On the Use of Conjoint Surveys with Market Simulation Analysis for Damages Estimation in Consumer Protection Class Action Litigation

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- Experts in consumer protection class action matters increasingly propose to apply a technical marketing research tool known as a conjoint survey, sometimes combined with an economic tool often used in merger analysis in which "but-for" market outcomes are simulated using mathematical models of competition, to estimate damages from alleged misrepresentations.
- Market simulations that we have seen used in consumer protection class action litigation apply what is known as the static Nash Bertrand model of competition to define the competitive interaction between firms in the market, a critical assumption that is often not explicitly disclosed, let alone examined and justified.
- While incorporating a model of the supply side of the market is a necessary step for predicting a but-for price, the static Nash Bertrand model of competition is not necessarily suitable for any given market because it makes strong assumptions about competitive behavior. Several studies in the peer-reviewed economics literature have demonstrated that simulations based on this model frequently fail to predict real-world prices with even reasonable accuracy when tested empirically.
- Retrospective merger studies have shown that static Nash Bertrand-based simulations can substantially overestimate or underestimate actual price changes, making them unreliable for quantifying damages—an application for which numerical accuracy is of high material importance.
- Identifying a model of the competitive process that is applicable to a given market requires market-specific empirical analysis, as different markets exhibit different competitive dynamics that significantly affect price predictions.

INTRODUCTION

There are multiple scenarios in litigation that require predicting the prices that would have prevailed in a market but for the alleged bad acts that are the subject of the lawsuit. For example,

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in a price fixing matter, the relevant economic question for assessing damages is what the price of the product would have been absent the alleged collusion. In a merger review (and potential litigation), a relevant economic question is what effect the merger would have on consumer prices. In consumer protection class action cases, a common allegation is that the defendant misled consumers about the characteristics of a product; in such cases, a commonly-asserted damages theory—discussed below—requires quantifying what the price of the product would have been absent the misrepresentation.

As a matter of economics, predicting but-for prices, particularly when the competing products are not identical but are differentiated in their characteristics, requires the use of sophisticated economic methods to measure consumer preferences and to account for the strategic competition among the supplying firms to determine equilibrium market prices. The use of sophisticated economic methods, both empirical and theoretical, for assessing liability and damages in antitrust litigation is common and, indeed, expected. Use of such tools in consumer class actions is more novel and, arguably, less well developed.

It is customary in antitrust litigation to apply market data on prices, market shares, and other market outcomes to estimate but-for prices using well-accepted econometric techniques. These tools can also be used in consumer protection class action litigation. Recently, however, experts in consumer protection class action litigation are increasingly proposing to instead use a tool imported from marketing research known as the conjoint survey. In particular, we have seen increasingly proposals to determine damages by implementing a conjoint survey combined with an economic tool often used in merger analysis in which market outcomes are simulated using mathematical models of competition. Rather than directly estimating but-for prices from market data, conjoint analysis with a market simulation uses survey data and a modeled form of strategic competition to estimate but-for prices.

Conjoint surveys are a technique of asking consumers a series of structured questions about their preferences over specified combinations of product characteristics and (sometimes) prices, for the purpose of estimating consumer preferences over characteristics of products. Applied in the context of damages analysis in litigation, these surveys can, if they are able to accurately quantify consumer preferences, estimate the shift in the demand curve that would result from changes in product characteristics at issue or changes in the information disclosed about products at issue.

To determine the effect on the price that would prevail for that product in the but-for world in which those different product characteristics or disclosed information about the products had been in effect it is not sufficient, of course, to quantify the shift in demand. Quantifying the effect of a shift in demand on the price that would prevail in the market—the equilibrium price—requires, in addition, modeling the supply curve along which the demand curve shifts or, more generally, modeling the competitive interaction among suppliers in the market. Our purpose is not to analyze the reliability of conjoint surveys for use in litigation to estimate effects of alleged bad acts on consumer demand; there is existing literature on the accuracy and reliability of conjoint surveys for estimating consumer preferences generally and in litigation specifically.[1] Our focus is on the supply side of the analysis. The purpose of this article is to explain that, while a proposed method of combining conjoint survey results and market simulation analysis to estimate a but-for price (from which to calculate damages) has been applied increasingly for damages estimation in consumer protection class actions, the validity and applicability of the market simulation aspect of these analyses has been largely unexamined for the purpose of quantifying damages.

We are not aware of any detailed discussion in the economics or other literature of the reliability of the market simulation component of conjoint-based methods for use in damages analysis. We consider the absence of such analysis in the literature to be a material deficiency because, as we will elaborate, the economics literature is clear that predictions about prices and other market outcomes that are based on market simulations are sensitive to the chosen simulation model. Indeed, the market simulation model that has been used with increasing frequency in conjoint-based damages estimation incorporates strong assumptions about competitive dynamics that, the economics literature shows, do not generally produce reliable predictions for prices in real markets. Hence, we conclude that unless the expert in any given litigation conducts a factual assessment of the competitive dynamics at work in the market at issue, selects and executes a model of the relevant competitive structure for the simulation that comports with those facts, and demonstrates that the simulation model accurately predicts observable outcomes in the relevant market—steps not yet taken in litigation to our knowledge—the results of the damages analysis are not likely to be reliable, for reasons wholly separate from validity of the conjoint survey itself for estimating demand effects.

This article proceeds as follows. We begin Part I with a general discussion of damages analysis in consumer protection class-action litigation. In Part I.A we provide an overview of the methods economists have conventionally used to estimate but-for prices in litigation, and in Part I.B we describe conjoint analysis generally and how it is increasingly being proposed as a methodology for estimating but-for prices. Part II.A discusses the historical development of the proposed uses of conjoint analysis in litigation. In Part II.B we describe the theory and practice of supply-side market simulation in economics. In Part II.C we discuss in detail the evidence from the economics literature that market simulation methodologies, at least as they have been implemented in litigation thus far, are not reliable for predicting but-for prices. We conclude with comments on the use of conjoint analysis and market simulations in the contexts in which

[1] *See, e.g.*, Greg M. Allenby, Nino Hardt & Peter E. Rossi, *Economic Foundations of Conjoint Analysis*, in 1 HANDBOOK OF THE ECONOMICS OF MARKETING 151 (2019). For a discussion of the use of and analysis of courts' acceptance of conjoint surveys in litigation, see George Derpanopoulos, Jaci Overmann & C. Paul Wazzan, *The use of conjoint analysis in high-stakes litigation: A historical review up to Navarro et. al., v. Procter and Gamble, which withstood a rigorous Daubert challenge*, 102 J. Pat. & Trademark Off. Soc'y 502, 502–526 (2021).

they have more traditionally been applied, and we provide our views on best practices for damages analysis in consumer class actions given the state of the literature today.

I. DAMAGES ANALYSIS IN CONSUMER PROTECTION CLASS-ACTION LITIGATION

Our article focuses on litigation in which it is alleged that a defendant has misled consumers about the characteristics of a product or service. The allegations may be that the defendant failed to disclose an undesirable characteristic of the product; that the defendant claimed that a desirable characteristic was present when it was not; or that the defendant advertised that the product performed functions that it did not; among others. In any such case, the implication is that the alleged misleading conduct caused class members to value the product more highly than they would have had they known the true product characteristics. For purposes of this article, we refer to these cases generally as consumer protection class actions. The common feature of these cases relevant to this article is that to construct a but-for world to estimate damages requires some means of assessing the amount by which consumers would have valued the product or service had the misrepresentation not occurred;[2] this, in turn, necessitates an ability to isolate the value to consumers of the misrepresented characteristic of the product, separate from the value generated by the array of other characteristics of the product that also create value for consumers.

One challenge of consumer class actions is to demonstrate that the purported class is certifiable. To certify a class, Rule 23 of the Federal Rules of Civil Procedure requires that, among other things, common issues predominate over questions affecting only individual class members.[3] Hence, variations in the effects of the alleged misrepresentations across consumers may preclude class treatment in some circumstances. If, for example, the product characteristic that was the subject of the alleged misrepresentation is valued by some consumers but not by others, or if the alleged misrepresentation was heard by some consumers but not by others, or if the alleged misrepresentation was believed by some consumers but not by others, the alleged misrepresentation may have been immaterial to the subjective valuation some consumers placed on the product while being material to others. A material variation in the subjective valuation placed on the misrepresented characteristic across potential class members—for example, if a meaningful but unidentifiable set of potential class members placed no value at all on the alleged misrepresented characteristic—could be an impediment to class certification if the plaintiffs' theory of harm relies on consumers' subjective valuation.[4]

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2 Mark Allen, Robert Hall, and Victoria Lazear, "Reference Guide on Estimation of Economic Damages," in REFERENCE MANUAL ON SCIENTIFIC EVIDENCE, 3rd ed. (Washington, D.C.: National Academies Press, 2011), p. 432.

3 Federal Rule of Civil Procedure, Rule 23(b)(3).

4 See, e.g., *In re Opperman, et al., v Path, Inc., et al.,* Case No. 3-cv-00453-JST (N.D. Cal. July 15, 2016) ("The chief problem with this analysis is that because consumers do not have identical preferences, each class member will place a very different value on the protection of – or misappropriation of – their contacts. ... No damages

A theory of harm that may, in principle, overcome this potential impediment to class certification is that the alleged misrepresentation affected the market price of the misrepresented product. We will call this the "overpayment theory of harm." Specifically, if one posits that there is a market price for the product that was paid by all consumers (as opposed to, say, a product whose price is individually negotiated by each customer), and the price is determined by market factors of supply and demand, then it follows from many economic models of price setting in markets that a misrepresentation that inflated the subjective valuation of the product for some (but not necessarily all) of the consumers will cause the equilibrium market price paid by all purchasers to be higher than it would be in the but-for world in which the misrepresentation did not occur.

From the standpoint of class certification, an appealing and convenient feature of this theory of harm is that the purported damages to each class member who purchased in the real world and who would have purchased in the but-for world is the same (per unit purchased) regardless of the extent to which they valued, if at all, the misrepresented characteristic. Under an overpayment theory of harm, the damages to each class member who purchased in the real world and who would have purchased in the but-for world is the difference between the per-unit price they actually paid (the actual market price) and the per-unit price they would have paid in the but-for world (the but-for equilibrium market price) times the number of units they purchased.[5] Hence, a convenient feature of a market-price-based theory of damages in class actions is that it overcomes at least some of the impediment to class treatment imposed by the fact that some consumers may not have experienced the misrepresentation or may not have cared about it.[6] As

number arising from this model will apply to all class members, particularly since some of the class members, by this measure, will not have been injured at all ..."). See also, *In re Sears, Roebuck & Co. Tools Mktg. & Sales Practices Litig.*, No. 05-C-4742 (N.D. Ill. Mar. 22, 2012) ("Each plaintiff in Greenfield's putative class will have to show that the alleged 'Made in USA' misrepresentation caused him or her damage, which would necessitate individualized proof. Accordingly, the proposed Florida class suffers from the same problems we previously identified. It is overbroad because it contains a great many individuals who were not deceived and could not have been injured, and plaintiff has not shown that his claim is typical of those of the putative class. In addition, individual questions of causation will continue to predominate despite the FDUTPA's lack of a reliance requirement."). See also, *Townsend v. Monster Beverage Corp.*, 303 F. Supp. 3d 1010 (C.D. Cal. 2018) ("In sum, Plaintiffs have not shown that there is a common answer to the question of whether a reasonable consumer would consider any of the challenged statements a material misrepresentation. In other words, there are significant individualized issues related to proof of reliance. Consequently, the Court finds Plaintiffs cannot maintain an action under Rule 23(b)(3).").

5 Of course, it is possible that some consumers would value the misrepresented characteristic by so much that they would not have purchased the product at all in the but-for world in which they were fully informed about the true product characteristics. Those consumers' harms would not be properly quantified as the difference between the actual and but-for price. It is also noteworthy that the misrepresentation may have harmed consumers who did not purchase the product in the real world but would have purchased in the but-for world because the price would have been lower and they placed little or no value on the misrepresented characteristic. But it is not likely to be possible to credibly identify who the customers of either of these types are.

