

## HOW ANTITRUST DAMAGES MEASURE UP WITH RESPECT TO THE *DAUBERT* FACTORS

### INTRODUCTION

Imagine a defendant standing trial for burglary. However, no photographs of the crime scene are presented. No fingerprints have been recovered. None of the stolen articles have been found. Instead, the prosecution seeks to demonstrate guilt by throwing the defendant in a pool of water to see if he floats, a sure sign of guilt.<sup>1</sup> The defense presents an expert witness who testifies that in the second millennium, science has rejected trial by ordeal as irrational and points to several scientific articles.<sup>2</sup> However, after the prosecution cites a string of witch trial cases in which courts approved the water evidence,<sup>3</sup> the court allows the defendant to be thrown in the water and the results admitted as evidence.

This hypothetical example shows an absurd result caused by a court that favored previous judicial decisions over current scientific testimony in the determination of whether scientific test results were admissible. *Daubert v. Merrell Dow Pharmaceuticals* recognized the importance of having courtroom scientific techniques keep pace with modern scientific developments.<sup>4</sup> While Rule 702 and *Daubert* require that courts evaluate scientific evidence and expert testimony according to certain criteria,<sup>5</sup> once a technique has been evaluated, many courts cite determinations made in previous cases as precedent.<sup>6</sup> However, time and the progress of science can draw these cases into conflict because previously upheld methods may subsequently fail to conform to the *Daubert* factors as the methods become obsolete in the scientific community.

This comment proposes that the solution for harmonizing the rulings is to construe the acceptance of scientific techniques as factual rather than

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<sup>1</sup> Trial by ordeal was driven by the belief that God would intervene in the administration of certain tests to produce certain results. Being thrown in water and sinking was a sign of innocence, whereas floating was believed to indicate guilt. In reality, the results themselves determined the verdict rather than being presented as evidence to a jury. BLACK'S LAW DICTIONARY 1129 (8th ed. 2004).

<sup>2</sup> See *id.*; John D. Jackson, *Making Juries Accountable*, 50 AM. J. COMP. L. 477, 490 (2002).

<sup>3</sup> See BLACK'S LAW DICTIONARY 1129 (8th ed. 2004).

<sup>4</sup> *Daubert v. Merrell Dow Pharms.*, 509 U.S. 579, 593-94 (1993).

<sup>5</sup> *Id.*; see *infra* Part I.

<sup>6</sup> Simon A. Cole, *Grandfathering Evidence: Fingerprint Admissibility Rulings from Jennings to Llera Plaza and Back Again*, 41 AM. CRIM. L. REV. 1189, 1238-1239 (2004); See, e.g. cases cited *infra* note 255-65.

legal findings.<sup>7</sup> By construing acceptability of methods as factual findings, the methods will be allowed to change as scientific advances are made. By construing acceptability as legal precedent, courts will be bound to what will eventually become outdated methods. To avoid this outcome will require that courts do two things. First, courts need to reject methods as they become outdated. Second, courts need to accept new methods as they become available and widely accepted in the field.

While the acceptability of scientific evidence has not stagnated to the point of allowing old witch trial methods, this comment shows that one area in which stagnation has become problematic is in antitrust damage calculation. By analyzing the problem and solutions through the lens of this body of law, the difficulty that courts have had in discarding outdated methods and adopting modern methods will become apparent. Part I describes Rule 702, *Daubert*, and its predecessor: *Frye v. United States*. Part II defines and describes the most common methods of antitrust damage calculation: Before and After, Yardstick, and Market Share, and shows how they have been applied. Part III describes how econometricians and statisticians deal with two of the *Daubert* factors: reducing and controlling error, and ensuring falsifiability of hypotheses. Part IV evaluates how well the Before and After and Yardstick methods now conform to *Daubert*, concluding that they are no longer appropriate. Part V describes the status of regression analysis as an alternative in estimation, to determine how often it is applied and how well courts accept it, before subjecting regression to the same *Daubert* analysis as applied to the other techniques, and showing that it generally, currently conforms to *Daubert*.<sup>8</sup> Part VI demonstrates the reluctance of courts to adapt when new methods become available—citing prior case law instead of applying the *Daubert* factors. I conclude that courts should construe prior acceptance of methods as factual findings rather than legal precedent.

## I. REQUIREMENTS FOR ADMISSIBILITY OF SCIENTIFIC EVIDENCE

Rule 702 of the Federal Rules of Evidence states that scientific knowledge may be offered into evidence through a witness qualified as an expert “if (1) the testimony is based upon sufficient facts or data, (2) the testimony

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<sup>7</sup> An example of the legal status that a finding regarding a scientific method can take is in *United States v. Baller*, 519 F.2d 463, 465-66 (4th Cir. 1975), in which the court describes a split in the circuits regarding the admissibility of spectrogram evidence.

<sup>8</sup> While regression is not the only available modern statistical tool, it is one of the most widely used and accepted. It is the most efficient unbiased estimator. See WILLIAM H. GREENE, *ECONOMETRIC ANALYSIS* 109 (4th ed. 2000).

is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.”<sup>9</sup> However, courts have frequently struggled with the admission of expert testimony because the reliability of that testimony is difficult for courts to monitor.<sup>10</sup> In *Daubert v. Merrell Dow Pharmaceuticals*, the Supreme Court established the following guidelines for evaluating the second prong of Rule 702: reliability of scientific methods. Under these guidelines, courts must consider: whether the method tests a hypothesis that can be falsified, the potential or known error rate and whether the technique has a way to estimate or control that error, whether the technique has been subjected to peer review and publication, and whether it is generally accepted in the field.<sup>11</sup> Before the 1993 *Daubert* decision, *Frye v. United States* set forth a standard of general acceptance in the relevant academic field.<sup>12</sup> Under *Frye*, “the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.”<sup>13</sup> This standard was subsequently adopted by various district courts and Courts of Appeal in the Second through Tenth Circuits.<sup>14</sup> However, in both the *Frye* and *Daubert* eras, the rules set forth have often been ignored in favor of approving scientific methods that prior cases have supported, essentially treating this prior support as case law.<sup>15</sup> If courts look to old cases, they will be bound to old methods, which is contrary to the principles set forth in *Frye* and *Daubert*.

## II. DEFINITIONS AND HISTORIES OF THE APPROACHES IN ANTITRUST DAMAGE CALCULATION

Antitrust damage estimation is one area of law wherein courtroom statistical evidence has failed to keep pace with statistical advances in the

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<sup>9</sup> FED. R. EVID. 702.

<sup>10</sup> See, e.g., *Baller*, 519 F.2d at 466 (describing the difficulty of cross-examination of experts, the apparent objectivity of expert testimony, and the undue weight that it might carry with the jury).

<sup>11</sup> *Daubert*, 509 U.S. at 593-94.

<sup>12</sup> *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923). See also *Daubert*, 509 U.S. at 585 (stating that *Frye* had been the dominant standard for the previous seventy years).

<sup>13</sup> *Frye*, 293 F. at 1014.

<sup>14</sup> See, e.g., *United States v. Williams*, 443 F. Supp. 269, 270 (D.N.Y. 1977); *United States v. Sample*, 378 F. Supp. 44, 52 (D. Pa., 1974); *Baller*, 519 F.2d at 465-66; *United States v. Grant*, 473 F. Supp. 720, 723 (D.S.C. 1979); *Christophersen v. Allied-Signal Corp.*, 939 F.2d 1106, 1110 (5th Cir. 1991); *United States v. Brown*, 557 F.2d 541, 556 (6th Cir. 1977); *United States v. Tranowski*, 659 F.2d 750, 755-56 (7th Cir. 1981); *United States v. Alexander*, 526 F.2d 161, 163-64 (8th Cir. 1975); *United States v. Solomon*, 753 F.2d 1522, 1526 (9th Cir. 1985); *United States v. Smith*, 776 F.2d 892, 898 (10th Cir. 1985).

<sup>15</sup> See, e.g., cases cited *infra* notes 255-65.

field. Section Four of the Clayton Act provides that “any person who shall be injured in his business or property by reason of anything forbidden in the antitrust laws . . . shall recover threefold the damages by him sustained, and the cost of suit, including a reasonable attorney's fee.”<sup>16</sup> While plaintiffs are entitled to compensation for those losses that they can prove through reasonably competent evidence,<sup>17</sup> damages can not be based on mere speculation.<sup>18</sup> The damages must also be of the type that the claimed illegal violations would be likely to cause.<sup>19</sup> For example, evidence that the injury follows from the illegal conduct may include proportionality between the extent of the illegal conduct and the degree of injury.<sup>20</sup> Particularly because any error in the damage calculation is multiplied by three, it is very important to determine damages as accurately as possible.

Calculation of damages in antitrust suits can depend heavily on the estimates offered by experts in econometrics.<sup>21</sup> The two most widely employed techniques for measuring antitrust damages are called “Before and After” and “Yardstick.”<sup>22</sup> The “Market Share” approach is less widely used and will be described, but since it is a combination of the Before and After and Yardstick methods, a separate analysis would be somewhat redundant.<sup>23</sup> While these techniques were developed between the 1920s and 1940s and were found acceptable then, this comment argues that they are now used improperly pursuant to *Daubert*, and before *Daubert*, they were often used improperly pursuant to *Frye*. This section begins with a description of the Before and After approach, then proceeds to describe the Yardstick approach, and concludes with a description of the Market Share approach.

#### A. *The Before and After Approach*

This technique uses information regarding the level of profits before the anti-competitive behavior occurred to estimate the profits that would

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<sup>16</sup> 15 U.S.C.S. § 15 (2004).

<sup>17</sup> *Eastman Kodak Co. v. S. Photo Materials Co.*, 273 U.S. 359, 376-77 (1927).

<sup>18</sup> *Id.* at 379.

<sup>19</sup> *Brunswick v. Pueblo Bowl-O-Mat Inc.*, 429 U.S. 477, 489 (1977).

<sup>20</sup> Roger D. Blair & William H. Page, *The Role of Economics in Defining Antitrust Injury and Standing*, 17 *MANAGERIAL AND DECISION ECONOMICS* 127, 128-29 (1996).

<sup>21</sup> *Webb v. Utah Tour Brokers Ass'n*, 568 F.2d 670, 678 (10th Cir. 1977).

<sup>22</sup> *Park v. El Paso Bd. of Realtors*, 764 F.2d 1053, 1068 (5th Cir. 1985).

<sup>23</sup> See generally, Michele Molyneaux, *Quality Control of Economic Expert Testimony: The Fundamental Methods of Proving Antitrust Damages*, 35 *ARIZ. ST. L.J.* 1049, 1065. The going concern approach will not be discussed since it is based more in accounting than in statistics. See *id.* (measuring the value of the business before the conduct as the assets plus the present value of its profits).

have been earned during the period of injury if the behavior had not occurred.<sup>24</sup> The approach is somewhat limited because it assumes that profits would have remained unchanged but for the anticompetitive behavior.<sup>25</sup> This means that nothing else would have changed to affect profits. In most cases, the plaintiff must show success in sales of the same product, in the same market, for a substantial period of time,<sup>26</sup> which is often several months.<sup>27</sup> This is a very limiting assumption because many things can change over the life of a business.<sup>28</sup> For example, new technology can emerge that makes the older technology partially or wholly obsolete. The neighborhood demographics near a retail business might change, or a new chief executive officer may affect profits.<sup>29</sup> Particularly with a new business, there may be a period of adjustment and growth before the business reaches a mature stage.<sup>30</sup> To overcome these concerns, the plaintiff may present testimony consisting of economic theory showing that the defendant's illegal acts would be expected to cause damage.<sup>31</sup> This may lower the burden for showing actual injury.<sup>32</sup> While a plaintiff need not exclude all possible alternative sources of harm,<sup>33</sup> even strong theoretical tendencies that the defendant's behavior caused the harm may be undermined by evidence of other possible causes of the plaintiff's demonstrated decline in profits.<sup>34</sup>

The Before and After method gained acceptance in *Eastman Kodak Co. v. Southern Photo Materials Co.*,<sup>35</sup> and is primarily used in overcharge and foreclosure cases.<sup>36</sup> Overcharge cases involve damage incurred either from purchasing at a monopoly price, purchasing a tied product, or selling at a monopsony price.<sup>37</sup> Foreclosure cases involve firms that engage in ex-

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<sup>24</sup> Molyneaux, *supra* note 23, at 1056.

