DUBIOUS ASSUMPTIONS, ECONOMIC MODELS, AND EXPERT TESTIMONY

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ABSTRACT

Courts expect plaintiffs in complex litigation to prove damages through sophisticated economic models using techniques like regression analysis. Courts in the Daubert *era also scrutinize the assumptions underlying those models and sometimes exclude expert testimony because of dubious assumptions. Through academic commentary and a survey of cases, this article describes the assumptions underlying economic models, identifies three types of assumptions courts find problematic, and clarifies the legal grounds and rationales courts use in declining to admit expert testimony based on such models.*

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I. INTRODUCTION

The increasing sophistication in valuing damages reflects the increasing complexity of litigating antitrust violations, securities fraud, and business tort and contract cases.[1] Economic models that incorporate statistical methods to analyze vast amounts of data are now "ubiquitous,"[2] with techniques like regression analysis becoming more common, if not required in some cases.[3] Their rise coincides, however, with the ever greater scrutiny given to expert testimony as mandated by the *Daubert* trilogy.[4] As the models grow more sophisticated, the assumptions underlying them likewise multiply.[5] Accordingly, while courts routinely admit into evidence expert testimony based on economic models, courts

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[1] Anthony J. Casey & Julia Simon-Kerr, *A Simple Theory of Complex Valuation*, 113 MICH. L. REV. 1175, 1177–78 (2015) (writing that "valuation has become its own industry within the world of complex litigation"); John W. Hill et al., *Increasing Complexity and Partisanship in Business Damages Expert Testimony: The Need for a Modified Trial Regime in Quantification of Damages*, 11 U. PA. J. BUS. L. 297, 297–98 (2009) (referring to the trend of "the increasingly sophisticated content of expert testimony" and the "complexities associated with estimating damages in civil litigation involving commerce").

[2] Rebecca Haw Allensworth, *Law and the Art of Modeling: Are Models Facts?*, 103 GEO. L.J. 825, 835 (2015); *see also* D.H. Kaye, *The Dynamics of* Daubert*: Methodology, Conclusions, and Fit in Statistical and Econometric Studies*, 87 VA. L. REV. 1933, 1986 (2001) (claiming that, "through the efforts of economists and statisticians in a broad spectrum of cases, courts became exposed to—and came to expect—more sophisticated and potentially more useful statistical models").

[3] John E. Lopatka & William H. Page, *Economic Authority and the Limits of Expertise in Antitrust Cases*, 90 CORNELL L. REV. 617, 689 (2005); *see also* Jeff Todd & R. Todd Jewell, *Major League Soccer and the Corrupted 2022 FIFA World Cup Bidding: Proving Harm and Recovering Damages*, 41 VERMONT L. REV. 23, 57 (2016) (recognizing that courts affirm multi-million-dollar damage awards based on the testimony of economics experts); Molly L. Zohn, Note, *How Antitrust Damages Measure Up with Respect to the* Daubert *Factors*, 13 GEO. MASON L. REV. 697, 727 (2005) (writing that courts routinely accept economic experts' use of regression analysis to prove damages).

[4] Michael D. Green & Joseph Sanders, *Admissibility Versus Sufficiency: Controlling the Quality of Expert Witness Testimony*, 50 WAKE FOREST L. REV. 1057, 1057 (2015) ("Parties now routinely challenge the admissibility of the opposing expert's testimony. This has led to the exclusion of experts in hundreds, possibly thousands, of cases." (citing Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579 (1993); Gen. Elec. Co. v. Joiner, 522 U.S. 136 (1997); Kumho Tire Co., v. Carmichael, 526 U.S. 137 (1999))); Hill et al., *supra* note 1, at 310 (citing a Federal Judicial Center study that showed an increase in exclusion from 25% in 1991 to 41% in 1998); *see also* FED. R. EVID. 702 (amended Apr. 17, 2000, effective Dec. 1, 2000) (enumerating the standards for the admission of expert testimony).

[5] Daniel M. Tracer, Note, *Overcharge but Don't Overestimate: Calculating Damages for Antitrust Injuries in Two-Sided Markets*, 33 CARDOZO L. REV. 807, 821 (2011) (writing about the "practical concerns" of calculating lost profits in antitrust cases because the "incredibly complex calculation [] requires many assumptions to be made about the plaintiff, the defendant, the markets in which they operate, and other related and uncertain future conditions").

exclude such testimony when the model contains unreasonable, unfounded, or unrealistic assumptions.[6]

Most assumptions are not subject to dispute. For example, the discipline of economics rests upon fundamental assumptions like "firms seek to maximize profits" and "information and transactions are costless"[7] that have not been challenged in court. And the soundness of regression analysis depends upon statistical assumptions that, if violated, can be corrected in most if not all studies through additional statistical procedures.[8] A third set of assumptions, however, relates to the rhetoric or argument inherent in all sciences, including economics.[9] Models are as much art as science, and economists must make choices in constructing the alternate reality of the but-for world of the model: what is the hypothesis, which variables should be included or excluded, how should data be gathered?[10] The economist must defend these choices because, as one Nobel laureate puts it, if any of the assumptions are "dubious," then the conclusions are "suspect."[11] If the assumptions are indefensible, the

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[6] Hill et al, *supra* note 1, at 311; Robert M. Lloyd, *Proving Lost Profits after* Daubert*: Five Questions Every Court Should Ask Before Admitting Expert Testimony*, 41 U. RICH. L. REV. 379, 399–400 (2007); Michele Molyneaux, Comment, *Quality Control of Economic Expert Testimony: The Fundamental Methods of Proving Antitrust Damages*, 35 ARIZ. ST. L. J. 1049, 1069 (2003); *see also* Malcolm B. Coate & Jeffrey H. Fischer, Daubert*, Science, and Modern Game Theory: Implications for Merger Analysis*, 20 SUP. CT. ECON. REV. 125, 129 (2012) (writing that "mathematical models, without facts, have no place in the courtroom").

[7] Kenneth G. Dau-Schmidt, *Relaxing Traditional Economic Assumptions and Values: Toward a New Multidisciplinary Discourse on Law*, 42 SYRACUSE L. REV. 181, 183 (1991) (discussing neoclassical assumptions common to economics like "people select the best opportunity according to their individual preferences; firms seek to maximize profits; resources, and so the selection of opportunities, are limited; preferences are exogenous and rational; no individual or firm exercises market power; and information and transactions are costless").

[8] *E.g.*, David L. Rubinfeld, *Reference Guide on Multiple Regression*, *in* FED. JUDICIAL CTR., REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 303, 322, 342 (3d ed. 2011); Alan O. Sykes, *An Introduction to Regression Analysis*, *in* CHICAGO LECTURES IN LAW AND ECONOMICS 1, 8–10, 26 (Eric A. Posner ed., 2000).

[9] JONATHAN SCHLEFER, THE ASSUMPTIONS ECONOMISTS MAKE 278 (2012) (writing that economists "need a sound argument for why [their] assumption is generally realistic" and that "realism may depend on circumstances"); *see also* Donald N. McCloskey, *The Rhetoric of Economics*, 21 J. ECON. LIT. 481 *passim* (1983) (discussing the different rhetoric employed by economists in making their arguments).

[10] Allensworth, *supra* note 2, at 828 (writing that models blend science and art so that "assumptions and choices" go into the construction of a model); Roger D. Blair & William H. Page, *"Speculative" Antitrust Damages*, 70 WASH. L. REV. 423, 429 (1995) ("[T]he but-for condition is the plaintiff's situation in a hypothetical world in which the violation has not occurred, but conditions are otherwise the same."); SCHLEFER, *supra* note 9, at 25 (writing that economists "make simplified assumptions about the economic world we inhabit and construct imaginary economies—in other words, models—based on those assumptions").

[11] Robert M. Solow, *A Contribution to the Theory of Economic Growth*, 70 Q.J. OF ECON. 65, 65 (1956) ("When the results of a theory seem to flow specifically from a special

party proffering model-based expert testimony loses a *Daubert* challenge, which in complex litigation results in losing the case.[12]

Several legal commentators have recognized the importance of assumptions underlying valuation models in complex litigation,[13] but none have treated assumptions as a discrete topic. This article identifies the types of assumptions vulnerable to challenge, the reasons why courts exclude expert testimony based upon them, and the justifications for that exclusion. Attorneys and judges need some fluency with basic concepts related to economics, statistics and regression analysis.[14] At the same time, although some courts purport to critique statistical problems like omitted variable bias,[15] the omitted variables were fundamental flaws of model construction rather than problems with regression analysis. For all of the cases surveyed in this article, attorneys targeted—and courts accepted—that which those with legal training understand best: the arguments that economists make about the reasonableness of their assumptions in light of the lack of support from other evidence in the case.[16] A better understanding of the types of assumptions that courts have found dubious will allow plaintiffs to construct stronger damages models, give defendants more specific grounds to challenge dubious assumptions, and permit courts to make more sound rulings about admissibility.[17]

Part II discusses the need for econometric models in determining remedies in complex cases, with a focus on assumptions as choices in

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crucial assumption, then if the assumption is dubious, the results are suspect."); *see also* Coate & Fischer, *supra* note 6, at 128 ("If these implicit assumptions [in an economic model] are wrong, the expert's analysis may be inaccurate.").

[12] *See, e.g.*, *In re* Live Concert Antitrust Litig., 863 F. Supp. 2d 966, 981–82 (C.D. Cal. 2012) (excluding expert whose model omitted key variables from his regression analysis and granting summary judgment for defendant in antitrust suit because plaintiffs' case no longer had evidentiary support for the damages element).

[13] *E.g.*, Allensworth, *supra* note 2, at 842–45 (explaining how assumptions in expert valuation models need to be checked where possible); Hill et al., *supra* note 1, at 330–31 (noting that damages experts are likely to be challenged if their assumptions do not fit the facts of the case); Lloyd, *supra* note 6, at 399–410 (urging courts to ask as one of five key questions about expert testimony, "Are the Expert's Assumptions Supported by the Record?").

[14] *See* Allensworth, *supra* note 2, at 876–77 (calling the notion of law as a "humanities subject" eroding because modeling based on statistics and economics is the "new lingua franca" and thus essential to judging); Franklin M. Fisher, *Multiple Regression in Legal Proceedings*, 80 COLUM. L. REV. 702, 736 (1980) (urging lawyers to "understand the regression model and the assumptions being used in any given regression study").

[15] *E.g.*, *Live Concert*, 863 F. Supp. 2d at 98–-82.

[16] *See infra* Part IV; Hill et al., *supra* note 1, at 331–32 n.253 (claiming that opponents target assumptions because assumptions are the most likely part of the expert's testimony that opposing counsel can understand).

[17] *E.g.*, Hill et al., *supra* note 1, at 375 (writing that "focusing on ways to achieve a greater degree of consensus on assumptions may hold some promise of meaningful change").

constructing the models, but also giving some attention to statistical problems that arise from violating assumptions related to regression analysis. This Part clarifies that logical assumptions used to generate the underlying economic model, rather than assumptions on which the statistical model is based, are ripe for attack. Part III summarizes the evidence law regarding expert testimony. Part IV turns to cases with sophisticated valuation models where assumptions were an issue. Drawn from cases cited by commentators, the survey includes actions in state and federal courts, both before and after *Daubert*. This Part identifies three categories of assumptions that courts have found dubious: (1) unreasonable comparisons among businesses, products, and/or markets; (2) unfounded simplifications and excluded variables that the record suggests are necessary; and (3) unrealistic scenarios about what parties or markets would have done but for the defendant's unlawful act.

Part V analyzes the case survey and offers three takeaways. First, courts have several legal grounds to support excluding testimony based upon dubious assumptions. Two commentators had a "sense" that courts were moving away from the *Daubert* factors and toward the "analytical gap" from *General Electric Co. v. Joiner* and the directive to focus on the case at hand from *Kumho Tire Co. v. Carmichael*.[18] The survey supports that conclusion but more: the greater complexity of the models sometimes pushes courts toward pre-*Daubert* authority about speculation and about regression analyses that omit too many variables.[19] Second, courts can justify relying on this legal authority because their rationales relate to poor arguments and lack of evidentiary support and thus mirror what commentators have addressed regarding assumptions underlying economic models.[20] One notable conclusion is that the pre-*Daubert* authority rests upon the same rationales as *Joiner* and *Kumho Tire*, so courts engage in similar analyses of the arguments and evidence and reach the same results—including in cases that purport to critique statistical problems relating to multiple regression. Third, the increasing sophistication of valuation models results in an irony: the power to control for more factors requires additional assumptions that create more points of vulnerability. Opponents can attack any or all three types of dubious assumptions as they occur in the same model, including attacking the

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[18] Green & Sanders, *supra* note 4, at 1094; *see also* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 592–95 (1993); Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997); Kumho Tire Co., v. Carmichael, 526 U.S. 137, 154 (1999).