6 There are, however, other impediments that this theory does not overcome, including the need to demonstrate that there is in fact a unique market price that all consumers pay. Prices in some markets are determined by individual negotiations or auctions, for example; an overpayment theory of harm likely would not be applicable in such markets.

long as all consumers paid the same price, and that price was higher in the real world than in the but-for world in which the misrepresentation did not occur, all purchasers were harmed.[7]

A few points are noteworthy about the economics of the overpayment theory of harm. First, as just noted, for the alleged misrepresentation to influence the market price, it is not necessary that all consumers subjectively value the misrepresented characteristic or that all consumers were subject to the misrepresentation. What is necessary is that enough consumers who valued the misrepresented characteristic were misled, and valued the misrepresented characteristic enough, that the market demand curve shifted sufficiently to result in a different equilibrium market price than would have prevailed but for the misrepresentation. The market demand curve is the sum of the individual demand curves of the actual and potential purchasers, and therefore even if only a subset would have had a lower demand curve in the but-for world (with the others' demand curves unaffected by the alleged misrepresentation), the market demand curve would be lower as well, thereby possibly resulting in a lower but-for price.[8]

Second, it will be useful to understand that a change in the known characteristics of the product that reduces its value to some consumers (while not increasing its value to any) would result in a downward shift in the demand curve. The downward shift may not necessarily be parallel to the real-world demand curve because the effect of the allegedly misrepresented characteristic may affect consumers' valuation of the product differently for different consumers and at different volumes of aggregate purchase; but the correct way to visualize the effect of the misrepresentation on demand is that the but-for demand curve would have been the same or lower at every quantity than the demand curve that prevailed in the actual world.

Third, the equilibrium price in a market depends not only on demand but also on the shape of the supply curve and on the nature of competition in the market. In particular, as we will elaborate later, economics teaches that (1) the effect of a shift in demand on the price of a product differs depending on the competitive structure of the market and the competitive strategies of the firms in it, and (2) a downward shift in the demand curve of any given dollar amount $x would not be expected to result in a decrease of $x in the market price.

Moreover, economics admits many possible coherent and rational competitive structures and strategies. Each well-defined model of strategic competition embeds different assumptions about how firms interact in markets, what they assume about the others' conduct, what information they have, and other factors. Each has quantitatively different implications for the effect on the equilibrium price of a shift in the demand curve. And in all cases the general principle that a

7 It may not be necessary that all consumers paid the same per-unit price to reach the conclusion that all were harmed by a measurable price premium if, for example, all purchasers paid an amount that is formulaically related to a market price, where the formula depends on characteristics that are observable to the court (as opposed to an individually negotiated price, for example). These nuances are outside the scope of this article.

8 We say "possibly" because, for reasons discussed below, a shift in demand is not sufficient for the equilibrium price to change.

downward shift in the demand curve of any given dollar amount, x, would not be expected to result in a decrease of $x in the market price holds. These points are central to this article and we will return to them shortly.

A. Traditional Ways that Economists Estimate the But-For Price in Litigation

What the overpayment theory of damages provides in theoretical parsimony for class actions it makes up for in analytical complexity. This is for two reasons. First, estimating the price that would have prevailed in a counterfactual world in which the alleged actual conduct had not occurred requires the application of nuanced econometric tools and the availability of adequate data to apply them. These econometric tools, while complex and demanding of a detailed understanding of the market to correctly apply, are well-developed and accepted in the context of price fixing litigation, and antitrust economists are practiced in their application if relevant data is available. Second, application of the relevant econometric tools is data intensive. In the context of an overpayment theory of harm in consumer class actions, estimating a but-for price where the counterfactual world pertains to a modification of the product itself (i.e., a shift in the demand curve), rather than a modification of the competitive structure of the market (e.g., collusive price setting), requires data that allows the analyst to measure in some way the amount of the demand shift.

One means by which economists sometimes estimate the prices that would have prevailed for transactions that were made in a real market had they been made under counterfactual circumstances is to examine data on the transactions that occurred in the presence of the counterfactual circumstances, and transactions that occurred in their absence. For example, in price-fixing litigation, it is common to estimate what the prices would have been for transactions that actually occurred during the alleged collusive period had the collusion not occurred by analyzing data on transactions made before and/or after the alleged collusive activity.[9] Analyzing the pre- and/or post-collusion period transactions enables estimation of the competitive price formation process that the companies actually used when there was no collusion, which can then be applied to estimate what the prices would have been if the companies had acted the same way rather than colluding during the alleged collusive period.[10] To account for differences in the economic conditions affecting price in the different time periods, other than the alleged collusion itself, a standard approach is to apply data on supply and demand factors, such as input costs, prices of substitute products, prices of complementary products, and/or relevant macroeconomic factors to estimate, using reduced-form regression techniques, the statistical relationship between the observed supply and demand factors and the observed prices during periods when the alleged collusion was not occurring.[11] These estimated statistical relationships are then applied to the

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9 Daniel L. Rubinfeld, *Quantitative methods in antitrust*, in 1 Issues in Competition Law and Policy 723 (Wayne D. Collins et al. eds., ABA Section of Antitrust Law, 2008), (hereinafter, *Rubinfeld 2008*), at 738.

10 *Rubinfeld 2008*, at 739–740.

11 *Rubinfeld 2008*, at 724–726, 739–740.

transactions that occurred during the collusive period to estimate what the prices would have been but for the collusion, adjusting for the values of the supply and demand factors during the collusive period.[12]

When the difference between the but-for world and the real world pertains to the existence, absence, or perception of a particular product characteristic, the analogous logic requires that the analyst observe market prices in the real world at times or in markets or circumstances where the characteristic is present and at other times or in other markets or circumstances where the characteristic is absent. For example, if the alleged misrepresentation pertains to wording on a product label, then if there are times or locations at which the allegedly offending language appears on the label and others at which the offending language is absent from the label of the same product, the difference in prices, if any, on those two package types may provide valuable data for estimating the market price shift due to the alleged misrepresentation using reduced-form regression techniques like those used to estimate but-for prices in price fixing cases. With such data, no consumer preference survey or market simulation would be necessary. Econometric methods would still potentially be necessary to control for differences in distribution channels, time frames, or other factors, but the logic of reduced-form econometric methods that are well understood, commonly applied, and accepted in price fixing cases would be the same.

Estimating the effect on market prices of variations in product characteristics as just described is known as hedonic price regression estimation.[13] Hedonic methods have been developed to estimate the effects on observed prices of adding or removing specific product characteristics by examining data on transactions of products with and without those characteristics, and/or data on transactions of products before and after a specific characteristic is changed. Economists apply standard reduced-form regression methods to such data to isolate the effect of specific product characteristics on observed market prices.[14] For example, in the case of an allegedly misleading product claim or characteristic, one common specification is to include in the regression an indicator variable for the challenged claim to identify those subsets of times and/or products and/or locations in which the claim was present, along with various controls for other supply and demand factors; the estimated coefficient on the indicator variable would be the estimate of the amount by which the challenged claim increased the equilibrium price. The counterfactual price (the price but for the challenged claim) can then be estimated by removing the estimated effect of the challenged claim—setting the coefficient on the indicator variable equal to zero—and

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12 *Rubinfeld 2008*, at 739–740.

13 *See generally* Sherwin Rosen, *Hedonic prices and implicit markets: product differentiation in pure competition*, 82 JOURNAL OF POLITICAL ECONOMY 34, 34–54 (1974).

14 LAURA O. TAYLOR, *Hedonics*, 13 THE ECONOMICS OF NON-MARKET GOODS AND RESOURCES 235 (Patricia A. Champ et al. eds., 2nd ed. 2017), at 235–237.

applying the remaining estimated regression coefficients to the data on the accused products during the accused time periods.

A virtue of reduced-form regression analyses using data on actual customer purchases and actual firm pricing decisions is that they relieve the analysis of multiple significant assumptions about how market participants interact—regression analyses of the type just described do not require asking consumers what they would do if confronted with hypothetical product choices and assuming that what they say they would do in that artificial setting resembles what they would do in the real world. They also do not require making assumptions about and constructing market simulations to attempt to mimic how suppliers compete with each other or what they assume about one another's strategies given the market structure and costs. Instead, they rely on data from actual transactions made by customers in real markets when confronted with actual products in their actual sales channels alongside their actual alternatives and requiring actual payment. The choice sets that consumers face in real markets are the result of competition (or lack thereof) among suppliers in the market, and the observed transaction prices depend on actual supply and demand factors including the pricing behavior of those suppliers, (unobserved) demand curves of consumers in the market, characteristics of the products that consumers notice, and consumers' perceptions of those characteristics in the context of their real-world shopping activities. Reduced-form regression analyses typically used to estimate but-for prices allow the data to summarize the statistical relationship between the characteristics of products and the equilibrium prices that are paid, given the actual market structure and supply factors such as costs and prices of complementary and substitute products in the market and macroeconomic conditions.

A challenge of hedonic regression analysis for estimating damages is the availability of data that would allow the analyst to observe actual market prices for the product in question both with and without either the feature about which the alleged misrepresentation occurred or both with and without the alleged misrepresentation itself. The example provided earlier, in which a product is sold with varying labeling in different time periods or geographic markets with and without the allegedly offending language, is highly conducive to reduced-form regression analysis for estimating a market price shift. But there are other, less ideal, circumstances in which reduced-form regression analysis may nevertheless be highly effective. For example, if the alleged misrepresentation occurs with respect to some products A, and not with respect to similar but not identical products B, it may be possible, using standard econometric techniques, to control for the effect on the market price of other product differences between A and B and estimate a valid price differential resulting from the alleged misrepresentation.

Rather than attempting to use market data and econometric techniques to estimate the effect of the misrepresented feature as just described, some experts in consumer protection class action cases propose to estimate the value to consumers of the misrepresented feature using survey methods and then to use the survey results in combination with assumptions about market conduct and competitive strategies of competing providers to simulate the effect of that value on market prices. We turn to this in the next section.

B. CONJOINT ANALYSIS IS INCREASINGLY BEING PROPOSED OR USED IN CONSUMER PROTECTION CLASS-ACTION LITIGATION AS A DAMAGES METHODOLOGY

Conjoint analysis is a survey-based methodology that is frequently used in marketing studies to attempt to estimate consumers' subjective valuations of various product characteristics. Indeed, conjoint surveys have been used for over 50 years and are commonly used by marketing professionals to provide guidance on pricing and product positioning.[15] Conjoint surveys are different from opinion surveys or customer satisfaction surveys with which readers may be familiar. A conjoint survey presents subjects with multiple sequential choice sets, each containing a set of hypothetical products with different product characteristics that vary systematically by experimental design, and asks subjects to choose their preferred option from each choice set.[16] The choice sets force subjects to make trade-offs between different product characteristics, and their responses to the choice set combinations provide information about the relative importance to consumers of the product characteristics included in the survey.[17] The results can be combined with assumptions about the mathematical form of consumers' utility (preference) functions to estimate the parameters of those functions, which can, in some cases, themselves be aggregated to an estimate of the demand curve for the product.[18]

Data on actual consumer purchase decisions in real markets is known as revealed preference data because consumers' choices in real markets reveal their preferences. Data derived from surveys is known as stated preference data because the data reflects what consumers say they would do in certain market circumstances, which may or may not be truthful and may or may not be accurate, even if truthful. There is debate in the literature as to whether confronting subjects with hypothetical or counterfactual combinations of product characteristics and prices in a survey setting can elicit decisions that realistically reflect what the subject would choose in a real shopping setting, a critique that calls into question the possible validity of the conjoint survey methodology itself for identifying consumers' subjective valuation of product characteristics.[19] In addition, it is agreed among practitioners that, if a conjoint survey methodology is valid in at

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15 *See generally* Paul E. Green & Vithala R. Rao, *Conjoint Measurement for Quantifying Judgmental Data*, 8 JOURNAL OF MARKETING RESEARCH 355 (1971) (hereinafter, *Green & Rao 1971*).

16 FELIX EGGERS, HENRIK SATTLER, THORSTEN TEICHERT & FRANZISKA VÖLCKNER, *Choice-based conjoint analysis*, HANDBOOK OF MARKET RESEARCH 781 (Christian Homberg et al. eds., 2022) (hereinafter *Eggers et al. 2022*), at 784.

17 *Eggers et al. 2022*, at 784, 782–783.

18 *See generally* Moshe Ben-Akiva, Daniel McFadden & Kenneth Train, *Foundations of stated preference elicitation: Consumer behavior and choice-based conjoint analysis*, 10 FOUNDATIONS AND TRENDS® IN ECONOMETRICS 1 (William H. Greene et al. eds., 2019) (hereinafter *Ben-Akiva et al. 2019*), at 36–60.