<sup>25</sup> Roger D. Blair & William H. Page, "Speculative" Antitrust Damages, 70 WASH. L. REV. 423, 437-38 (1995).

<sup>26</sup> Amerinet Inc. v. Xerox Corp., 972 F.2d 1483, 1498 (8th Cir. 1992).

<sup>27</sup> Blair & Page, *supra* note 25, at 445.

<sup>28</sup> See generally BRADFORD CORNELL, CORPORATE VALUATION: TOOLS FOR EFFECTIVE APPRAISAL AND DECISIONMAKING, 56-143 (1993).

<sup>29</sup> See *id.* at 124 (listing many things that IBM misjudged upon release of the PS/2).

<sup>30</sup> See generally *id.* at 56-143.

<sup>31</sup> Blair & Page, *supra* note 25, at 440.

<sup>32</sup> *Id.*

<sup>33</sup> Zenith Radio Corp. v. Hazeltine Research, 395 U.S. 100, 114 n.9 (U.S. 1969).

<sup>34</sup> Bigelow v. RKO Radio Pictures, 327 U.S. 251, 264 (1946).

<sup>35</sup> Eastman Kodak Co. v. S. Photo Materials Co., 273 U.S. 359, 379 (1927).

<sup>36</sup> Molyneaux, *supra* note 23, at 1052.

<sup>37</sup> *Id.* A monopsony is a market situation consisting of many sellers but only one buyer. See <http://www.websters-online-dictionary.org/definition/monopsony> (last visited July 20, 2005).

clusive dealing such as refusals to deal, tying of products, and non-price restraints.<sup>38</sup>

### 1. Overcharge

*Eastman Kodak Co. v. Southern Photo Materials Co.* is one example of an overcharge case.<sup>39</sup> The plaintiff was a retailer of photography supplies.<sup>40</sup> The defendant was a manufacturer of photography supplies, who had been engaged in the purchasing of retail businesses, and had established a dominant presence in the area.<sup>41</sup> The plaintiff complained that upon his refusal to sell the business to the defendant, the defendant would no longer sell its products to the retailer at other than retail prices.<sup>42</sup> This effectively made the plaintiff unable to sell his wares for prices that would compete with the defendant's retail shops.<sup>43</sup>

*Eastman Kodak* addressed the concern that exact damages are difficult to determine.<sup>44</sup> The Court allowed circumstantial evidence of damages so that the defendant would not profit by his misconduct.<sup>45</sup> The Court found that the plaintiff's business over the previous four years had been well established and inferred that profits during the period of injury would have been the same as they were before the period of injury.<sup>46</sup>

### 2. Foreclosure

*Independence Tube Corp. v. Copperweld Corp.* is an example of a foreclosure case.<sup>47</sup> This dispute involved the Corporate Secretary of a steel tube company who sought to resign and establish his own corporation.<sup>48</sup> However, the plaintiff's former employer wanted to prevent the plaintiff from competing in a different firm.<sup>49</sup> Since there was no non-compete agreement, the defendant sent letters to the plaintiff company's suppliers,

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<sup>38</sup> Molyneaux, *supra* note 23, at 1052-53.

<sup>39</sup> *Eastman Kodak Co.*, 273 U.S. at 368.

<sup>40</sup> *Id.* at 368.

<sup>41</sup> *Id.* at 368-69.

<sup>42</sup> *Id.*

<sup>43</sup> *Id.* at 368.

<sup>44</sup> *Id.* at 379.

<sup>45</sup> *Eastman Kodak Co.*, 273 U.S. at 379.

<sup>46</sup> *Id.* at 378-79.

<sup>47</sup> *Independence Tube Corp. v. Copperweld Corp.*, 691 F.2d 310 (7th Cir. 1982), *rev'd on other grounds sub nom. Copperweld Corp. v. Independence Tube Co.*, 467 U.S. 752 (1984).

<sup>48</sup> *Id.* at 313-14.

<sup>49</sup> *Id.* at 314.

expressing that it would take all necessary action to protect its trade secrets.<sup>50</sup> This caused suppliers to cancel contracts, which delayed the plaintiff company's opening.<sup>51</sup>

The court decided two issues with respect to the expert testimony. First, the plaintiff offered testimony from a University of Chicago professor of business.<sup>52</sup> The defense objected that the professor was not qualified because he was not a professor of economics.<sup>53</sup> The court ruled that the professor was qualified, distinguished, and had published widely in the fields of econometrics and statistics.<sup>54</sup> It was not required that the professor's office be in any particular department.<sup>55</sup> Second, the court ruled that the professor's use of data during the undamaged period to determine what profits would have been during the damage period was an accepted way to arrive at an estimate of lost profit.<sup>56</sup>

This case shows that it is irrelevant whether the undamaged reference period occurred before or after the damaged period. Since the business had been delayed in opening for nine months, there was no "Before" reference.<sup>57</sup> Therefore, the economist analyzed both market conditions during the damage period and the plaintiff's growth rate after the anticompetitive conduct had ended in order to estimate what the plaintiff would have earned during the damage period.<sup>58</sup>

### B. *The Yardstick Approach*

The Yardstick approach estimates the plaintiff's lost profits as the plaintiff's actual profits subtracted from the profits of a substantially similar business.<sup>59</sup> The advantage of this approach is that it does not assume that occurrence of the anti-competitive conduct was the only thing that changed. In addition, it allows damage calculations where the plaintiff alleges the inability to enter the market or otherwise has no suitable prior history of its business to provide a foundation for damages.<sup>60</sup> Where the plaintiff has not yet entered the market, he must prove that he intended to enter it and was

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<sup>50</sup> *Id.*

<sup>51</sup> *Id.*

<sup>52</sup> *Id.* at 329-30.

<sup>53</sup> *Independence Tube Corp.*, 691 F.2d at 329-30.

<sup>54</sup> *Id.*

<sup>55</sup> *Id.* at 330.

<sup>56</sup> *Id.*

<sup>57</sup> *Id.* at 328.

<sup>58</sup> *Id.* at 330.

<sup>59</sup> See Molyneux, *supra* note 23, at 1053.

<sup>60</sup> Blair & Page, *supra* note 25, at 451.

prepared to do so.<sup>61</sup> A showing of preparedness can include prior experience in the industry, financial preparedness, and the taking of actual steps to effect entry.<sup>62</sup> Therefore, the plaintiff can obtain relief even where market or firm conditions changed substantially, as long as the plaintiff can find the profits of another firm with similar characteristics in a similar market.

In 1946, the Supreme Court accepted this technique in *Bigelow v. RKO Radio Pictures*.<sup>63</sup> The plaintiff owned a movie theater and complained that the defendant distributor was engaging in anti-competitive conduct by distributing films to different theaters at different times.<sup>64</sup> The theaters getting to show films first were able to charge more by the exclusion of competitors.<sup>65</sup> The plaintiff claimed to have been injured by the practice because his theater did not have a good place in the showing order.<sup>66</sup>

The plaintiff theater's profits were subtracted from those of a theater that had a better slot in the release schedule.<sup>67</sup> The plaintiff also offered evidence regarding the theater's profits in a preceding period, using the Before and After method.<sup>68</sup> The jury verdict was for an amount between these figures and the Court ruled that the jury could use figures derived from both methods to inform its decision.<sup>69</sup>

A plaintiff may not estimate lost profits based on profits of another firm or firms without identifying the comparable factors in the firm or firms used.<sup>70</sup> In *William Inglis & Sons Baking Co. v. Continental Baking Co.*, the testifying expert sought to base profit estimates on the average profits of other baking companies, particularly those in the region.<sup>71</sup> The court determined that without outlining specific similarities between the plaintiff company and those surveyed, the results were merely speculative.<sup>72</sup>

One very common problem with the Yardstick approach is that it is impossible to find an exactly identical business on which to base a damage assessment. Courts are then left with the unenviable task of deciding how close is close enough and which differences are material. If there is no

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<sup>61</sup> Hecht v. Pro-Football, Inc., 570 F.2d 982, 994 (D.C. Cir. 1977).

<sup>62</sup> *Id.*

<sup>63</sup> See *Bigelow v. RKO Radio Pictures*, 327 U.S. 251 (1946).

<sup>64</sup> *Id.* at 254.

<sup>65</sup> *Id.* at 247.

<sup>66</sup> *Id.* at 254.

<sup>67</sup> *Id.* at 257-58.

<sup>68</sup> See *Bigelow*, 327 U.S. at 257-58.

<sup>69</sup> *Id.* at 260.

<sup>70</sup> *William Inglis & Sons Baking Co. v. Continental Baking Co.*, 942 F.2d 1332, 1341 (9th Cir. 1991).

<sup>71</sup> *Id.* (using a yardstick method to evaluate the business' going concern value, which is the value it could have sold for before the unlawful behavior).

<sup>72</sup> *Id.*

comparable yardstick firm, the plaintiff may be left with no remedy.<sup>73</sup> For example, in *Home Placement Service*, where Homefinder used its own Nashville office as a yardstick for damages at its Providence franchise, the court concluded that this failed to take into account different regional rental patterns, unemployment, colleges, and summer rentals.<sup>74</sup> Here, although the plaintiff alleged that these offices had similar seasonal patterns, prices, and were both Homefinder establishments, and the defendant did not offer evidence that they were not comparable, the court determined that the burden of proof for comparability rested with the plaintiff and that Homefinder had not met this burden.<sup>75</sup> Therefore, while the Yardstick approach may be useful where there is no history available for a Before and After analysis, there may still be circumstances in which neither of these approaches will allow recovery. For example, recovery will be impossible where there is no history of the firm before the damage period and where there is no sufficiently comparable company.

### C. *The Market Share Approach*

The Market Share approach allows relaxation of some of the assumptions of the Before and After and Yardstick approaches by borrowing aspects of each. Under the Market Share Approach, the plaintiff calculates lost market share caused by the defendant's antitrust violations and then determines the corresponding lost output and the resulting loss of profit.<sup>76</sup> For example, the expert in *Heattransfer Corp. v. Volkswagenwerk, A.G.* used this approach.<sup>77</sup> Here, the plaintiff, Heattransfer, was a manufacturer of Volkswagen air conditioning units.<sup>78</sup> Originally, the plaintiff controlled 65% of the sales of units to dealerships. However, after Volkswagen acquired both the plaintiff's main competitor and the plaintiff's distributor,<sup>79</sup> it implemented an illegal tying scheme.<sup>80</sup> Heattransfer alleged that these actions caused its market share to drop to 37%.<sup>81</sup> Although Heattransfer

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<sup>73</sup> See Molyneaux, *supra* note 23, at 1054-55 (2003) (stating that the largest obstacle in using the Yardstick method is finding a comparable yardstick); see also *Eastman Kodak Co. v. S. Photo Materials Co.*, 273 U.S. 359, 379 (1927) (stating that while results need not be proven to a mathematical certainty, they must not be speculative).

<sup>74</sup> *Home Placement Serv., Inc. v. Providence Journal Co.*, 819 F.2d 1199, 1207 (1st Cir. 1987).

<sup>75</sup> *Id.*

<sup>76</sup> Molyneaux, *supra* note 23, at 1061.

<sup>77</sup> *Heattransfer Corp. v. Volkswagenwerk, A.G.*, 553 F.2d 964, 984-85 (5th Cir. Old 1977).

<sup>78</sup> *Id.* at 973.

<sup>79</sup> *Id.* at 974.

<sup>80</sup> *Id.* at 979.