[19] *See infra* Part V(A); *see, e.g.*, Bazemore v. Friday, 478 U.S. 385, 400 n.10 (1986) (affirming the use of regression analysis even with omitted variables but noting the potential for the omission of so many variables that the model becomes inadmissible as irrelevant).

[20] *See infra* Part V(B).

model as a whole because the accumulation of assumptions makes courts view the model with "extreme skepticism."[21] The article concludes in Part VI with recommendations for further study.

II. ALTERNATE REALITIES IN LITIGATION: ECONOMIC MODELS AND UNDERLYING ASSUMPTIONS

A. *The Need for Sophisticated Valuation Models in Complex Litigation*

Determining remedies in complex cases often requires predicting an alternate reality.[22] The plaintiff typically is entitled to market damages, the value of the entitlement that plaintiff lost (or in some cases that plaintiff never gained), and sometimes to consequential damages caused by loss of the entitlement, like lost profits.[23] For example, the defendant breached a contract or tortiously interfered with the plaintiff's bid on a contract, so the plaintiff must prove the benefit of the bargain or the prospective economic advantage it would have had but for the breach or wrongful act.[24] Or the defendant violated antitrust laws, so the plaintiff must prove damages by showing what its market share would have been but for the anticompetitive practices.[25] Perhaps the defendant sold products that infringed a patent, so the plaintiff must prove the difference between what

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[21] Lloyd, *supra* note 6, at 409; *see infra* Part V(C).

[22] Allensworth, *supra* note 2, at 836-37 (writing that damages in antitrust cases are measured as the difference between the real world and the but-for world of the model); Blair & Page, *supra* note 10, at 429 (calling the but-for condition a "hypothetical world"); Roger D. Blair & Amanda Kay Esquibel, *Yardstick Damages in Lost Profit Cases: An Econometric Approach*, 72 DENV. U. L. REV. 113, 12–21 (1994) (writing that "multiple regression analysis, by isolating and estimating the importance of the determinants of profits, makes possible the prediction of profits 'but for' the wrongful action"); DAN B. DOBBS, LAW OF REMEDIES: DAMAGES—EQUITY—RESTITUTION 216 (2d ed. 1993) (calling the market a "construct" and "an effort to estimate what market value would be if there were a market").

[23] DOBBS, *supra* note 22, at 216, 220, 224–29.

[24] *E.g.*, Inter Med. Supplies, Ltd. v. EBI Med. Sys., Inc., 181 F.3d 446, 461–63 (3d Cir. 1999) (affirming damages of lost profits based upon economic expert testimony in tortious interference with prospective economic advantage case); Schonfeld v. Hilliard, 218 F.3d 164, 174–75 (2d Cir. 2000) (rejecting evidence of lost profits as too speculative but allowing evidence of diminution of asset value in breach of contract case).

[25] *E.g.*, Conwood Co. v. U.S. Tobacco Co., 290 F.3d 768 (6th Cir. 2002) (affirming judgment for plaintiff in antitrust case where expert used regression analysis to calculate market share in areas where defendant did not engage in anticompetitive practices). Although several articles examine expert valuation in the context of antitrust cases, their "conclusions and observations" apply more generally to all areas of law that involve models. Allensworth, *supra* note 2, at 831.

it earned and what it should have earned but for the infringement.[26] At a fundamental level, these remedies require nothing more than subtraction: "losses are the difference between the value the plaintiff would have received if the harmful event had not occurred and the value the plaintiff has or will receive, given the harmful event."[27]

Arriving at the difference between what is and what should have been presents a number of evidentiary challenges for the plaintiff—or, more precisely, the plaintiff's expert since expert testimony is "highly desirable," if not required, in cases that involve complex valuation.[28] First is the need to sort through voluminous data, such as market information showing prices and sales, or financial records showing revenues and expenses.[29] Time complicates the calculation because the expert must establish reality by looking backward at performance prior to the unlawful act and then determine the alternate reality by projecting performance several years into the future.[30] Time also affects the amount of the award because future loses must be discounted to present value.[31] The expert must consider other variables like changes in the market or differences between products that could affect plaintiff's losses if not negate the defendant's wrongful act as the cause of harm.[32] Sometimes there is no market for the asset because it is unique, so plaintiff must construct a

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[26] *E.g.*, Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp., 103 F. Supp. 2d 268, 273 (S.D.N.Y. 2000) (recognizing the necessity of proving how many products a patent holder could have sold, and at what price, during period in which alleged infringement occurred).

[27] Mark E. Allen, Robert E. Hall & Victoria A. Lazear, *Reference Guide on Estimation of Economic Damages*, *in* FED. JUDICIAL CTR., REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 425, 430 (3d ed. 2011).

[28] Hill et al., *supra* note 1, at 317–18.

[29] DOBBS, *supra* note 22, at 235 (writing that the "most persuasive evidence" often involves "detailed business statistics or marketing and production information, coupled with expert testimony") (footnote omitted).

[30] *See* Blair & Esquibel, *supra* note 22, at 115 (showing damages calculation that includes symbols for each year in which profits would have been earned).

[31] DOBBS, *supra* note 22, at 208, 219, 241–42 (writing that past and future damages are paid in a lump sum so that they must be reduced to present value and discussing the discounted cash flow method of valuation).

[32] Allen, Hall, & Lazear, *supra* note 27, at 432 (writing that the but-for scenario measures only those damages "*caused* by the harm harmful act" so must "exclude any change in the plaintiff's value arising from other sources") (emphasis in original); Blair & Page, *supra* note 10, at 435 ("Ideally, the only causal factor accounting for the difference between plaintiff's actual experience in the damage period and its but-for experience should be the defendant's illegal conduct."); Lopatka & Page, *supra* note 3, at 687 (writing that the damage model should isolate the offense "as the single causal factor" so "the model must account for other major causal factors").

hypothetical market based on factors like the income produced by the asset.[33]

For complex cases involving vast data, experts therefore must show a trend over time and account for multiple variables, so they often construct models using statistics.[34] A powerful statistical technique is regression analysis because it explains a dependent variable—the "outcome of interest"—through one or more independent variables that might produce changes in the dependent variable.[35] The aim is to show a correlation among variables—that the dependent variable is associated with the independent variables in a way that is more than chance.[36] From this correlation, the expert can infer a causal relationship—that the independent variables cause changes in the dependent variable.[37] Regression analysis also accounts for the "nontrivial, residual element of unexplained effects on the variable of interest," the "noise" of observations taken from an economic system rather than a controlled experiment.[38] Regression analysis is thus "well suited to the analysis of data about competing theories for which there are several possible explanations for the relationships among a number of explanatory variables."[39]

Statistics in general and regression analysis in particular are not simple, and calculating damages is not simply a question of accurate mathematics. The economic expert will use econometrics, the application of statistics to analyze economic data,[40] to estimate the damages, but it is

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[33] DOBBS, *supra* note 22, at 238–39; *see also* Hill et al., *supra* note 1, at 347 (writing that "the net present value of discounted future cash flows" is sometimes "the only viable method for valuing intellectual capital").

[34] Allen, Hall, & Lazear, *supra* note 27, at 431 ("Many damages studies use statistical regression analysis."); Casey & Simon-Kerr, *supra* note 1, at 1178 ("Complex valuation cases introduce an added dimension: they require mathematical models."); Lopatka & Page, *supra* note 3, at 687–88 (writing that "an expert typically must . . . project the but-for world using an appropriate theoretical model . . . and appropriate statistical methods, usually multiple regression analysis").

[35] Allensworth, *supra* note 1, at 836–38; *see also* Rubinfeld, *supra* note 8, at 305; Sykes, *supra* note 8, at 1.

[36] Rubinfeld, *supra* note 8, at 309; *see also* David H. Kaye & David A. Freedman, *Reference Guide on Statistics*, *in* FED. JUDICIAL CTR., REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 211, 268 (3d ed. 2011) ("A regression model attempts to combine the values of certain variables (the independent variables) to get expected values for another variable (the dependent variable).").

[37] Rubinfeld, *supra* note 8, at 310; Sykes, *supra* note 8, at 1.

[38] Fisher, *supra* note 14, at 705–06; see also Sykes, *supra* note 8, at 7 ("Multiple regression analysis is in fact capable of dealing with an arbitrarily large number of explanatory variables.").

[39] Rubinfeld, *supra* note 8, at 305.

[40] Blair & Esquibel, *supra* note 22, at 120; Sykes, *supra* note 8, at 1; Zohn, *supra* note 3, at 707.

the underlying economic model that provides the alternate but-for reality and allows for meaningful damages estimates.[41] Models are "mathematic abstractions used to predict or describe natural or market processes."[42] They "aim to make sense of data or to abstract away from chaotic reality to distill simple patterns and implications."[43] Models have two features: they are always simplifications of a more complicated process, and they have a purpose to predict or measure that which is "unknown or unseen."[44] Econometric analysis straddles the line between science and art: it relies on mathematical techniques like regression analysis to perform the complex damages calculations, and it relies on economic models that are constructed by experts who use "intuition or inspiration" to make "choices and assumptions that are too complex to navigate systematically."[45]

B. Assumptions, Arguments, and Evidence in the Art of Modeling

Assumptions are not necessarily problematic; indeed, all models are a "set of assumptions."[46] The scientific method requires starting with an assumption: the hypothesis is "a prejudice" based upon "having some reason to choose what is and is not worth observing."[47] And the assumptions do not end there: "it is necessary to make additional assumptions beyond the theory itself."[48] Many view the practice of science as based in laboratories or perhaps observations of nature, but mathematical analyses are also a type of science and are especially relevant when controlled experiments are not possible for the object of study.[49] As with other approaches to scientific inquiry, regression tests are

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[41] Allen, Hall, & Lazear, *supra* note 27, at 429; *see also* SCHLEFER, *supra* note 9, at 25 (writing that economists use models to "draw practical conclusions" about actual economic questions).

[42] Allensworth, *supra* note 2, at 828.

[43] *Id.* at 862.

[44] *Id.* at 832–33.

[45] *Id.* at 829; *see also* Blair & Esquibel, *supra* note 22, at 120 ("A basic tool of econometrics is multiple regression analysis, a statistical technique."); Hill et al., *supra* note 1, at 350 (writing that statistical techniques like multiple regression analysis are "as much art as science"); Kaye & Freedman, *supra* note 36, at 281 (writing that assumptions are made going in to a model).

[46] Kaye & Freedman, *supra* note 36, at 272.

[47] David Goodstein, *How Science Works*, *in* FED. JUDICIAL CTR., REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 37, 40 (3d ed. 2011).

[48] *Id.* at 41.

[49] Rubinfeld, *supra* note 8, at 312; *see also* Coate & Fischer, *supra* note 6, at 151 (contrasting economics with "hard" sciences because the former relies upon observations of reality rather than controlled experiments); Joseph Sanders, *Science, Law, and the Expert Witness*, 72 LAW & CONTEMP. PROBS. 63, 64 (2009) (listing aids to scientific reasoning as

hypotheses.[50] Economists therefore construct models with mathematical parameters that use data samples from the population.[51]

Models provide a "check on thinking" to help guide the economist from assumptions to conclusions.[52] "The role of models is to be sure that assumptions are consistent, to understand their implications as well as possible, and to frame a coherent view that you can compare with historical experience."[53] Accordingly, "the true art of economic analysis lies in understanding the assumptions of the model and their implications for the analysis."[54] Because all models "are crude approximations of the real world,"[55] the key is determining the simplest assumptions that lead to sound analysis "while still accurately describing the problem or phenomenon."[56]

For a model to be realistic, its underlying assumptions must likewise be "founded on reality."[57] This foundation moves the economist away from math and toward reasoning because the underlying assumptions for a model's "theoretical construction and its data must be logical."[58] Reasoning is not enough: the economist must have a "sound argument" for why assumptions are "generally realistic" and be able to describe any critical assumptions.[59] Realism depends on circumstances because "models—especially statistical models—are rather fact-specific," so assumptions must be pertinent to the situation.[60] Put another way, models predict unknown outcomes, so models always—though sometimes tacitly—assume that "the known conditions are similar to the unknown conditions."[61] Because models are simplifications, some conditions are ignored, but those conditions "must be relatively unessential [to] the

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"mathematics in its many different forms as well as experimental and quasi-experimental designs and other investigatory devices").

[50] Zohn, *supra* note 3, at 726.

[51] Rubinfeld, *supra* note 8, at 312.

[52] SCHLEFER, *supra* note 9, at 29.

[53] *Id.* at 267.

[54] Dau-Schmidt, *supra* note 7, at 184.

[55] Kevin A. Kordana & Terrance O'Reilly, Daubert *and Litigation-Driven Econometrics*, 87 VA. L. REV. 2019, 2026 (2001) (quoting *The New NBER: Has Scholarship Been Hurt?*, BUS. WK. 6 (Oct. 6, 1980)).

[56] Dau-Schmidt, *supra* note 7, at 184.

[57] SCHLEFER, *supra* note 9, at 277.

[58] Blair & Esquibel, *supra* note 22, at 134–35.

[59] SCHLEFER, *supra* note 9, at 278, 280.

