IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF MASSACHUSETTS

Natchitoches Parish Hospital Service District And J.M. Smith Corp. D/B/A Smith Drug Co., On Behalf Of Themselves And All Others Similarly Situated, Plaintiffs, v. Tyco International, Ltd.; Tyco International (U.S.), Inc.; Tyco Healthcare Group, L.P., and The Kendall Healthcare Products Company Defendants.	)	**Civil Action No. 05-12024**

REPORT OF ORLEY ASHENFELTER

Regarding the Motion to Exclude
The Testimony of Professor Einer Elhauge

I. ASSIGNMENT

I have been asked by the court to assist in clarifying the issues regarding the Daubert motion to exclude the testimony of Professor Einer Elhauge. It is my understanding that I am to concentrate specifically on the econometric analyses that Professor Elhauge presents. For that reason, I limit my analysis to Professor Elhauge's econometric studies.

The defendants also challenge Professor Elhauge's credentials for undertaking econometric work. This is a subtle issue for economists, and it is perhaps no accident that the economist experts for the Defendants do not engage in a direct discussion of Professor Elhauge's credentials.

Economics is a relatively new science[1] and its finest practitioners have historically come from a wide variety of backgrounds. As a result, economists, unlike, say, medical doctors, who are licensed and sometimes certified as well, have relied generally upon a direct appraisal of a scholar's work to assess credentials. Econometrics, (usually defined as the application of statistical methods to economic problems) is appraised no differently.

I have not found it necessary or useful to engage in a detailed evaluation of Professor Elhauge's credentials. Instead, in what follows I rely on the actual material that has been presented by the parties for my analyses and appraisal.

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[1] For example, what is generally referred to as the Nobel Prize in Economics was first awarded in 1969 and was not one of the original prizes established by Alfred Nobel's will in 1895.

II. BACKGROUND

In this section of my report I summarize the plaintiffs' allegations. I also describe the relationship of Professor Elhauge's work to those allegations and the role that Professor Elhauge's econometric analyses play in supporting his conclusions.

A. Class Definition and Allegations

The class consists of all those who bought sharps containers from Tyco International (US) Inc, Tyco Healthcare Group LP, and the Kendall Healthcare Products Company ("Covidien") from October 4, 2001 through the present. The plaintiffs allege that Covidien has used exclusionary contracts (the "challenged practices")—both with group purchasing organizations ("GPOs") and with hospitals—to maintain or enhance its market power. Plaintiffs maintain that this behavior prevented Covidien's rivals from competing effectively in a portion of the market ("foreclosed" the market) and thereby caused prices to be higher than they would be in a "but-for" world where the challenged practices did not exist.

B. Professor Elhauge's Assignment and The Role of His Econometric Studies

Professor Elhauge was asked by the plaintiffs to analyze whether the prices paid by the class for sharps containers would have been lower in the absence of the challenged practices (I will refer to the hypothetical world in which Covidien did not engage in the challenged practices as the "'but-for" world.') He was not asked to quantify the difference between actual prices and prices in the "but-for" world.

Professor Elhauge concludes that if the market shares of Covidien's competitors would have been higher in the "but-for" world, then the class would have paid lower prices as a result. He bases this on several theoretical arguments [2]

Professor Elhauge also concludes that Covidien's competitors would have had higher market shares in the "but-for" world. He bases this conclusion on four types of evidence. First, he provides documentary evidence that Covidien themselves considered these contracts to be a method to maintain and increase sales levels.[3] Second, he provides documentary evidence that Covidien's rivals believed that the contracts were a barrier to increasing sales.[4] Third, he provides a set of econometric analyses, which he interprets as providing evidence that Covidien's share of sharps container sales was higher than it would have been in the "but-for" world. I describe these econometric analyses in more detail below. Finally, he argues that Covidien would be irrational to offer these contracts if the firm did not believe that the contracts led to more sales.[5]

My goal here is to evaluate only the econometric analyses. I note, however, that these four arguments are not dependent on one another. An outside decision-maker could find any set of the above arguments persuasive while finding others unpersuasive without any logical contradiction. One important implication of this fact is that if, strictly for the sake of this discussion, one accepted Professor Elhauge's arguments for market foreclosure based on documents and logic, then this does not imply that Professor Elhauge's econometric analyses

[2] See for example, Elhauge 12-18-07 report, ¶ 201-204.
[3] Elhauge 12-18-07 report, ¶ 119-137.
[4] Elhauge 12-18-07 report, ¶ 171-178.
[5] Elhauge 12-18-07 report, ¶ 199

actually measure that foreclosure. Conversely, any decision regarding Professor Elhauge's empirical analysis does not necessarily imply that his other analyses either are or are not correct.