<sup>81</sup> *Id.*

sought out other markets for its product, it was not successful and went out of business.<sup>82</sup>

Heattransfer sued for antitrust damages, measured with the Market Share method.<sup>83</sup> The plaintiff's expert economist offered testimony, accepted by the Fifth Circuit, that involved a projection of units that would have been sold, under the assumption that the plaintiff's market share would have remained the same during the damage period as it had been before.<sup>84</sup> The court concluded that this assumption was not speculative because the main competitor's products faced growing consumer dissatisfaction and there was no evidence of potential entrants to the market.<sup>85</sup> This meant that there was no reason for the plaintiff's market share to decline.<sup>86</sup> The method was, therefore, acceptable to the court.

This approach was also employed in *LePage's, Inc. v. 3M*.<sup>87</sup> The plaintiff's expert calculated the total United States transparent tape sales during the damage period and produced estimates of how these sales would be allocated between private label and branded sectors of the market.<sup>88</sup> He estimated that private label sector growth was 1% per year.<sup>89</sup> He then estimated how LePage's share of the market would have shifted but for the anticompetitive conduct, taking into consideration its shares of the private label and branded sectors.<sup>90</sup> By using the Market Share approach, the plaintiff was able to create a hypothetical offense-free world to use as a yardstick, and this was acceptable to the court.<sup>91</sup>

### III. HOW DO ECONOMETRICIANS DECIDE HOW TO ESTIMATE STATISTICS?

In order to evaluate whether the Before and After techniques conform to *Daubert* or conformed to *Frye*, we need to compare these courtroom techniques to techniques in the relevant academic fields, which are econometrics and statistics.<sup>92</sup> The *Daubert* factors capture some of the central

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<sup>82</sup> *Id.* at 975.

<sup>83</sup> *Heattransfer Corp.*, 553 F.2d at 974-75. A tying scheme is where the seller of a product agrees to sell to buyers on condition that buyers purchase a second product that they would not normally purchase. *Id.* at 975.

<sup>84</sup> *Id.* at 983-84.

<sup>85</sup> *Id.* at 984-86 n.19-20.

<sup>86</sup> *Id.*

<sup>87</sup> *LePage's, Inc. v. 3M*, 324 F.3d 141, 165 (3d Cir. 2003).

<sup>88</sup> *Id.*

<sup>89</sup> *Id.*

<sup>90</sup> *Id.*

<sup>91</sup> *Id.*

<sup>92</sup> *See Independence Tube Co. v. Copperweld Corp.*, 691 F.2d 310, 330-31 (7th Cir. 1982), *rev'd on other grounds sub nom. Copperweld Corp. v. Independence Tube Co.*, 467 U.S. 752 (1984).

principles of econometric and statistical reasoning: reduction of error and falsifiability of hypotheses. Since *Daubert* does not formalize these concepts in statistical terms, this section shows the principles by which the relevant academic fields treat these issues. Since econometrics is the application of statistical reasoning to economics settings, a basic understanding of the principles that statisticians consider in determining how to make an estimate is also helpful.<sup>93</sup>

This section provides basic definitions of statistical terms and shows how different rules of estimation affect the quality of the estimate in terms of bias, efficiency, and hypothesis testing. I use an easy to relate to non-economic example of height measurements to explain concepts before applying them to more complicated antitrust issues. The next section uses this foundation to evaluate the Before and After and Yardstick methods against the requirements of Rule 702 and the *Daubert* factors.

#### A. *Definitions*

The rule or strategy used for estimation is called an estimator.<sup>94</sup> For example, the Before and After and Yardstick methods are rules for estimating damage caused by antitrust violations. When econometricians choose an appropriate estimator, they evaluate it based on certain criteria, including bias, efficiency, and hypothesis testing capability.<sup>95</sup> By reducing bias and increasing efficiency, econometricians can reduce and control error. Hypothesis testing forces the expert to explicitly set out her hypothesis, the alternatives, and the circumstances in which the hypothesis will be supported or rejected, corresponding to the *Daubert* factor of falsifiability.<sup>96</sup>

A statistic is “any function computed from the data in a sample.”<sup>97</sup> A parameter is “a number that describes the population . . . but in practice we do not know its value.”<sup>98</sup> We often use statistics to estimate parameters. For example, the parameter we want to estimate could be the mean height of ten-year-old children. Our sample could consist of all of the ten year olds in one school. We could compute a statistic, the mean height of the ten-year-

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<sup>93</sup> See GREENE, *supra* note 8, at 1. An important feature of economic data is that it does not tend to derive from controlled experimental settings. E-mail from Bruce Kobayashi, Professor of Law, George Mason University, to Molly Zohn, George Mason University Law School Student, (Dec. 9, 2004, 09:04:37 EST) (on file with author).

<sup>94</sup> See GREENE, *supra* note 8, at 103.

<sup>95</sup> See *id.* at 103-04.

<sup>96</sup> See *id.* at 147; *infra* discussion Part III.C.

<sup>97</sup> GREENE, *supra* note 8, at 100.

<sup>98</sup> DAVID S. MOORE & GEORGE P. MCCABE, INTRODUCTION TO THE PRACTICE OF STATISTICS 268 (3d ed. 1999) [hereinafter MOORE & MCCABE].

old children in the school, to estimate the parameter, the mean height of ten-year-old children generally. In an antitrust context, the parameter we want to estimate is damages caused by illegal anticompetitive conduct. Therefore, we must choose a statistic on which to base our estimate.

An estimator will generate this statistic.<sup>99</sup> In our height example, there are several estimators that could be employed to compute the mean. We could use the mean of the sample, the median, the mode, the minimum, the maximum, etc. If we took multiple samples of the population, for example, samples of all ten year olds from each of thirty schools, and used the estimator to estimate the mean in each school, we would generate a sampling distribution. This distribution would show the means of the heights in each of the schools. Similarly, we could take samples of profits from firms in a given industry, compute the statistic, and generate a sampling distribution. In *Before and After*, this statistic could be the difference in profits between the periods. In *Yardstick*, it could be the difference in profit between each potential yardstick firm and the plaintiff firm.

#### B. *Measuring and Controlling Error: Bias and Efficiency*

Bias occurs where the mean of the sampling distribution is not equal to the true value of the parameter.<sup>100</sup> A biased estimator will tend to systematically under- or overestimate the parameter's true value.<sup>101</sup> In our height example, some of the proposed estimators are clearly biased. For example, if we computed the minimum height in each school (i.e. the shortest child), this would tend to underestimate the mean of the ten-year-old population and we would call the estimator biased.<sup>102</sup> Bias is not inherent in the *Before and After* and *Yardstick* methods, but by selecting the data in a biased manner, a plaintiff may easily produce a biased result.<sup>103</sup> For example, the plaintiff could choose a very unprofitable "after" point and a very profitable "before" point.

Efficiency is generally used to choose among unbiased estimators.<sup>104</sup> Since data can be difficult or expensive to obtain, the efficiency criterion is important so that the data is not wasted.<sup>105</sup> While efficiency is generally a secondary concern to bias, where an estimator is slightly biased and the unbiased estimator requires too much data, the biased estimator may be

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<sup>99</sup> See GREENE, *supra* note 8, at 103.

<sup>100</sup> MOORE & MCCABE, *supra* note 98, at 272.

<sup>101</sup> *Id.*

<sup>102</sup> See generally GREENE, *supra* note 8, at 103.

<sup>103</sup> See generally MOORE & MCCABE, *supra* note 98, at 260-61.

<sup>104</sup> GREENE, *supra* note 8, at 103-04.

<sup>105</sup> *Id.*

considered.<sup>106</sup> When two estimators are unbiased, it is more efficient to choose the one with the smaller sampling variance.<sup>107</sup> The sampling variance refers to the amount of spread between estimates. Therefore, if there is great variation between the means at these schools, then there will be a higher sampling variance. In the school height example, one way to reduce the sampling variance would be to draw thirty samples of students from among the different schools, instead of taking the mean height from each school. Each school might have different demographic characteristics, such as race, that might affect height. By drawing samples randomly from among the schools, these factors will be mitigated before each mean is estimated.

### C. *Falsifiability: Hypothesis Testing*

One very important purpose of statistics is to test hypotheses.<sup>108</sup> Hypotheses are tested by setting out a null hypothesis and an alternative hypothesis.<sup>109</sup> The null hypothesis in an antitrust case would likely be that the defendant's conduct did not cause any damage to the plaintiff. The alternative hypothesis would be that the conduct did cause damage to the plaintiff. The statistician then determines a rule for when to accept the null hypothesis and when to reject it.<sup>110</sup>

In setting this rule, the analyst risks two types of error.<sup>111</sup> A Type 1 error occurs when the procedure rejects the null hypothesis when it is true.<sup>112</sup> A Type 2 error occurs when the procedure accepts the null hypothesis when it is false.<sup>113</sup> By resting the burden of proof on plaintiffs, courts favor Type 2 error, preferring to occasionally deny relief even where the claim is true. Statisticians often use confidence intervals to define the rule of accepting and rejecting the null hypothesis.<sup>114</sup> Confidence intervals are based on the distribution of the data and give a range of reasonable values for the parameter.<sup>115</sup> If a value falls outside this range, then it would be unreasonable to accept it and the statistician would reject it.<sup>116</sup> This enables the plaintiff to

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<sup>106</sup> *Id.* at 104.

<sup>107</sup> *Id.* at 103.

<sup>108</sup> GREENE, *supra* note 8, at 147.

<sup>109</sup> *Id.*

<sup>110</sup> *Id.*

<sup>111</sup> *Id.*

<sup>112</sup> *Id.*

<sup>113</sup> *Id.* at 147.

<sup>114</sup> GREENE, *supra* note 8, at 149.

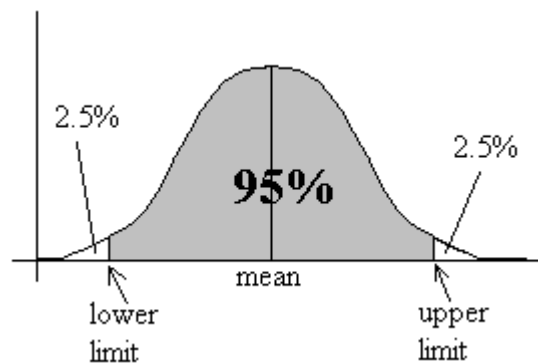
<sup>115</sup> *Id.*

<sup>116</sup> *Id.*

ascertain a range of plausible values around the estimate.<sup>117</sup> However, if the defendant can show that this range is very big and that the true damage is almost as likely at one point as at another, the plaintiff's estimate might be treated as speculative.

The range often used is two standard errors on either side of the estimate.<sup>118</sup> This yields a 95% confidence interval, which means that when we reject a null hypothesis outside of the interval, we are 95% certain that we are properly rejecting it.<sup>119</sup> Figure One shows such a distribution with a 95% confidence interval.<sup>120</sup>

Figure One



Note that this may be a very high burden for the plaintiff to overcome, certainly exceeding a preponderance of the evidence standard and a “merely speculative” standard. However, courts may define what confidence interval will be deemed not speculative and it need not render 95% certainty. The interval chosen is arbitrary, based on the needs of the user.<sup>121</sup> Therefore, courts could decide that hypotheses falling outside a 70% confi-

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<sup>117</sup> Consideration of multiple values to inform a jury award was allowed in *Bigelow v. RKO Radio Pictures*, 327 U.S. 251, 266 (1946).

<sup>118</sup> See, e.g., *GREENE*, *supra* note 8, at 150.