[60] Allensworth, *supra* note 2, at 855; *see also* SCHLEFER, *supra* note 9, at 278, 280.

[61] Allensworth, *supra* note 2, at 843.

question under discussion."[62] Economists cannot ignore the "inconvenient facts" that do not fit their model.[63]

C. A Note on Assumptions and Statistical Problems in Regression Analysis

While recognizing that a thorough treatment of regression analysis is beyond the scope of this article,[64] we shall see in Part IV, *infra*, that some courts have examined regression models, including addressing multicollinearity and omitted variable bias. A basic understanding of assumption issues that arise with regression analysis, as distinguished from assumptions made in the construction of econometric models, is therefore helpful. Consider one common type of regression, ordinary least squares (OLS), which provides an unbiased, consistent, and efficient estimate for the model's parameters—"[u]nder appropriate assumptions."[65] One fundamental assumption is that effects of the uncontrolled random variable—the one that accounts for the unobservable "noise" in the quasi-experiments of economics—are independent of the controlled effects of the independent variables.[66] Another assumption is that the random error term is in fact random; if it were possible to observe the unobservable, each would be independent of the other so that no observation would be able to predict successive observations.[67]

Violating these assumptions harms the utility of the regression analysis as an estimator because of problems with multicollinearity and omitted variable bias.[68] Regarding the former, multiple regression requires the independent variables to be independent not only of the

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[62] SCHLEFER, *supra* note 9, at 277 (quoting Knut Wicksell, *Introduction*, *in* LECTURES ON POLITICAL ECONOMY 1, 9 (Lionel Robins ed., Vol. 1 1977)).

[63] *Id.* at 27.

[64] For more on statistics and multiple regression as they relate to litigation and evidence law, see Fisher, *supra* note 14; Kaye & Freedman, *supra* note 36; Rubinfeld, *supra* note 8; Sykes, *supra* note 8.

[65] Rubinfeld *supra* note 8, at 342; *see also* Sykes, *supra* note 8, at 9. Unbiased means that the analysis is correct on average so that repeated calculations with different samples would not err systematically one way or another. Fisher, *supra* note 14, at 709; Rubinfeld, *supra* note 8, at 342. Consistent means that, if the sample were very large, the estimates would be close to the true parameters because the probability of obtaining different estimates is close to zero. Fisher, *supra* note 14, at 709; Rubinfeld, *supra* note 8, at 342. Efficient means that the estimators have a small variance. Rubinfeld, *supra* note 8, at 342.

[66] Fisher, *supra* note 14, at 710.

[67] *Id.* at 709–11.

[68] Sykes, *supra* note 8, at 20–26 (calling omitted variable bias and multicollinearity the two most common and important statistical problems when assumptions about the regression analysis do not hold).

random error term but also of each other;[69] after all, the power of multiple regression lies in isolating the effect of each independent variable on the dependent variable.[70] If changes in two independent variables are highly correlated, then they move together—*i.e.*, they are collinear.[71] Under conditions of multicollinearity, the model reflects the *joint* effect of the collinear independent variables on the dependent variable; however, nothing in the data permits the modeler to ascertain the *separate* effect of each independent variable.[72] When the issue at hand is establishing the size of an individual parameter, multicollinearity complicates this task.

If the model omits an independent variable that has an influence on the dependent variable, then it becomes part of the random, unobservable error term, potentially making the error term systematic rather than merely random noise.[73] The most serious consequence is that the coefficients of the included independent variables will be biased if they partially reflect the effects of the omitted variables.[74] In other words, the omission of an important variable could mean that each parameter reflects more than its purported limits, thus incorrectly estimating the correlation between the independent and dependent variables.[75]

Neither multicollinearity nor omitted variable bias dooms the regression analysis because these are statistical problems rather than fatal flaws in the model's construction.[76] For example, multicollinearity increases standard errors of the parameter estimates, therefore making hypothesis testing less precise, while omitted variable bias decreases the goodness of fit between the independent and dependent variables, thus making the regression less powerful as a whole.[77] Violating a statistical assumption that leads to multicollinearity or omitted variable bias "does not necessarily invalidate a regression analysis, however."[78] While these issues affect the amount of confidence in the regression formula as an estimator of individual parameters, these problems are not necessarily serious or even "disastrous" because the regression analysis is still valid.[79]

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[69] Rubinfeld, *supra* note 8, at 323.

[70] Sykes, *supra* note 8, at 6.

[71] *Id.* at 23–24.

[72] *Id.*; Rubinfeld, *supra* note 8, at 323.

[73] Sykes, *supra* note 8, at 20.

[74] *Id.* at 20–21.

[75] *Id.* at 21.

[76] *Id.* at 20.

[77] *Id.* at 20–21, 23–25.

[78] Rubinfeld, *supra* note 8, at 322.

[79] Sykes, *supra* note 8, at 22, 25 (writing that a "serious" omitted variable bias merely "diminishes" the utility of regression and that multicollinearity introduces "considerable uncertainty," but the problem may not be "disastrous").

Plus, the economist can apply other statistical methods that might be appropriate to correct for such statistical problems.[80]   Accordingly, multicollinearity and omitted variable bias are not so much problems as they are merely challenges that a competent expert can surmount.

When the problem with the analysis relates to assumptions in the design of the model itself, however, the science of statistics can do little to resolve the issue.[81]   To use an analogy, picture a mechanic building an engine from a set of blueprints for the first time. If the proper tools and equipment are available, a competent mechanic can build a working engine, and the mechanic can overcome any trouble that is encountered since he or she has the appropriate tools and experience. If the blueprints are flawed, though, then the mechanic will likely create something that does not work. Like the mechanic, econometricians have a huge toolbox of statistical methods and expertise to test and control for statistical problems like multicollinearity and omitted variable bias. However, if the underlying economic model is inappropriate—a flawed blueprint—then no statistical tool can fix it.

A distinction should be made at this point regarding the term "omitted variable bias."   In statistics, omitted variable bias means something specific in terms of the statistical properties of the estimator.[82] As discussed above, this type of problem can limit the precision of econometric models, but it is not likely to be fatal on its own. If, however, the economic expert fails to include relevant variables in the underlying economic model—to extend the analogy, if the mechanic leaves out an important engine part on the blueprints—then the expert is likely setting the analysis up for failure. In other words, the statistical issue of omitted variable bias and omitting variables from the economic model that drives the econometric analysis are similar, but the former affects the statistical significance of the regression, while the latter arises from choices made in constructing the model and can easily invalidate any statistical results.[83]

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[80] Rubinfeld, *supra* note 8, at 322; *see also* Sykes, *supra* note 8, at 26; PETER KENNEDY, A GUIDE TO ECONOMETRICS 25 (6th ed. 2008) (writing that econometricians turn to "alternative estimators" if the ordinary least squares estimator no longer retains its desirable properties).

[81] KENNEDY, *supra* note 81, at 1–2 (noting the distinction between the "extremely sophisticated statistical techniques" that econometricians have developed and the "data deficiencies and the many questionable assumptions required for the successful application of these techniques").

[82] *Id.* at 93–95 (explaining the statistical problems caused by omission of a relevant independent variable).

[83] *Compare* Sykes, *supra* note 8, at 20–23 (discussing the effect of omitted variable bias on the statistics of the regression analysis), *with* Fisher, *supra* note 14, at 705 ("[i]n multiple regression, one first specifies the major variables that are believed to influence the dependent

Courts and opposing counsel do not need to challenge the statistics for what are essentially bad arguments in model construction: poor choices, weak rationales, and lack of logical or record support. Part V, *infra*, will develop this point further, but first the article turns to a summary of the evidence law governing expert testimony.

III. THE ADMISSIBILITY OF EXPERT TESTIMONY

Calculating the amount of damages raises issues of proof.[84] If the plaintiff's case is the type where quantification is expected—business as opposed to personal injury—then the "most persuasive evidence" often involves "detailed business statistics or marketing and production information, coupled with expert testimony."[85] The Federal Rules of Evidence require a "gatekeeping role for the judge" in admitting expert testimony.[86] Rule 702 permits a qualified expert to offer opinion testimony if:

> (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
> (b) the testimony is based on sufficient facts or data;
> (c) the testimony is the product of reliable principles and methods; and
> (d) the expert has reliably applied the principles and methods to the facts of the case.[87]

The expert can base his or her opinion on facts and data not admitted into evidence, provided that "experts in the particular field would reasonably rely on those kinds of facts or data in forming an opinion on the subject."[88] Otherwise inadmissible facts or data may be revealed "only if their probative value in helping the jury evaluate the opinion substantially outweighs their prejudicial effect."[89]

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variable"), *and* Kaye & Freedman, *supra* note 36, at 281 (calling the decision to omit some variables "assumptions made going into the analysis").

[84] DOBBS, *supra* note 22, at 1, 235 (writing that proving consequential damages requires reasonable certainty as to both their existence and amount) (footnote omitted).

[85] *Id.* at 211, 235.

[86] Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 597 (1993); *see, e.g.*, Hill et al., *supra* note 1, at 310.

[87] FED. R. EVID. 702.

[88] FED. R. EVID. 703.

[89] *Id.*

The Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* rejected the "general acceptance" standard and held that the trial judge must ensure "that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand. Pertinent evidence based on scientifically valid principles will satisfy those demands."[90] Expert testimony is reliable if it is grounded in the "methods and procedures" of the scientific method.[91] Relevance is a question of "fit": "Rule 702's 'helpfulness' standard requires a valid scientific connection to the pertinent inquiry as a precondition to admissibility."[92] The Court furnished a "flexible" and non-exhaustive list of factors that a trial judge can consider: first, whether the theory or technique "can be (and has been) tested"; second, whether the theory or technique has been subjected to peer review; third, the error rate and other professional standards associated with the theory or technique; fourth, the "[w]idespread acceptance" of the theory or technique (with the caveat that general acceptance does not control admissibility).[93]

In *General Electric Co. v. Joiner*, the Court rejected the assertion that *Daubert* limits the gatekeeping role only to the expert's methodology.[94] Chief Justice Rehnquist wrote that

> conclusions and methodology are not entirely distinct from one another. Trained experts commonly extrapolate from existing data. But nothing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered.[95]

The Court therefore held that the trial court did not abuse its discretion in excluding the testimony of two experts, who had relied upon studies insufficient to support their conclusions.[96] Thus, the Court strengthened the gatekeeping role of the judge by limiting the ability of the expert to be the bridge between method and results.

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[90] 509 U.S. at 597.
[91] *Id.* at 589–90.
[92] *Id.* at 591–92.
[93] *Id.* at 592–95.
[94] 522 U.S. 136, 146–47 (1997).
[95] *Id.* at 146.
[96] *Id.* at 146–47.

The Court in *Kumho Tire Co. v. Carmichael* reaffirmed the gatekeeper role established in *Daubert* where the "factual basis, data, principles, methods, or their application [in expert testimony] are called sufficiently into question."[97] The Court clarified the judge's "broad latitude" by holding that a trial court need only consider one or more of the *Daubert* factors to the extent "doing so will help determine that testimony's reliability."[98] The expert was an engineer who engaged in visual and tactile examination of an allegedly defective tire that blew out and resulted in personal injury.[99] In affirming that the trial court did not abuse its discretion in refusing to admit the testimony, the Supreme Court stated that the question of reliability did not relate to the reasonableness of the expert's method.[100] "Rather, it was the reasonableness of using such an approach, along with [the expert's] particular method of analyzing the data thereby obtained, to draw a conclusion regarding *the particular matter to which the expert testimony was directly relevant.*"[101] In requiring the admissibility analysis to focus on the case at hand rather than "on broad general principles and theories,"[102] *Kumho Tire* "continued to blur the methodology-conclusion distinction."[103]

Amendments to Rule 702 in 2000 reinforced the point in *Kumho* that "a court must scrutinize not only the expert's data and formal analysis, but also the expert's grounds for drawing particular conclusions."[104] The amendments required the expert's opinion to be "based upon" data and to apply principles properly.[105] The impact of this heightened scrutiny is significant because it can mean that expert testimony never makes it to a jury. While circuit courts recognize that challenges to assumptions typically go to weight and not admissibility,[106] one court in a challenge to a damages expert concluded that "where a purported expert fails to meet the requirements of the Federal Rules of Evidence and *Daubert,* courts within the Second Circuit have not hesitated to exclude the expert's testimony at trial."[107]

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[97] 526 U.S. 137, 149 (1999).

[98] *Id.* at 141–42.

[99] *Id.* at 142–45.

[100] *Id.* at 153–54.

[101] *Id.* at 154 (emphasis in original); *see also* Lopatka & Page, *supra* note 3, at 646 (writing that *Kumho Tire* requires courts to scrutinize the methodology of the expert).

[102] Green & Sanders, *supra* note 4, at 1076.

[103] Kaye, *supra* note 2, at 1982.

[104] Lopatka & Page, *supra* note 3, at 629.

[105] *Id.* (citing FED. R. EVID. 702).

