal articulation of an economic story would both count as models.)

12. Specification includes a full description of the economic model and an account of the nature of stochastic components (errors). See Reiss and Wolak (2005, §§4.1, 4.2).

13. Manski (1995) defines ''identification'' as the range of conclusions that could be drawn if one could use the sampling process to obtain an unlimited number of observations (as distinct from the additional ''statistical'' problems in making inferences arising from the fact that samples are finite). His definition includes the use we make of the term identification, namely whether a model that distinguishes between policy-relevant conclusions and alternative explanations of the same phenomena can be estimated.

14. The Merger Guidelines suggest an algorithm for inferring unilateral effects from market shares, but this algorithm is rarely if ever employed, as it depends on the generally unrealistic assumption that each product's market share reflects not only its relative appeal as a first choice to buyers but also its relative appeal as a second choice, and hence as a competitive constraint.

15. Baker (2003a) explores why the antitrust enforcement agencies adopted unilateral effects theories in merger analysis.

16. On the limited probative value of market shares in assessing likely unilateral effects, see Baker (1997b).

17. However, some remain skeptical of the possibility of unilateral effects when market shares are low. *United States v. Oracle Corp.*, 331 F. Supp. 1098 (ND Cal. 2004).

18. In a monopolization case the inquiry would be different, typically asking whether there is market power in the industry already that might be sustained by an anticompetitive act or practice. Market definition offers an imperfect way to get at this question too. For a discussion of market definition in cases in which the alleged harm is retrospective and the alleged anticompetitive conduct is exclusionary, see Baker (2006).

19. US Department of Justice and Federal Trade Commission Horizontal Merger Guidelines (1992, revised 1997), available at ⟨http://www.ftc.gov/bc/doc/horizmer.htm⟩.

20. Market definition is exclusively concerned with the economic force of demand substitution under the methodology of the merger guidelines. In nonmerger contexts, some US courts also incorporate considerations of supply substitution in the market definition step, rather than later in antitrust analysis. The use of supply substitution to define markets is criticized in Baker (2006).

21. The firm's residual demand function is the demand curve that results after accounting for the best response of nonmerging rivals.

22. This condition follows from the first order condition for profit maximization, assuming differences in price and price–cost margin among sellers within the group can be ignored. For a general discussion of related issues, see Werden (1998).

23. As will be discussed, calculations of the Lerner Index must deal with a range of issues including aggregation problems (as arise from heterogeneity in prices and costs among the market participants) and the difficulties associated with inferring a sensible economic measure of marginal cost from accounting data.

24. If the errors are correlated with other independent variables, the bias could go in either direction.

25. Empirical studies of retailer behavior find that products generally decline in price during predictable periods of peak demand (such as seasons for some products or certain holidays for others). See Hosken and Reiffen (2004a,b), Chevalier, Kashyap, and Rossi (2003), MacDonald (2000), Warner and Barsky (1995). The literature interprets this observation as typically resulting from a reduction in the retailer's per-customer distribution costs (which decline as the density of customers grows). (Alternative explanations—that demand tends to grow more elastic at predictable peaks, or that manufacturers choose to compete more aggressively—appear inconsistent with evidence that promotion levels typically surge and manufacturer margins generally do not decline.) In consequence the model may need to account for the possibility that marginal cost as well as demand varies seasonally or that both marginal cost and demand could be related to the level of promotional activity. Alternatively, a model in which interactions between buyers and sellers are explicitly dynamic (i.e., one in which price is not determined in the one period run) might be employed.

26. Hendel and Nevo (2002).

27. For detailed discussions of the identification issues, see Reiss and Wolak (2005, sec. 7.1) and Bresnahan (1998).

28. This type of argument was successful in *New York v. Kraft General Foods, Inc.*, 926 F. Supp. 321 (SD NY 1995). A similar argument was advanced by defendants in responding to the FTC's challenge to the merger of two baby food producers, Beech-Nut and Heinz. See Baker (2004).