19 *See, e.g.*, Jonas Schmidt & Tammo H. A. Bijmolt, *Accurately measuring willingness to pay for consumer goods: a meta-analysis of the hypothetical bias*, 48 JOURNAL OF THE ACADEMY OF MARKETING SCIENCE 499 (2020). *See also* Min Ding, Rajdeep Grewal, & John Liechty, *Incentive-Aligned Conjoint Analysis*, 42 JOURNAL OF MARKETING RESEARCH 67-82 (2005).

least some circumstances, the validity of any particular survey will depend on the subjects' familiarity with the class of products being studied and their characteristics, the extent to which the menu design balances market realism with the variation needed for statistical accuracy, the incentive alignment of the choices subjects are asked to make, and the representativeness of the sample of subjects, among other factors.[20]

It has become increasingly popular to propose the use of conjoint analysis for estimating market price shifts in consumer class actions; we provide several examples in the next section. When used in litigation for damages analysis, the survey expert typically either uses the data from the conjoint survey, or provides the data resulting from the survey to an economist, to estimate the prices that would have been observed for the product(s) at issue in the but-for world in which the alleged bad acts had not occurred. Estimating the but-for prices using a conjoint survey requires not only estimating demand parameters using the conjoint data (often referred to as estimating the "demand side") but also requires simulating the competitive interaction among suppliers and other factors that affect the quantity supplied (often referred to as simulating the "supply side") that, together with the demand side, determine but-for equilibrium prices in the market. This second step—applying the demand parameter estimates that result from a conjoint survey in the first step to a supply side simulation to arrive at predicted but-for prices that would prevail in a market given the changes in demand and the quantity responses of suppliers—is the focus of this article.

It is not our purpose in this article to analyze or critique the validity of conjoint surveys for estimating realistic demand curves. We will not be exploring the details of survey design or execution. Generally, a survey expert decides which product attributes to include, how many product options to show survey subjects in each choice task, how many choice tasks to present to survey subjects, and the range and levels of prices to present to subjects, among other survey design criteria. The survey expert also decides on a target population and sample size, selects a representative sample, and conducts the survey. For our purposes, we assume that the survey expert uses best practices for survey design and execution. We also assume that the survey produces stated preference data that accurately reflects the decisions that respondents would make in the actual market if confronted with the same hypothetical choices—i.e., we assume the survey data accurately represents what would be reflected in revealed preference data if such data was available. Our purpose is to explain how data from conjoint surveys is used in consumer protection class action litigation to estimate but-for prices via market simulation methods to quantify damages based on an overpayment theory of harm, and assess the suitability of those simulation methods for that purpose.

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20 *See, e.g.*, *Ben-Akiva et al. 2019*, Table 2.1.

II. CONJOINT-BASED BUT-FOR PRICE PREDICTIONS USING MARKET SIMULATIONS ARE NOT RELIABLE, AT LEAST AS CURRENTLY PRACTICED

A. HOW CONJOINT SURVEYS HAVE BEEN USED IN CLASS-ACTION LITIGATION

The use of conjoint surveys in consumer protection class action litigation has evolved over the last two decades, as courts have come to better understand the potential role of conjoint survey data for determining market prices. Initially, conjoint surveys as used in consumer class action litigation were applied only, or at most, to estimate demand parameters; those demand parameters were used only to quantify consumers' willingness to pay for the accused attribute. For example, the first use of conjoint surveys in class action litigation appears to have been in *Schwab v. Philip Morris USA, Inc.*[21] This was a class action lawsuit involving the labeling of light cigarettes as safer than regular cigarettes for one's health. Plaintiffs alleged that claiming light cigarettes are safer for one's health than regular cigarettes was misleading and led to consumers overpaying for light cigarettes.[22] The plaintiffs relied on the expert report of a marketing professor who conducted a conjoint survey to determine whether health risks are a contributing factor in consumers' decisions to purchase light cigarettes; to quantify the proportion of light cigarette smokers who factored health risks into their purchase decision; and to assess how consumers' valuations and products' market shares would react to cigarettes with different health risk claims.[23] The expert found that health risks are a contributing factor for 90 percent of light cigarette consumers in their choice of light cigarettes over regular cigarettes, and concluded that the value that purchasers of light cigarettes place on the perceived health benefits of light cigarettes was 47 percent of the price of the pack. The class was certified on September 25, 2006.[24]

The expert's analysis in *Schwab v. Philip Morris* was, as just described, based only on the results of the conjoint survey for consumers' willingness to pay for the challenged attribute. Whatever the merits of the expert's conjoint-survey-based conclusion that consumers' valuation of the challenged attribute amounted to nearly half of the price of a pack of light cigarettes, as an economic matter those results do not translate to the effect on the price of a pack of cigarettes that would prevail in the market if the challenged label language were removed. That is because willingness to pay is not the same thing as market price. That is to say, it does not follow that removing the challenged language from light cigarette labels would result in the price of light cigarettes falling by (nearly) half, or that the price of the light cigarettes would have been lower by nearly half had the challenged language not appeared. This is because the price of a product is not determined by willingness to pay alone because willingness to pay is only a demand factor.

[21] Schwab v. Philip Morris USA, Inc., 449 F. Supp. 2d 992 (E.D.N.Y. 2006), at 1167.

[22] Philip Morris, 449 F. Supp. 2d, at 1018.

[23] Expert Report of Dr. John R. Hauser, Philip Morris, 449 F. Supp. 2d, July 9, 2006, ¶ 10, 12–13.

[24] Philip Morris, 449 F. Supp. 2d, at 992, 1278.

Market prices are determined, as already discussed, by the interaction of demand and supply factors. The interaction of demand and supply to produce an equilibrium price depends, in turn, on the market structure, pricing strategy, investment strategies, and product strategies of the suppliers. Conjoint surveys can measure only the preferences of the consumers or purchasers of a product and therefore the results are inputs only into demand. A but-for market price therefore cannot be determined on the basis of conjoint survey results alone.

Eventually some courts learned that conjoint survey results alone cannot translate into a but-for market price, or, in turn, into overpayment damages because prices are determined by supply as well as demand factors. An early articulation of this point is seen in the 2014 litigation of *Saavedra v. Eli Lilly & Co*. This was a class action lawsuit in which plaintiffs alleged that Eli Lilly misrepresented withdrawal symptoms in the marketing, advertising, and labeling of its antidepressant.[25] The plaintiffs' expert proposed using a conjoint survey to determine the relative value consumers place on a drug having a lower withdrawal risk.[26] The court said that plaintiffs' expert focused "only on the demand side of the equation, rather than on the intersection of supply and demand"[27] and by "ignoring supply…convert[ed] the lost-expectation theory from an objective evaluation of relative fair market values to a seemingly subjective inquiry of what an average consumer wants."[28] The court ruled that the plaintiffs' proposed methodology using conjoint survey results to determine a relative value (or, a "subjective inquiry of what an average consumer wants") was inadequate—plaintiffs had not demonstrated that the proposed methodology could be used to determine an absolute valuation of damages, and correctly rejected the methodology for determining class damages (denying class certification).[29]

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25 Saavedra v. Eli Lilly & Co., No. 2:12-cv-9366-SVW (MANx), 2014 BL 368152, at *1–2 (C.D. Cal. Dec. 18, 2014).

26 Saavedra v. Eli Lilly & Co., No. 2:12-cv-9366-SVW (MANx), 2014 BL 368152, at *5 (C.D. Cal. Dec. 18, 2014).

27 Saavedra v. Eli Lilly & Co., No. 2:12-cv-9366-SVW (MANx), 2014 BL 368152, at *5 (C.D. Cal. Dec. 18, 2014).

28 Saavedra v. Eli Lilly & Co., No. 2:12-cv-9366-SVW (MANx), 2014 BL 368152, at *6 (C.D. Cal. Dec. 18, 2014).

29 Saavedra v. Eli Lilly & Co., No. 2:12-cv-9366-SVW (MANx), 2014 BL 368152, at *13 (C.D. Cal. Dec. 18, 2014). Other courts have also rejected conjoint-based damages models that lack a supply side simulation. Examples include *In re NJOY, Inc. Consumer Class Action Litig.*, 120 F. Supp. 3d 1050 (C.D. Cal. 2015) ("In this case, as in Saavedra and Apple, the proffered damages methodology is divorced from the marketplace. A consumer's subjective valuation of the purported safety message, measured by their relative willingness to pay for products with or without the message, is not an accurate indicator of restitutionary damages, because it does not permit the court to calculate the true market price of NJOY e-cigarettes absent the purported misrepresentations."); *Morales v. Kraft Foods Grp., Inc.*, No. LA CV14-04387 JAK (PJWx) (C.D. Cal. June 09, 2017) ("Here, both parties agree that the conjoint analysis does not provide any insight into the money received by the Defendant in connection with the sale of the Product. Rather, it bears only on the claimed loss to Plaintiffs. Thus, the evidence provided by Plaintiffs about their potential willingness to pay a premium due to the use of the "natural cheese" label is insufficient to establish a basis for calculating restitution."); *In re* General Motors LLC Ignition Switch Litigation, 14-MD-2543 (JMF) (S.D.N.Y. Aug. 6, 2019) ("As discussed, that law requires that benefit-of-the-bargain damages be calculated based on the difference in market value between the

As a result of some courts rejecting conjoint survey results because they consider only consumer demand and ignore supply factors, some experts began attempting to augment the conjoint survey results with a formal model of supply factors to estimate but-for prices. In particular, experts have begun advancing damages models that combine estimates of consumer valuations of challenged characteristics from conjoint surveys with market simulations that purport to incorporate supply factors. The purpose of the supply side market simulations is presumably to substitute for direct estimation of the price formation process via standard techniques such as reduced-form econometrics using market data. For example, in three recent alleged false advertising cases with which we are familiar, *Benson v. Newell Brands* (NUK), *Lytle v. Nutramax* (Nutramax), and *Freeman v. MAM* (MAM), plaintiffs' experts all proposed combining a conjoint survey with a supply side market simulation based on an assumed model of competition to estimate purported price premiums.[30] The courts certified the classes for *Benson*

product as warranted and the product as sold and defines market value as the product of both a consumer's willingness to pay and a merchant's willingness to sell, when neither are under any compulsion to do so. Applying that law, the Court is compelled to conclude that Boedeker's analysis does not, without more, suffice to prove that any of the Bellwether State Plaintiffs suffered benefit-of-the-bargain damages based on a difference in value. Because there is no more — that is, Plaintiffs point to no other evidence from which a factfinder could find damages based on a difference in value — there is an "absence of evidence" on an "essential element" of Plaintiffs' claims for such damages."); *Zakaria v. Gerber Prods. Co.*, No. LA CV15-00200 JAK (Ex) (C.D. Cal. Aug. 09, 2017) ("Howlett's conjoint analysis does not show what amount of money, if any, Defendant received as a result of its alleged misrepresentations. Rather, at most it bears only on the claimed loss to Plaintiffs. Thus, the evidence provided by Plaintiffs about their potential willingness to pay a premium due to the use of the 1st And Only Label is insufficient to establish a basis for calculating either restitution or actual damages."); and *In re Volkswagen "Clean Diesel" Marketing, Sales Practices, & Products Liability Litigation*, No. 15-MD-02672-CRB (JSC) (N.D. Cal. Nov. 12, 2020) ("Mr. Gaskin does not actually calculate a market price premium; he examines only what consumers say they would be willing to pay for certain vehicles. As Defendants point out, this ignores the "supply" part of the supply/demand curve."). However, we are aware that some experts continue to propose conjoint-based damages models that ignore the supply side of the market by asserting that the vertical demand shift associated with the characteristic in suit is *equal* to the price differential, an assertion that is equivalent to assuming a perfectly competitive market in which the supply curve is vertical. It is clear as a matter of economic first principles that such models are invalid and will necessarily lead to erroneous and overstated estimated damages (for a discussion of this point in the context of consumer class actions, see Lisa Cameron, Daniel McFadden & Pablo Robles, *Price Premium Damages in Product Market Litigation: Issues in Survey-Based Market Simulations*, in PRODUCT LIABILITY 2022, at 23 (Adela Williams & Tom Fox eds., 20th ed. 2022)); we do not address these methodologies further in this paper other than to note that we conducted a LexisNexis search for expert reports associated with class certification motions in cases filed in the years 2020–2024 that mention "conjoint" and "market simulation." We identified an additional 33 cases in which experts proposed a conjoint survey combined with a purported "market simulation." In 32 of these cases, however, there was no simulation or any other economically meaningful supply side analysis. Some courts continue to certify classes on the basis of such methodologies or proposed methodologies.