[106] Boucher v. U.S. Suzuki Motor Corp., 73 F.3d 18, 21 (2d Cir. 1996).

[107] Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp., 103 F. Supp. 2d 268, 279 (S.D.N.Y. 2000).

Another Supreme Court case, but one outside of the *Daubert* trilogy, is relevant to valuation models based on regression analysis. In the race discrimination case *Bazemore v. Friday*, the trial court excluded several regression analyses that purported to show employment discrimination.[108] Although the analyses included independent variables like race, job title, education, experience, and tenure, the trial court ruled them inadmissible for not including other relevant independent variables like "across the board and percentage pay increases which varied from county to county."[109] Justice Brennan wrote that "failure to include variables will affect the analysis' probativeness, not its admissibility."[110] Indeed, even a regression analysis with less than all measurable variables can help plaintiffs to prove their case.[111] Justice Brennan noted the possibility, however, of "some regressions so incomplete as to be inadmissible as irrelevant."[112]

The invocation of relevance suggests that Rule 702 is not the only Federal Rule of Evidence that could affect the admissibility of expert testimony. Rule 401 defines evidence as relevant if "it has any tendency to make a fact more or less probable than it would be without the evidence" and "the fact is of consequence in determining the action."[113] Rule 402 allows the admission of relevant evidence but mandates that "[i]rrelevant evidence is not admissible."[114] Under Rule 403, courts can exclude "relevant evidence if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence."[115] Rule 104(b) also relates to relevance: "[w]hen the relevance of evidence depends on whether a fact exists, proof must be introduced sufficient to support a finding that the fact does exist."[116]

This Part has focused on federal evidence law because much litigation incorporating sophisticated valuation models occurs in federal courts with causes of action arising under federal law like antitrust,

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[108] 478 U.S. 385, 398–400 (1986).

[109] *Id.* at 398–99 (quoting Bazemore v. Friday, 751 F.2d 662, 672 (4th Cir. 1984) (the appellate court's opinion below)).

[110] *Id.* at 400.

[111] *Id.*

[112] *Id.* at 400 n.10.

[113] FED. R. EVID. 401 (a)–(b).

[114] FED. R. EVID. 402.

[115] FED. R. EVID. 403.

[116] FED. R. EVID. 104 (b). (Courts may admit testimony "on the condition that the proof be introduced later.").

securities, and patents.[117]   Plus, federal courts often have diversity jurisdiction over complex cases involving common law actions like fraud, tortious interference, and breach of contract.[118] Sometimes, however, state courts have jurisdiction over these cases. Many states have evidence rules analogous to Rule 702, so the holdings from the *Daubert* trilogy would apply to court actions in those states.[119] Other states rely upon the older general acceptance standard equated to *Frye v. United States*, or have a hybrid approach to admitting expert testimony.[120] As discussed in the next Part, courts in these states also exclude economic expert testimony as speculative where their valuation models rest on dubious assumptions.

IV. VALUATION MODELS AND INADMISSIBILITY: THREE TYPES OF DUBIOUS ASSUMPTIONS

The economist's underlying methodology is typically not open to challenge because statistics in general, and multiple regression in particular, are well-accepted scientific methods that satisfy the *Daubert* standards.[121] Indeed, in some cases, courts have required the expert to conduct a multiple regression analysis,[122] and plaintiffs have lost for failing to use regression analysis to prove damages.[123]   However, established methodologies do not guarantee admissibility.[124] One role of the judge is to evaluate "the soundness of the facts or assumptions on

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[117] 28 U.S.C. §§ 1331 (federal question), 1337 (commerce and antitrust), 1338 (patents and other intellectual property).

[118] *Id.* § 1332; *see, e.g.*, Todd & Jewell, *supra* note 3, at 52 (stating that plaintiffs in complex transnational tort litigation have the option of suing in state or federal court).

[119] Hill et al., *supra* note 1, at 302.

[120] *Id.*; *see also* Frye v. United States, 293 F. 1013, 1014 (D.C. Cir. 1923) (holding that expert opinion based on a scientific technique is admissible only if the technique is generally accepted as reliable in the relevant scientific community).

[121] Kaye & Freedman, *supra* note 36, at 214; Rubinfeld, *supra* note 8, at 308; *see also* Blair & Esquibel, *supra* note 22, at 136 (calling multiple regression analysis "well-recognized and widely used by economists and statisticians" with principles that are "generally accepted" and treatment in "numerous well-respected statistical treatises and textbooks"); Zohn, *supra* note 3, at 727 (*citing* Petruzzi's IGA Supermarkets v. Darling-Delaware Co., 998 F.2d 1224 (3d Cir. 1993) and cases immediately following *Daubert* that called regression analysis "a reliable 'scientific method used by economists'").

[122] Lopatka & Page, *supra* note 3, at 689.

[123] Rubinfeld, *supra* note 8, at 308 (citing *In re* Exec. Telecard Ltd. Sec. Litig., 979 F. Supp. 1021, 1241 (S.D.N.Y. 1997)).

[124] *See* Lopatka & Page, *supra* note 3, at 690 ("It is not enough that regression is a legitimate technique for estimating damages; the expert's use of it must be reliable and consistent with economic authority.").

which [experts] base their valuations."[125] Experts are not prevented from making simplifying assumptions, "so long as the experts have legitimate grounds for their choices."[126] If experts do not, then courts deny admission because of "some disconnect involving assumptions, analysis, or fit with the facts of the case."[127]

This Part surveys cases to identify the types of assumptions that evince a "disconnect" so severe as to warrant exclusion of expert damages testimony. The assumptions fall into three categories. First, the modeler makes unreasonable comparisons between the plaintiff, its product, or its market and another business, product, or market. Second, the modeler makes unfounded simplifications or omissions, thus tacitly assuming that a relevant factor is irrelevant. Third, the modeler makes unrealistic assumptions not supported by the record about how a party, or even the market, would have behaved but for the defendant's unlawful act.

A. Unreasonable Comparisons

Courts allow comparisons in determining value. Where a market exists for items like the plaintiff's lost entitlement, the comparison is straightforward with data from resources like trade publications, price lists, and Blue Books.[128] Where no market exists, such as for unique items like real estate, testimony about comparable sales of similar land can help establish value.[129] Comparisons are also common in more complex litigation like antitrust cases, such as when the plaintiff claims that a competitor has prevented it from entering a market. Because the business lacks a track record by which to compute damages, courts have allowed the yardstick approach, which compares the plaintiff's business to another business that is substantially similar.[130] The underlying assumption is that but for the anticompetitive behavior, plaintiff's business would have performed like the comparator, thus providing a measure for damages.[131]

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[125] Casey & Simon-Kerr, *supra* note 1, at 1203, 1206 (urging courts "to question the assumptions that the experts make, to insist that experts persuade them that theirs is the best methodology, to be meticulous in questioning the pieces that make up that methodology"); Kaye & Freedman, *supra* note 36, at 281 (writing that courts may inquire into what assumptions were made in the model and why they are applicable).

[126] Lopatka & Page, *supra* note 3, at 662–63.

[127] Hill et al., *supra* note 1, at 311; *see also* Coate & Fischer, *supra* note 6, at 151 ("Expert evidence fails when it is metaphysical opinion, totally unsubstantiated, or devoid of causal content.").

[128] DOBBS, *supra* note 22, at 240.

[129] *Id.* at 240–41.

[130] Blair & Esquibel, *supra* note 22, at 113–14.

[131] *Id.* at 114.

To establish the evidentiary foundation, the expert must show that something like the but-for scenario has actually happened, either to it or to a similar firm, under comparable circumstances.[132]

Pre-*Daubert* cases rejected these assumptions as too speculative if the company chosen to be the yardstick was not a reasonable comparator.[133] For example, in *Admiral Theatre Co. v. Douglas Theatre Co.*, the expert compared the plaintiff's movie theater to another in the same market.[134]   The court excluded the testimony because the anticompetitive behavior would have affected the entire market— including the comparator, thus defeating the very purpose of making the comparison.[135] Looking to different markets does not necessarily alleviate the problem. In *Home Placement Service, Inc. v. Providence Journal Co.*, the plaintiff used its own offices in Nashville as a yardstick for damages at its Providence franchise.[136] The court concluded that the comparison failed to account for differences between the markets, such as different regional rental patterns, unemployment, colleges, and summer rentals.[137]

Courts in the *Daubert* era have likewise faulted unreasonable comparisons, even those involving more sophisticated analyses made by well-credentialed experts.   In *Lippe v. Bairnco Corp.*, the defendant asbestos manufacturers filed for bankruptcy, and the experts for a trust of asbestosis victims performed numerous calculations to value the companies and determine the potential tort liabilities, which was based in part upon comparisons to other businesses.[138] The trial court excluded the testimony because of "indicia of unreliability" like the expert's "inability to explain a number of variables and assumptions used in his analysis, such as price/earnings multipliers, income projections, and which companies were comparable to those being valued."[139] In affirming, the circuit court cited *Kumho Tire* and emphasized the expert's shortcomings in relating their methodology to the case. For example, the court thought that "much of the problem" was that one expert "failed to adequately explain *why* he chose not to use [discounted cash flow] as a check against the comparables he employed in the valuations."[140]   Another problem related to control premiums, but not the fact that they were added to the valuation, but rather

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[132] Blair & Page, *supra* note 10, at 436.

[133] Blair & Esquibel, *supra* note 22, at 117.

[134] 437 F. Supp. 1268, 1297 (D. Neb. 1977).

[135] *Id.* at 1298–99.

[136] 819 F.2d 1199, 1206 (1st Cir. 1987).

[137] *Id.* at 1207.

[138] 99 Fed. Appx. 274, 276–79, 282 (2d Cir. 2004).

[139] *Id.* at 279.

[140] *Id.* at 278 (emphasis in original).

the lack of "meaningful explanation" for how they were applied.[141] The court held that the trial court did not abuse its discretion in excluding the expert testimony as inadmissible under Rule 702.[142]

Another case rejected assumptions about the fungibility of products across markets. In *Lithuanian Commerce Corp. v. Sara Lee Hosiery*, the Lithuanian distributor brought fraud, breach of contract, tortious interference and other claims against a U.S. manufacturer for allegedly defective pantyhose.[143] The court cited to *Joiner* and other authority for the proposition that courts should reject expert testimony that is too speculative as a matter of law.[144] The court ruled the testimony of the damages expert inadmissible because of "dubious assumptions," including several unfounded comparisons.[145] The expert failed to distinguish between former and current clients of Sara Lee; he compared Lithuanian Commerce Corp. to two domestic distributors that would not face the same tax, tariff, and import restrictions; and he relied upon a study of U.S. women's purchasing patterns for pantyhose to predict the amount of purchases by Baltic women.[146] The court excluded the expert's testimony as inadmissible under *Daubert*.[147] Because the opinion preceded *Kumho Tire*, there was some disagreement about whether *Daubert* applied to non-scientific expert testimony.[148] Accordingly, the court further ruled the testimony "inadmissible under the Federal Rules of Evidence without consideration of the *Daubert* standard" because it was "premised on unsupported and speculative assertions."[149] The court cited pre-*Daubert* authority where circuit courts of appeals had "excluded

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[141] *Id.* at 278–79.

[142] *Id.* at 279.

[143] 179 F.R.D. 450, 454–55 (D.N.J. 1998).

[144] *Id.* at 457 (citing Gen. Elec. Co. v. Joiner, 522 U.S. 136, 118 (1997); Target Mkt. Publ'g, Inc. v. ADVO, Inc., 136 F.3d 1139, 1143 (7th Cir. 1998)).

[145] *Id.* at 460–61.

[146] *Id.*; *see also* Pfizer, Inc. v. Advanced Monobloc Corp., No. 97C-04-037-WTQ, 1999 WL 743927, at *16-17, 24-25 (Del. Super. Sept. 2, 1999) (relying on *Schonfeld* to exclude marketing expert's testimony, in part for assuming without sufficient support that the product in question, a premium women's shave gel, would have achieved the same market coverage as the plaintiff's bargain men's shave gel); Kordana & O'Reilly, *supra* note 55, at 2026 (claiming that relying upon a single study brings a risk of being misled by an error or statistical fluke) (quoting *The New NBER: Has Scholarship Been Hurt?*, BUS. WK. 6 (Oct. 6, 1980)).

[147] *Lithuanian Commerce Corp.*, 179 F.R.D. at 462.

[148] *Id.*; *see also* Kumho Tire Co., v. Carmichael, 526 U.S. 137, 147 (1999) (concluding that a trial court's gatekeeping role under *Daubert* applies to all expert testimony, not only scientific expert testimony).