C. Implications of Professor Elhauge's Analyses for Measures of Damages

Professor Elhauge restricts himself to determining whether the challenged practices raised prices. That is, he does not claim that his analyses measure the difference in prices paid by the class between the actual world and the "but-for" world in which the practices did not exist. Another expert retained by the plaintiffs, Dr. Hal Singer, addresses this question.

However, Dr. Singer's analysis requires a measurement of sharps container market shares in the "but-for" world, and he chooses to use the output of one of Professor Elhauge's econometric analyses to supply these market shares. Dr. Singer's analysis consists of an economic model in which "but-for" market shares translate directly into a measure of "but-for" prices. These prices are then used to calculate the damages. This means that while Professor Elhauge may be only intending to identify the direction of impact of the alleged anticompetitive behavior, the results of his econometric analysis form a crucial input to Dr. Singer's damages calculation. A decision that Professor Elhauge has shown positive impact, but that he has not measured "but-for" market shares, would require Dr. Singer to find an alternative measure of market shares in the "but-for" world to use in calculating damages.

III. THE PROBLEM OF CAUSAL INFERENCE

Professor Elhauge's problem is one that is sometimes referred to as a problem of "causal inference." That is, he is attempting to measure the difference in market share that is *caused* by the challenged practices.

To frame the nature of the inference problem it is useful to ask first what the ideal analysis would entail. An ideal analysis of this type would compare actual market shares during the class period among members of the class to market shares during the class period for manufacturers of sharps containers among members of the class in a world where the challenged contracts were not permitted. This comparison is ideal because the *only* difference between the actual and the hypothetical "but-for" world is that the challenged practices were permitted in the actual world and were not permitted in the hypothetical "but-for" world. As a result, one can be confident that any observed difference in market shares results from the difference in what types of contract are permitted and not from some other factor.

Obviously, it is not possible to implement this strategy. We cannot go back to the beginning of the class period and re-run history making the needed change in contracting practices and observing whether and how market shares change. Indeed it is very unusual in econometrics for the ideal solution to be practical. Nevertheless, in evaluating the credibility of an econometric study, it is useful to analyze how an actual study compares with what an econometrician would design as a study absent constraints on data and analytical methods.

In the Daubert Hearing, I asked each expert what he thought would constitute an ideal experiment to settle the econometric issue here. It was clear from his answer that Professor McFadden understood the basic problems of taking account of differences in the characteristics of the buyers and in the strategies of suppliers, and that an ideal experiment would control for

these issues.[6] It was less clear that Professors Ordover and Elhauge had thought very carefully about this.[7]

IV. PROFESSOR ELHAUGE'S APPROACH

Professor Elhauge performs initial analyses that he argues measure the impact that Covidien's challenged practices had on its rivals' market share. Each of these analyses compares the market shares of Covidien's rivals at two different groups of actual buyers. In each case one group consists of buyers who had one or more of the challenged contract forms and the other group did not. [8]

In making these comparisons, Professor Elhauge elects not to control for other market factors That is, he does not study whether there are other differences between these groups of buyers that would lead to differences in market shares even in the absence of the challenged practices. As a result, he implicitly assumes that market shares in the groups without the challenged contracts measure market shares in the "but-for" world and that market shares in the group with the challenged contracts measure market shares in the actual world.

Therefore, for these analyses to be a measure of the impact of Covidien's contracts and not of other factors, the evidence for two key assumptions should be addressed: (1) Are the groups with the challenged contracts representative of all buyers in the actual market, both in their behavior and in how others interact with them? (2) Are the groups without the challenged

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[6] Daubert Hearing 01-09-2009, 13:14-14:19

[7] For Ordover, see Daubert Hearing 01-08-2009, 167.3-170:6. For Elhauge, see Daubert Hearing 01-09-2009, 44:17-44:25.

[8] In some cases the two groups of buyers consist of the same buyers observed at different points in time.

contracts representative of all buyers in the "but-for" market, both in their behavior and in how others interact with them.