29. For surveys, see Werden and Froeb (2005) and Epstein and Rubinfeld (2004). The quantitative analysis underlying a merger simulation is closely related to the quantitative analysis underlying a market definition or market power assessment. In the merger setting, key inputs include estimates of the substitution possibilities between the products of the merging firms and among the products of the merging firms and other sellers and estimates of the competitive response to a merger by other firms. The simulation methodology takes those inputs and puts them in a helpful and policy-relevant form, facilitating interpretation and the evaluation of the practical economic significance of alternative assumptions, but it cannot substitute for weaknesses in the estimates. In the market definition setting, a simple simulation methodology called "critical loss analysis," based on estimate of the magnitude of demand substitution, is sometimes employed. In practice, however, the approach commonly embodies a number of simplifying assumptions that do not invariably hold, and can in consequence lead to misleading results. For a discussion, see Baker (2006).

30. See, generally, Ashenfelter et al. (2006) and Baker (1999).

31. The empirical study of natural experiments involving changes in market structure can also provide an indication of the likely price effects from the loss of localized competition, by facilitating a comparison between prices with and without the presence of that localized competition. This is an alternative interpretation of the econometric study relied upon by the FTC in *Staples*. A similar study was introduced by defendants in the baby food merger case. Baker (2004).

32. For example, Bresnahan (1987), Berry, Levinsohn, and Pakes (1995), Goldberg (1995), Nevo (2000), Petrin (2002), and Trajtenberg (1990).

33. For example, Borenstein and Rose (1994), Leslie (2004), Shephard (1991).

34. For example, Athey and Levin (2001), Bajari and Hortacsu (2003), Guerre, Perrigne, and Vuong (2000), and Hedricks and Porter (1988). Identification for auction models is discussed in Athey and Haile (2001).

35. The types of evidence available for assessing demand substitution in market definition are surveyed in Baker (2006).

36. We describe an anecdote of this sort taken from our consulting experience in Baker and Bresnahan (1992, p. 6).

37. Berry and Pakes (1993), Berry, Levinsohn, and Pakes (1995), Bresnahan, Stern, and Trajtenberg (1997), and Nevo (2000, 2001).

38. See the discussion of conjoint survey methods in Baker and Rubinfeld (1999).

39. Notification M/04/032, Proposed Acquisition of IBM Ireland Limited Of Schlumberger Business Continuity Services (Ireland) Limited, Irish Competition Authority (October 28, 2004), available at ⟨http://www.tca.ie/⟩.

40. Whether the most convincing evidence about economic concepts, like market power or efficiencies, is systematic empirical evidence derived from econometric analysis or more qualitative, as with much evidence derived from documents and testimony, such evidence is necessarily predicated on a set of assumptions that permit inference. As we noted previously when describing information as local, empirical analysis cannot be conducted in a vacuum. Even when systematic empirical methods are employed, documents and testimony invariably and appropriately play a role in specifying a model and interpreting its results.

41. Another example of such a data set, from outside the litigation context, comes from Bresnahan and Ramey (1994), who use information on managers' reported motives for temporary automobile plant closings and shift changes in the automobile industry. The economic literature on the study of sales and on couponing (e.g., Nevo and Wolfram 2002) has made progress on understanding these phenomena without managerial information.

42. If the views of industry experts (e.g., including the views of sellers of complementary products) are used to judge the likely buyer substitution responses to prices, their reliability as evidence would be assessed similarly to what is inferred from seller conduct: based on whether the experts are in a position to gather direct information about buyers, and on whether they base costly business decisions on that information.

43. Of course, the absence of supply shifters would equally prevent identification of the demand elasticity using quantitative methods.

44. The defense might also raise problems with the government's inference other than identification. For example, a defense showing that the firms monitor other rivals nearly as much as they monitor each other can be thought of as a qualitative analogue to problems with estimation in data analysis.

45. Some commentators view monopoly power as another term for market power; others view it as market power of more than some threshold magnitude. Either way, proof of monopoly power requires proof of market power.

46. Many of these methodologies are surveyed in Reiss and Wolak (2005), Porter (2005), Bresnahan (1989), and, less technically, in Baker and Bresnahan (1992).

47. If a firm (or group of firms) with market power (collectively) excludes a rival with no legitimate (procompetitive) justification, antitrust law will not require proof that price has increased. The best economic interpretation comes from a decision-theoretic framework: false acquittals are unlikely (since the firms involved could exercise or be exercising market power) and false convictions are unlikely (since there is no procompetitive reason for the conduct).