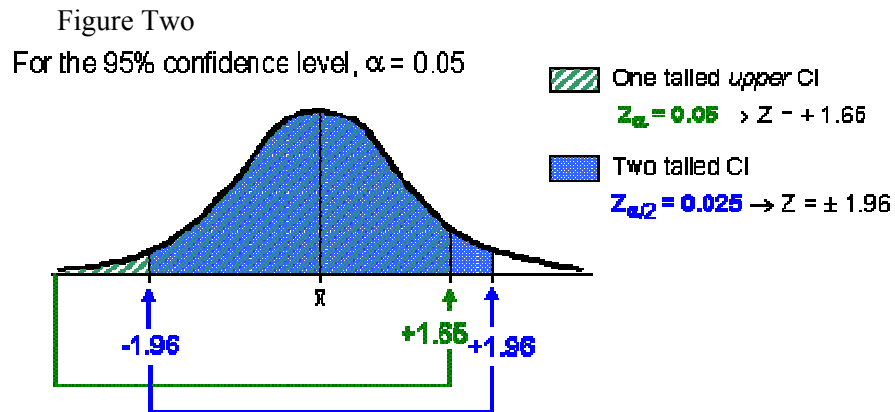
<sup>119</sup> See, e.g., *id.*

<sup>120</sup> This diagram is from: PROPORTIONS AND THE NORMAL DISTRIBUTION, at <http://richardbowles.tripod.com/maths/proportion/proportion.htm> (last visited Jul. 17, 2005).

<sup>121</sup> WASHINGTON STATE DEP'T OF HEALTH, GUIDELINES FOR USING CONFIDENCE INTERVALS FOR PUBLIC HEALTH ASSESSMENT, at <http://www.doh.wa.gov/Data/Guidelines/ConfIntguide.htm> (last visited Jul. 17, 2005); E-mail from Bruce Kobayashi, Professor of Law, George Mason University School of Law, to Molly Zohn, George Mason University School of Law Student (Dec. 9, 2004, 09:04:37 EST)(on file with author) (stating that the confidence interval is arbitrarily chosen and sets the Type I and Type II errors. The Type II error is also influenced by the number of observations, standard error of the estimate, and alternative hypotheses under consideration).

dence interval will satisfy the “just and reasonable” test of *Bigelow* and will not be speculative.<sup>122</sup>

Some plaintiffs may prefer to use a one-tailed test. A two-tailed test would consider that the anticompetitive conduct could have either helped or hindered the plaintiff company.<sup>123</sup> A one-tailed test could benefit plaintiffs by excluding the possibility that the conduct helped the plaintiff. By excluding the probability of benefit, it is easier to meet the burden of harm. See Figure Two for a diagram of a two tailed test contrasted with a one tailed test.<sup>124</sup>



However, the use of the one-tailed test should be confined to those situations in which one is certain that the defendant’s conduct did not help the plaintiff.<sup>125</sup> For example, in *Bigelow v. RKO Radio Pictures*, the defendant argued that the plaintiff had benefited from the phased release of the movies for at least some part of the damage period because this excluded some of the plaintiff’s competitors from competing with the plaintiff.<sup>126</sup> Therefore, by using confidence levels, courts can determine, by a very clear standard, the amount of damages that the plaintiff has established or which the jury may reasonably award.

Since *Daubert* is concerned with making evidence in the courtroom meet the academic standards of the relevant field, bias and efficiency should be considerations in determining whether an estimator is permissible

<sup>122</sup> See *Bigelow v. RKO Radio Pictures*, 327 U.S. 251, 264 (1946).

<sup>123</sup> See MOORE & MCCABE, *supra* note 98, at 455-56 (stating that a one-sided test should only be employed in the face of strong theoretical reasons for excluding a side).

<sup>124</sup> LAB 4: STATISTICAL ESTIMATION, at <http://office.geog.uvic.ca/geog226/frLab4.html> (last visited Jul. 17, 2005).

<sup>125</sup> See MOORE & MCCABE, *supra* note 98, at 455.

<sup>126</sup> *Bigelow*, 327 U.S. at 261.

in court. Bias and efficiency are two of the primary ways in which econometricians measure and control error. Also, statisticians ensure the falsifiability of hypotheses by requiring set rules for accepting or rejecting hypotheses. Courtroom conceptions of *Daubert* requirements might be likewise sharpened.

#### IV. HOW WELL DO THE BEFORE AND AFTER AND YARDSTICK METHODS CONFORM TO THE *DAUBERT* FACTORS?

Courts face difficulty when confronted with a choice between a method that has been previously accepted in courts and methods that are currently accepted in the relevant academic field. Previously accepted methods in antitrust cases seem to carry the weight of precedent.<sup>127</sup> However, methods currently applied in econometrics and statistics are the only methods that conform to the *Frye* requirement that the method be generally accepted, and the corresponding *Daubert* factor.<sup>128</sup> This section analyzes how well the Before and After and Yardstick methods conform to the Rule 702 requirement of applying techniques in standard ways and the *Daubert* factors for choosing reliable methods. Before and After will be considered separately, except for the factor of general acceptance in the field, where they are considered together.

##### A. *Before and After Approach*

###### 1. Has the Technique Been Applied in a Standard Way?

Rule 702 requires that the method be applied in a standard way, “reliably to the facts of the case.”<sup>129</sup> Applying a method in a standard way must mean applying it as it is applied in the appropriate substantive academic field. Otherwise, the requirement to use methods from the appropriate field would be nonsensical.<sup>130</sup> In court, the preferred method of applying Before and After reasoning is to measure damage by net profits lost or net earnings.<sup>131</sup> Net profit lost estimates often derive from use of trends or reduced

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<sup>127</sup> See discussion *infra* Part VI.A.

<sup>128</sup> See *Independence Tube Co. v. Copperweld Corp.*, 691 F.2d 310, 329-31 (7th Cir. 1982), *rev'd on other grounds sub nom. Copperweld Corp. v. Independence Tube Co.*, 467 U.S. 752 (1984).

<sup>129</sup> FED. R. EVID. 702.

<sup>130</sup> See *Bailey v. Allgas, Inc.*, 284 F.3d 1237, 1251-53 (11th Cir. 2002) (stating that the appropriate fields are economics and statistics).

<sup>131</sup> 16 AM. JUR. PROOF OF FACTS 2D 253 § 17 (2004).

price per units multiplied by the number of units.<sup>132</sup> Some courts assume that profits before the injury period would have remained constant.<sup>133</sup>

In *Callahan v. A.E.V., Inc.*, the court addressed arguments from both sides regarding whether the Before and After analysis was done properly.<sup>134</sup> Before 1985, the Pittsburgh beer distributorship business was dominated by “mom and pop” shops, and regulations prohibited a single company from owning multiple shops.<sup>135</sup> The plaintiffs alleged that the defendant evaded these regulations, gained monopoly status, and injured the plaintiffs’ profits.<sup>136</sup> The plaintiffs contended that the defendant persuaded its suppliers to deal on less favorable terms with the plaintiffs.<sup>137</sup> The main argument the defense made as to the manner in which the Before and After test was applied was that the expert had averaged across plaintiffs and that there was not data for all plaintiffs in every year.<sup>138</sup> The defendant argued that the plaintiff’s expert had failed to cite any authority for the averaging of the data.<sup>139</sup> While it might have made the defendant’s argument stronger, the defense did not cite Rule 702, even though the method was not being applied as it had been applied in the past.<sup>140</sup> Notably, in determining that the plaintiffs had met their burden to survive a motion for summary judgment, the court failed to consider whether the decision to average across plaintiffs would have been accepted by econometricians.<sup>141</sup> The court cited *Rossi v. Standard Roofing* in supporting its determination that use of past profits as a benchmark was permissible.<sup>142</sup> However, the court recognized that using these figures assumed that other conditions before the anticompetitive conduct were substantially similar to those after.<sup>143</sup> Hence, in its determinations of whether a method had been applied in a permissible manner, the court looked to prior case law, not to academic literature setting forth standards in the field.

In the field, econometricians do not use the Before and After method in their own analyses. The standard econometric text of William Greene mentions no technique called “Before and After.”<sup>144</sup> Instead, the method

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<sup>132</sup> *Id.*

<sup>133</sup> *Id.* at § 21.

<sup>134</sup> See *Callahan v. A.E.V., Inc.*, 182 F.3d 237, 258-59 (3d Cir. 1999).

<sup>135</sup> *Id.* at 240.

<sup>136</sup> *Id.*

<sup>137</sup> *Id.* at 245.

<sup>138</sup> *Id.* at 258-59.

<sup>139</sup> Brief of A.E.V., Inc. at 24, *Callahan* (No. 98-3456).

<sup>140</sup> *Id.*

<sup>141</sup> *Callahan*, 182 F.3d at 258-59.

<sup>142</sup> *Id.* at 257 (citing *Rossi v. Standard Roofing, Inc.*, 156 F.3d 452, 485-86 (3d Cir. 1998)).

<sup>143</sup> *Id.* at 257.

<sup>144</sup> GREENE, *supra* note 8.

Greene describes for estimating values over a period of time or forecasting is called a time series.<sup>145</sup> Similarly, in the introductory statistics book of Moore and McCabe, there is no mention of forecasting by use of a Before and After method; however, they also offer a brief description of time series analysis.<sup>146</sup> Chatfield defines a time series as “a collection of observations made sequentially in time.”<sup>147</sup> Description, explanation, and prediction are three common objectives of a time series analysis.<sup>148</sup> The primary feature a time series might describe in a time plot of firm profits is whether trends change at certain points.<sup>149</sup> For example, sales could change seasonally or they could drop at the time of the alleged injury or rise at the alleviation of the alleged injury.<sup>150</sup> Explanation is done by using variation of one variable in the time series to explain variation in another time series variable, often through the use of multiple regression.<sup>151</sup> Prediction of what profits would have been in the absence of the damaging conduct would be a crucial step in determining what damages occurred.<sup>152</sup>

This is not to say that time series and Before and After must necessarily be mutually exclusive. In fact, Chatfield’s definition would seem to include the Before and After technique.<sup>153</sup> We can conceive of Before and After as a standard univariate regression or time series equation that does not control for other explanatory variables.<sup>154</sup> An example of a model might be:

$$\text{Firm Profits (t)} = \mathcal{B}_1 * \text{Firm Profits}_{(t-1)} + \mathcal{B}_2 * \text{Firm Profits}_{(t-2)} + C + E^{155}$$

where firm profits in the current period (t) is a function of profits in the previous two periods plus a constant and an error term. By estimating the magnitude of the affect of previous profits ( $\mathcal{B}_1$  and  $\mathcal{B}_2$ ), we can predict

<sup>145</sup> *Id.* at 748-810.

<sup>146</sup> MOORE & MCCABE, *supra* note 98, at 19-21.

<sup>147</sup> CHRIS CHATFIELD, *THE ANALYSIS OF TIME SERIES: AN INTRODUCTION*, 1 (5th ed. 1996). *See also* B.P. Emmett, *The Design of Investigations into the Effects of Radio and Television Programmes and Other Mass Communications*, 129 J. ROYAL STAT. SOC’Y SERIES A (GENERAL) 26, 28 (1966) (recognizing Before and After, but noting that the difference with time series is merely one of degree).

<sup>148</sup> CHATFIELD, *supra* note 147, at 5.

<sup>149</sup> TERENCE C. MILLS, *TIME SERIES TECHNIQUES FOR ECONOMISTS* 10 (1990).

<sup>150</sup> *See id.*

<sup>151</sup> CHATFIELD, *supra* note 147, at 6 (1996).

<sup>152</sup> *Id.*

<sup>153</sup> *See id.* at 1.

<sup>154</sup> *See* E-mail from Bruce Kobayashi, Professor of Law, George Mason University, to Molly Zohn, George Mason University Law School Student (Dec. 9, 2004, 09:04:37 EST) (on file with author).

<sup>155</sup> *See generally* GREENE, *supra* note 8, at 712-810.

what profits in  $t$  should be with a known rate of error. If the previous periods occurred prior to the damage period and the observed profits in time= $t$  is significantly lower than projected, the plaintiff would argue that this shows the anticompetitive conduct caused the significant decline. However, since the univariate technique does not control for other potential causes of the decline, it suffers from falsifiability problems.<sup>156</sup> These can be corrected by the use of more modern multivariate techniques that add the other possible causal factors to the equation, thereby separating out the effects of the variables.<sup>157</sup> Therefore, courts may not need to change their terminology if a plaintiff's expert can testify by citing a Before and After theory, while using more current time series or regression methods.