Assumptions (1) and (2) are important because if they do not hold, then it is possible that the measured difference in market share reflects differences in characteristics between groups rather than the effect of the contracts. Some examples of this have already been raised in this case, such as the possibility that the group with the challenged contracts has a preference for Covidien's products. What has been referred to as "selection bias" in this case encompasses examples of violations of these conditions due to the methods of categorizing buyers into groups

Another way to think about this is that Professor Elhauge has implicitly set up control groups (the groups without the challenged contracts) and treatment groups (the groups with the challenged contracts).[9] His analyses compare market shares in his control groups with those in his treatment groups. The validity of this comparison depends on whether the two groups, absent the alleged misconduct, would have behaved similarly.

We can also consider what assumptions are required of an analysis that is only intended to determine whether the challenged contracts lower market shares for Covidien's competitors and not to measure the extent of that depression. In that case, assumptions (1) and (2) could be relaxed. Instead of having groups that truly represented the whole market in the actual and "but-for" worlds, we could measure the impact of the challenged practices on a part of the market that would be assumed to exist, with the same characteristics, in the real world and the "but-for"

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[9] The terms "treatment group" and "control group" come from clinical trial experiments where, for example, the treatment group receives a new medical treatment while the control group receives an older treatment or a placebo. The effect of the new treatment is measured by comparing outcomes in the two groups. The validity of this comparison is ensured by randomizing people who would otherwise be a part of the control group into the treatment group.

world. This type of analysis might be accomplished by looking at shares in the same group of buyers at different points in time. At some times the buyers would have the challenged contracts and at others they would not. As I describe below, two of Professor Elhauge's analyses attempt this strategy.

V. PROFESSOR ELHAUGE'S ECONOMETRIC ANALYSES

A. Professor Elhauge's "Simultaneous" Analyses

The first type, which he refers to as "simultaneous," consists of graphs that show that two of Covidien's rivals—Becton-Dickinson ("BD") and Daniels—had lower market shares at buyers that were "burdened" by Covidien's challenged practices than at buyers that were not. Professor Elhauge shows four graphs of this type, using different definitions of "burdened" in each graph. The four definitions of burdened are: (1) buyers that either have a contract with Covidien for an agreed-upon share of sharps containers (a "share commitment contract"), that designate Covidien as their "prime vendor," or that sign a letter of commitment with Covidien; [9] (2) buyers who are a member of a GPO with a sole-source agreement with Covidien; (3) buyers who fall into category (1) and (2); (4) buyers who fall into category (1) or (2). In every case, Professor Elhauge finds that rivals have at least eight times as much market share in the unburdened group as in the burdened group.[10]

Professor Elhauge also displays simultaneous graphs that show that Covidien had lower market share at buyers who were "burdened" by exclusionary contracts with BD. He performs

[9] Elhauge 12-18-07 Report, ¶ 159.
[10] Elhauge 12-18-07 report, ¶ 180-183 and Exhibits 9-12.

this analysis as a test of the idea that it is exclusionary contracts themselves that cause the market foreclosure, rather than some other characteristic that is specific to Covidien as a firm. Using the same four possible definitions of "burdened," Professor Elhauge finds that in every case Covidien has at least nine times as much market share in the unburdened group as in the burdened group.[12]

In response to a suggestion made by the defendants,[13] Professor Elhauge, also performs simultaneous analyses using what he refers to as the "access" approach. In this approach, Professor Elhauge again uses four possible definitions of "burdened." They are: (a) any buyer who has ever been a member of a GPO that currently offers share-based Covidien contracts; (b) any buyer who has ever been a member of a GPO that currently has a sole-source Covidien contract; (c) any buyer in group (a) or (b); (d) any buyer in group (a) and (b) Professor Elhauge finds that the absolute difference in rival share between the burdened and unburdened group is always at least 27 share points.[14]

B. Professor Elhauge's Novation Analysis

The second kind of analysis that Professor Elhauge performs tests whether BD and Daniels had higher shares at Novation (a GPO) one year after Novation's sole-source contract with Covidien ended than while the contract was in place.[15] He finds that these shares were roughly three times higher after the sole source contract ended. (He refers to this as an example of a "longitudinal" study.)