30 Expert Report of Professor Jean-Pierre H. Dubé, July 28, 2021, ¶ 16, Benson v. Newell Brands, Inc., No.: 1:19-CV-06836 (N.D. Ill.) (hereinafter, *Dubé NUK Report*). Expert Report of Professor Jean-Pierre H. Dubé, August 23, 2021, ¶¶ 12, 14, 16, 21-22, Lytle v. Nutramax Labs, Inc., No.: 5:19-cv-00835-JBG-SP (C.D. Cal.) (hereinafter, *Dubé Nutramax Report*). Expert Report of Jeremy A. Verlinda, Ph.D., January 20, 2023, ¶ 13, Appendix D, Freeman v. MAM USA Corp., No.: 1:20-cv-01834 (N.D. Ill.) (hereinafter, *Verlinda Report*).

v. Newell and *Lytle v. Nutramax* (accepting the methodology).[31] The parties in *Freeman v. MAM* settled and the court dismissed the case before ruling on class certification.[32]

Using market simulation models to fill in the supply side of a price formation analysis, however, requires assuming a particular form of competition rather than letting the data dictate the relationship between costs, demand, and prices. As we will establish in the rest of this article, the types of simulation models that have been used or proposed for combination with conjoint survey data in litigation of which we are aware entail strong assumptions about market conduct that have been tested in the economics literature and, we conclude, have been found to be unreliable as a general matter (i.e., for application to any specific market without first demonstrating the applicability of the model's assumptions to that market) for the purpose of estimating damages in litigation.

B. WHAT IS MARKET SIMULATION?

As discussed above, in real markets, prices are determined by the market structure and strategies that suppliers adopt given customers' demand for the product, costs of production, and macroeconomic conditions. If a demand curve is estimated from conjoint survey data that is capable of isolating the effects of the characteristics at issue on demand, it must be combined with a means of estimating the interactions of supply and demand to determine a but-for price. Hence, estimating the prices that would prevail in a counterfactual world in which product characteristics are different from their real-world characteristics, or in which consumers' information about the product characteristics are accurate (in contrast to the inaccurate information alleged to prevail in the real world) requires not only understanding or, alternatively, making assumptions about consumers' demand for a product (and how demand would change when certain characteristics of that product change), but also requires understanding the competitive strategies adopted by suppliers and how those demand and supply factors interact to determine a market price.

Market simulation of a counterfactual world that incorporates supply factors in which a given product characteristic or description is changed is a method by which the analyst: (1) makes assumptions about the competitive strategies of the suppliers in a particular market; (2) writes out a set of mathematical equations that formalize those assumptions; (3) solves for the simultaneous solution of those equations assuming that actual market prices reflect an equilibrium of the modeled system; and (4) uses the set of mathematical equations to calculate what the price would be in a hypothetical world in which the product characteristic in question were different, holding all other supply factors constant. These methods have been developed

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31 Memorandum Opinion and Order, Benson v. Newell Brands, Inc., No. 19 C 6836, slip op. at 16 (N.D. Ill. Nov. 16, 2021). Lytle v. Nutramax Labs., Inc., No. 22-55744, slip op. at 2 (9th Cir. Apr. 22, 2024).

32 Freeman v. MAM USA Corp., No.: 1:20-cv-01834, docket entry 228 (N.D. Ill. July 22, 2024).

over the last thirty years, in the context of merger enforcement.[33] As elaborated later, the enforcement agencies apply market simulation methods, along with other analyses, to assess whether a proposed merger is likely to cause a material increase in prices. To understand their function in the context of damages analysis in consumer class actions, we will now discuss each of these steps in turn.

Implementing a market simulation amounts to constructing a set of mathematical equations derived from applied game theory that reflects the analyst's assumptions about the competitive strategies of the firms in the market. Each hypothesized supplier is represented by an equation that purports to describe the supplier's decision about price or quantity or another market variable in response to or as a reaction to the set of decisions taken by each of the other suppliers, given the market demand curves. These equations are called reaction functions. For a market with N hypothesized or modeled firms participating in the market, there are N reaction functions. Each equation, because it describes the firm's decision as a function of all the other firms' decisions, incorporates the modeled or estimated demand functions for all relevant products in the market, and incorporates all modeled assumptions about competitive strategy. It is assumed that each firm behaves as described in its reaction function and that the solution to the N equations represents an equilibrium, which means that the price (or other strategic variable) selected by each firm maximizes that firm's profit, given the price (or other strategic variable) selected by all other firms, and that no firm would change its behavior. Hence, the second step in conducting a market simulation entails constructing the reaction functions according to a set of assumptions that the analyst considers reasonable for the market, and then calculating the solution to those N equations.

In standard game theoretic models of firms competing in a market, the equilibrium prices depend on the demand each firm faces, each firm's competitive strategy and the competitive strategies of its rivals, and firms' marginal costs. Because prices in the actual world are presumed observable and known, each firm's strategy is assumed by the analyst as an input to the model (i.e., they are built by assumption into the reaction functions), and the demand elasticities are estimated from the conjoint survey results, firms' marginal costs are the remaining fundamental but unknown variable in the set of market equations. The process of predicting but-for prices in a market simulation leverages the idea that if you have the equations that, you assumed, accurately describe the competitive interaction of the firms in the market, and can therefore be solved for the equilibrium market price given the demand elasticities the firms face and the firms' marginal costs, then if you already know the actual market prices you can reverse-solve the equations for what the firms' marginal costs must be to have arrived at those observed market prices.[34] This is

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33 For a detailed survey of market simulation methodologies in merger review, see Oliver Budzinski & Isabel Ruhmer, *Merger simulation in competition policy: A survey*, 6 JOURNAL OF COMPETITION LAW AND ECONOMICS 277 (2010) (hereinafter, *Budzinski and Ruhmer 2010*).

34 *See, e.g.*, Aviv Nevo, *Mergers With Differentiated Products: The Case Of The Ready-To-Eat Cereal Industry*, THE RAND JOURNAL OF ECONOMICS 395 (2000) (hereinafter *Nevo 2000*).

done by solving the reaction functions for what firms' marginal costs would have to be for the assumed model of competition to result in the observed market prices as the equilibrium (solution) to the equations. That is, because the assumed competitive strategies of the firms, together with the demand functions and the firms' marginal costs, determine in a game theoretic equilibrium the market prices, one can plug the actual prices into the reaction functions and, assuming those prices are the solution of those reaction functions, calculate what the implied marginal costs had to be to arrive at those prices. This is step (3) in the process laid out above.

Once the reaction functions have been reverse-solved for the implied marginal costs, the final step in performing the market simulation to calculate but-for prices is to conduct the counterfactual simulation. In the context of consumer class actions, performing the counterfactual simulation to determine what the equilibrium prices would have been but-for the alleged misrepresentation of a product attribute requires modifying the demand curve that was estimated using the conjoint survey results to represent what the demand would have been in the but-for world in which consumers had been informed that the disputed attribute was absent or present, as the case may be. Conjoint survey results are purportedly able to isolate the effect on demand of product characteristics, and a conjoint survey designed to isolate consumers' willingness to pay for the attribute in question purportedly allows the analyst to accurately modify the estimated demand curve to represent the relevant but-for demand. Sometimes this is referred to as "turning on" or "turning off" the relevant characteristic in the demand equation.

Having thereby modified the estimated demand to remove the effects of the alleged bad act, the analyst calculates the new (counterfactual) solution to the N reaction functions for the equilibrium prices, holding the reverse-engineered marginal costs constant. The outcome is, in theory, the prices that would prevail in equilibrium in a counterfactual world in which the alleged misrepresentation had not occurred, assuming the counterfactual demand based on the conjoint survey is correct, that the assumed model of competition is correct, that the firms' true marginal costs in the real world that were purportedly calculated via reverse-solving the reaction functions are correct, and that the firms' marginal costs would be the same in the but-for world as in the real world.

The difference between these simulated but-for equilibrium prices and prices observed in the actual world is the purported price premium attributed to the alleged misrepresentation.

It is useful here to emphasize two points. First, as noted, the logic of the exercise requires that the assumed model of competitive strategic interactions is correct—that the equations that describe how each firm would react to the prices or other strategies of its rivals accurately describe how they would in fact react. If that model does not describe actual firm conduct, the price predictions of the model would not be accurate and the premise of the rest of the mathematics would fail.

Second, the only data from the real market technically required to perform a market simulation is real-world product prices. In particular, the but-for prices that are the objective of this process depend critically on the firms' marginal costs; but the marginal costs used in the simulation are not based on any data about firms' actual marginal costs—they are inferred from the model and rely on the validity of the assumed competitive model chosen. There is no step in the process that requires comparing the implied marginal costs, calculated by reverse-solving the reactions functions (assuming the competitive model chosen is correct), to any data on firms' actual marginal costs.[35]

To illustrate conceptually how the assumptions of the competitive model adopted are used to reverse-engineer the competitors' supposed marginal costs and those are then used to calculate purported counterfactual prices, suppose for purposes of illustration that all consumers have the same preferences and the competitive process is assumed to be very simple. Specifically, suppose that each company ignores every other company and sets its price at half the difference between the maximum that consumers are willing to pay for a particular product as determined by an (assumed-known) demand function, and the company's marginal cost. If this were the assumed model of competition, then if the conjoint survey analysis estimated that the maximum that consumers are willing to pay for a product with a particular set of characteristics is \$8, and the actual price is \$6, this assumed theory of competition would *imply* that the firm's marginal cost of producing these products must be \$4. This is because if the company knew that consumers' willingness-to-pay is \$8, it would, per our hypothesized model of competition, set price at \$6 if and only if its marginal cost were \$4. Hence, if we see in the market that the actual price it charges is \$6, and we know that consumers' willingness-to-pay is \$8, and we know the model of competitive pricing is the example we just described, we can reverse-solve the pricing equation to infer that the marginal cost must have been \$4. Rather than examining cost data to determine if the firm's marginal cost is in fact \$4, this method would infer (effectively, assume) that it is \$4, by relying on the validity of the assumed but unknown and unobserved competitive strategies of the firms in the industry.

Now suppose that the results of the analysis of the conjoint survey data imply that for a hypothetical product that is identical to the actual product but without the misrepresented characteristic (i.e., the but-for product), consumers would pay at most \$7. That means that the willingness-to-pay for the characteristic itself (i.e., the value that consumers place on the

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35 While proponents of conjoint methods often point out that the conjoint simulation process entails calibration against market data, the calibration involved pertains to adjusting the estimated *demand* parameters that are calculated from the conjoint survey so that they are consistent with the brands' true market shares. Although some peer-reviewed studies that involve market simulation use real-market cost data to determine which competitive model better fits the market being studied (*see, e.g.*, Aviv Nevo, *Measuring market power in the ready-to-eat cereal industry*, 69 ECONOMETRICA 307 (2001)), a topic we will discuss in more detail below, there is no step in the standard simulation analysis that requires calibration to data on true marginal cost or other supply factors. Indeed, in the instances in which we have seen market simulation used in litigation, real-market cost data has not been used at all, even for model selection.

characteristic, according to the conjoint survey results) is $1. Then the model would predict that the counterfactual price of this product (the market price that would have been charged for the product if the challenged characteristic had been removed) would have been $4 + ($7 - $4)/2 (i.e., half the difference between the maximum willingness to pay and the inferred marginal cost) = $5.50. That is, applying the same competitive assumptions as assumed to have determined observed prices in the real world to the modified demand in the counterfactual world and assuming the marginal costs to be the same $4 that were reverse-solved in the previous step results in the calculation of a purported but-for price of $5.50. In this example, then, the purported price premium attributed to the challenged characteristic would be $0.50 (= $6 - $5.50). Implied damages to each member of the purported class would be $0.50 times the number of units of the product purchased by that consumer during the class period; total damages for which the defendant would be responsible, under this damages theory, would be $0.50 times the total number of units purchased during the class period.