[149] *Lithuanian Commerce Corp.*, 179 F.R.D. at 462.

expert damages testimony where it was based on unreliable data and assumptions."[150]

B. *Unfounded Simplifications and Excluded Variables*

Regression and other techniques that lead to composites produce "more reliable and precise damages estimate[s]" because they account for more variables,[151] but those variables rely upon assumptions about facts and data.[152] When the facts and data in evidence support the assumptions, then the expert testimony is permitted. Consider *Conwood Co. v. United States Tobacco Co.*, where plaintiffs alleged that U.S. Tobacco's tactics related to product display cases restrained trade in violation of antitrust law.[153] Plaintiffs submitted the testimony of an economics expert who performed a regression analysis to test his hypothesis that U.S. Tobacco's acts in the markets where Conwood's share was already low—as compared to those where Conwood already have a foothold—had the strongest impact.[154] The trial court overruled the defendant's argument that his damages estimate had no basis in fact and submitted the case to the jury, which returned damages of $350 million, which the court subsequently trebled to $1.05 billion.[155] The Sixth Circuit found that the regression analysis had accounted for alternative explanations for Conwood's harm by testing the theories of defendant's expert.[156] The court also found that the expert relied upon sworn affidavits from hundreds of Conwood employees about U.S. Tobacco's unethical acts.[157] Accordingly, the Sixth Circuit found that the district court did not abuse its discretion because the expert's regression analysis was supported by the record.[158]

When the record does not support the assumptions, then courts frequently exclude the testimony rather than face reversal on appeal.[159]

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[150] *Id.* (citing Benjamin v. Peter's Farm Condominium Owners Assoc., 820 F.2d 640, 642 (3d Cir. 1987); Gumbs v. Int'l Harvester, 718 F.2d 88, 98 (3d Cir. 1983)).

[151] Blair & Esquibel, *supra* note 22, at 120.

[152] Hill et al., *supra* note 1, at 374–75.

[153] 290 F.3d 768, 773–80 (6th Cir. 2002).

[154] *Id.* at 780, 794.

[155] *Id.* at 773, 791–92.

[156] *Id.* at 793.

[157] *Id.* at 794.

[158] *Id.*; *see, e.g.*, U.S. v. Gushlak, 728 F.3d 184, 202 (2d Cir. 2013) (affirming expert's calculation of restitution owed to crime victims because the regression analysis was "grounded in the record before the district court").

[159] Hill et al., *supra* note 1, at 374–75 (writing that assumptions about facts and data are inputs into valuation models, and that the leading reason for courts to exclude expert testimony

Often, the lack of support manifests not in an explicit assumption or unreasonable comparison but in a simplistic model or omitted variable. Faced with a lack of factual support, the expert often glosses over essential differences—or simply ignores the inconvenient facts by constructing the model without them. In other words, the tacit assumption is that some important and relevant factor is unimportant and irrelevant.

Consider *American Booksellers Ass'n v. Barnes & Noble, Inc.*, where independent bookstores alleged that the defendant's large bookstores received secret discounts not available to them in violation of federal antitrust law and California unfair competition law.[160] They relied upon an expert's economic simulation model to show the difference in prices paid between plaintiffs and defendants as proof of causation as well as amount of damages.[161] The trial court granted summary judgment to defendants for plaintiffs' claims for damages under the Robinson-Patman Act.[162] The court relied upon *Daubert* in asking whether the expert testimony "is sufficiently tied to the facts of the case that it will aid the jury in resolving a factual dispute,"[163] as well as the *Joiner* language about rejecting analytical gaps.[164] The court found the model "entirely too speculative to support a jury verdict" because the "model contains entirely too many assumptions and simplifications that are not supported by real-world evidence."[165] Among the litany of unsupported assumptions were that all price differentials were the result of unlawful competition rather than lawful cost differences; that plaintiffs and defendants were general bookstores in competition only with each other, thus artificially limiting the market by ignoring competition from online booksellers and other businesses that sold books like specialty bookstores and department stores; and that lost sales were attributable to unlawful price differences rather than to factors like distance between defendants and their competitors.[166] Notably, the court ruled that even if the model were admissible to prove causation, the online and mail order defendants would still be entitled to summary judgment because the model relied entirely upon competition between "physical stores in the same geographic location."[167] The

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is the validity of facts and data); Zohn, *supra* note 3, at 728 ("Regression involves assumptions about variables that might not be true.").

[160] 135 F. Supp. 2d 1031, 1035 (N.D. Cal. 2001).

[161] *Id.* at 1037.

[162] *Id.* at 1042.

[163] *Id.* at 1041 (citing Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 591 (1993)).

[164] *Id.* (citing Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997)).

[165] *Id.* at 1041–42.

[166] *Id.* at 1040–41.

[167] *Id.* at 1042.

plaintiffs conceded a lack of evidence, with the expert stating in his report that "there was not sufficient information to quantify price differentials resulting from this term of sale and they are omitted from the analysis."[168]

The court in *Concord Boat Corp. v. Brunswick Corp.* more bluntly criticized an expert's failure to account for record evidence.[169] Numerous boat builders sued engine manufacturer Brunswick, alleging that its program to award discounts to builders only if they purchased a certain percentage of their stern drive engines from Brunswick violated the Sherman and Clayton Acts.[170] The builders' main evidence of damages came from an economics expert, who used the Cournot model to assume that a competitive market would have resulted in Brunswick having a 50% market share against a competitor with an equal product, so its actual market share of 78% was unlawful.[171] The builders prevailed at trial, with the jury awarding over $44 million in damages.[172] The circuit court recognized that an expert method that satisfies the *Daubert* factors, like the Cournot model, "should not be admitted if it does not apply to the specific facts of the case" under *Kumho Tire*.[173] The circuit court found the expert's use of the Cournot model problematic because it "was not grounded in the economic reality of the stern drive engine market, for it ignored inconvenient evidence."[174] The "inconvenient evidence" was that Brunswick had achieved a market share of 75% prior to the discount program and its acquisition of other engine companies.[175] Based on this and other failures to incorporate relevant aspects of the "economic reality of the stern drive engine market" into the model, the court found the expert's conclusion "mere speculation" because the opinion lacked a sufficient foundation.[176] The jury had relied on this testimony in reaching its damages claim, so the improper admission of the testimony affected Brunswick's substantial rights.[177] The circuit court reversed and vacated the judgment and remanded for entry of judgment in Brunswick's favor.[178]

Some courts scrutinize assumptions in models based on regression analysis for omitted variables and other simplifications that affect the validity of the model. The court in *In re Live Concert Antitrust Litigation*

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[168] *Id.*
[169] 207 F.3d 1039, 1055–57 (8th Cir. 2000).
[170] *Id.* at 1044-45.
[171] *Id.* at 1046-47.
[172] *Id.* at 1047. The district court then trebled the damages. *Id.* at 1049.
[173] *Id.* at 1055–56.
[174] *Id.* at 1056.
[175] *Id.*
[176] *Id.* at 1057.
[177] *Id.*
[178] *Id.* at 1063.

excluded expert testimony because the regression analysis omitted important explanatory variables.[179] Plaintiffs alleged that Clear Channel engaged in monopolistic practices in its promotion of music concerts that resulted in higher ticket prices.[180] They submitted expert testimony based on regression analysis to show the increase in ticket prices from 2000 (the year Clear Channel acquired promotion company SFX) until 2006 for rock concerts and the resulting damages.[181] The defendants challenged the expert under Rule 702(d)—"the expert has reliably applied the principles and methods to the facts of the case"—so the court turned to *Bazemore* for the "somewhat unique body of law" surrounding admission of regression analysis.[182] In particular, it recognized the importance of "reasonable assumptions" and the possibility of "omitted variable bias" if the regression analysis fails to account for major factors.[183] Accordingly, the "key question" for admissibility is whether the analyses "account for the 'major factors;'" in other words, if there is "some indication that the excluded variables would have impacted the results," then the expert testimony is inadmissible.[184] With respect to his before-and-after analysis, the only major variable was time.[185] The court concluded that the expert had failed to test the assumption of increased ticket prices relating to a monopoly by failing to account for two major variables: changes in artist quality during the time period and the emergence of downloadable digital music, which put pressure on bands to raise ticket prices to offset losses from album sales.[186] The court found it "most troubling" that the analysis did not account for the "dramatic increase in ticket prices that occurred in 1999, the year *before* Clear Channel entered the rock concert promotion market," which is notable because downloadable music emerged approximately between 1998 and 1999.[187] The court granted the motion to exclude the expert testimony, and then granted summary judgment because plaintiffs' claims lacked evidentiary support.[188]

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[179] 863 F. Supp. 2d 966, 981–82 (C.D. Cal. 2012).

[180] *Id.* at 969.

[181] *Id.* at 976–80.

[182] *Id.* at 973 (citing Bazemore v. Friday, 478 U.S. 385 (1986)).

[183] *Id.* at 973–74 (citing 2A P. AREEDA & H. HOVENKAMP, ANTITRUST LAW ¶ 399c, p. 447, ¶ 399c2, at 455 (3d ed. 2006)).

[184] *Id.* at 974.

[185] *Id.* at 978.

[186] *Id.* at 978–79.

[187] *Id.* at 980 (emphasis in original).

[188] *Id.* at 982. The expert had conducted other analyses, most of which were excluded. *Id.* at 976, 982–83 (excluding testimony about yardstick damages and rejecting pooled samples analysis as "fatally flawed"). Though it focuses on prices rather than damages, another antitrust case ruled expert testimony inadmissible for omitting variables based on unsupported assumptions that changes in the quality of a product were not relevant. Freeland v. AT&T Corp.,

In *In re REMEC Inc. Securities Litigation*, a class of purchasers of REMEC stock sued for securities fraud and relied upon expert testimony to show loss causation, a necessary but-for element akin to actual cause in torts.[189] The expert performed multivariate regression analysis purporting to prove that three of REMEC's corrective disclosures about fraudulent tactics by the company caused the stock price to drop.[190] In response to defendant's motion for summary judgment, the court scrutinized the regression model, including listing the formula and explaining the independent and dependent variables.[191] The court cited *Bazemore* in rejecting the expert's model for assuming that company-specific information in the disclosures was the only factor affecting stock price and making no attempt to include variables that could have affected price like industry-specific news, market-specific news, or other macroeconomic variables.[192] Although variables consumed most of the court's analysis, the court also pointed to other problems with the model, including failing to test the model for multicollinearity. The court found that it would not be unreasonable to suspect that two indices—market and industry—moved together and thus skewed the coefficients.[193] For these reasons, the court ruled the expert testimony was irrelevant and unreliable under *Daubert* and Rule 702.[194] The court therefore granted the objections to the expert declaration, and because plaintiffs now had no evidence of loss causation, the court dismissed their claims.[195]

C. Unrealistic But-For Scenarios

To calculate damages, the expert constructs a model that assumes an alternate reality. Sometimes the model gazes backward to predict how the business would have performed from the moment of the unlawful act until the time of trial.[196] Other times the model predicts the future from

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238 F.R.D. 130, 148–49 (S.D.N.Y. 2006) (faulting expert testimony alleging illegal tying of cell phones to cell plans for not accounting for price differences related to the switch from analog to digital phones and the incorporation of cameras into phones).

[189] 702 F. Supp. 2d 1202, 1211–12, 1266 (S.D. Cal. 2010).

[190] *Id.* at 1266–67.

[191] *Id.* at 1272 (presenting the regression equation as $Y_{PR} = \beta0 + \beta1(X_{mi}) + \beta2(X_{ini})$ and explaining each variable).

[192] *Id.* at 1273 (citing Bazemore v. Friday, 478 U.S. 385 (1986)).

[193] *Id.* at 1274–75 (suggesting that an autoregressive model would have been more appropriate because of a potential problem with autocorrelation).

[194] *Id.* at 1275.

[195] *Id.*

[196] *E.g.*, *In re* Live Concert Antitrust Litig., 863 F. Supp. 2d 966, 976–77 (C.D. Cal. 2012) (calculating damages for higher ticket prices for sales from 2000 through 2006 because of allegedly anticompetitive conduct).

the time of trial to estimate gains that would have been earned but for the monopoly, the tort, or the breach.[197] Frequently, the model looks both backward and forward.[198] Courts tend to find that the expert's assumptions about what could have been or what shall come to pass are reasonable. For example, the Third Circuit affirmed an expert's assumption that the plaintiff, who had been fired by the defendant, would have managed his competing distributorship the same way he managed the defendant's, and that his distributorship would have achieved the same sales during the damages period as the defendant's.[199] In a case where a manufacturer sought to recover for losses caused by machines made by the defendant, the court found that the economic expert's assumption that the plaintiff's business will expand was reasonable, holding that the "likelihood and extent" of expansion were jury issues.[200]

Courts nevertheless exclude expert testimony—or even reverse judgments based on expert testimony—that claim growth based upon unsupported assumptions that particular events would have or shall come to pass. No matter how sophisticated the economic analysis and statistical methods, expert testimony is vulnerable if the assumptions lack adequate support in the record. In one pre-*Daubert* case, *Southern Pacific Communications Co. v. American Telephone & Telegraph Co.*, start-up telephone company Southern Pacific Communications Company ("SPCC") alleged that AT&T and Bell System monopolized the private telephone line industry.[201] Following a bench trial, the court used particularly harsh language in rejecting the expert model, characterizing its but-for world—half of which preceded trial, half of which followed—as an "'imaginary' made-for-trial-fiction."[202] The assumption that SPCC would attain 60% of the market share ignored the existence of at least eight other competitors—plus, nothing in the record supported the assumption that SPCC would be one of the three remaining competitors to AT&T.[203] The assumption of increased demand for private lines was negated by the

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[197] *E.g.*, Lithuanian Commerce Corp. v. Sara Lee Hosiery, 179 F.R.D. 450, 458 (D.N.J. 1998) (projecting damages for lost pantyhose sales for periods ranging from fifteen to twenty-two years).