Time series theories and models have advanced significantly since the first antitrust damage cases were decided, possibly explaining the lag in their courtroom adoption.<sup>158</sup> While time series analyses of various forms have been performed since the tenth century, when plots of planetary movements were made,<sup>159</sup> modern theories did not begin to be developed until the 1940s-1960s.<sup>160</sup>

Since time series is a method of forecasting used by economists, it should be the method used in the courtroom.<sup>161</sup> Even if courts and practitioners retain the terminology, "Before and After," courts should endeavor to confirm that the methods employed by the econometricians are accepted time series models in a modern sense.

Rule 702 requires that a method be applied in a standard way. What was standard in *Eastman Kodak* in 1927 is no longer standard in 2005. While prediction methods employed in Before and After cases have often used univariate techniques, over the last thirty years, multivariate analysis has become more widely used.<sup>162</sup> Therefore, it is no longer necessary for experts to confine their analyses to univariate prediction. Furthermore, in an antitrust case in which the expert employs univariate analysis studying only

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<sup>156</sup> See Emmett, *supra* note 147, at 28 (stating that its univariate character limits the analysts' ability to control for other variables); see also discussion *infra* Part IV.A.2.

<sup>157</sup> Segregation is now required by many courts, even segregation of the effects of the defendant's legal and illegal conduct. See Charles N. Charnas, Comment, *Segregation of Antitrust Damages: An Excessive Burden on Private Plaintiffs*, 72 CAL. L. REV. 403, 415-16 (1984).

<sup>158</sup> See generally David R. Brillinger, *John W. Tukey's Work on Time Series and Spectrum Analysis*, 30 THE ANNALS OF STATISTICS 1595, 1595-98 (2002) available at <http://stat-www.berkeley.edu/users/brill/Papers/time.pdf> (last visited Aug. 7, 2005).

<sup>159</sup> *Id.* at 1595.

<sup>160</sup> *Id.*

<sup>161</sup> See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 594 (1993); *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923) (stating that the techniques used in the field are the preferred methods in court)

<sup>162</sup> See CHATFIELD, *supra* note 147, at 76.

profits over time, the expert implicitly assumes that any changes in profits during the alleged damage period are attributable to the illegal acts of the defendant. A multivariate analysis is more capable of controlling for other things that may have changed over time such as potential customer base.

Notably, the Market Share method attempts to solve this problem by assuming only that the plaintiff's market share would have stayed the same, but that those things exogenous to the firm would have changed in the way that they actually changed historically, regardless of the anticompetitive conduct. This allows variables exogenous to the firm to vary in a way that the Before and After analysis does not allow. For example, changes in technology that might have rendered plaintiff's product partially obsolete, occurring at about the same time as the conduct, will shrink the market as a whole. Therefore, the plaintiff's profits based on its share will be predicted to be smaller than if we based the plaintiff's predicted profits solely on profits prior to the injury period. However, since multivariate time series through the use of multiple regression and other models are more widely accepted by statisticians and econometricians,<sup>163</sup> these techniques should be used in court.

## 2. Can the Hypothesis Be Falsified?

The first *Daubert* factor is whether the method tests a hypothesis that can be falsified.<sup>164</sup> A hypothesis is a tentative theory adopted to explain a set of facts.<sup>165</sup> Falsifiability requires that the hypothesis must be capable of being tested and proven false.<sup>166</sup> Therefore, the first step in evaluating this factor is to define what each method could be said to hypothesize.

The Before and After method hypothesizes that a lower level of profits will be observed during the alleged damage period relative to the profits projected for that period from data in the undamaged period. This hypothesis can be falsified because the data may show no diminished profits. However, this will not show that the illegal anticompetitive conduct of the defendant caused the harm. By analyzing only the plaintiff's performance over time, the Before and After approach assumes that all financial losses

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<sup>163</sup> See generally *id.* at 76-79.

<sup>164</sup> *Daubert*, 509 U.S. at 593.

<sup>165</sup> WEBSTER'S DICTIONARY at <http://www.webster-dictionary.org/definition/hypothesis> (last visited Aug. 7, 2005).

<sup>166</sup> *Daubert*, 509 U.S. at 593; WEBSTER'S DICTIONARY at <http://www.webster-dictionary.org/definition/falsifiable> (last visited Aug. 7, 2005).

that occurred during the alleged injury period are attributable to the defendant. Assumptions are not falsifiable.<sup>167</sup>

This problem often prompts defendants to object that other things could be responsible for the plaintiff's decline in profits.<sup>168</sup> To prove that nothing else caused the damage, an expert is permitted to examine circumstantial evidence, which is what the court allowed in *Eastman Kodak*.<sup>169</sup> However, where an expert believes that another variable could have a significant impact, the expert is obliged to test whether it does and whether it changed in a way that would significantly affect profits.<sup>170</sup> In *Craftsmen Limousine Inc. v. Ford Motor Co.*, the court determined that the expert's failure to control for general economic conditions rendered the testimony inadmissible.<sup>171</sup> In contrast, the expert in *Conwood Co., L.P. v. U.S. Tobacco Co.* augmented the Before and After technique with a test of whether foothold status affected market share growth rate and concluded that since there was no correlation, the damage was attributable to the anti-competitive acts of U.S. Tobacco Co.<sup>172</sup> In that case, the court found that these Before and After results could be considered by the jury.<sup>173</sup> Therefore, a Before and After method is not falsifiable unless the analyst conducts other tests to exclude other possible causes.

### 3. Does the Technique Have a Way to Estimate or Control Error?

Error is commonly defined as an "amount of deviation from a standard or specification."<sup>174</sup> The Before and After and Yardstick approaches both give estimates of the damage suffered by the plaintiff firm. In the case of Before and After, the data used is prior performance. In the case of Yardstick, the data used is the profits of another firm.

Since the Before and After approach only takes into account the prior performance, other variables might be neglected, causing error from omitted variable bias. Omitted variable bias occurs when variables are not included in an estimation, because the effects of the variables are not sepa-

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<sup>167</sup> See generally GREENE, *supra* note 8, at 213 (stating that the purpose of assumptions is to inform the choice of estimator. The assumptions themselves are not tested.).

<sup>168</sup> See, e.g., *Conwood Co., L.P. v. U.S. Tobacco Co.*, 290 F.3d 768, 794 (6th Cir. 2002).

<sup>169</sup> *Eastman Kodak Co. v. S. Photo Materials Co.* 273 U.S. 359, 379 (1927).

<sup>170</sup> See, e.g., *Craftsmen Limousine, Inc. v. Ford Motor Co.*, 363 F.3d 761, 770-71 (8th Cir. 2004).

<sup>171</sup> *Id.*

<sup>172</sup> 290 F.3d at 793-94.

<sup>173</sup> *Id.*

<sup>174</sup> MERRIAM-WEBSTER ONLINE DICTIONARY at <http://www.m-w.com/dictionary> (last visited Aug. 7, 2005).

rately quantified.<sup>175</sup> For example, The Blind Maker, Inc.'s reply brief in *Springs Window Fashions Division, Inc. v. The Blind Maker, Inc.*, argued that "Dr. Vinson's 'before and after' method leads to 'one complete calculation incapable of division into separate elements' . . . It is impossible to discern what portion of his 'total' arises from any particular event or, more particularly, from any alleged fraud."<sup>176</sup> When effects can not be separated out, damages from changes in the market or the costs of production may be inappropriately attributed to the defendant's conduct.<sup>177</sup>

In order to counter a claim of omitted variable bias, the plaintiff would need to show that the omitted variable could not or did not contribute to the damage. Without actually testing for this relationship, one can not know whether the original damage estimate was biased, and by how much. Also, many things tend to change over time such as population demographics and technology. In order to determine the damage inflicted by the defendant on the plaintiff, it is necessary to subtract out the damage from other sources.<sup>178</sup> Therefore, by confining the analysis to past performance, plaintiffs may face difficulty in controlling the error caused by omitted variable bias.

## B. *Yardstick Approach*

### 1. Has the Technique Been Applied in a Standard Way?

There is no Yardstick method cited in Greene, Moore and McCabe, or Amemiya.<sup>179</sup> Therefore, to determine whether this method is applied in court in a similar manner to a method that exists in the field we must find those estimators in the field that are the most closely related.

#### a. *Point Estimate*

The closest relative to the Yardstick approach in statistics might be a point estimate.<sup>180</sup> A point estimate is a statistic computed from a sample that estimates the value we have been trying to predict (parameter). For exam-

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<sup>175</sup> See generally GREENE, *supra* note 8, at 334-38.

<sup>176</sup> Appellee's Reply Brief at 8, *Springs Window Fashions Division, Inc. v. The Blind Maker, Inc.* 2004 WL 828160 (Tex. App. 2004) (No. 03-03-00376-CV).

<sup>177</sup> Charnas, *supra* note 157, at 415-16.

<sup>178</sup> For a discussion of multicollinearity, see generally GREENE, *supra* note 8, at 255-59.

<sup>179</sup> See TAKESHI AMEMIYA, *ADVANCED ECONOMETRICS* (1985); see also GREENE, *supra* note 8, at 101-09; MOORE & MCCABE, *supra* note 98.

<sup>180</sup> See generally GREENE, *supra* note 8, at 101-09.

ple, once we determine how market size, firm size, and other variables affect profits via an equation, we can plug in the values for the plaintiff's firm and predict profits. This prediction is a point estimate. Generally, to determine the relationships between these variables and profits requires collecting data on many firms as a sample and using an estimator.<sup>181</sup>

As a method of point estimation, the Yardstick approach is different from other techniques of statistical inference because it often rests on a sample of one.<sup>182</sup> The more data one uses, the better one's estimate.<sup>183</sup> A sample design is the method of choosing a sample from the population.<sup>184</sup> A poor sample design will produce misleading results.<sup>185</sup> Using only one data point eliminates the variability that would otherwise tend to improve the quality of the estimate.<sup>186</sup> The larger the sample, the closer the estimate will be to the true parameter.<sup>187</sup> By requiring comparability on the relevant variables, randomization and sample size are lost, making the estimate less reliable. These misleading results are presumably what the first prong of Rule 702 seeks to avoid by requiring that sufficient data be used.<sup>188</sup>

#### b. *Case Study*

Although social science methodologies are not permitted, the Yardstick approach is analogous to a technique in social science called the case study. Case studies are most often used for descriptive purposes when the variables at issue are not easily quantifiable.<sup>189</sup> They may study one or only a few cases, but usually do so in great detail.<sup>190</sup> For example, one may do a case study of a presidential election to generate hypotheses about campaign tactics by interviewing the people running the campaigns. By generating very detailed information from these interviews, the researcher can create a model, most often a verbal rather than algebraic model.<sup>191</sup> This is analogous

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<sup>181</sup> *Id.* at 103.

<sup>182</sup> *See, e.g.,* *Bigelow v. RKO Radio Pictures*, 327 U.S. 251, 257-58 (1946).

<sup>183</sup> *See* MOORE & MCCABE, *supra* note 98, at 272.

<sup>184</sup> *Id.* at 256.

<sup>185</sup> *Id.*

<sup>186</sup> *Cf. id.* at 272 (observing that large sample sizes are "more likely to produce an estimate close to the true value of the parameter because there is much less variability among larger samples than among small samples.") A sample design using only one data point provides no indicia of variability.

<sup>187</sup> *Id.*

<sup>188</sup> FED. R. EVID. 702.

<sup>189</sup> *See* GARY KING, ET AL., *DESIGNING SOCIAL INQUIRY* 44 (1994).

<sup>190</sup> *Id.* at 52.