As we hope our description of the simulation process makes clear, the price premium (and the associated damages) thus calculated depends on a variety of assumptions that include but are in addition to the validity of the conjoint survey results themselves. To see the sensitivity of the results to the assumed model of competitive strategy suppose that, instead of the model of competition that we just described, the assumed competitive model were that each firm set the price at 2/3 (rather than one half) of the difference between consumers' maximum willingness to pay and the firm's marginal cost. In this case, the same arithmetic steps just described would imply that the marginal cost for the actual product with a price of $6 and maximum willingness to pay of $8 must have been $2, not, as in the previously-assumed competitive model, $4. If the inferred marginal cost is $2, the counterfactual price implied by the model, again assuming that the results of the conjoint survey were correct, would be $5.33 and the purported price premium would be $0.67, 34 percent higher than under the first competitive model.[36] Hence, the modification of our simple illustrative competitive model, holding constant the conjoint survey results and all other assumptions that enter the simulation process, and assuming the results of the conjoint survey for the consumers' willingness-to-pay for the characteristic at issue to be accurate, would cause the inferred marginal cost to be half of the estimate in the original model, and the estimated price premium—and therefore the estimated damages—to be a third higher, despite the assumed willingness-to-pay being the same in both calculations. But the modification of the competitive model—that firms set their price at 2/3 rather than 1/2 of the difference between their marginal cost and consumers' willingness-to-pay—is not tested in the simulation process. It is purely an assumption.

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36 The marginal cost MC is first recovered from this equation: $MC + (8 - MC)\frac{2}{3} = 6 \Rightarrow \frac{MC}{3} = \frac{2}{3} \Rightarrow MC = 2$. Then the but-for price is recovered from the following equation: $p^{BF} = 2 + (7 - 2)\frac{2}{3} = \frac{16}{3} \approx \$5.33$. The overcharge or price premium is then the difference between $6 and $5.33, which is $0.67. Given that the first model predicts that the price premium is $0.50, the difference is ($0.67 - $0.50)/$0.50 = 34%.

The competitive model in this example is a very simple process, chosen for purposes of exposition because it allows us to illustrate the concept of reverse-engineering the marginal costs and the implications for the implied but-for price with simple arithmetic that the reader can do in their head rather than requiring calculating the simultaneous solution to N equations. The competitive model typically used in market simulations, discussed shortly, is more complex. But the conceptual points illustrated in our example hold regardless of the specific competitive model chosen. First, the choice of competitive model directly determines the implied price premium associated with a challenged characteristic. And second, the purported premium can be highly sensitive to the choice of model of the competitive process.

Hence, for a simulation methodology to predict accurate and realistic counterfactual prices, it is not sufficient for the demand estimates that arise from the conjoint survey to be accurate predictors of real consumer decision-making in the marketplace; in addition, the simulation model that embeds assumptions about the strategic conduct of suppliers in the market must lead to reliable results as well.

C. ARE SIMULATION METHODS RELIABLE?

There are numerous theoretical models of competition that are accepted in the economics literature as coherent and as potentially descriptive of some aspects of competition in some kinds of markets for some kinds of analyses;[37] which model, if any, is relevant to any given market, differs by market and by the question being asked. The economist Sam Peltzman, in a review of The Handbook of Industrial Organization, summarized the types of questions that must be answered to determine which competitive model is best suited to study a particular market, and emphasized that this list is not exhaustive and that the answers to these questions can critically affect the results:

> (1) How many players are there? (2) Who moves first? (3) Who remembers what (e.g., are there information lags)? (4) Who knows what (e.g., is knowledge common or private)? (5) When do they know it? (See also question 3 above.) (6) Who can communicate with whom and when? (7) What is the probability of any outcome? (8) How reasonable are the players? (9) Is choice once for all or subject to change over time? If subject to change, in how many periods? (10) How long is each period? (11) What is the discount rate? (12) How long do the players live? (13) How do players today respond to past play (e.g., do players develop reputations)? (14) Does an equilibrium exist? (15) Is equilibrium coalition proof? (See question 1 above.) (16) Is equilibrium robust to changes in assumptions? (17) How are deviations punished? (18) Is there a continuum of reactions or a discrete number? (19) Are the players' reaction functions smooth or discontinuous? (20) What does player A believe about B's objective function and vice versa?[38]

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37 *See, e.g.*, JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION Chs. 5–10 (MIT Press, 7th ed. 1994) (hereinafter, *Tirole 1994*).

38 Sam Peltzman, The Handbook of Industrial Organization: A Review Article, 99 J. POL. ECON. 201 (1991), at 207.

The numerous competitive models recognized as useful in the economics literature differ in these dimensions and more, and each model can give vastly different price predictions. Some models may not even have unique predictions.

One game theoretic model of competition commonly used in simulation analyses is what is known as the static Nash Bertrand (SNB) model,[39] and this is the model we have seen used or proposed by experts in consumer protection class action litigation.[40] The SNB model has the virtue of being relatively tractable mathematically and therefore is fairly well-suited to the programming demands of simulation analysis. Implicit in the SNB model, however, like all economic models of competitive interaction, is a laundry list of assumed answers to questions like those listed by Professor Peltzman, above. In particular, according to the SNB model each firm in the market competes by setting the price that it expects will maximize its profits given the prices set by its competitors, each assuming that its price decision will not affect the pricing decision of other competitors;[41] that competition occurs only on the dimension of price, and that, while each company's products may be differentiated from each other's products, each competitor treats its own and rival product characteristics as fixed and not subject to modification to make them more competitive, unique, or attractive; that competitors set price without consideration for whether the price they set will affect the future expectations or decisions of their competitors; that no firm knows what its competitors' prices are when it sets its own price (i.e., firms set prices simultaneously), but each firm has complete information about its competitors' costs and the demand for their products, so they can perfectly predict what its competitors' prices will be; and other assumptions.[42]

The SNB model, however, is only one possible way that competition in a market may be described and modeled. For example, another commonly used model of competition in the economics literature, known as the static Nash Cournot or often just Cournot model, assumes instead that competitors choose the quantity of output they wish to sell or the capacity of their output capabilities, taking as given the volume of product produced by or capacities of their competitors, and then adjust their prices according to demand.[43] These two simple types of models (static Nash Cournot or static Nash Bertrand) have substantially different implications for

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39 *Budzinski and Ruhmer 2010*, at 4.

40 SNB is the model that was proposed by the experts in all four cases mentioned above that modelled supply. See *Verlinda Report*, ¶ 60; *Dubé NUK Report*, Appendix C; *Dubé Nutramax Report*, Appendix C; Expert Report of Richard J. Eichmann, October 9, 2021, app. 3, Won v. General Motors LLC, No.: 2:19-cv-11044 (E.D. Mich.).

41 The Nash Bertrand equilibrium is a set of prices such that each firm's price does in fact maximizes that firm's profit given the prices of its competitors. Each firm's price, in equilibrium, depends on every other firm's price in equilibrium, but each firm sets its price assuming that every other firm's price is given and would not be affected by its own price. *See* PETER DAVIS & ELIANA GARCÉS, QUANTITATIVE TECHNIQUES FOR COMPETITION AND ANTITRUST ANALYSIS (Princeton University Press, 2010) (hereinafter, *Davis and Garcés 2010*), at 47-53.

42 *Davis and Garcés 2010*, at 47-53.

43 DENNIS CARLTON & JEFFREY PERLOFF, MODERN INDUSTRIAL ORGANIZATION, (Pearson Education Limited, 4th ed. 2015) (hereinafter, *Carlton and Perloff 2015*), at 185–188.

the resulting implied marginal costs and equilibrium prices.[44] Moreover, neither model incorporates other dimensions of competition as alternative or adjunct avenues of competition, such as, for example, modifications of product characteristics, investment in innovation or research, consideration of the effects of today's pricing or output decisions on future competitive interactions, or expenditures on advertising.[45]

Because the SNB model does not admit the possibility of competitors setting their prices in consideration of their own or competitors' past prices or the possibility of setting prices to influence the future pricing or other decisions of competitors, it is in a class of oligopoly models considered static or one-shot games.[46] Static oligopoly models assume that competition in each period (e.g., day, month, year) happens in isolation, without any consideration of firms' histories or expectations about future behavior or other market dynamics. As one prominent economics professor wrote, however, no real-life industry consists of firms engaged in a one-shot game, and "[t]hat makes the one-shot game totally uninteresting."[47]

It is well-established in the economics literature that repeated interaction between competitors may lead to prices that differ significantly from those predicted by static models.[48] The possibility of each competitor modifying its pricing strategy to respond to competitors' prices and/or learn from past experience opens the door for many price patterns to be equilibria. For example, the recognition by each competitor that it will be competing repeatedly with its rivals in the future can soften competition by reducing the incentive of each rival to undercut the others' prices, lest doing so trigger retaliation by the rivals via still lower prices or a price war.[49]

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44 *Carlton and Perloff 2015*, at 198. For differentiated products, *see, e.g.*, Xavier Vives, *On the Efficiency of Bertrand and Cournot Equilibria with Product Differentiation*, 36 J. ECON. THEORY 166 (1985). For example, assume a market with two firms with differentiated products. Assume that the estimated demand parameters imply that the firms face the following demand: $q_1 = 1400 + 100p_2 - 200p_1$ and $q_2 = 1400 + 100p_1 - 200p_2$, and the observed equilibrium price is $p = 6$. If we assume this represents a static Nash Bertrand equilibrium, the implied marginal costs would be $c_B = 2$. If, however, we assume that this represents a static Nash Cournot equilibrium, the implied marginal cost would be $c_C = 0.67$. Now assume that the but-for demand parameters imply that the firms face the following but-for demand: $q_1 = 1000 + 100p_2 - 200p_1$ and $q_2 = 1000 + 100p_1 - 200p_2$. (Note that demand shifts down for both products in the but-for world.) Assuming constant marginal costs, as is typically assumed in the market simulations we have reviewed, the but-for Nash Bertrand equilibrium price would be 4.67 (a reduction of 22 percent), and the but-for Nash Cournot equilibrium price would be 4.40 (a reduction of 27 percent). The purpose of the example is only to show that the but-for price depends on the competitive model assumed; the quantitative difference in the prices that result from different competitive models can, of course, be greater or smaller than this example illustrates.

45 *Davis and Garcés 2010*, at 61.

46 We define static games to represent not only simultaneous move games, but also single period games. See *Carlton and Perloff 2015,* at 184.

47 Franklin M. Fisher, *Games Economists Play: A Noncooperative View*, 20 THE RAND JOURNAL OF ECONOMICS 113 (1989) (hereinafter, *Fisher 1989*), at 115.

48 *Tirole 1994*, at 239.

49 *See, e.g.*, *Tirole 1988*, at 240.

Economic theorists have expanded game-theoretic models of oligopolistic competition to relax the assumption that firms choose their prices (or quantities) simultaneously and to account for repeated interactions. A simple version is called Stackelberg models, and they assume that one competitor makes its strategy decision after observing the strategy of the first mover.[50] Stackelberg models, however, are still relatively simple constructs that do not have a feedback mechanism from the second mover's strategy back to the first mover's strategy in subsequent periods.[51]

Other, more sophisticated, models explicitly allow for the possibility of repeated interactions in which competitors make their strategic decisions taking into account the history and potential future responses of one another. These are known as repeated games or dynamic games. Repeated game models, while generally more realistic than static models in the allowable factors that competitors may consider in their strategic decisions, tend to have multiple solutions (i.e., there are multiple possible equilibria). To be usable as a damages methodology, a necessary feature of a model of competition is that if one enters demand and cost data into the model, the model predicts a unique price for each company; but repeated games tend to find that numerous possible prices for each company can be a solution to the model, so they do not result in a prediction of what the prices would be.[52] Static games can be better than dynamic games at yielding clear price predictions that can be calculated, but only by imposing restrictions that distance them from real market characteristics.[53] As a result, while the predictions of static models may be clear, they may not be very accurate. And the predictions of static games depend materially on the assumptions imposed regarding the types of strategies employed by the competitors, among other factors—factors that are not necessarily known and that vary from market to market.[54]

As a matter of principle, there is no reason that market simulations must be based on the SNB model. With appropriate mathematics and programming, a market could be simulated using other

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50 *Carlton and Perloff 2015*, at 200.

51 *Carlton and Perloff 2015*, at 184.