[198] *E.g.*, S. Pac. Comms. Co. v. Am. Tel. & Tel. Co., 556 F. Supp. 825, 1080 (D.D.C. 1982) (estimating damages relating to an antitrust claim for the ten years preceding trial and the ten years following it).

[199] Rossi v. Standard Roofing, Inc., 156 F.3d 452, 486–87 (3d Cir. 1998).

[200] Polymer Dynamics, Inc. v. Bayer Corp., 67 Fed. R. Evid. Serv. 201, 205 (E.D. Pa. 2005).

[201] 556 F. Supp. at 850–51.

[202] *Id.* at 1073, 1076, 1080 (court noting the twenty-year damages period from 1972 to 1991).

[203] *Id.* at 1076–79.

sole-source policy of the Department of Defense, which precluded SPCC from servicing the largest user of private lines.[204] The model assumed SPCC prices 15% below AT&T's and thus did not account for the possibility that AT&T would modify prices to be competitive.[205] The model also assumed a product that was the largest-ever network of its kind and a company that would start construction projects on time and never experience delays in obtaining permits and other government approvals.[206] The court concluded that "plaintiffs' damage claim does not provide the Court with any basis to make a 'just and reasonable' approximation of the amount of damages even if SPCC had proven all the other elements of its claim," so it entered judgment in favor of AT&T because any damages amount it would have awarded "could only be based on pure speculation or guesswork."[207]

Turning to a case from the *Daubert* era with a "dauntingly complex" damages model, *Johnson Electric North America Inc. v. Mabuchi Motor America Corp.* involved counterclaims related to an alleged infringement of Mabuchi's small motor patents.[208] Johnson challenged Mabuchi's expert, an econometrician who used regression analysis, and the court granted the motion to exclude his testimony.[209] Relying on *Joiner*, the court looked beyond the methodology—which was concededly sound—to determine whether the analysis was based upon relevant and reliable data.[210] The court characterized the assumption that Johnson would not have entered the micro-motor market until March 1989 when it developed a non-infringing alternative as "unrealistic" because Johnson had been manufacturing and selling motors for small appliances since the early 1960s.[211] An "even farther stretch" was the assumption that Mabuchi would have made every sale that Johnson made, especially because the record did not show whether Mabuchi sold motors in every country that Johnson did.[212] Because these assumptions were unreliable, the court did

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[204] *Id.* at 1079.

[205] *Id.* at 1080–81.

[206] *Id.* at 1084–85.

[207] *Id.* at 1098.

[208] 103 F. Supp. 2d 268, 273, 287 (S.D.N.Y. 2000).

[209] *Id.* at 270, 274–76, 287.

[210] *Id.* at 283.

[211] *Id.* at 284.

[212] *Id.* Another questionable assumption related to record evidence: the expert relied upon reference guides with general automotive sales data about cars with automatic locks rather than the invoices provided by Johnson to calculate the number of infringing sales. *Id.* at 283–84.

not have "the slightest difficulty in concluding that Dr. Dubin's opinion fail[ed] to satisfy Rule 702's requirement."[213]

Sometimes, a seemingly simple but-for assumption might make an expert's damages model unreliable. In a New York state case, *Kenford Co. v. County of Erie*, landowners contracted with the county to convey some of their land for the construction of a domed stadium, with the plan to develop other land they owned adjacent to the proposed stadium.[214] The landowners sued for breach of contract when the stadium was not built. The plaintiffs prevailed at trial, but the appellate court reversed on the calculation of damages: "[p]laintiff's appraiser valued the land as of projected completion dates ranging from 1973 to 1979 and based his estimates on the assumption that the property was improved with the specific items that we now find speculative as a matter of law, i.e., theme park, office buildings, and golf course."[215] The court, therefore, ordered a new trial on the calculation of damages, but based on the value of unimproved "raw" land adjacent to new domed stadiums.[216] The New York Court of Appeals affirmed this holding in a per curiam opinion, though it characterized the projections of development as a "multitude of assumptions" that "require speculation and conjecture, making it beyond the capability of even the most sophisticated procedures to satisfy the legal requirements of proof with reasonable certainty."[217] Other courts have likewise excluded expert projections of growth and related income when unsupported by the record.[218]

Pre-*Daubert* state cases like *Kenford* survive as sound authority, including controlling the outcome in federal courts sitting in diversity. *Schonfeld v. Hilliard* was a fraud and contract case related to plaintiffs'

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[213] *Id.* at 287.

[214] 489 N.Y.S.2d 939, 941–42 (App. Div. 1985), *aff'd in part*, 493 N.E.2d 234 (N.Y. 1986).

[215] *Id.* at 944–45.

[216] *Id.* at 945.

[217] Kenford Co. v. Cty. of Erie, 493 N.E.2d 234, 236 (N.Y. 1986).

[218] *E.g.*, Target Mkt. Publ'g, Inc. v. ADVO, Inc., 136 F.3d 1139, 1140 (7th Cir. 1998) (rejecting the assumption that enterprise in only two markets with a handful of advertisers would penetrate into forty-nine marketing zones and obtain a certain number of advertisers per zone); Am. Road Equip. Co. v. Extrusions, Inc., 29 F.3d 341, 344–45 (8th Cir. 1994) (reversing part of damages award that was based on the testimony of an expert who assumed without support that the 1989 business plan projections were valid for 1990); E. Auto Distribs., Inc. v. Peugeot Motors of Am., Inc., 795 F.2d 329, 338 (4th Cir. 1986) (affirming judgment n.o.v. on one part of plaintiff's case, where expert assumed that plaintiff's market share from 1977 to 1981 would have been the same as in 1983 for failing "to take account of EAD's admittedly more efficient dealer force in 1983, the large increase in demand for Peugeot products during this period, the shift in demand from gas to diesel automobiles and then back to gas, and the introduction of new Peugeot models").

attempt to start a television network that used BBC programming.[219] The trial court granted summary judgment for the defendant, relying on *Kenford*, holding that "Schonfeld could not prove, with reasonable certainty, the existence or amount of damages for lost profits;" interestingly, because of this holding, the court did not rule on the *Daubert* challenge to Schonfeld's expert.[220] The circuit court affirmed based on the trial court's application of *Kenford* and did not rely upon *Daubert*.[221] That court noted the "seemingly endless list of assumptions upon which [the expert] relied in determining lost profits" and his failure to account for market risks.[222] One assumption was that a new business entity would see profits of $112 to $269 million despite introducing "a *new product*, the 'Americanized' version [of BBC international news], into a *new market*, the United States."[223]   The court compared this reasoning to the suppositions about the potential stadium in *Kenford*, with alleged lost profits "stemming from the sale of untested programming to a hypothetical subscriber base, sold to advertisers at a hypothetical price and supported by hypothetical investors and carriers."[224] Citing the "chilly reception" that New York courts give to "claims for profits lost in unsuccessful entertainment ventures" because of "the changing whims and artistic tastes of the general public," the court found that the assumptions about financing, advertising, and market reach, relied upon by the expert, were unrealistic.[225]

Another case with fantastic assumptions about how parties and entire markets would have acted is *Three Crown Ltd. Partnership v. Salomon Bros.*, where a financial economist calculated lost profits related to the defendant's market manipulation in enticing plaintiff, Three Crown, away from its "butterfly strategy" of investing.[226] The court scrutinized the underlying assumptions about market conditions in U.S. Treasury Securities and about the sorts of trades the plaintiff would have made in that market.[227] The expert

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[219] 218 F.3d 164, 168–70 (2d Cir. 2000).

[220] *Id.* at 171 (citing *Kenford Co.*, 493 N.E.2d at 235).

[221] *Id.* at 172–73.

[222] *Id.* at 173–74.

[223] *Id.* at 171, 173 (emphasis in original).

[224] *Id.* at 173 (quoting Schonfeld v. Hilliard, 62 F. Supp. 2d 1062, 1079 (S.D.N.Y. 1999)).

[225] *Id.* at 174.

[226] 906 F. Supp. 876, 880–82 (S.D.N.Y. 1995).

[227] *Id.* at 883 (the expert also assumed that the defendants caused Three Crown to deviate from its strategy and did not account for other possible causes of deviation like more profitable opportunities).

made the assumptions that a trading strategy existed, the starting and ending dates of that strategy, what the prices of the April and May Notes would have been absent the alleged manipulation, what financing rates Three Crown would have received and paid in maintaining its leveraged positions during its execution of the strategy, and what investments and other trading activity would have ensued if Three Crown had maintained its positions.[228]

The court excluded his testimony because the "damages would rest upon numerous assumptions without the type of support required under the case law."[229] This conclusion was not in spite of the expert's "complicated calculations" but because of them. Rather than rely upon *Daubert* or Rule 702, the court ruled that the testimony could "confuse and mislead a jury" and was therefore inadmissible under Rule 403.[230]

V. ANALYSIS AND TAKEAWAYS

A. Analytical Gaps, the Case at Hand, Speculation, and Confusion: The Multiple Legal Grounds for Exclusion

Daubert serves as a shorthand for the evidentiary standards that govern the admission of expert testimony, with courts invoking it along with Rule 702. In one recent article about scientific expert testimony, however, the authors concluded, "[t]he 'analytical gap' language in *Joiner* and the focus on the case at hand in *Kumho Tire* both push courts away from a *Daubert*-factor analysis and toward a decision as to whether there is sufficient evidence to support a plaintiff verdict."[231] Although they examined toxic tort cases, their sense that courts have trended away from the *Daubert* factors and instead assess sufficiency also seems accurate for courts analyzing assumptions in economic valuation models.

None of the surveyed cases relied upon the *Daubert* factors in analyzing the reliability of testimony based on economic models. The one court that purported to rely on a *Daubert* factor analysis actually did not,

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[228] *Id.* (citations omitted).

[229] *Id.* at 894.

[230] *Id.* (citing ARP Films, Inc., v. Marvel Entm't Grp., Inc., 952 F.2d 643 (2d Cir. 1991); Tyger Constr. Co. v. Pensacola Constr. Co., 29 F.3d 137 (4th Cir. 1994)); *see also* FED. R. EVID. 403; Weissberg v. Peinado, No. A097102, A097232, 2003 WL 1849243, at *3 (Cal. App. Apr. 10, 2003) (rejecting damages expert in part because of assumptions about how real property would have sold in market at that time and about how plaintiff would have invested the money).

[231] Green & Sanders, *supra* note 4, at 1094.

instead citing *Daubert*'s quotation of a Third Circuit case that had interpreted Rule 702 about whether the expert testimony "is sufficiently tied to the facts of the case that it will help the jury in resolving a factual dispute."[232] This emphasis on the case at hand was expanded and clarified in *Kumho Tire* and is embodied in the revised Rule 702.[233]

Some courts have specified that the *Daubert* factors are not always necessary. The *Concord Boats* court recognized that an expert who satisfied *Daubert* might nevertheless be excluded under *Kumho Tire*, and conducted its analysis under the latter case.[234] The *Johnson Electric* court conceded that the expert's methodology was sound under *Daubert*, so it turned to *Joiner* to determine whether the model relied upon relevant and reliable data.[235] Courts have relied on *Kumho Tire* or *Joiner* to reject all three types of dubious assumptions.

As damages valuation has become more sophisticated, some courts pay only lip service to Rule 702 and the *Daubert* trilogy and focus their analysis on pre-*Daubert* authority rejecting expert testimony that is too speculative. For example, in *Lithuanian Commerce Corp.*, the court excluded the damages model under *Joiner*, then it cited to pre-*Daubert* authority about "unreliable data and assumptions" to hold that the testimony was also inadmissible because it was "premised on unsupported and speculative assertions."[236] Accordingly, courts might still turn to older authority like *Southern Pacific Communications Co.* for guidance in analyzing assumptions in valuation models.[237] Both the trial and appellate courts in *Schonfeld* relied upon the New York state case *Kenford* to rule the evidence speculative without reaching the Federal Rules of Evidence or *Daubert*.[238] Accordingly, whether in federal or state court, judges might rule testimony inadmissible if the expert's economic model has unsupported assumptions.

Where the model relies upon regression analysis, one court recognized the "somewhat unique body of law" flowing from *Bazemore*.[239] Courts have taken footnote ten in *Bazemore* as a directive to

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[232] Am. Booksellers Ass'n v. Barnes & Noble, Inc., 135 F. Supp. 2d 1031, 1041 (C.D. Cal. 2001) (citing Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 591 (1993)).