48. Thus, with n products, equation (1.1) is from R^n to R^n.

49. In many studies of product differentiated industries, however, equation (1.2) is not estimated. Alternative methods that might be employed in studying such industries are discussed below under the headings "estimating demand" and "direct measurement."

50. Much of the literature focuses on differentiated products, but a substantial new literature looks at the implications for market power of increasing firm marginal costs. The electricity industry has proven fertile ground for such studies, because good observable indicators of cost-related variables like (the other) firms' capacity and variety in the efficiency of plants are often available. See, for example, Borenstein, Bushnell, and Wolak (2002), Borenstein and Bushnell (1999), and Wolfram (1999).

51. In the context of a homogeneous goods industry, this is the slope of the industry demand curve times industry quantity. In a product-differentiated industry, it depends on the slopes of individual products and on which products are provided by a particular firm. See Bresnahan (1982) for details.

52. Baker and Bresnahan (1985, 1988).

53. See, for example, Wolfram's (1999) study of duopoly pricing in electricity. Wolfram's careful analysis shows that where both firms are located on their short-run marginal cost function, prices rise because their plants vary in efficiency. See also Wolak (2003) for discussion of the California energy crisis emphasizing unilateral market power that arose because of capacity constraints. As weather shocks constrained the capacity of hydroelectric producers, fossil-fuel producers faced less elastic residual demand curves.

54. Coordinating firms that find it difficult to reach consensus and deter deviation may moreover adopt inflexible pricing rules. Then simple methods of inferring L based on observing price responses to changes in the elasticity of demand or observable components of cost (discussed below) may not be able to distinguish coordination from competition.

55. For example, a test for monopoly could be based on the prediction that a monopolist that sells a single product and does not discriminate in price would set its price such that $L = 1/\varepsilon$ or, equivalently, such that $L\varepsilon = 1$. See Genesove and Mullin (1999) for an implementation of this test.

56. The Lerner Index estimate is presumably derived as an average of the price–cost margins in a number of transactions, over which price and cost vary because of shifts in the exogenous variables Y, W, and Z and the stochastic terms u and v. In general, the precision of the inference about firm conduct will depend on the variation in L from transaction to transaction, and on whether this variation can be linked empirically to variation in the important determinants of firm conduct across those transactions. Moreover the Lerner Index for an industry is not well defined unless price plays an allocative role in transactions, so this method of inference is difficult to employ in the presence of certain forms of price discrimination such as volume discounts and loyalty discounts across multiple products sold by a single firm.

57. Special problems in relating a measure of the Lerner Index to market power arise in industries with high fixed costs and low (and nonincreasing) marginal costs. These might include computer software, airline transportation, or some entertainment industries, for example. In such industries, some or all buyers will likely be charged a price in excess of marginal cost, even when there is free entry, if the fixed costs are so high that an increase in competition would lead a new entrant to be unprofitable. One problem that arises under such circumstances is that it is theoretically possible that the threat of entry constrains existing firms. More precisely, the average prices of incumbent firms might be constrained not to exceed entrant average cost. In that case the competitive price would need to be defined relative to the incremental cost associated with an entrant, a variant of marginal cost. This problem is unlikely to be important in practice, however, as the presence of such a powerful constraint by potential entrants has not been identified in any market studied in the empirical economics literature and appears to call for extreme assumptions theoretically.

Another problem that arises under such circumstances is that the exercise of market power can theoretically be efficient. If the fixed costs of entry are large relative to the size of the market, adding competitors may reduce welfare, even though price is above marginal cost. This result suggests a possible efficiency justification for an

acquisition in an industry with high fixed and low marginal costs. Such a justification should be considered only with great caution, for demonstrating empirically that a less competitive market structure is more efficient is very difficult. Such a justification should almost never be considered in technologically progressive industries. This is because the efficiency conclusion can only follow if there were no benefits of innovation rivalry among active firms.

58. These difficulties with measuring the appropriate economic concept of marginal cost also arise when accounting information on marginal cost is used as an input into the simulation of price increases. This may occur in antitrust litigation, in the analysis of competitive effects of firm conduct, or in market definition, where "critical loss" simulations are sometimes employed.