52 A particularly well-known result in this literature is known as the folk theorem. The folk theorem is that in a game (or model of competition) that accounts for repeated interactions, if the players (in this case the firms) are sufficiently patient (i.e., do not discount future profits relative to current profits excessively), "then any feasible, individually rational payoffs can be enforced by an equilibrium." DREW FUDENBERG & JEAN TIROLE, GAME THEORY, (MIT Press, 1991) (hereinafter, *Fudenberg and Tirole 1991*), at 150. This means that these models predict that any of hundreds or thousands of prices could result and it is not possible to say which one or ones *will* result. Even static games do not necessarily produce unique equilibria; some static games have multiple equilibria and some have no equilibrium. Much ink in the economics literature is spilled on identifying the mathematical characteristics of static games that ensure the existence of a unique equilibrium. *See, e.g.*, *Fudenberg and Tirole 1991*, pp. 18-19.

53 In the case of a mixed logit demand system and a multi-product firms Nash Bertrand supply model, an equilibrium may not exist and, if one does, it may not be unique. *See, e.g.*, Christopher Conlon & Jeff Gortmaker, *Best Practices for Differentiated Products Demand Estimation with PyBLP*, 51 THE RAND JOURNAL OF ECONOMICS 1108, at 1125, fn. 61 (2020) (hereinafter, *Conlon and Gortmaker 2020*).

54 *See, e.g.*, *Perloff and Carlton 2015*, Table 6.1, pp. 189, 204.

assumptions about the competitive process in the market, such as those embedded in alternative commonly used theoretical oligopoly models. As noted, however, in practice simulation models used in conjoint-based damages analyses, as well as other policy applications, embed the SNB model of competition, an assumption that tends to be both opaque in the litigation context and unsupported.

While it is unassailable that the spectrum of strong assumptions embedded in the SNB model are unrealistic, economists will typically respond—and correctly so—that an economic (or other scientific) model is not judged by the realism of its assumptions but by the reliability of its predictions. Indeed, a tenet of economic methodology is that a model may have highly unrealistic assumptions, and most do, a fact that necessitates skepticism of its predictions. But if its predictions comport with reality, it is considered a sound and useful model. As Milton Friedman explained in his canonical 1966 essay on economic methodology and "how to decide whether a suggested hypothesis or theory should be tentatively accepted" as science, "[t]he ultimate goal of a positive science is the development of a 'theory' or, 'hypothesis' that yields valid and meaningful (i.e., not truistic) predictions about phenomena not yet observed."[55] He explained that "theory is to be judged by its predictive power for the class of phenomena which it is intended to 'explain.'"[56] Importantly, he reminds us that only factual evidence can be used to validate a theory.[57] The only real test of the validity of a theory is the comparison of its predictions with actual outcomes; the hypothesis is rejected—or "falsified"—if its predictions are contradicted by empirical facts.[58]

We would add a corollary to that principle. A theory may be useful and reliable for some applications and poorly suited to others. If, for example, the economic theory of perfectly competitive markets is to be applied merely to predict whether the volume sold of a product would go up or down when the industry's input costs go up, the predictive power of the model is likely to be very good despite its possibly unpalatable assumptions of perfectly homogenous products, perfect information, and free entry. Qualitative conclusions are likely to be robust. Quantitative conclusions, however, may be poor, if any are forthcoming at all. Hence, applying the model of perfect competition to analyze questions for which qualitative conclusions are all that is required may be very reliable indeed. Applying the model to applications where numerical accuracy of the predictions is required may be unsupportable.

Similarly, because the SNB model is founded on many unrealistic assumptions, and because it is only one of many possible competitive models, its use in economic inquiries that rely on its

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55 Milton Friedman, *The Methodology of Positive Economics*, ESSAYS IN POSITIVE ECONOMICS 3, (University of Chicago Press, 1966) (hereinafter, *Friedman 1966*), at 3, 7.

56 *Friedman 1966*, at 8.

57 *Friedman 1966*, at 8-9.

58 *Friedman 1966*, at 8-9.

quantitative predictions requires testing the validity of the model by asking whether the SNB model reliably predicts prices.

This question has been studied extensively in the economics literature, and the short answer is no. While SNB can be the most reliable among a set of candidate competitive models in some settings, it is not generally the most reliable, and simulation models in which competition is modeled as SNB do not generally predict prices well.

The studies that test the predictions of the SNB model can be divided into two general categories. Studies in the first category, which we refer to as horserace studies, pit alternative competitive models against each other. Economists have compared the predictions of alternative oligopoly models, including the SNB model, to the actual outcomes in real markets, to assess which model (among those considered) appears to best represent competition in specific markets. We discuss several comparisons of multiple standard competition models that have been published in the peer-reviewed economics literature in the next subsection (Part II.C.1). These horserace studies indicate that the model that best describes real markets varies by market, and that the SNB model is frequently found to be inferior to other models in explaining or predicting real market conduct. Determining the most reliable model for predicting but-for prices in a given market requires an empirical analysis of the real market characteristics and competitive practices before tentatively settling on a particular supply side model for that market; and then testing that model's predictions against known facts and data before concluding that it is a good candidate for simulation analysis of that market.

Assessing which of several models best represents competition in a specific market, as is done in the horserace literature, is not sufficient to conclude that a model can quantitatively predict but-for prices in a counterfactual world accurately, however. This is for at least two reasons. First, even if a model fits the observed prices in a market well, it may not predict prices well in a counterfactual scenario. Economic studies show that two models may both appear to fit observed data in a market well—both do well in a horserace with respect to a particular market—and yet have substantially different predictions for a counterfactual scenario. Hence, testing whether a model's predictions comport well with observed data is a necessary step to validate a model, but it is not sufficient to demonstrate that the model would generate accurate predictions of prices in a but-for world.

The second reason that the best of several models may not accurately predict prices is simply that the *best* model among available choices is not necessarily a *good* model for predicting quantitative outcomes—the very use to which some experts have attempted to use simulation models to quantify damages in consumer protection class action litigation. Economists have conducted multiple studies that directly test whether simulated prices based on the SNB model are reliable by comparing its predictions to the actual prices in real markets. After discussing the horserace studies, we turn in Part II.C.2 to discussing this second category of studies that test whether prices predicted by the SNB model are reliable when compared to actual prices. This literature shows that the SNB model does not perform well in such tests, and that prices predicted by the SNB model can be highly inaccurate from a quantitative standpoint in the context of damages calculations.

Of note, the studies discussed in the following sections that test the validity and reliability of the SNB model are based on analyses that use real market (revealed preference) data for the demand side estimation. They do not rely on conjoint survey or other stated preference data. Hence, the failure of the models studied to reliably predict market prices is not due to the potential deficiencies of survey-based demand data. To the extent that conjoint survey data results in less reliable demand estimates than does real market data, that would only exacerbate the deficiencies arising from the supply-side simulations in damages methodologies based on conjoint surveys.

1. *Which Competitive Model, If Any, Fits an Industry Requires an Industry-Specific Inquiry*

Empirical studies of a variety of models of oligopolistic competition have been conducted and demonstrate how sensitive these models' results are to the underlying assumptions and, in particular, how the results of the static, complete information Nash Bertrand (i.e., the SNB) model of competition do not, as a rule, comport well in a quantitative sense in real markets with respect to the observed prices, price changes, and other conduct in the market. These studies demonstrate the importance of empirical validation of theoretical models to determine whether a particular theoretical model of oligopolistic competition is relevant to the facts of a particular market.

For example, two studies by economists Nathan Miller and Matthew Weinberg published in leading peer reviewed journals demonstrated that the SNB model of competition is inferior to other models of competition with respect to the implied marginal costs and the prediction of actual price changes in the market studied. These authors analyzed the joint venture of SABMiller and Molson Coors Brewing (MillerCoors) in the United States brewing industry in 2008. The authors calculated a market simulation using an SNB model with sales data from before the joint venture to generate predictions of what the prices would be after the joint venture.[59] They conducted simulations using other models of competition as well to run the horserace. The purpose was to test which model(s) of competitive strategy most closely predicted the actual price changes that occurred after the joint venture.

The studies documented large actual price increases following the joint venture for products owned by either MillerCoors or competitor AnheuserBusch (ABI).[60] In their 2017 study, Miller and Weinberg found that data on price changes that occurred after the joint venture rejected an

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[59] Nathan H. Miller & Matthew C. Weinberg, *Understanding the price effects of the MillerCoors joint venture*, 85 ECONOMETRICA 1763 (2017) (hereinafter, *Miller and Weinberg 2017*). Nathan H. Miller, Gloria Sheu & Matthew C. Weinberg, *Oligopolistic price leadership and mergers: The United States beer industry*, 111 AMERICAN ECONOMIC REVIEW 3123 (2021) (hereinafter, *Miller et al. 2021*).

[60] *Miller and Weinberg 2017*, Figure 1, p. 1769; *Miller et al. 2021*, Figure 1, p. 3131.

SNB model of competition. The authors concluded that "the observed post-merger prices of these firms are six to eight percent higher than they would have been under [SNB] competition and markups are 17%–18% higher."[61] They also concluded that a model incorporating tacit collusion is more credible than the SNB model.[62]

In their 2021 study, Miller, Sheu, and Weinberg presented a new model of competition with a dynamic, rather than static, price-setting process, and evaluated the new model using the same market data on prices and quantities from the U.S brewing industry as in the 2017 Miller and Weinberg study.[63] The structure of the model was designed to more closely resemble the dynamic price setting process that the authors observed based on their documentary analysis of the competitive conduct in the market. The authors demonstrated that the implied (i.e., reverse-solved) marginal costs using their more fact-driven model were substantially different from the predictions that arose from the SNB model, demonstrating the significant sensitivity of oligopoly models to the assumptions adopted regarding the competitive interaction of the rivals in the market and demonstrating the importance of tailoring the simulation model to the known facts of the particular industry under study.[64]

Although the dynamic model tested in the 2021 study appeared to predict the observed (actual-world) market data reasonably well, so did the tacit collusion model of the 2017 study. This does not imply that either model would be suitable for predicting prices in a counterfactual setting, however. The authors also tested the models by using them to estimate prices in a but-for world in which the merger had not occurred, and the results differed significantly, implying significantly different price effects of the merger. The difference in the predicted prices between the two models varied from a low of 12 percent for Miller to a high of over 76 percent for Coors, with an average difference of 36 percent in the predicted but-for prices between the two models that otherwise fit the observed data well.[65] The significant quantitative differences in the predictions in the otherwise-winning models indicates the degree to which simulation models—models that predict prices on the basis of assumed competitive conduct in counterfactual settings—raise concerns about reliability of simulation model predictions for which testing may not be possible.

Other studies reinforce the importance of the choice of competitive model in a simulation. As noted earlier, one assumption of the SNB model of competition is that firms have complete information about their competitors' costs, demand, and strategies—that is, it is a game of complete information. However, as observed in the Handbook of Industrial Organization, a

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61 *Miller and Weinberg 2017*, at 1764, 1787.

62 *Miller and Weinberg 2017*, at 1764, 1782–1784, 1786.

63 *Miller et al. 2021*, at 3129–3131.

64 *Miller et al. 2021*, at 3141–3144. The Nash Bertrand model would predict large increases in estimated marginal costs for ABI after the merger compared to other brands (Modelo and Heineken). There is no support for such an increase.

65 *Miller et al. 2021*, Table 6, Column (1); *Miller and Weinberg 2017*, Table X, Columns (i) and (v).

standard source for research economists, "games of complete information are an idealization. In practice, everyone has at least a slight amount of incomplete information about the others' objectives."[66] In an assessment of this aspect of the SNB model, Sweeting et al. (2022) also studied the United States brewing industry, modeling price competition not as a static game of complete information but as a repeated game in which firms do not perfectly know the marginal costs of their competitors; rather, they learn about them from the observed prices over time. The authors calibrated their model using market share and price data from around the time of the joint venture and showed that their repeated game model of incomplete information and learning fit the data from before the joint venture much better than did a simple complete-information SNB model.[67] They further showed that their model predicted the distribution of price changes after the joint venture better than a tacit collusion model similar to that of Miller and Weinberg (2017).[68]

This series of studies of the same market demonstrates that the restrictive assumptions of the SNB model materially degrade its ability to predict prices in the industry studied. In particular, it shows the importance of testing different models to determine which is the best fit in a particular market. Importantly, these studies also demonstrate that it is feasible to do so.

Other researchers have also conducted horse races among competing oligopoly models to test the accuracy of their predictions against each other in specific markets. Roy et al. (2006) applied statistical tests to distinguish between several static oligopoly models of competition based on the conduct of the two main competitors in each of five diverse industries: microprocessors, personal computers, facial tissue, disposable diapers, and automobiles.[69] The candidate oligopoly models included the SNB model as well as Cournot, Stackelberg, and collusion models.