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[12] Elhauge 12-18-07 report, ¶ 184-185 and Exhibits 13-16.
[13] Tyco's Motion to Exclude Elhauge, p. 11.
[14] Elhauge Declaration, ¶ 66-73.
[15] Elhauge 12-18-07 report, ¶ 189 and Exhibit 17.

In response to a suggestion by the defendant's expert Professor Daniel McFadden, Professor Elhauge also performs an analysis in which he compares the growth rates of these rivals' shares at Novation before and after the contract change.[16] He finds that the growth rate of those two rivals was 0.83% higher per month in the period after the contract ended than before and that this difference is statistically significant at the 10% level.[17] He also finds that if he compares three-month average shares then the growth rate of the rivals was 0.52% higher per month, which is statistically significant at the 1% level.

C. Professor Elhauge's Regression Analyses

In addition to the longitudinal study of Novation, Professor Elhauge also performs regression analyses to compare market shares in various ways.[18] As with his study of Novation, Professor Elhauge refers to these analyses as "longitudinal" studies.

In the first group of regression analyses Professor Elhauge compares the monthly combined share of BD and Daniels at burdened and unburdened buyers after taking account of variations in total BD and Daniels share over time that occur independently of the incidence of the challenged practices. He also performs these analyses on only the subset of buyers who switch status from burdened to unburdened or vice versa. He finds that using both

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[16] Elhauge Declaration, ¶ 27-28

[17] It is conventional to refer to statistical significance as the probability of rejecting a proffered hypothesis by chance alone. If the probability that the hypothesis would be rejected by chance alone is low, we typically reject the hypothesis and say that the result is statistically significant. Confidence intervals are constructed to provide an interval for an estimated effect at a specified level of confidence. By construction, if the 95% confidence interval does not include the proffered hypothesis, then it can be rejected at the 5% significance level. Tests of significance and confidence interval estimation are thus related, although they are not identical.

[18] Elhauge 12-18-07 report, ¶190-191 Table 9.

methodologies, and the varying definitions of "burdened," that rival share among burdened buyers is at least 40% (a proportion, not share points) lower than in the unburdened group.[19]

Professor Elhauge also performs a second set of regression analyses in response to a suggestion from Professor McFadden.[20] This type of analysis is the same as his other regression analyses except that, in addition to adjusting for variation over time in market shares, he also adjusts for variation from buyer to buyer in mean rival market share over the period studied. (That is, he includes "fixed effects" for the buyers in his regression model.) Professor Elhauge also adds a substantial amount of data to these regressions and changes the functional form of the dependent variable from logarithmic to linear. These analyses yield estimates that rivals have roughly 10 percent more share at unburdened buyers than at burdened buyers.[21]

VI. DEFENDANT'S EXPERTS' CRITIQUES OF PROFESSOR ELHAUGE'S ANALYSES

Professors Janusz Ordover and Daniel McFadden make several criticisms of Professor Elhauge's econometric analysis. They fall into two categories. First, they criticize the model of the "but-for" world that Professor Elhauge's analyses imply. These criticisms are referred to variously as selection bias, endogeneity, and failure to isolate the effect of the challenged practices. Second, taking Professor Elhauge's model as given, they make several criticisms of his specific econometric implementation.

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[19] Elhauge 12-18-07 report, ¶ 190-191 and Table 9.

[20] McFadden Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 23-29 and Table 2.

[21] Elhauge Declaration, Table 1C.

A. Criticisms of Professor Elhauge's Measure of the "But-for" World

Professor Ordover argues that Professor Elhauge's simultaneous comparisons do not measure actual impact because they could find impact even in hypothetical situations where there was none.[22] His argument is that, in the first definition of "burdened" above, buyers could choose to be in the burdened category or not for reasons other than the exclusionary nature of the contracts and that this could lead to Professor Elhauge's finding that Covidien's rivals have higher share in the unburdened category. Professor Ordover provides the following example to illustrate this point:

> As an example, consider a world with five identical hospitals and no share contracts. In this example, Covidien sells to four of the hospitals and Becton Dickinson sells to the fifth. Now suppose that share contracts are made available but the hospitals' purchasing patterns remain as they were prior to the introduction of share contracts. Although the four hospitals that were purchasing from Covidien do not change their behavior, Professor Elhauge would now classify them as "restricted" because their purchases are now made pursuant to a share contract. Meanwhile, the hospital purchasing from Becton Dickinson would be designated as unrestricted because its purchases are not made under a share contract with Covidien. Under this example, it is clear that the share contracts had no impact on the hospitals' purchases. However, application of Professor Elhauge's proposed methodology would yield a finding the Becton Dickinson's share among unrestricted hospitals is 100 percent, while its share among restricted hospitals is zero.[23]