59. Bresnahan (1982) and Lau (1982). For example, Reiss and Wolak (2005) show that if equation (1.1) is specified as $P = \alpha_0 + \alpha_1 Y + \beta Q^{1/\gamma} + u$, and marginal cost is specified as $C = c_0 + c_1 W + v$, a function that does not depend on output, then the quasi-supply function (1.2) simplifies to the reduced form $P = [1/(\gamma + \theta)][(\alpha_0\theta + \gamma c_0) + \alpha_1\theta Y + \gamma c_1 W + (\theta u + \gamma v)]$. If the demand curve parameters α_1 and γ have been estimated, then θ, an estimator of $L\varepsilon$, can be inferred from the coefficient on Y in this equation, so θ is identified. The key to econometric identification of θ in this example is the presence of a variable Y, which allows the demand function to rotate in observable ways.

60. Economists recognize that price discrimination can occur in markets where entry competes the long-run profit rate to zero for marginal entrants. Restaurants in a large city, which often discount entrees for "early bird" customers, might present an example. (In this case we assume that such discounts are greater than might be explained by any reduction in marginal cost, as might reflect the lower probability of reaching a capacity constraint during off-peak periods.) Baker (2003b) describes this limiting case as an example of the exercise of market power without out the possibility of anticompetitive effect. (Product differentiation could similarly compete profits to zero, as in the model of monopolistic competition, but it more commonly allows firms to create niches for their products that rivals could not profitably enter, allowing the firm to earn economic profits. The limiting case of monopolistic competition again represents the exercise of market power without anticompetitive effect.)

61. This is evident from the example in note 58. Without the presence of a variable Y that rotates demand, it would be impossible to infer θ, the estimator of $L\varepsilon$. The parameter cannot be backed out of the intercept term $[1/(\gamma + \theta)][(\alpha_0\theta + \gamma c_0)]$ because that term depends both on θ and on c_0, the average level of marginal cost.

62. *American Tobacco Co. v. United States*, 328 US 781 (1946).

63. *United States v. Addyston Pipe & Steel Co.*, 85 F. 271 (6th Cir. 1898) (Taft, J.).

64. See Baker (1999).

65. Carlton and Perloff (2005, pp. 128–30).

66. Bajari and Summers (2002), Porter and Zona (1993), and Porter and Zona (1999).

67. Baker (2002b). When coordinated effects of merger are alleged, it is important to understand more than merely whether the industry structure is conducive to coordination—whether firms can plausibly reach consensus as to the terms of coordination, deter deviation (cheating) on those terms, and prevent new competition (entry)—but also to understand the mechanism by which coordinated competitive effects of mergers might arise. The latter question may be addressed by identifying a maverick firm that constrains coordination from becoming more effective, and evaluating how the merger affect the pricing incentives of that firm.

68. Baker (2002b) terms this the revealed preference strategy (when based on prices) or the natural experiment strategy (when based on costs) for identifying a maverick. An example in which the revealed preference strategy was applied based on qualitative evidence appears in Bresnahan (2002). Another approach, termed by Baker the a priori factors strategy, identifies a maverick firm from structural characteristics tending to suggest that it has more incentive than its rivals to keep coordination from becoming fully effective or complete. For example, if excess capacity creates price pressure in the view of industry participants, a merger of firms intending to reduce capacity could be understood as a transaction likely to alter the incentives facing firms likely to spoil attempts at more effective coordination. See *FTC v. Cardinal Health, Inc.*, 12 F. Supp. 2d 34, 63–64 (DDC 1998).

69. Similarly, using data from the steel industry during the Great Depression, Baker (1989) shows that unexpected declines in demand (inferred from an estimated demand function) reduced price more than would be explained merely by the effects of a demand decline on price, holding conduct constant, and concludes that the negative demand shocks led firms to act more competitively for a time. The firms switched from a high-price to a low-price regime, at the same time as unexpected negative demand shocks, suggesting a causal connection.

70. See Porter (2005) for a more nuanced and complete discussion of this topic. This methodology could alternatively be thought of as a way of comparing observed conduct with that of competitive firms, which would not be expected to experience occasional large reductions in price unrelated to shifts in cost or demand.