The authors found that, among the models they considered, the best fit to the observed pricing conduct in the market for the microprocessor industry was Stackelberg price competition led by Intel.[70] For the personal computer industry they found, subject to data limitations that caveat their conclusion for this industry, that the competitive model that best fit the observed pricing conduct was Stackelberg quantity competition led by Dell.[71] The authors found that in the facial tissue industry, the observed competition between the two major brands, Kleenex and Puffs, was

[66] Drew Fudenberg & Jean Tirole, *Noncooperative Game Theory for Industrial Organization: An Introduction and Overview*, 1 HANDBOOK OF INDUSTRIAL ORGANIZATION (Richard Schmalensee & Robert Willig eds., 1989), at 303.

[67] Andrew Sweeting, Xuezhen Tao & Xinlu Yao, *Dynamic Oligopoly Pricing with Asymmetric Information: Implications for Horizontal Mergers*, 16 AMERICAN ECONOMIC JOURNAL: MICROECONOMICS 345 (2024) (hereinafter, *Sweeting et al. 2024*), at 363, Table 4.

[68] *Sweeting et al. 2024*, at 368–369, Table 6.

[69] Abhik Roy, Namwoon Kim & Jagmohan S. Raju, *Assessing new empirical industrial organization (NEIO) methods: The cases of five industries*, 23 INTERNATIONAL JOURNAL OF RESEARCH IN MARKETING 369 (2006) (hereinafter, *Roy et al. 2006*).

[70] *Roy et al. 2006*, at 375.

[71] *Roy et al. 2006*, at 376.

best explained by a model of tacit collusion on prices. In the automobile industry the authors tested which of the candidate models best predicted the prices of the Ford Thunderbird and the Chrysler New Yorker, finding that the market was best described by the model of Stackelberg price competition led by the Thunderbird. Among the five markets studied, a SNB model—compared to the other models tested—best depicted the competition only between the two major diaper brands, Pampers and Huggies.[72]

These results, again, demonstrate that modeling competition in real markets cannot be reliably performed without analyzing the market itself. The relevant economic difference in the markets studied by Roy et al. is not the nature of the product per se, but rather the relevant differences are factors that determine the inferences that competitors draw about one another's output, pricing, and product positioning strategies; the relationship between fixed and variable costs; and other factors. There is no unified theory of oligopoly that can determine which model of oligopoly is best suited to which market as a purely theoretical matter; as discussed, and as the literature we have cited shows, such a determination must come from an analysis of the market itself by, for example, performing statistical tests to compare out-of-sample model predictions to actually-observed price changes. Each market must be assessed on its own merits and modeled according to its own unique characteristics.

2. *Empirical Tests of The Predictions of SNB Models Demonstrate That They Do Not Necessarily Give Reliable Price Predictions*

Much of the applied policy use of economists' models of competition is related to merger regulation. When two firms wish to merge, the United States Department of Justice or Federal Trade Commission may seek to review or challenge the merger if the agency believes that the merger will lessen competition in a relevant market and lead to consumer harm. Examining whether a proposed merger will lessen competition in a relevant market sometimes includes an analysis in which the parties or the agency simulate what the prices would be in the relevant market if the proposed merger occurred. Simulating what the prices would be in that hypothetical scenario is performed by assuming a model of oligopolistic competition. The use of game-theoretic models for market simulation in the context of merger enforcement has thereby motivated economic analysis of the validity and accuracy of these models.

A natural method for evaluating the reliability of simulation models is to compare the model's predicted price changes to the price changes that actually occurred once the merger went through. We call these retrospective merger studies. Whereas the horserace studies we discussed above ask which model (among a selected set) best fit observable data in a given market, retrospective merger studies test the accuracy of the predictions of the commonly-used merger simulation models against the actual post-merger price changes they were intended to predict. Because the SNB model is commonly used for merger simulation, several retrospective studies

72 *Roy et al. 2006*, at 374–376.

have been performed to probe the validity of the SNB model in simulation analysis, and they find that SNB models are not reliably good price predictors.

Ashenfelter and Hosken (2010) is one example of a retrospective study of merger simulation models.[73] Among the mergers analyzed in this study is the purchase of Ralcorp's Chex cereals by General Mills. Ashenfelter and Hosken used retail scanner data from before and after the merger to analyze how prices actually changed as a result of the merger. They concluded that the merger led to statistically significant increases in the prices of Cheerios, Honey Nut Cheerios, and Wheaties of 4.4–4.6 percent, 3.5–10.5 percent, and 2.6–2.7 percent, respectively (relative to the prices of the comparison group), and statistically insignificant increases in the prices of Chex cereals of less than one percent (the price changes of Chex products ranged from 0.1 to 0.8 percent, relative to the prices of the comparison group).[74] These results are in stark contrast to Nevo (2000), which predicted on the basis of a merger simulation assuming the SNB competition model that, as a result of the merger, the prices of General Mills' Cheerios, Honey Nut Cheerios, and Wheaties would increase 1.1 percent, 0.8 percent, and 0.1 percent, respectively, and that the price of Ralcorp's Chex cereal would increase 12.2 percent.[75] That is, Ashenfelter and Hosken found that Nevo's SNB-based merger simulation model predicted prices that either far overestimated or far underestimated the actual price effects of the merger, depending on the brand.

In another merger retrospective study, Peters (2006) used airline ticket sales data and an SNB merger simulation model to simulate five airline mergers from the 1980s and predict post-merger prices for those mergers. The author compared the simulated post-merger prices with observed post-merger prices,[76] and found that, for three of the five mergers analyzed, there were "significant differences between the average observed price changes and the average predicted price changes."[77] He found that the merger simulation substantially overstated the observed price

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73 Orley Ashenfelter & Daniel Hosken, *The effect of mergers on consumer prices: Evidence from five mergers on the enforcement margin*, 53 THE JOURNAL OF LAW AND ECONOMICS 417 (2010) (hereinafter, *Ashenfelter and Hosken 2010*).

74 *Ashenfelter and Hosken 2010*, Table 8.

75 *Nevo 2000*, Table 5. The market demand side of the simulation was estimated by Nevo from market (i.e., revealed preference) data, not conjoint survey (i.e., stated preference) data. In addition to deciding about the form of market competition, the analyst performing a merger simulation must make decisions about the form of demand to be assumed in the analysis. Nevo assumed a mixed logit demand structure. When estimating a demand curve from conjoint survey data the analyst must also make a decision about the form of demand to be assumed in the analysis. It is common in conjoint analysis in consumer class action litigation to also assume a mixed logit demand structure.

76 Craig Peters, *Evaluating the Performance of Merger Simulation: Evidence from the US Airline Industry*, 49 THE JOURNAL OF LAW AND ECONOMICS 627 (2006) (hereinafter, *Peters 2006*). Peters used revealed preference (i.e., market) data and a generalized version of a multinomial logit demand system to estimate demand for air travel.

77 *Peters 2006*, at 642.

effects for one of the mergers, and understated the effects of two others, making it impossible to predict whether the simulated prices are likely to be too high or too low.[78]

For the remaining two mergers examined, the Peters study found that the difference between average predicted price changes and the average observed price changes are "modest relative to the variance around those averages,"[79] which means that uncertainty around the estimated price changes was large enough that the 95 percent confidence interval around the estimate would include the actual price changes. However, as the author notes,[80] even for those mergers the actual price change and the predicted price change were far apart: in one of these mergers the average predicted price change was approximately 20.8 percent but the actual price change was 16 percent, an overstatement of 30 percent; in the other, the average predicted price change was 7.6 percent but the actual observed price change was 11.8 percent, an understatement of just under 36 percent.[81] Damages estimates in class action litigation based on a predicted but-for price overcharge due to the alleged bad acts of 20.8 percent would overstate the total dollar amount of damages by 30 percent if the true overcharge were 16 percent which, in a class action, may be many millions of dollars. Damages estimates in class action litigation based on a predicted but-for price overcharge of 7.6 percent would understate the damages incurred by the class by 36 percent if the true overcharge were 11.8 percent which, again, may be many millions of dollars.

Another example of a retrospective analysis of simulated price changes using the SNB model is a 2013 merger retrospective study that evaluated: (1) the merger between Pennzoil and Quaker State brands of passenger car motor oil, and (2) the purchase of Log Cabin breakfast syrup by the owner of the Mrs. Butterworth brand.[82] Weinberg and Hosken (2013) compared the price predictions of multiple merger simulations based on various demand systems and a SNB model of competition to price changes directly estimated from post-merger data to be due to the merger.[83] The authors found that the predictive value of the merger simulations was unreliable:

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78 *Peters 2006*, at 642, Table 4.

79 *Peters 2006*, at 642.

80 *Peters 2006*, fn. 33.

81 *Peters 2006*, Table 3.

82 Matthew C. Weinberg & Daniel Hosken, *Evidence on the accuracy of merger simulations*, 95 REVIEW OF ECONOMICS AND STATISTICS 1584 (2013) (hereinafter, *Weinberg and Hosken 2013*).

83 *Weinberg and Hosken 2013*, Table 2. Note that *Weinberg and Hosken 2013* tested whether the difference in price can be explained by misspecified demand rather than by unreliability of the supply side of the model. The authors concluded that this is not the case. See *Weinberg and Hosken 2013,* at 1595. The authors also tested whether changes in marginal costs after the merger could explain the difference; they found that the changes in marginal costs would need to be implausibly large and rapid for changes in marginal costs to explain the failure of the model to accurately predict prices. See *Weinberg and Hosken 2013*, at 1596.

"the merger simulations systematically underestimate the price effects of the motor oil merger and overestimate the price effects of the syrup merger."[84]

One may argue that the deviations between the predicted prices from the merger simulations and the actual post-merger prices resulted not from the assumed model of competitive strategy embedded in the merger simulations but rather from the assumed structure of demand. If the prediction inaccuracies were the result of inapplicable assumptions about the demand model, then our focus on the simulation model step of conjoint analyses used in class action litigation may be misplaced. However, this does not appear to be the case. Peters further examined whether the deviations of the predictions from the actual price changes were due to the demand model, the model of competition, or both. He found that, with one exception, the majority of the prediction error of the simulation model was due to unobserved supply-side changes, suggesting that the SNB model of competition did not accurately capture the reality of competition among airlines.[85] The author concluded that "deviations from the assumed model of firm conduct play an important role in accounting for the differences between the predicted and observed price changes."[86]

Overall, the results of multiple merger retrospective studies demonstrate that market simulations based on SNB competition models do not necessarily provide reliable estimates of price changes. While there may be markets in which the SNB model is a good representation of the competitive process for purposes of predicting but-for prices, the literature indicates that one cannot assume that SNB-based market simulations will be reliable as a general matter. In combination with the horserace studies, the literature indicates that use of simulation methods in damages analysis in class action litigation should be preceded by disciplined analysis to determine how competition in the relevant market should be modeled, and to assess whether it can be modeled with sufficient accuracy in the market at issue in the case to yield reliable results.

These issues have long been recognized in merger litigation scholarship. In a 2004 article, Werden, Froeb, and Scheffman advocated for a "Daubert discipline" for merger simulation.[87] The authors stated that predictions based on merger simulations are "*at best* reasonable, but rough, estimates"[88] and argued that, because merger simulation does not have a consistently

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84 *Weinberg and Hosken 2013*, at 1592. *See also* Matthew C. Weinberg, *More Evidence on the Performance of Merger Simulations*, 101 AMERICAN ECONOMIC REVIEW: PAPERS & PROCEEDINGS 51 (2011), which studied the market for sanitary pads and tampons and found that the merger simulation underestimated price effects of the 1997 Proctor and Gamble acquisition of Tambrands.

85 *Peters 2006*, Table 4, pp. 644–647.

86 *Peters 2006*, at 647. In the context of mergers, the change in firms' conduct may derive from the change in market structure caused by the merger; in the context of changes in product labeling, as relevant here, the change is in one of the ways that firms differentiate and market their products, changes which can also modify firm conduct in ways that the SNB model cannot capture.

87 Gregory J. Werden, Luke M. Froeb & David T. Scheffman, *A Daubert Discipline for Merger Simulation*, 18 ANTITRUST 89 (2004) (hereinafter, *Werden et al. 2004*).