In a separate report, Professor Ordover makes a similar point:

> The critical premise of Professor Elhauge's methodology is that there is no reason to think that the average hospital in the Affected group is any more likely to favor Covidien for reasons of clinical merit, price, familiarity, or some other reason unobservable to the analyst, than is the average hospital in the Unaffected

[22] Ordover 01-31-08 report, ¶ 117, 119, 120.
[23] Ordover 01-31-08 report, ¶ 117.

> group. Hence, according to Professor Elhauge, any difference in Covidien shares across the Affected and Unaffected groups must be due to the contracts.[24]

Professor Ordover goes on to argue that this premise is false: that buyers might choose Covidien's products for many reasons, and, having made that choice, they might then decide to accept one of the challenged contracts. Similarly, buyers might choose to buy from Covidien's rivals for reasons unrelated to the contracts. Professor Ordover argues that these possibilities mean that Professor Elhauge's analysis do not accurately measure the effect of the challenged practices and could even find an effect where none existed.[25]

Professor Ordover also objects to the fact that when a share-commitment contract ends or when a GPO sole source contract ends, Professor Elhauge reclassifies the buyer from burdened to unburdened. Professor Ordover argues that this reassignment mechanically favors the plaintiffs' case by continuing to find the same level of impact over time even if rivals' market shares are growing.[26] Professor Ordover's point is that when an event occurs that calls into question the alleged foreclosure—a buyer's contract ends and the buyer starts buying from rivals – Professor Elhauge reclassifies the buyer so that his analysis does not reflect rivals' success in competing in the allegedly foreclosed part of the market.

Regarding Professor Elhauge's simultaneous GPO sole-source analysis ("burdened" definition (2) above), Professor Ordover argues that this is flawed because Professor Elhauge does not classify as burdened any buyer that is a member of a sole-source GPO but chooses not

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[24] Ordover Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 13
[25] Ordover Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 14-16.
[26] Ordover Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 21-22

to buy sharps containers under that GPO contract. Professor Elhauge does not include these buyers in either the burdened or unburdened group. Professor Ordover argues that this automatically means that those buyers who prefer Covidien products will be more likely to be classified as burdened, while those who do not will be dropped from the sample.[27]

Regarding Professor Elhauge's simultaneous analyses generally, Professor McFadden makes a point similar to Professor Ordover's:

> . .a basic principle of economics holds that market outcomes are the product of the balancing effects of supply and demand factors which must be accounted for in any valid economic study. For example, Professor Elhauge's approach tacitly and inappropriately assumes that all events in which Covidien succeeded in bidding for a challenged contract were the result of anti-competitive practices. Professor Elhauge has provided no evidence to support this contention, nor has he ruled out through proper econometric methods the plausible possibility that Covidien would have been a successful bidder for many GPO contracts without any of the pricing practices that he alleges were anti-competitive.[28]

Professor McFadden continues to argue that because Professor Elhauge has not considered relative prices in his analyses, he cannot draw any conclusion about whether the outcomes he observes could be due to price competition.[29]

Regarding Professor Elhauge's longitudinal study of Novation, Professor Ordover argues that the analysis is uninformative for two reasons. First, the contract change was based on a decision by Novation. This point is relevant because Novation chose to change contract status for reasons that are unobservable, but that could have ramifications for relative shares aside from the contract itself.

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[27] Ordover Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 26.
[28] McFadden Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 14.
[29] McFadden Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 17.

For example suppose initially that Novation has ten member hospitals and a sole source contract with Covidien. Suppose all ten hospitals buy all their sharps containers through the contract. Then suppose that BD and Daniels make quality improvements to their products. This induces five of Novation's members to begin shifting their purchases towards BD and Daniels outside of the sole source arrangement. Novation notices that its members' preferences have shifted towards BD and Daniels, which causes Novation to end the sole source agreement and develop multi-source contracts with BD and Daniels. Novation does this in order to keep up its customer service towards its members. This contract change has no effect on buyer behavior, since those buyers who still prefer Covidien, still buy from Covidien and those who have started to shift towards Covidien's rivals continue to do so. In this hypothetical, Novation's contract change is due to changes in buyers' preferences and does not affect their purchase behavior.