71. See Bresnahan (1989) and Reiss and Wolak (2005) for reviews of some of this literature.

72. See, for example, Bresnahan (1987) and Berry, Levinsohn, and Pakes (1995) on variation in market power within the US automobile industry.

73. See Bresnahan and Reiss (1987) or Sutton (1991).

74. The strategic approach to understanding entry conditions transcended an older debate between pioneering industrial organization economists Joe S. Bain and George Stigler. Bain emphasized the role of structural factors in creating entry barriers, including absolute cost advantages of incumbents, product differentiation and economies of scale. Stigler's definition of entry barriers was limited to costs that must be borne by an entrant though not an incumbent. Stigler also questioned whether high capital requirements could prevent entry given the wide range of financing opportunities from well-funded participants in financial and credit markets. Modern industrial organization economists see Stigler's framework as including disadvantages to entrants that arise from the strategic forces determining industry structure. Many of these entry barriers are closely linked to costs, as strategic entry problems can arise particularly when the fixed costs of entry are sunk and can be exacerbated by information asymmetries in financial and credit markets. For example, Sutton (1991) shows that the presence of sunk costs, including irreversible expenditures on research and development, capital and advertising, is a precondition for one form of strategic entry barriers.

75. Accordingly, this effort could be thought of as more than a critique of the structure-conduct performance approach. It could be viewed instead as a second effort to establish a broad presumption, this time that few industries exercise market power and possess entry barriers.

76. See, for example, the chapters in Weiss (1989).

77. For a brief survey of the three major eras in US antitrust enforcement, classical, structural, and Chicago school, see Baker (2002a).

78. As a strategy for learning about antitrust enforcement generally, this approach has significant limitations. The primary benefits of enforcement may come from deterring anticompetitive conduct among nondefendants rather than from identifying and remedying specific problems in the markets in which enforcement occurred, and in which the benefits of enforcement (or lack thereof) might be observed. Also we should expect antitrust enforcers to be selective if markets vary. Deterrence and selection make identification difficult. Suppose, for example, we were to find that past mergers had no effect on competition. That could either mean that competition policy authorities are doing a good job screening out anticompetitive mergers, or that their policies are far too stringent in some dimension. To resolve the question, we would like to know what would happen if a different set of mergers had been permitted. but cannot perform that experiment. In Baker (2003a) this identification problem is addressed using qualitative evidence on the behavior of US firms during four periods or situations without effective antitrust enforcement, and by examining the behavior of firms across national antitrust regimes with different degrees of effectiveness.

79. Easterbrook (1984) and Posner (1981).

80. For example, the legal rules concerning predatory pricing have been modified over the past few decades to create nearly insurmountable hurdles for plaintiffs. New procedural rules involving antitrust injury have combined with rules involving summary judgment standards in conspiracy cases to make it difficult for a dealer to challenge its termination by a manufacturer as resulting from a vertical agreement between the manufacturer and rival dealers as to price. Also the legal rules concerning vertical nonprice agreements, which formally require a reasonableness analysis, have been applied in practice to make successful challenges extremely rare.

81. On the other hand, the recent development of structured inquiries like quick look rules for Sherman Act analysis can be understood as moving some antitrust doctrine in the direction of bright line rules. The current dispute as to whether "profit sacrifice" is a good guide to monopolization can also be understood as an effort by the federal enforcement agencies to encourage adoption of a bright line rule. For criticism, see Gavil (2005) and Salop (2005).

82. Krattenmaker and Salop (1986).

83. For example, Baker and Bresnahan (1985).

84. Brodley, Bolton, and Riordan (2000).

85. Baker (2002b).

86. For example, *Toys 'R' Us v. FTC*, 221 F.3d 928 (7th Cir. 2000).

87. Gilbert and Sunshine (1995).

88. For example, United States v. Microsoft Corp., 253 F.3d 34 (DC Cir. 2001). In this case the government alleged that a number of Microsoft's actions maintained high entry barriers into its operating system monopoly. The court's standard was truncated in the sense that it did not require the government to show that lower entry barriers would necessarily have led to entry and new competition, instead requiring only a showing that the challenged conduct was exclusionary. (Of course, this standard permits a defense based on a procompetitive justification of the challenged practices.)