<sup>191</sup> *See id.* at 49-50.

to the Yardstick method because that method is very fact intensive using a very small number of cases.<sup>192</sup>

While case studies are generally good at generating hypotheses, they are recognized as often incapable of testing hypotheses because of indeterminacy.<sup>193</sup> Inability to test the hypothesis fails to satisfy the factor of falsifiability.<sup>194</sup> To avoid indeterminacy, it is necessary to have at least one observation for every inference tested.<sup>195</sup> Therefore, by using only one firm as a yardstick, only one inference may be tested. The plaintiff will argue that the inference to be drawn from the difference in profits is that this difference was caused by the defendant's illegal conduct. The defendant may argue that the difference is really caused by something else or is the product of mere random variation. With one observation, the plaintiff can neither hold other variables constant nor ascertain the plausibility of a random variation explanation. The study is, therefore, indeterminate. Allowance of a few yardsticks is beneficial because predictions are always more accurate when they rely on more observations even if some of them are not very analogous.<sup>196</sup>

King, et al. describe the factors that influence the number of observations required to make valid inferences in qualitative research as: variability in the dependent variable, the degree of uncertainty of the causal inference we are willing to tolerate, collinearity of the causal and control variables, and variance of the values of the causal explanatory variable.<sup>197</sup> The more unexplained variability there is in the dependent variable, the more observations are necessary in making an inference.<sup>198</sup> In the case of predicting profits from firms, there is likely to be a great deal of variation since some firms go out of business quickly and some are able to grow quickly.<sup>199</sup> The amount of uncertainty we are willing to tolerate in antitrust cases is defined as not "speculative," but the estimate need not be proven to a mathematical certainty.<sup>200</sup> In antitrust cases, the more collinearity there is between the

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<sup>192</sup> See, e.g., *Farmington Dowel Prods. Co. v. Forster Mfg. Co.*, 421 F.2d 61, 82 (1st Cir. 1969) (conducting a fact-intensive inquiry on comparability citing differences such as: the product mix of the companies, differences in the companies' sales and distribution networks, and differences in their levels of capitalization).

<sup>193</sup> See KING, ET AL., *supra* note 189, at 118-19.

<sup>194</sup> See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 593 (1993).

<sup>195</sup> See KING, ET AL., *supra* note 189, at 118-19.

<sup>196</sup> See *id.* at 212.

<sup>197</sup> See *id.* at 213-17.

<sup>198</sup> *Id.* at 214.

<sup>199</sup> See, e.g., CORNELL, *supra* note 28, at 125 (recounting forecasters' wide-ranging estimates of an instant sign company's future financial success as an example of the difficulty in predicting firms' value and profits).

<sup>200</sup> See *Eastman Kodak Co. v. S. Photo Materials Co.*, 273 U.S. 359, 379 (1927).

causal variable (anticompetitive behavior) and the control variables (firm size, city, etc.), the more firms we will need to examine.<sup>201</sup> One recognized problem occurs when a firm engages in several antitrust violations.<sup>202</sup> The plaintiff may then be required to estimate the effect of each of those violations,<sup>203</sup> encountering collinearity which clearly requires more data than a single firm yardstick can provide when required to estimate separate effects.

Therefore, the Yardstick method is not analogous to any accepted technique in econometrics or statistics. While in some ways it resembles a point estimate, it fails to satisfy basic data requirements by its use of only one or very few data points that are not randomly selected. In addition, as the next sections explain, as a point estimate, the Yardstick method will often fail to provide reliable estimates due to bias and inability to falsify. The Yardstick method more closely resembles the case study method because it uses only a one or a few data points and studies them in great detail. However, the object of the case study is to generate hypotheses, not test them. In addition, the case study is a social science methodology. Therefore, it will not be accepted in court.

## 2. Falsifiability

The Yardstick approach tests the hypothesis that a firm's illegal conduct caused damage by comparing the plaintiff's profits to those of a substantially similar firm that did not suffer from the illegal conduct.<sup>204</sup> The hypothesis is falsifiable if: 1) a perfect yardstick firm is found; and 2) the analyst can demonstrate that it is perfectly comparable. If these requirements are satisfied and there is a difference in the amount of profit, then the conclusion must be that there were damages.

A plaintiff must first find a firm that is comparable.<sup>205</sup> If no comparable firm is located, then, as a practical matter, the hypothesis cannot be falsified. For example, in *Home Placement Service, Inc. v. Providence Journal Co.*, the court deemed the comparability of the market, product, and firm as relevant.<sup>206</sup> However, the court did not suggest how comparability

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<sup>201</sup> See KING ET AL., *supra* note 189, at 215 (observing that the "higher the correlation between the causal variable and any other variables that we are controlling for, . . . the larger the number of observations which need to be collected in order to achieve the same level of certainty.").

<sup>202</sup> Charnas, *supra* note 157, at 403-04.

<sup>203</sup> *See id.*

<sup>204</sup> *See Home Placement Serv., Inc. v. Providence Journal Co.*, 819 F.2d 1199, 1205-06 (1st Cir. 1987).

<sup>205</sup> *See id.* at 1206-08.

<sup>206</sup> *Id.* at 1206.

could be measured.<sup>207</sup> While the plaintiff's expert stated that he chose a particular yardstick because of factors such as similar seasonal patterns, vacancy rates and number of housing units, the court found that the plaintiff had failed to take into account other factors such as unemployment, summer rentals, and colleges.<sup>208</sup> If the plaintiff cannot establish comparability among every single one of these many variables, the plaintiff may have difficulty obtaining a remedy.<sup>209</sup> If there is no comparable business, then the hypothesis proposed by this method can not be falsified because the profits can not be compared to profits of any other firm proceeding under normal conditions.

The second reason that Yardstick hypotheses are difficult to falsify is because the perfect yardstick is difficult to identify. If only one yardstick firm is analyzed, we can not know how far that firm is from the mean in the distribution of firms.<sup>210</sup> In order to reject the null hypothesis, most statistical estimators will use a confidence interval and determine if the estimate is sufficiently different from the null hypothesis given this confidence interval.<sup>211</sup> The confidence interval is based on variations in the data sampled.<sup>212</sup> One way to make rejecting the null hypothesis easier is to increase the sample size.<sup>213</sup> With a sample size of one, it is impossible to calculate a confidence interval because there are zero degrees of freedom.<sup>214</sup> The number of degrees of freedom partially define how wide the confidence interval is.<sup>215</sup> With zero degrees of freedom, this cannot be defined; therefore, mathematically, the null hypothesis cannot be rejected.<sup>216</sup> Hence, we would not be able to recognize a perfect yardstick even if one existed. Some courts have begun to accept yardstick analyses that use more than one firm for comparison, but the use of a single firm has yet to be rejected on account of inability to falsify.<sup>217</sup>

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<sup>207</sup> *Id.* at 1205-06.

<sup>208</sup> *See id.* at 1207.

<sup>209</sup> *See Molyneaux, supra* note 23, at 1052-55.

<sup>210</sup> *Cf. MOORE & MCCABE, supra* note 98, at 455-56 (explaining how rejection of the null hypothesis requires that know the distribution of the variable).

<sup>211</sup> *Id.* at 483-93.

<sup>212</sup> *Id.*

<sup>213</sup> *Id.* at 486.

<sup>214</sup> *See id.* at 53 (giving the formula for degrees of freedom as  $n-1$ ).

<sup>215</sup> *Id.* at 505-07.

<sup>216</sup> *See MOORE & MCCABE, supra* note 98, at 53.

<sup>217</sup> *See Coastal Fuels of Puerto Rico, Inc. v. Caribbean Petroleum Corp.*, 79 F.3d 182, 200 (1st Cir. 1996) (recognizing that a yardstick approach is valid using either a single firm or multiple firms).

### 3. Measuring and Controlling Error

Courts have recognized two types of errors in the Yardstick approach that may need to be controlled. First, the company used as the yardstick may not be similar enough to the injured business to draw a reasonable inference of profits for the injured business but for the anticompetitive conduct.<sup>218</sup> For example, in *Home Placement Service, Inc. v. Providence Journal Co.*, the court faced the issue of whether plaintiff's office in another city could be used as a yardstick to predict damages in the first office and determined that it was not similar enough.<sup>219</sup> Second, it can be difficult to separate injuries caused by the defendant's lawful activities from those caused by the defendant's unlawful activities.<sup>220</sup> While courts recognize that this is a concern, they will not require a specific showing where this would allow the defendant to profit by his illegal conduct.<sup>221</sup>

What has not been discussed in courts is the great potential for bias when using the Yardstick approach. Imagine that there are one hundred businesses that could be called similar. There will still be variety among them, including in the profits that they earn during the injury period. It is in the plaintiff's best interest to choose the firm with the highest profits and claim that the plaintiff's firm would have earned that amount, but for the defendant's illegal conduct.<sup>222</sup> This will lead to a biased overestimation of damages. If we were to look at all one hundred firms, we would be aware of the difference between the profits of the firm chosen by the plaintiff and the mean profit of all the similar firms. However, by looking at only one or a few businesses, we do not know where that measure of profits is located in the distribution, and we should be skeptical of the plaintiff's choice of a yardstick.<sup>223</sup>

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<sup>218</sup> See *Home Placement Serv., Inc. v. Providence Journal Co.*, 819 F.2d 1199, 1207-08 (1st Cir. 1987).

<sup>219</sup> *Id.*

<sup>220</sup> See *Group Health Plan, Inc. v. Philip Morris USA, Inc.*, 344 F.3d 753, 761-762 (8th Cir. 2003).

<sup>221</sup> See *id.* at 762-63.

<sup>222</sup> See discussion *supra* Part III.B. (discussion of bias, choice of estimators).

<sup>223</sup> See generally discussion *supra* Part III.A. (giving an example of height distributions of ten year old children).

C. *Have the Before and After and Yardstick Techniques Been Subject to Peer Review and Publication, and Are They Generally Accepted in the Relevant Field?*

The Court in *Daubert* stated that this factor was less important than the others when a technique might be so new as to not have had an opportunity to be reviewed and published.<sup>224</sup> While decades have passed since these techniques were first used in court, the literature in these fields regarding the Before and After and Yardstick techniques is sparse and criticized, and the methods tend to be discussed in the context of litigation.<sup>225</sup>

For example, E.K. Valentin points out that two problems with the Before and After approach are that profits may not fall off precipitously when the anticompetitive behavior begins, and that alternative causes often times cannot be ruled out using that test.<sup>226</sup> He also writes that the Yardstick approach rests in part on the assumption that similar products exhibit similar sales patterns, but he contends that this proposition is generally incorrect.<sup>227</sup> Furthermore, use of the Yardstick approach to predict sales data is absent in the economics literature, while other techniques have been shown to predict successfully.<sup>228</sup> For these reasons, E.K. Valentin concludes that the Yardstick technique is too speculative and the Before and After approach is not reliable.<sup>229</sup>

In non-litigation contexts, the Yardstick method generally refers to something entirely different: the yardstick method of regulation.<sup>230</sup> This method involves regulation of private industries based on government experience with those industries.<sup>231</sup> The Before and After method has sometimes been used in non-litigation contexts to evaluate whether levels of a variable increased or decreased around a certain point, but authors have recognized that this cannot accurately be attributed to any particular cause.<sup>232</sup> Therefore, its use for this purpose in antitrust cases is misplaced. B.P. Emmett suggests that the difference between the Before and After

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<sup>224</sup> See *Daubert v. Merrell Dow Pharms.*, 509 U.S. 579, 593-94 (1993).

<sup>225</sup> See, e.g., E.K. Valentin, *Estimating Patent Infringement Damages: A Critique of the Yardstick Approach*, 2 J. PROD. & BRAND MGMT. 4, 4 (1993).

<sup>226</sup> *Id.* at 5.

<sup>227</sup> *Id.*

<sup>228</sup> *Id.* at 6.

<sup>229</sup> See *id.* at 5-6.