[233] Green & Sanders, *supra* note 4, at 1076–77.

[234] Concord Boat Corp. v. Brunswick Corp., 207 F.3d 1039, 1055–56 (8th Cir. 2000).

[235] Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp., 103 F. Supp. 2d 268, 283 (S.D.N.Y. 2000).

[236] Lithuanian Commerce Corp. v. Sara Lee Hosiery, 179 F.R.D. 450, 462 (D.N.J. 1998).

[237] *See generally* S. Pac. Comms. Co. v. Am. Tel. & Tel. Co., 556 F. Supp. 825 (D.D.C. 1982).

[238] Schonfeld v. Hilliard, 62 F. Supp. 2d 1062, 173-74, 174 n.6 (S.D.N.Y. 1999), *aff'd*, 218 F.3d 164, 172–73 (2d Cir. 2000).

[239] *In re* Live Concert Antitrust Litig., 863 F. Supp. 2d 966, 973 (C.D. Cal. 2012).

look specifically at what the model *excludes*.[240] If the record suggests that a factor is relevant, but the model fails to account for it, then the entire model is irrelevant.[241] Federal Rules of Evidence 104(b) (which states that relevance might depend upon other facts) and 402 (which deems irrelevant evidence inadmissible) support this reasoning.[242] Neither of the courts from our survey that relied upon *Bazemore* cited either of these rules. In *Three Crown*, the court did exclude an otherwise relevant damages model under Rule 403 because the model had too many assumptions about what the plaintiff and the markets would have done.[243]

In sum, federal courts considering assumptions in economic models look more to *Joiner* and to *Kumho Tire* than to *Daubert* and its factors. Federal courts also look outside of Rule 702 and the *Daubert* trilogy, so the party proffering the economic model and the one challenging it should consult—and can cite—pre-*Daubert* authority for guidance about the types of assumptions that courts find dubious. State court opinions also support the exclusion of testimony based upon dubious assumptions.

B.   *Justifications for Exclusion and the Irrelevance of Statistical Problems: Dubious Assumptions as Poor Arguments That Lack Evidentiary Support*

Kumho Tire and *Joiner* work together to direct the court to consider whether the expert has reasonable arguments supported by evidence that the assumptions fit with the circumstances of the case. Plus, though they use different language, the pre-*Daubert* and state authority accord: a model's assumptions are speculative or irrelevant unless linked sufficiently to the case at hand. Case law shows assumptions must be reasonable and not controverted by evidence, which accords with the academic commentary discussed in Part II(B), *supra*.

Recall the definition of econometrics: the application of statistical principles to answer economics questions.[244] The court should therefore ask whether the model's assumptions "apply to the case at hand."[245]

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[240] Bazemore v. Friday, 478 U.S. 385, 400 n.10 (1986).

[241] *Live Concert*, 863 F. Supp. 2d at 978–79; *In re* REMEC Inc. Secs. Litig., 702 F. Supp. 2d 1202, 1273 (S.D. Cal. 2010).

[242] FED. R. EVID. 104(b), 402.

[243] Three Crown Ltd. P'ship v. Salomon Bros., 906 F. Supp. 876, 894 (S.D.N.Y. 1995) (citing FED. R. EVID. 403).

[244] Blair & Esquibel, *supra* note 22, at 120; Sykes, *supra* note 8, at 1; Zohn, *supra* note 3, at 707.

[245] Kaye & Freedman, *supra* note 36, at 281 (writing that "the court may well inquire about the assumptions behind the model and why they apply to the case at hand"); *see also*

Though sophisticated, valuation models serve a straightforward purpose: to create an alternate but-for world so that the plaintiff can prove damages as the difference between the hypothetical and real worlds.[246] The assumptions in that model must therefore approximate the real-world with support from "real-world evidence."[247] After all, models are "fact-specific,"[248] so they must accurately describe the problem at hand without ignoring any inconvenient facts.[249] The model does not stand on its own, however, because it is only a part of the expert's testimony.[250] The expert during deposition or cross-examination must therefore have sound arguments for the assumptions underlying that model because attorneys attack that which their legal training helps them to understand best— arguments that lack foundation.[251] If the expert cannot defend the assumptions in light of the record, the court will rule the testimony inadmissible.[252] The plausibility of the assumptions therefore "depends upon both the sufficiency of the evidentiary foundation and the persuasiveness of the reasoning."[253]

If in federal court (or a state court following federal standards), the opponent should base a challenge to a model's assumption upon both *Joiner* and *Kumho Tire*, highlighting the interplay between the expert's reasoning and the lack of factual support. This interplay might be strongest with the second category of assumptions, where the expert omits a relevant factor or when the record contains evidence that contradicts the assumption. For example, to prove damages in the antitrust case *Concord Boats*, the plaintiffs' model made assumptions linking the allegedly anticompetitive acts to defendant's market share of 78%.[254] The record

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Rubinfeld, *supra* note 8, at 308–09 (writing that "courts have rejected regression studies that did not have an adequate foundation or research design with respect to the issues at hand").

[246] *See supra* Part II(A).

[247] Rubinfeld, *supra* note 8, at 309 n.20 (quoting Am. Booksellers Ass'n v. Barnes & Noble, Inc., 135 F. Supp. 2d 1031, 1041 (C.D. Cal. 2001)).

[248] Allensworth, *supra* note 2, at 855.

[249] Dau-Schmidt, *supra* note 7, at 184; SCHLEFER, *supra* note 9, at 27.

[250] *See* Hill et al, *supra* note 1, at 331 (writing that damages experts must know the facts of the case "to avoid an inability to defend assumptions used in valuation models").

[251] Blair & Esquibel, *supra* note 22, at 134–35; Hill et al., *supra* note 1, at 332 n.253 ("Assumptions that form the inputs to valuation models are the most likely aspect of a damages expert's report and testimony that opposing counsel will attack."); *see also* DOBBS, *supra* note 22, at 235 (claiming that statistics might be inadequate unless they "conform to commonsense expectations").

[252] Hill et al., *supra* note 1, at 331 n.253 (citing Lippe v. Bairnco Corp., 99 Fed. Appx. 274 (2d Cir. 2004)) ("A failure on the part of a valuation expert to adequately explain the analytic assumptions in a valuation can also be cause for exclusion of expert testimony.").

[253] Blair & Page, *supra* note 10, at 436.

[254] Concord Boat Corp. v. Brunswick Corp., 207 F.3d 1039, 1046–47 (8th Cir. 2000).

belied that assumption because the defendant already had a 75% market share before the allegedly anticompetitive acts.[255]

That rationale for excluding testimony is weaker when the argument is not specifically contradicted by the record but merely lacks support. In cases from all three categories of assumptions, however, courts have excluded testimony when the record suggested that the expert's reasoning was not sound or was silent as to the assumption. Because the opponent has challenged the assumption, and because economic modeling involves an element of argumentation, the expert must therefore have strong reasons to support the assumption. For example, in *Lippe*, the expert's calculations included comparisons to other companies, but one expert could not explain those comparator companies, nor could the two experts explain how their methodology connected to the case.[256] In *American Booksellers Ass'n*, the court granted summary judgment for the online retailer defendants because the expert admitted to a lack of evidence to show a relationship between them and the brick-and-mortar plaintiffs.[257] The *Johnson Electric* court faulted as unrealistic two assumptions about what the parties would have done but for infringing patents: one about the timing of entry in the small motor market that was belied by the record of the company's participation in that market since the 1960s, and the other about foreign sales by Mabuchi had no support in the record.[258] Because courts recognize that experts sometimes base their estimates "on the most unrealistic of assumptions,"[259] economists should be conservative where the model lacks support in the record.[260]

Turning to pre-*Daubert* authority, the rationales are similar and the results the same as applying *Joiner* and *Kumho Tire*. Indeed, *Lithuanian Commerce Corp.* ruled the testimony inadmissible under *Joiner* for being too speculative because of its numerous dubious assumptions.[261] The court also turned to pre-*Daubert* authority about "unreliable assumptions" to exclude the testimony as "premised on unsupported and speculative assertions."[262] Not only does the connection to reliability jibe with *Daubert*, but the language about speculation mirrors that used by a federal

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[255] *Id.* at 1056.

[256] *Lippe*, 99 Fed. Appx. at 278–79.

[257] Am. Booksellers Ass'n v. Barnes & Noble, Inc., 135 F. Supp. 2d 1031, 1042 (C.D. Cal. 2001).

[258] Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp., 103 F. Supp. 2d 268, 284 (S.D.N.Y. 2000).

[259] Lloyd, *supra* note 6, at 402 ("Courts have recognized that experts . . . will base their projections on the most unrealistic of assumptions.").

[260] *Id.* at 386.

[261] Lithuanian Commerce Corp. v. Sara Lee Hosiery, 179 F.R.D. 450, 457 (D.N.J. 1998).

[262] *Id.* at 462.

court in 1982 in *Southern Pacific Communications Co.* and by a state court in *Kenford*.[263] This implies that the results in those cases would likely be the same if *Joiner's* "analytical gap" and *Kumho Tire's* focus on circumstances of the case governed. *Schonfeld* offers further support: that court declined to apply *Daubert* and relied instead on *Kenford* to find the assumptions of what the parties would have done in the hypothetical but-for world too "unrealistic."[264] The *Johnson Electric* court applied *Joiner* to reach a similar conclusion that the parties' but-for world was "unrealistic" and a "stretch."[265]

The two surveyed cases that cite *Bazemore* deserve special attention because both mention omitted variables, with the *Live Concert* court noting the possibility of omitted variable bias that results from violation of a regression assumption.[266] However, neither court analyzed omitted variables as a statistical problem. There was no reference to how the omitted variables affected the statistics, to the robustness of the regression analysis, or to other statistical tools the expert applied to fix the problems. Instead, both courts focused on the same fundamental econometric assumptions of model construction as the other courts in the survey. For example, the *Live Concert* plaintiffs had to prove that Clear Channel's monopoly from 2000 to 2006 led to higher ticket prices.[267] The court faulted the model for assuming that differences in the quality of the product did not affect ticket price; the failure to account for lawful price differences was similarly recognized in *American Booksellers*.[268] The court also faulted the model for ignoring the increase in ticket prices in 1999, before the monopoly period; a similar contradiction by the record was key in *Concord Boats*.[269] In short, the problems related to poor argumentation and poor evidentiary support; therefore, the analysis and results were the same as if *Joiner* and *Kumho Tire* applied.

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[263] S. Pac. Comms. Co. v. Am. Tel. & Tel. Co., 556 F. Supp. 825, 1098 (D.D.C. 1982) (calling the damages estimate "based on pure speculation or guesswork"); Kenford Co. v. Cty. of Erie, 489 N.Y.S.2d 939, 944–45 (App. Div. 1985) (calling the assumption "speculative as a matter of law"); Kenford Co. v. Cty. of Erie, 493 N.E.2d 234, 236 (N.Y. 1986) (writing that the "multitude of assumptions . . . require speculation and conjecture").

[264] Schonfeld v. Hilliard, 218 F.3d 164, 173–74 (2d Cir. 2000).

[265] Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp.., 103 F. Supp. 2d 268, 284 (S.D.N.Y. 2000).

[266] *In re* Live Concert Antitrust Litig., 863 F. Supp. 2d 966, 974 (C.D. Cal. 2012); *In re* REMEC Inc. Secs. Litig., 702 F. Supp. 2d 1202, 1274 (S.D. Cal. 2010).

[267] 863 F. Supp. 2d at 969.

[268] *Compare id.* at 978–79, *with* Am. Booksellers Ass'n v. Barnes & Noble, Inc., 135 F. Supp. 2d 1031, 1040–41 (C.D. Cal. 2001).

[269] *Compare Live Concert*, 863 F. Supp. 2d at 980, *with* Concord Boat Corp. v. Brunswick Corp., 207 F.3d 1039, 1056 (8th Cir. 2000).

The main impact of *Bazemore* seems to be that courts scrutinize not only assumptions of inclusion but also assumptions of exclusion, about what the expert thinks is and is not worthy of attention.[270] A corresponding takeaway for practitioners is that, "when faced with an opposing expert who has done a regression study, one should find out how the expert decided on the variables he included."[271] Opponents therefore need not attack the statistical problems of the regression analysis because they can attack the expert's reasoning, or more precisely, lack of reasoning and foundation, as in the model in *REMEC*. Indeed, that court did not even refer to omitted variable bias but instead criticized the expert for making "no attempt" to "establish that other major factors have been accounted for . . . aside from his assertion/assumption that company-specific information is the only major factor."[272] In short, the court did not rest its holding upon statistical assumptions but upon the lack of support for the econometrician's choices.[273]

Finally, Rule 403 provides a basis for excluding economic models. This rule allows courts to exclude evidence where the probative value is substantially outweighed by "unfair prejudice, confusing the issues, [or] misleading the jury."[274] These dangers often arise in sophisticated economic models, especially those based on regression analysis. "An inescapable feature of economic or financial testimony is that even slight changes of a few peripheral assumptions lead to substantial differences in valuation estimates."[275] Further, "[b]ecause of its power and complexity, multiple regression analysis also carries a significant risk of misleading the courts if its assumptions are not met and it is not used properly."[276] Though Rule 403 might support exclusion, courts need not necessarily rely upon it; after all, the court that cited it, *Three Crown*, was decided after *Daubert* but before *Joiner* and *Kumho Tire*.[277] The problematic assumptions—conjecturing without support that parties and markets would have behaved a certain way but for the defendant's acts—were

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[270] *See* Goodstein, *supra* note 47, at 40 (characterizing the hypothesis as a "prejudice" based upon "having some reason to choose what is and is not worth observing").