88 *Werden et al. 2004*, at 90.

demonstrated track record of accuracy, its reliability should be assessed by carefully examining the modeling process. That is, an expert proposing a market simulation approach should ensure that each modelling choice is accompanied by an empirical justification demonstrating that the model fits the facts of the relevant industry; or, for modelling choices where fit cannot be established empirically, each should be accompanied by rigorous sensitivity analysis to show how results change under reasonable alternatives. The authors emphasized that a model must explain past market outcomes reasonably well before it can reliably predict future effects, and that it would be a "serious mistake" to predict the future without first ensuring the model explains the past.

Indeed, some courts have also recognized this issue in merger litigation. For example, in United States v. H&R Block the government sued to block the merger between H&R Block and TaxACT. The government's economic expert applied an SNB model to simulate hypothetical post-merger prices and claimed the merger would lead to higher prices for consumers. While the court stated that "results of the merger simulation tend to confirm the Court's conclusions based upon the documents, testimony, and other evidence in this case" that the merger was "likely" to increase prices, the court did not put significant weight on the specific magnitude of the predicted price increases. According to the court, "the merger simulation model used by the government's expert is *an imprecise tool*, but nonetheless has *some probative value* in predicting the likelihood of a *potential* price increase after the merger."[89]

CONCLUSIONS AND RECOMMENDATIONS

We have presented extensive evidence from the peer-reviewed economics literature that the SNB simulation model does not generally produce reliable price predictions. Retrospective merger studies show that SNB-based simulations can substantially overestimate or underestimate actual price changes, while horserace studies demonstrate that the SNB model is frequently inferior to alternative models of competition in explaining real market outcomes. These findings are particularly troubling in the context of damages calculations, where numerical accuracy is

[89] See United States v. H&R Block, Inc., 833 F. Supp. 2d 36 (D.D.C. 2011), p. 78. See also, FTC v. IQVIA Holdings Inc., 687 F. Supp. 3d 248 (S.D.N.Y. 2023), p. 81, citing United States v. H&R Block, and noting that "the merger simulation 'is not meant to be an exact prediction of post-merger pricing.'" The court in FTC v. CCC Holdings also criticized an expert's use of an SNB merger simulation, although on different grounds than the critiques we are addressing in this paper. Specifically, the issue that was apparently the focus of the experts in that case pertained not to the validity of the strategic competitive model chosen but to the expert's estimates, based on actual market data, of the extent to which consumers viewed the merging parties' products as substitutes for each other vis à vis other products in the market (their "diversion ratios"). These estimates were used as inputs to the merger simulation model. The court concluded that the amount of data upon which the estimates of the diversion ratio inputs relied was too limited to be reliable. (see FTC v. CCC Holdings Inc., No. 08-2043 (RMC), 2009 WL 1038112, at 74 n.48 (D.D.C. Mar. 18, 2009)). Our point in this article, in contrast, is that SNB-based simulation models themselves have been found to be generally unreliable; the evidence of their unreliability includes studies with ample data.

paramount, and errors of the magnitude found in the cited studies could translate to millions of dollars in over- or under-compensation.

We pointed out at the outset that conjoint surveys have been used in marketing departments of business firms for fifty years. One may ask, if the supply side of conjoint analysis is unreliable for determining prices, why have marketing departments found it worthwhile to commission and use conjoint surveys? We believe there is no inconsistency, for several reasons. First, pricing decisions in business firms are an iterative process based on a triangulation of numerous pieces of evidence about the market, including experimentation and managerial judgement, opinion surveys, focus groups, statistical analysis, and in some cases, conjoint surveys.[90] But conjoint surveys are not, in our experience working with business firms, used as the sole determinant of pricing decisions.

Second, the use of conjoint surveys by marketing departments includes qualitative applications, such as ranking which product characteristics are most important or valuable to consumers. This may be valuable for prioritizing R&D dollars and/or for assessing which characteristics to emphasize in advertisements.[91] Any given marketer may or may not use the results for quantitative determination of pricing at all. And the collection of conjoint survey data by marketing departments for the various uses to which it may be put may not involve the use of supply side simulation using SNB models (or any competitive models) at all because, again, the use of conjoint analysis in marketing applications is not always quantitative or even related to price.

And third, in the marketing context, unlike litigation, if a pricing decision based on a conjoint survey turns out to be a poor choice (the demand or profit response is unfavorable compared to expectations) the seller can change the price, unlike in litigation in which there is no ex-post validation of the predicted price, and no opportunity for a damages award to be corrected if facts later proved the predictions to be unreliable.

Perhaps more to the point of this article, it is also natural to ask, if the economics literature is clear that market simulations using SNB models are demonstrably unreliable for quantifying prices in counterfactual scenarios, why is their use acceptable to the antitrust agencies in merger reviews? We believe the fundamental reason is that, as the Merger Guidelines make clear, the use of market simulation in merger investigations is not for the purpose of predicting quantitative outcomes but is for qualitative assessment. As the Merger Guidelines describe it, "[t]he Agencies

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90 *See, e.g.*, THOMAS T. NAGLE & GEORG MÜLLER, THE STRATEGY AND TACTICS OF PRICING: A GUIDE TO GROWING MORE PROFITABLY, (Routledge, 6th ed. 2018) (hereinafter, *Nagle and Müller 2018*), at 19–20. *See also* RAKESH V. VOHRA & LAKSHMAN KRISHNAMURTHI, PRINCIPLES OF PRICING: AN ANALYTICAL APPROACH, (Cambridge University Pres, 2013), at 20–22, 191–192.

91 In one notable example, Courtyard by Marriott used conjoint analysis to design the "optimal" hotel chain "catering primarily to business travelers[.]" *See* Paul E. Green, Abba M. Krieger & Yoram Wind, *Thirty years of conjoint analysis: reflections and prospects*, INTERFACES (2001), at 67–68. See also *Nagle and Müller 2018*, at 192–194.

use [merger simulation] models to give an indication of the scale and importance of competition, not to precisely predict outcomes."[92] While the studies we have discussed in this article indict the quantitative reliability of market simulations as currently practiced, the studies may or may not invalidate merger simulations for purposes of giving "an indication of the scale and importance of competition," a conclusion that is outside the scope of our analysis here. Certainly, the Merger Guidelines are clear that the agencies consider a variety of qualitative and quantitative evidence when they investigate a merger, only one part of which, at most, is a merger simulation. At least some courts appear to have recognized the limitations of simulation analysis for purposes of making quantitative predictions of merger outcomes, as we discussed in the previous section. Hence, appeal to the use of merger simulations by the antitrust agencies as part of their merger investigations cannot reasonably support the use of market simulations with SNB models—without further analysis and support—to quantify damages in class action litigation.

But if conjoint analysis with supply side simulation using SNB modeling cannot be assumed to be reliable as a means of quantifying damages in a litigation setting, how then to estimate class-wide damages in consumer class actions? We believe the following guidance is prudent and supported by the literature. First, we have found there to be far too little appetite in the world of consumer class actions for use of traditional econometric methods to estimate but-for prices using revealed preferences and other market data. Plaintiffs may dismiss too quickly the possibility of relying on market data to estimate damages using standard econometric techniques. As we discussed in Part I.B, hedonic regression analysis and other reduced-form econometric techniques that rely on revealed preference data are well-established and, given the unreliability of SNB as a default market model in simulation analyses, have significant advantages over conjoint-based simulation approaches. Established econometric methods using actual market data—reflecting real transactions at market prices made by actual consumers facing real choices presented by actual firms in competition with each other in actual markets—allow the data to reveal how equilibrium prices (and quantities) change as product characteristics change without requiring untested assumptions about firms' competitive strategies. When data permitting such analysis is available—for instance, when products are sold with and without the allegedly misleading characteristic or claim across different time periods or markets—these traditional econometric approaches should be strongly preferred.

We are mindful, of course, that devising a valid econometric methodology and assembling the necessary data and necessary controls may be challenging and, in some cases, may not be possible. Our observation, however, is that the possibility of collecting and developing market data and applying econometric techniques to it to quantify the effect on demand of the accused product features may not be given adequate effort and attention in favor of the seemingly simpler opportunity to manufacture demand data through a conjoint survey and estimate the target effect via a simulation. The conjoint-based methodology may be a relatively economical approach in

[92] U.S. Dep't of Justice & Fed. Trade Comm'n, 2023 Merger Guidelines 36 (2023).

litigation but only at the expense of a potential complete failure of reliability of the quantitative result.

At a minimum, we believe that estimating the effects of misleading information on the prices consumers paid in a market using revealed preference and market conduct data is necessary as a benchmark or sanity check against which to compare the results of a conjoint method, if one is executed.

If, however, after due analysis and consideration, it is clear that data limitations make it impossible to estimate but-for prices using market data, as is commonly done in price fixing litigation, the stated-preference data from conjoint surveys should not simply be fed into game theoretic market simulation models without investigation and analysis that justifies the particular competitive model that is simulated. While modeling the supply side by borrowing existing simulation models from the merger investigations toolbox may be convenient, there is no reason that market simulation requires, as a matter of theory, that the assumed competitive interaction be SNB. One could build a simulation in which the assumed competitive interaction is modeled as another of the standard (or not standard) game theoretic competition models. Which model would be valid to apply in any given litigation would depend on the particular characteristics of the market. As the literature review we provided showed, scholars have developed and applied techniques for assessing which game theoretic model best captures the strategic dynamic in a market. While determining which competitive model, if any, would provide acceptably accurate predictions of but-for prices would entail fact-specific analysis of the market, methods for conducting such an analysis can be found in the literature we have cited and can include validation testing by estimating before and after prices in relation to a market change unrelated to the conduct at issue.

At a minimum, any proposed simulation analysis should be supported by at least three critical elements: first, a rigorous empirical study of the relevant market to determine the strategic model that most accurately reflects the documented competitive dynamics in that specific market and accurately predicts market outcomes; second, an empirical demonstration that the chosen model generates reasonably accurate predictions when tested against known market outcomes; and third, sensitivity analysis showing how the damage estimates change under alternative, economically plausible modeling assumptions. These three elements we have enumerated for supporting a conjoint-based simulation damages estimate impose no greater demands of rigor than the demands normally placed on damages estimates made by economists using revealed preference data and econometric methods. The Werden et al. 2004 article we discussed above noted that a virtue of the type of formal modeling used for market simulations is that it requires explicit assumptions which, in turn, facilitates rigorous study and demonstration of the sensitivity of the model to its underlying assumptions. The authors suggested considering, for example: aspects of non-price competition such as marketing; responses to economic shocks such as cost changes or product innovations and how well the SNB model would have predicted them; and whether the price-cost margins of the relevant products are accurately predicted by the SNB model.[93] In addition, if possible, simulation-based damage estimates should be corroborated by independent evidence of a price premium derived from actual market data.

Finally, we note two additional unresolved methodological concerns related to the kinds of damages models we have studied in this article. First, as discussed above, a model that appears to fit observable data well may result in substantively different counterfactual predictions—and therefore purported damages—than another model that fits observable data similarly well. Second, while some practitioners in some situations have calculated purported confidence intervals around the market simulation model predictions, those are created using the confidence intervals of the statistical estimates of the demand parameters, and do not take into account uncertainty about the assumed supply parameters—they take the assumed model of competition as given. We are unaware of any generally accepted methodologies for addressing either of these issues at this time.

The stakes in consumer protection class actions are often substantial. As a result, the magnitude of error that can be associated with a quantification of damages using simulation methods that have repeatedly failed empirical validation is also substantial. While conjoint analysis undoubtedly has value in marketing applications where directional insights suffice as an input into an ongoing and always-evolving process of product design and product pricing; and while SNB-based market simulations may provide useful guidance in merger analysis when supplemented by nuanced market analysis and regulatory oversight, the use of SNB-based simulations to calculate damages in litigation should be viewed with skepticism given the research results to date. The economics profession's well-established principle that models must be judged by the accuracy of their predictions, not the elegance of their mathematics, remains useful guidance.

93 *Werden et al. 2004*, at 90. The authors noted, in particular, that if the marginal costs inferred from the SNB model differ substantially from likely true marginal costs, or if there is implausibly large variation in marginal costs across products, the SNB model does not explain pricing in the relevant market well. As an example, they explained that if the implied marginal costs are negative—which, in our experience, is not uncommon when using an SNB model—then pricing is much more aggressive in the real world than an SNB model would predict (*Werden et al. 2004*, at 91).