<sup>230</sup> See Douglas N. Jones, *Extension of the Social Control of Utilities*, 41 LAND ECON. 297, 301 (1965); Theodore J. Lowi, *Interest Groups and the Consent to Govern: Getting the People Out for What*, 413 ANNALS AM. ACAD. OF POL. & SOC. SCI. 86, 99 n.12 (1974).

<sup>231</sup> See Jones, *supra* note 231, at 301; Lowi, *supra* note 231, at 99 n.12.

<sup>232</sup> See Sebastian Edwards, *Openness, Trade Liberalization, and Growth in Developing Countries*, 31 J. ECON. LITERATURE 1358, 1378 n.33 (1993); Emmett, *supra* note 147, at 28.

method and a time series is simply one of degree.<sup>233</sup> He states that data from before and after an event can be helpful, but it is not the best solution.<sup>234</sup> Therefore, these methods are not supported in the relevant fields.

Before wholeheartedly abandoning or significantly revising the practice of accepting these methods, it is important to show that there are other more modern methods that are more appropriate and may be more feasible.

## V. REGRESSION

### A. *Definition and Applications*

While time series seems to be a convenient alternative to Before and After analysis, there is nothing that so neatly parallels the Yardstick approach. In those cases in which there is no sufficient firm history, we still need an alternative. Regression analysis may be thought of as a conceptual mirror of the Yardstick approach. In the Yardstick approach, there is no attempt to assess the relationship among the variables. Instead, we are to attempt to hold the variables themselves constant, rendering the relationship among them irrelevant. An equation describing the variables and the relationships among them might be:

$$\text{Firm Profits(\$)} = \mathcal{B}_1(\text{Population in market city}) + \mathcal{B}_2(\text{Average income of city population (\$)}) + \epsilon$$

where  $\mathcal{B}_1$  represents the affect in dollars of a one person increase in population,  $\mathcal{B}_2$  represents the affect on firm profits of a one dollar increase in average income in the city population, and  $\epsilon$  represents random variation (error). In the Yardstick approach, we assume the Betas are constant and find a firm where the independent variables are the same as for the plaintiff firm, except that the Yardstick firm did not suffer any antitrust injury. We assume that the Yardstick firm's profits equal what the plaintiff's firm would have earned in the absence of injury.

A linear regression model tests the relationship between a dependent variable, which is the variable we seek to explain, and one or more independent variables, which are those variables we believe may affect the dependent variable.<sup>235</sup> We begin by gathering data on all of these variables for a variety of firms, which we will use to estimate the Betas. Then, we can

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<sup>233</sup> See Emmett, *supra* note 147, at 28.

<sup>234</sup> *Id.*

<sup>235</sup> GREENE, *supra* note 8, at 210.

plug in the values for the independent variables that pertain to plaintiff's firm and compute a point estimate of the firm profits for the plaintiff in the absence of wrongdoing.<sup>236</sup> Because of the variety in the data used, we will have standard errors around the estimate and can choose a confidence interval and level of certainty. The actual damages can be estimated by subtracting the profits realized from this estimate.

Another conception of the regression could add in a dummy variable for having suffered antitrust damages. A dummy variable, sometimes called a binary variable, takes the values of zero and one.<sup>237</sup> Where there is only one firm that suffered antitrust damages, the dummy variable might be called "Antitrust Injury" just as well as it might be called "Effect of being Firm X," since only Firm X's data informs the result. This estimate is not likely to be very precise, but it is no less precise than if we simply predicted the point estimate for the firm if it did not suffer damages and subtracted plaintiff's actual profits from it.

To overcome the problem of having only one case, we can create many observations from that one case.<sup>238</sup> For example, in a case like *Conwood Co., L.P. v. U.S. Tobacco Co.*, where several of the plaintiff's stores and display racks were tampered with on numerous occasions, the plaintiff could evaluate profits from each store to obtain a distribution of losses. In this way, we can estimate the amount of error involved in the plaintiff's own profit estimate. Where multiple firms have suffered damage, they may all be included in the analysis and will tend to give better estimates of damage than using one firm as one observation. This would be a very feasible method to use in a case like *Callahan v. A.E.V., Inc.*, in which there were multiple plaintiffs alleging injury.<sup>239</sup>

#### B. *How Well Does Regression Conform to the Daubert Factors?*

Regression tests hypotheses that can be falsified. Regression sets out a null hypothesis, which in an antitrust case would be that the defendant's conduct did not cause the plaintiff to suffer any damage. Statistically, this can be disproved to whatever level of certainty the court deems not speculative. Frequently, econometricians will use a 95% confidence interval around the estimate.<sup>240</sup> This means that 2.5% of the time, the model will incorrectly attribute the damage to the defendant's conduct, when there was

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<sup>236</sup> See generally *id.* at 101-09.

<sup>237</sup> *Id.* at 316.

<sup>238</sup> KING, ET AL., *supra* note 189, at 217-28.

<sup>239</sup> See generally *Callahan v. A.E.V., Inc.*, 182 F.3d 237 (3d Cir. 1999).

<sup>240</sup> See, e.g., GREENE, *supra* note 8, at 147.

no such damage. Therefore, the hypothesis of damage may be falsified. However, courts may define what confidence interval will be deemed not speculative, and it need not be a 95% interval. The interval chosen is arbitrary, based on the needs of the user.<sup>241</sup> Therefore, courts can determine what will be deemed not speculative based on a mathematically ascertainable standard.

Regression allows the expert to determine results and specify the error that may be contained in those results, thereby controlling error. For example, by appropriately setting the confidence interval, the expert may give testimony that damages are estimated at \$1.5 million, and that she is 75% certain that damages are between \$1.25 million and \$1.75 million.

While regression is less widely used in the courtroom, it has been applied there as it is applied in the field. The Third Circuit was the first to approve the use of regression analysis in proof of damages for an antitrust case in 1993.<sup>242</sup> In *Petruzzi's IGA Supermarkets v. Darling-Delaware Co.*, the plaintiff argued that the defendants had conspired to exclude competitors from the fat and bone rendering industry because those competitors refused to participate in price fixing.<sup>243</sup> The plaintiff's two economists used multiple regression to show above competitive market prices.<sup>244</sup> The court determined that regression analysis was a reliable "scientific method used by economists."<sup>245</sup> The fact that juries might be confused or misled could be dealt with on cross-examination.<sup>246</sup>

Regression was also permitted in *Conwood Co., L.P. v. U.S. Tobacco Co.*<sup>247</sup> Both companies were manufacturers of moist snuff, which is a finely chopped tobacco placed between the cheek and the gum.<sup>248</sup> Conwood alleged that U.S. Tobacco was trying to limit the snuff shelf space in retail stores to its own products, and specifically exclude competitors' discount lines.<sup>249</sup> Conwood claimed that U.S. Tobacco accomplished this by sending misleading product data to retailers, and that when U.S. Tobacco Co. representatives set up displays on their shelf space, they displaced Conwood products and removed Conwood shelves.<sup>250</sup> The expert employed by Con-

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<sup>241</sup> Guidelines for Using Confidence Intervals for Public Health Assessment, Washington State Department Health Data, at <http://www.doh.wa.gov/Data/Guidelines/ConfIntguide.htm> (last visited Aug. 7, 2005).

<sup>242</sup> *Petruzzi's IGA Supermarkets v. Darling-Delaware Co.*, 998 F.2d 1224, 1238 (3d Cir. 1993).

<sup>243</sup> *Id.* at 1228-29.

<sup>244</sup> *Id.* at 1237.

<sup>245</sup> *Id.* at 1238.

<sup>246</sup> *Id.* at 1240-41.

<sup>247</sup> *Conwood Co., L.P. v. U.S. Tobacco Co.*, 290 F.3d 768, 793 (6th Cir. 2002).

<sup>248</sup> *Id.* at 773.

<sup>249</sup> *Id.* at 777.

<sup>250</sup> *Id.* at 778.

wood analyzed damages using Before and After, Yardstick, and Regression analysis.<sup>251</sup> While the defense claimed inadequate control of other variables, the court responded that the regression analysis did not need to control for all conceivable variables; the expert had controlled for all of the variables for which he had data.<sup>252</sup>

By suggesting that courts transition into using more time series and regression approaches, I do not argue that they should turn acceptance of these approaches into legal precedent. Instead, factual findings must be involved and courts should actually discuss each *Daubert* factor in making a determination on whether a method will be accepted in a particular case. Regression is a convenient tool because of its wide application in econometrics. However, it might not solve every problem. Regression involves assumptions about the variables that might not be true, and courts should be open to the use of other techniques when they are more appropriate.

## VI. COURTS SHOULD CONSTRUE THE ACCEPTANCE OF THESE TECHNIQUES AS FINDINGS OF FACT.

### A. *Evidence of the Durability of the Before and After and Yardstick Techniques*

*Webb* suggests the techniques of damage calculation are not fixed, but that a technique will be acceptable as long as it is “credible and substantial,” and the evidence has some foundation in prior experience.<sup>253</sup> This prior experience may be used to inform a projection.<sup>254</sup> Courts and practitioners have used acceptance or lack of acceptance in prior cases to inform their decisions and arguments regarding acceptability of methods in cases at bar, suggesting that this acceptance has precedential value. This trend is contrary to the construction I advocate: of regarding these findings as factual determinations.

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<sup>251</sup> *Id.* at 793.

<sup>252</sup> *Id.* at 794.

<sup>253</sup> *Webb v. Utah Tour Brokers Ass’n*, 568 F.2d 670, 678 (10th Cir. 1977).

<sup>254</sup> *Id.*

Examples of this trend abound. In *Concord Boat Corp. v. Brunswick Corp.*, the court rejected the plaintiff's use of a Cournot model<sup>255</sup> in part because there was no precedent supporting its use in an antitrust case.<sup>256</sup> In *Coastal Fuels of Puerto Rico, Inc. v. Caribbean Petroleum Corp.*, the court determined that the plaintiff could be required to use a Yardstick method if the Before and After approach were deemed unworkable, depending on the length and reliability of the firm's record.<sup>257</sup> The defense argued that, as a new market entrant, the plaintiff was required to use the Yardstick approach and the court did not reject this reasoning.<sup>258</sup> In the plaintiff's brief in *Conwood Co., L.P. v. U.S. Tobacco Co.*, the plaintiff argued that the Before and After and Yardstick methods were "the standard—even preferred—economic methods for establishing antitrust damages."<sup>259</sup> In *Spring Window Fashions Divisions, Inc. v. The Blind Maker, Inc.*, the parties argued about whether the case law had accepted the Before and After technique with the appellee citing case law to support the contention that this was a preferred method of damage calculation.<sup>260</sup> The court in *Park v. El Paso Board of Realtors*, noted that the plaintiff had failed to prove damages by either the Before and After or Yardstick approaches, stating that these are the two approaches that are generally accepted and dismissing plaintiff's expert estimates as too speculative.<sup>261</sup> In *Arden Architectural Specialties v. Washington Mills Electro Minerals Corp.*, the plaintiff proposed use of either a regression-modified Before and After analysis or a Yardstick analysis to show damages.<sup>262</sup> The court determined that the damage could be shown to have a class-wide impact because regression had been allowed previously for that purpose.<sup>263</sup> However, with respect to the issue of measuring damages, the court certified it only on the basis of the Yardstick evidence, not on the basis of regression.<sup>264</sup> The Sixth Circuit has accepted the use of regression analysis, but recognizes that it is less often

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<sup>255</sup> A Cournot model is an economic theory reflecting firm output and prices. Firms strategically choose output by taking into account how their competitors will respond. See generally DAVID M. KREPS, A COURSE IN MICROECONOMIC THEORY, 326-28 (1990).

<sup>256</sup> *Concord Boat Corp. v. Brunswick Corp.*, 207 F.3d 1039, 1056 (8th Cir. 2000).