[271] Fisher, *supra* note 14, at 715.

[272] *In re* REMEC Inc. Secs. Litig., 702 F. Supp. 2d 1202, 1273 (S.D. Cal. 2010).

[273] *Id.* at 1274 (similarly, the court noted a potential problem of multicollinearity, but it did not engage in an analysis of it as a statistical problem).

[274] FED. R. EVID. 403.

[275] Kenton K. Yee, *Dueling Experts and Imperfect Verification*, 28 INT'L REV. OF L. & ECON. 246, 246 (2008).

[276] Hill et al., *supra* note 1, at 352.

[277] Three Crown Ltd. P'ship v. Salomon Bros., 906 F. Supp. 876, 894 (S.D.N.Y. 1995).

similar to those in the later case *Johnson Electric*, which does rely on the *Daubert* trilogy.[278]

C. *The Irony of Sophistication: The Greater Power of Economic Models Requires Additional Assumptions That Weaken Their Defensibility*

Despite being relatively straightforward, the calculation of damages in some yardstick cases that predate *Daubert* resulted in plaintiffs losing because of a single inapposite comparison to a company or market.[279] As the complexity of the damages calculations has increased, so has the number of assumptions "about the plaintiff, the defendant, the markets in which they operate, and other related and uncertain future conditions."[280] This results in an irony: the power of models built upon sophisticated techniques like regression analysis to control for numerous factors becomes a weakness when each additional assumption has the potential to be dubious.

Without a basis in reason or evidence, a single assumption can doom even the most sophisticated model. In *American Booksellers*, the court ruled that, even if the model were admissible to prove causation, summary judgment was proper for online retailers because the assumption that they were similar to the onsite plaintiffs could not be supported.[281] The *Kenford* court ruled that damages for the value of land purchased near a proposed stadium must be based on the raw land because the assumption that the land would have been developed could not be supported.[282] Other courts suggest that a particularly dubious assumption could control the outcome, even though other aspects of the model were also problematic. For example, the only assumption faulted by the *REMEC* court was that company-related press releases and no other factors resulted in damages, even though that court also mentioned a failure to account for a potential multicollinearity issue.[283]

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[278] Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp., 103 F. Supp. 2d 268, 283–84, 287 (S.D.N.Y. 2000).

[279] *E.g.*, Home Placement Serv., Inc. v. Providence Journal Co., 819 F.2d 1199, 1205–09 (1st Cir. 1987) (rejecting comparison between different offices of the same company because of differences in the markets in which they operate).

[280] Tracer, *supra* note 5, at 821.

[281] Am. Booksellers Ass'n v. Barnes & Noble, Inc., 135 F. Supp. 2d 1031, 1042 (C.D. Cal. 2001).

[282] Kenford Co. v. Cty. of Erie, 489 N.Y.S.2d 939, 944–45 (App. Div. 1985); *but see* Kenford Co. v. Cty. of Erie, 493 N.E.2d 234, 236 (N.Y. 1986) (characterizing the multiple proposed developments on that land as a "multitude of assumptions").

[283] *In re* REMEC Inc. Secs. Litig., 702 F. Supp. 2d 1202, 1273–74 (S.D. Cal. 2010).

Sometimes a model has several dubious assumptions of a particular type, like the two unrealistic assumptions about timing and foreign sales in *Johnson Electric*.[284] But problems in a model are not constrained to the category of unreasonable comparisons, unfounded omissions, or unrealistic scenarios. Part IV, discussed above, segregated dubious assumptions into three categories for ease of explanation, but the same model can suffer from two or all three of these problems. The *American Booksellers* court listed multiple instances where the model failed to account for relevant factors (Category 2), but it also held that the record did not support the expert's assumption that online and onsite book retailers were comparable (Category 1).[285] The expert in *Schonfeld* made unrealistic projections about the growth of its business and response from consumers (Category 3), but the court found those projections unrealistic because of the tacit comparison between American and British television viewers (Category 1).[286] The experts for Southern Pacific Communications Company had numerous unsupportable and unrealistic assumptions about how the company would have grown (Category 3), but one specific problem was ignoring the inconvenient fact that the largest purchaser of fixed lines had a sole-source policy that would have limited growth (Category 2).[287] Accordingly, attorneys should prepare for the admission of expert testimony involving economic models by reference to the three types of dubious assumptions. These can serve as a checklist for proponents to avoid vulnerable points in the model; they also arm opposing counsel with multiple weapons of precise attack so that a single successful strike can result in the entire model being excluded.

Sometimes, the model need not have any overtly dubious assumptions to fail. Commentators recognize that some assumptions are open to dispute. If the expert and the opponent disagree on a single assumption, such as whether a variable is necessary, then the issue is one of probity so that the court should admit the testimony and allow the jury to resolve the matter.[288] Where an expert makes many disputable assumptions, however, courts will rule as a matter of law that the model itself is dubious. One commentator writes that courts view models like

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[284] Johnson Elec. N. Am. Inc. v. Mabuchi Motor Am. Corp., 103 F. Supp. 2d 268, 284 (S.D.N.Y. 2000).

[285] *See supra* text accompanying notes 161–69.

[286] *See supra* text accompanying notes 221–27.

[287] *See supra* text accompanying notes 203–09.

[288] David L. Faigman, Christopher Slobogin, & John Monahan, *Gatekeeping Science: Using the Structure of Scientific Research to Distinguish Between Admissibility and Weight in Expert Testimony*, 110 NW. U. L. REV. 859, 865–66 (2016) (noting that disputes over key variables in a regression analysis should go to the jury rather than be excluded by the judge).

that in *Lithuanian Commerce Corp.* with "extreme skepticism" because of the "cumulative effect" of the numerous assumptions.[289] In that case, and others like *Three Crown*, the courts did not identify a single assumption as particularly problematic; instead, the accumulation of unsupported assumptions weakened the force of the conclusions to the point that they were speculative.[290]

VI. CONCLUSION AND RECOMMENDATIONS

This article builds upon earlier works to describe assumptions underlying the construction of econometric models and how problems with argumentation and evidence can render expert testimony inadmissible. The reasoning and the results are the same whether in federal or state court. Federal courts rely upon *Joiner* and *Kumho Tire* rather than *Daubert* and its factors, though they also turn to pre-*Daubert* authority about speculation, authority that mirrors the rationales of state opinions. Notably, the increased power of sophisticated models to control for more variables means that they must rely upon more assumptions, thus weakening the model. Also, though courts cite to problems arising from the violation of regression assumptions like omitted variable bias, those courts excluded expert testimony not because of statistical problems but because of poor choices in model construction.

While the article provides some answers, it also suggests new questions for additional research. For example, this article has identified dubious assumptions based on a positive analysis of how courts have ruled but has stopped short of establishing comprehensive normative guidelines for how they should rule. Often the decision to exclude testimony is straightforward, as when the assumption is contradicted by the record or the expert does not have an explanation for a challenged assumption. When assumptions are merely questionable, however, courts may be confusing legal grounds by ruling the expert testimony inadmissible when they are actually evaluating the sufficiency of that testimony—and potentially invading the province of the jury by considering the weight of that evidence.[291] One focus for future articles could be better clarity about

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[289] Lloyd, *supra* note 6, at 402, 409.

[290] *See* Three Crown Ltd. P'ship v. Salomon Bros., 906 F. Supp. 876, 894 (S.D.N.Y. 1995) (recognizing the "numerous assumptions without the type of support required under the case law").

[291] Green & Sanders, *supra* note 4, at 1079 (writing that courts sometimes blur the distinction between admissibility and sufficiency); *see also* Allensworth, *supra* note 2, at 864 (arguing that courts sometimes let "the perfect be the enemy of the good" by excluding too many models that, while not perfect, are nevertheless valid); Casey & Simon-Kerr, *supra* note 1, at

assumptions and the distinctions among admissibility, sufficiency, and weight.

Also, we concluded that attorneys can attack even the most sophisticated models by doing what they are trained to do: targeting the expert's arguments and the model's fit with other evidence. However, many cases involve multiple models constructed by opposing experts.[292] Consider *In re Emerging Communications, Inc. Shareholder's Litigation*, where each side submitted a model based on different assumptions and therefore widely different damages estimates, so the battle of the experts boiled down to a battle of assumptions.[293] Additional articles could explore assumptions in such multi-expert situations and what role argumentation and evidence play in resolving that battle.

This article also focused on valuation models in complex commercial litigation because economic models are frequently employed to prove damages in cases like antitrust, because more assumptions flow from the requirement of establishing remedies by constructing a hypothetical but-for world, and because several articles deal with damages models.[294] Economic models serve other purposes in litigation, such as proving discrimination or establishing the requirements for class certification. These models also rely on assumptions. For example, one recent article on economic models in discrimination cases discusses a model that was faulty because of its assumptions, unsupported conclusions, and omitted variables.[295] In *In re Graphics Processing Units Antitrust Litigation*, the court declined to grant a certification motion based in part on the expert "assum[ing] that there is a common set of factors that impacted each transaction between defendants and each particular direct purchaser," thus leading to conclusory statements because of the omission of factors like performance, features, and customization of different products.[296] Exploring more non-remedies cases could reveal a different understanding of assumptions, additional types of dubious assumptions, and varying levels of tolerance courts have for questionable assumptions.

1181–82 (equating complex valuation based on expert testimony with "run-of-the-mill fact-finding").

[292] *See* Dale B. Thompson, *Valuing the Environment: Courts' Struggles with Natural Resource Damages*, 32 ENVTL. L. 57, 77 (2002).

[293] No. Civ. Action 16415, 2004 WL 1305745, at *40–41 (Del. Ch. May 3, 2004).

[294] *E.g.*, Allensworth, *supra* note 2; Casey & Simon-Kerr, *supra* note 1; Hill et al., *supra* note 1; Lloyd, *supra* note 6.

[295] Joni Hersch & Blair Druhan Bullock, *The Use and Misuse of Econometric Evidence in Employment Discrimination Cases*, 71 WASH. & LEE L. REV. 2365, 2413 (2014) (citing Franklin v. Local 2 of the Sheet Metal Workers Int'l Ass'n, 565 F.3d 508 (8th Cir. 2009)).

[296] 253 F.R.D. 478, 495–96 (N.D. Cal. 2008).

Besides the case law and Federal Rules of Evidence, this article has drawn primarily from commentary written by legal academics or, when by economists, written for legal academics.[297] Our conclusions are therefore limited to assumptions as understood in the field of law. Economists writing for each other have engaged in a multi-decade debate about the necessity of realism in assumptions, a debate that continues today.[298] Interdisciplinary study comparing and contrasting assumptions as perceived in the economics and in legal literature could provide invaluable insight for both fields.

Finally, this article combined a summary of cases with academic commentary to explain what assumptions are, to identify when they are dubious, and to justify excluding expert testimony based upon them. Future articles might examine these conclusions through more in-depth analyses of specific economic models.[299] By showing how assumptions work in the construction and application of economic models in litigation, scholars can assist the bench and bar not only to acquire the *lingua franca* of economics but also to speak it as a necessary part of modern law practice.[300]

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[297] *E.g.*, Fisher, *supra* note 14, at 702 (economist publishing in law review); Rubinfeld, *supra* note 8, at 303 (economist writing chapter for litigation reference guide); *see also* SCHLEFER, *supra* note 9, at xiv (acknowledging that his book about economic models has "no mathematical requirements" for the reader).

[298] *See, e.g.*, Yew-Kwang Ng, *Are Unrealistic Assumptions/Simplifications Acceptable? Some Methodological Issues in Economics*, 21 PAC. ECON. REV. 180, 180–82 (2016) (citing, *inter alia*, Milton Friedman, *The Methodology of Positive Economics*, *in* ESSAYS IN POSITIVE ECONOMICS 3 (1953)).

[299] For an example of one article with a detailed explication of the damages expert's model in an antitrust case, see Kaye, *supra* note 2, at 1988–2013.

[300] *See* Allensworth, *supra* note 2, at 876–77 (calling the notion of law as a "humanities subject" eroding because modeling based on statistics and economics is the "new lingua franca" and thus essential to judging); Casey & Simon-Kerr, *supra* note 1, at 1215 (writing that a problem with scientific evidence is whether "the attorneys involved . . . understand the science well enough to discredit tenuous claims").