89. On the decision-theoretic framework for developing antitrust rules, see, for example, Beckner and Salop (1999).

90. See Bresnahan (1989) and Reiss and Wolak (2005) for literature reviews.

91. In consequence the only principled argument against antitrust enforcement generally is the contested claim, made by some antitrust opponents, that government actions seeking to remedy anticompetitive acts almost invariably leave the economy worse off than the anticompetitive conduct itself, even after accounting for additional harm that would arise from removing the deterrent effect of antitrust enforcement in industries where no violation was found to remedy. For an analysis of the benefits and costs of antitrust that reaches the opposite conclusion, see Baker (2003c).

92. See the discussion in Bresnahan (1989). The subsequent literature on product-differentiated consumer products industries has, with a few exceptions, assumed Bertrand competition. Peters (2003) and Nevo (2004) compare the predicted price change under Bertrand competition to the actual price change ex post mergers in the Airline and RTE cereals industries.

Careful attention to the supply-side along with demand becomes important only when the question shifts from whether the firm or firms exercise market power—the issue in market definition or unilateral effects of merger among sellers of differentiated products—to whether changes in supply, as from the efficiencies that may result from firm conduct or the increased competition that could result from proposed remedies, would counteract the exercise of market power in such markets.

93. For example, Scott-Morton (1997, 1999, 2000).

94. Schmalensee (1999, at paras. 33, 34, 37, 59, 135).

95. In this connection we applaud the recent decision of the European Union's antitrust authority to deepen its economics capability and to appoint a chief competition economist.

96. There are occasional exceptions, for there are a number of very economically oriented attorneys and judges who are not PhD economists.

97. The Federal Trade Commission frequently hosts workshops and conferences on antitrust topics, often inviting participation from academic economists.

98. The value of improving the economic expertise available to judges deciding antitrust cases is heightened by the recent increase in challenges to admissibility of expert economic testimony in the wake of *Daubert v. Merrell Dow Pharmaceuticals*, 509 US 579 (1993), where the Supreme Court encouraged such challenges as a means of weeding out complaints based on "junk science." Issues related to Daubert challenges are surveyed in Gavil (2000).

99. This approach has been encouraged by both Justice Breyer, *General Electric Co. v. Joiner*, 522 US 136, 149–50 (1997) (J. Breyer, concurring) and Justice Posner (1999), two economically sophisticated antitrust experts. For an antitrust example, see *New York v. Kraft General Foods, Inc.*, 926 F. Supp. 321, 351–52 (SDNY 1995) (testimony of court-appointed expert economist, Dr. Alfred Kahn, relied upon in evaluating merger challenge). The *CASE* (Court Appointed Scientific Experts) program of the American Association for the Advancement of Science, while primarily focused on health and physical sciences, has facilitated the connection of court-appointed economists in legal proceedings. Through this program, economist Frank Wolak was selected to serve as a court-appointed expert in the *High Fructose Corn Syrup* antitrust litigation. Wolak provided highly helpful assistance to the district court judge was during the pretrial litigation that preceded a settlement.

100. Economist Carl Kaysen assisted the district court judge who decided *United States v. United Shoe Machinery Corp.*, 110 F. Supp. 295 (D. Mass. 1953), *aff'd per curium*, 347 US 521 (1954), a major monopolization case. Kaysen (1987).

101. The court might also request the clarifying expert to address specific questions of concern to the judge.

102. Party experts would also be encouraged to explain the bases of their opinions more fully, for fear of having omissions exposed in the clarifying expert's report (as well as exposed during cross-examination, as occurs today).

103. If the clarifying expert's report were filed before Daubert challenges to the admissibility of expert testimony were resolved, it could aid the court in that task, for example.

104. A possible alternative for achieving this end would be to require the opposing experts to negotiate and file with the court a pre-trial statement clarifying where they agree and where they disagree. It may be difficult to negotiate such a statement in an adversarial context, however, unless it is written vaguely, reducing its usefulness.

105. Baker (1997a) argues that the deep engagement of economists in agency decision-making confers the benefits of applying cost–benefit analysis even absent a formal requirement to do so.

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