<sup>257</sup> *Coastal Fuels of Puerto Rico, Inc. v. Caribbean Petroleum Corp.*, 79 F.3d 182, 200 (1st Cir. 1996).

<sup>258</sup> *Id.*

<sup>259</sup> Final Brief for Appellees at 50, *Conwood Co., L.P. v. U.S. Tobacco Co.*, 290 F.3d 768 (6th Cir. 2002) (No. 00-6267).

<sup>260</sup> Appellee's Reply Brief at 8, *Spring Window Fashions Division, Inc. v. The Blind Maker, Inc.*, 2005 WL 1787440 (Tex. App. 2005) (No. 03-03-00376-CV).

<sup>261</sup> *Park v. El Paso Bd. of Realtors*, 764 F.2d 1053, 1068 (5th Cir. 1985).

<sup>262</sup> *Arden Architectural Specialties, Inc. v. Wash. Mills Electro Minerals Corp.*, 2002 U.S. Dist. LEXIS 21506, at 32-33 (W.D.N.Y. Sept. 17, 2002).

<sup>263</sup> *Id.*

<sup>264</sup> *Id.*

applied than Before and After or Yardstick.<sup>265</sup> In the unpublished opinion of *Piggly Wiggly Clarksville, Inc. v. Interstate Brands Corp.*, the court contended that while Before and After and Yardstick are two generally accepted methods of computing damages, the court was not required to accept results of a regression analysis presented in a Before and After context.<sup>266</sup>

Further evidence of this phenomenon is the lack of cases in which courts evaluate a method against the *Daubert* factors. A simple LexisNexis search of all federal and state cases of “*Daubert* and antitrust! and falsif!” yielded only one application of the falsification factor in an antitrust context, indicating that courts are generally ignoring this criterion in antitrust cases. The only case in which this factor was applied was *City of Tuscaloosa v. Harcros Chemicals*<sup>267</sup> Here, the court excluded the expert’s testimony, stating that it was based on the expert’s subjective assessments, and that these could not be falsified.<sup>268</sup>

Antitrust damage estimation is not the only field in which courtroom methods have lagged behind academic progress. A testifying expert in *United States v. Mitchell* argued that in fingerprint cases, once courts had approved fingerprint analysis techniques, the courts failed to exercise further judicial scrutiny regarding acceptability in the field.<sup>269</sup> In another fingerprint case, the district court determined that because the methods of analysis had been widely applied in the courtroom, it was not necessary for them to be based in scholarly journals.<sup>270</sup> This highlights a lack of awareness that precedent may affect what experts later choose to present and debate in court.

While many courts have allowed other types of analysis to be used, they have generally accepted Yardstick and Before and After results, and in doing so, cite earlier cases rather than practitioners in the field. The citation of the acceptance of a technique in previous cases tends to raise that finding to legal precedent which, over time, comes into conflict with *Daubert* and Rule 702.

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<sup>265</sup> *Conwood Co., L.P. v. U.S. Tobacco Co.*, 290 F.3d 768, 793 (6th Cir. 2002).

<sup>266</sup> *Piggly Wiggly Clarksville, Inc. v. Interstate Brands Corp.*, 100 Fed. Appx. 296, 299 (5th Cir. 2004).

<sup>267</sup> *City of Tuscaloosa v. Harcros Chems.*, 877 F. Supp. 1504, 1528-1529 (D. Ala. 1995), *aff’d in part, rev’d in part, vacated in part, remanded by* 158 F.3d 548 (11th Cir. 1998).

<sup>268</sup> *Id.*

<sup>269</sup> *United States v. Mitchell*, 365 F.3d 215, 228 (3d Cir. 2004), *cert. denied*, 125 S. Ct. 446 (2004).

<sup>270</sup> *United States v. Havvard*, 260 F.3d 597, 599 (7th Cir. 2001).

B. *What Explains the Durability of the Yardstick and Before and After Techniques?*

There are three reasons these techniques are accepted in court. First, modern regression and time series techniques were unavailable when *Eastman Kodak* and *Bigelow* were decided. Second, accounting methods had an established place in courtroom assessments of business value because of IRS regulations. Third, a symbiotic relationship developed between courtroom and field techniques; courts demand a technique so the field supplies it.

The Before and After approach was conceived in *Eastman Kodak Co. v. Southern Photo Materials Co.* in 1927.<sup>271</sup> Since modern time series analysis was not developed until the 1940s-1960s, these techniques could not have been generally accepted or subject to peer review and publication.<sup>272</sup> However, the analysis of data across time is a very well developed statistical field now, developed and discussed in at least hundreds of publications.<sup>273</sup> Regression was not well developed or accepted until almost the mid-twentieth century.<sup>274</sup> The first publication that used regression-like techniques was Galton (1894), in which Galton plotted the weights of daughter pea seeds against the weights of mother pea seeds and spotted a correlation.<sup>275</sup> While he calculated a coefficient, his methods for the calculation differ significantly from those of later scholars.<sup>276</sup> The basic form of the modern linear regression was not developed until Pearson's breakthrough work in *Mathematical Statistics and Data Analysis* in 1938.<sup>277</sup>

Accounting methods for antitrust litigation should not be unexpected given the relationship between courtroom and field accounting methods for business valuation with respect to tax issues.<sup>278</sup> The IRS has set out the factors that must be considered.<sup>279</sup> Among these factors are the stock prices of similar businesses.<sup>280</sup> Use of comparable companies for tax purposes is therefore a legal necessity, whether or not it is proper in an antitrust context. The IRS also takes into account future earnings by considering the

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<sup>271</sup> *Eastman Kodak Co. v. S. Photo Materials Co.*, 273 U.S. 359 (1927).

<sup>272</sup> See Brillinger, *supra* note 158, at 1595-98.

<sup>273</sup> See CHATFIELD, *supra* note 147, at 262-70.

<sup>274</sup> See Jeffrey Stanton, *Galton, Pearson, and the Peas: A Brief History of Linear Regression for Statistics Instructors*, 9 J. STAT. EDUC. 3 (2001) at <http://www.amstat.org/publications/jse/v9n3/stanton.html> (last visited Aug. 7, 2005).

<sup>275</sup> *Id.* at ¶ 2.

<sup>276</sup> *Id.*

<sup>277</sup> *Id.*

<sup>278</sup> See *Bader v. United States*, 172 F. Supp. 833, 836 (D. Ill. 1959).

<sup>279</sup> *Id.*

<sup>280</sup> *Id.*

“economic outlook in general and the condition and outlook of the specific industry in particular.”<sup>281</sup> This may be analogous to the Before and After method, whose closest cousin in accounting is the discounted cash flow approach.<sup>282</sup>

Innovation is barred because the IRS prescribes the methods of valuation by law. Given the law’s attachment to these methods in something as important as calculating tax obligations, it may not be surprising if these legal precedents have spilled over into other decisions. Similarly, the methods of estimation in antitrust cases, if deemed legal precedent, would tend to discourage innovation.

In fact, when courts accept the Before and After and Yardstick approaches, they cite case law, not scholarly journals.<sup>283</sup> This suggests that the law is infusing the relevant fields with methodology.<sup>284</sup> If this is the case, lawyers would not simply tell experts to estimate damages in whatever ways the experts see fit.<sup>285</sup> The lawyer needs to make sure that the estimates are legally acceptable. When the lawyer reads many cases using a set of methods, the lawyer might instruct the economist that those are the acceptable methods and ask that the economist employ only those models in formulating damage estimates.<sup>286</sup> In this way, the field of economics may develop a subfield of economic techniques that are used only in court, not in the field. For example, an economist frequently testifying in patent infringement cases, M.J. Wagner, reports that the three methods that may be used to compute damages are Before and After, Yardstick, and Market Modeling.<sup>287</sup> E.K. Valentin writes that market modeling includes econometric modeling and simulations.<sup>288</sup> Separately categorizing Before and After and Yardstick implies that he does not recognize these methods as econometric methods.

Economic consulting firms are also thriving by providing litigation support. Several firms now offer expert testimony support for antitrust

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<sup>281</sup> *Id.*

<sup>282</sup> *See generally* CORNELL, *supra* note 28, at 100-143.

<sup>283</sup> *See, e.g.*, Park v. El Paso Bd. of Realtors, 764 F.2d 1053, 1068 (5th Cir. 1985).

<sup>284</sup> Economic consulting firms, which exist for the purpose of testifying, use approaches that have been approved in court for antitrust damage calculation. The ERS Group specifically names “going concern” and “overcharge” analysis. THE ERS GROUP, ANTITRUST BROCHURE, *available at* <http://www.ersgroup.com/media/Downloads/Antitrust1.pdf> (last visited July 9, 2005) [hereinafter THE ERS GROUP].

<sup>285</sup> *See* Stephen D. Easton, *Ammunition for the Shootout with the Hired Gun’s Hired Gun: A Proposal for Full Expert Witness Disclosure*, 32 ARIZ. ST. L.J. 465, 497-502 (2000).

<sup>286</sup> *See id.*

<sup>287</sup> Valentin, *supra* note 226, at 4.

<sup>288</sup> *Id.* at 5.

cases.<sup>289</sup> The ERS Group advertises: “Over 3,000 clients, including Fortune 500 companies, law firms, industry trade associations and government agencies, have retained ERS Group professionals in a wide variety of cases involving numerous industries.”<sup>290</sup> The antitrust brochure lists some cases in which the Group has used “overcharge” and “going concern methods.”<sup>291</sup>

Another entirely separate academic field, forensic accounting, has sprung up to answer the demand for the use of court approved measures. Forensic accounting is the way in which the accounting profession deals with litigation problems.<sup>292</sup> There is a Journal of Forensic Accounting. One may get a master’s degree in forensic accounting.<sup>293</sup> Forensic accounting calculates damages using the Before and After, Yardstick, or Market Model methods.<sup>294</sup> The techniques used in forensic accounting have some relationship to business valuation techniques in accounting.<sup>295</sup> While we have seen that valuation methods explicitly derived from accounting are not generally accepted in court, accounting methods were not barred until 1982 and thus had the opportunity to become case law.<sup>296</sup>

## CONCLUSION

The cases that laid the foundation for damage calculation in antitrust were decided in a time when the science of statistics was not as well developed as it is now. The techniques that complied with the *Frye* criteria in the 1920s-1940s no longer do. However, the cases of that time approved the techniques of that time. While these approvals are now often construed by scholars and practitioners as findings of law, perhaps they are better construed as findings of fact. This construction would allow courts to update methods directly from the fields, rather than develop bodies of law that,

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<sup>289</sup> Among these are: The ERS Group (<http://www.ersgroup.com/home.asp>), Economic Insight, Inc. (<http://www.econ.com>), Huron Consulting Group (<http://www.huronconsultinggroup.com>), Charles River Associates (<http://www.crai.com>), and others.

<sup>290</sup> THE ERS GROUP, *supra* note 285.

<sup>291</sup> *Id.*

<sup>292</sup> The Law Offices of Paul Michael DeCicco, *What is a Forensic Accountant?* at <http://www.pmdlaw.com/Lost%20Profits/sld003.htm> (last visited July 9, 2005).

<sup>293</sup> For an example of a Forensic Master of Accounting program, see the Florida Atlantic University College of Business website at <http://www.masters-in-forensic-accounting.com/?source=adw> (last visited July 19, 2005).

<sup>294</sup> Wayne G. Bremser, *Damages Measurement for New Economy Firms*, 3 J. FORENSIC ACCT. 253, 253 (2002).

<sup>295</sup> See generally CORNELL, *supra* note 28, at 56-143.

<sup>296</sup> See *Independence Tube Co., v. Copperweld Corp.*, 619 F.2d 310, 330-31 (7th Cir. 1982), *rev'd on other grounds sub nom. Copperweld Corp. v. Independence Tube Co.*, 467 U.S. 752 (1984); *Bailey v. Allgas, Inc.*, 284 F.3d 1237, 1251-53 (11th Cir. 2002).

over time, come into conflict with the principles on which they were originally based.

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