Professor Ordover also points out that the change in contract status was accompanied by changes in price by Covidien that might have caused the observed change in market share even if there were no change in the form of the contract.[20]

Professor McFadden argues that, regarding the Novation study, Professor Elhauge's inference about the causes of a difference in market share is improper because of Professor Elhauge's failure to account for pricing or buyer preferences.[21] He argues further that because there could be a pre-existing positive trend in rival market share at Novation, it is appropriate to consider whether the rival market share *growth rate* changed when the contract status changed, rather than the rival market share. Professor McFadden performs this analysis using several time

[20] Ordover 01-31-08 report, ¶ 121.
[21] McFadden Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 19.

periods that are different from the one Professor Elhauge uses, and finds that there is not a statistically significant increase in rival market share growth rate at Novation following the contract change.[32]

Regarding Professor Elhauge's longitudinal share regressions, Professor Ordover makes a criticism similar to the one he made regarding reassignment of burdened status in the simultaneous analyses. His point is that anytime a rival is successful in converting a buyer out of the burdened category, that buyer will be reclassified as unburdened. This means that the analyses do not capture the competitive success that rivals have against the challenged contracts, and, therefore, will exaggerate the impact of the contracts.[33] Professor Ordover also criticizes Professor Elhauge for lumping together the performance of Daniels and BD. Professor Ordover claims that Daniels did no better at unburdened buyers than at burdened buyers.[34]

Professor Ordover also claims that Professor Elhauge's longitudinal regressions do not tell us why buyers' contract statuses changed and, therefore, one cannot know whether rivals' share at those buyers changed due to the change in the incidence of the challenged contracts or due to other factors.[35]

B. Criticisms of Professor Elhauge's implementation of his Analyses.

Professor McFadden objects to Professor Elhauge's longitudinal share regressions on two major grounds. First, he points out that because Professor Elhauge uses the logarithm of rival

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[32] McFadden Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 20-21.
[33] Ordover 01-31-08 report, ¶ 123.
[34] Ordover 01-31-08 report, ¶ 124.
[35] Ordover Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 31.

share as his dependent variable, he must necessarily exclude from the analysis buyers who buy nothing from Covidien's rivals [36] This constitutes 90% of the data, according to Professor McFadden Professor McFadden demonstrates that Professor Elhauge's estimates are sensitive to this functional form assumption and to the exclusion of so much data. Professor McFadden shows that by implementing Professor Elhauge's regressions on the same data, but with a linear form, the estimated share differences fall by about 60-80%. He then shows that by using these specifications, but including all data where Covidien's share was 100%, that the estimated share differences fall to 0-1% for the regressions including buyers whose contract status did not change. He finds that the estimated share differences fall to 2-5% for the regressions including only buyers whose contract status changed [37] Second, Professor McFadden points out that Professor Elhauge has not controlled for differences among buyers that might drive differences in purchasing behavior aside from the challenged contracts Professor McFadden argues that a proper analysis should account for individual buyer effects.[38]

VII. COMMENTS ON PROFESSOR ELHAUGE'S ECONOMETRIC ANALYSES

A. General Comments on Professor Elhauge's Analyses

First, I will make some comments about Professor Elhauge's analyses generally, and then I will consider them individually to determine what one can learn from them. Professor Elhauge offers several different analyses that are intended to measure the impact of the contracts. He also

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[36] The logarithm of zero is "undefined" in the same mathematical sense that the result of dividing by zero is undefined.

[37] McFadden Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 27-28 and Table 2.

[38] McFadden Declaration in support of Defendants' Motion to Exclude Elhauge Testimony, ¶ 25.

modifies these analyses several times in response to defendants' experts. Much of his analysis appears to be reactive to suggestions from the defendants. This is particularly true of his changes to his longitudinal share regressions. In that case, he added roughly ten times as much data, changed the functional form of the dependent variable and added adjustments for differences across buyers, all in response to Professor McFadden. Overall, the changes he makes in response to defendants' suggestions alter his estimate of the impact on rivals' share considerably.

Before discussing each analysis in more detail, I note that there is a fairly direct progression of fewer necessary assumptions for the validity of causal inference as we move through Professor Elhauge's analyses. First, there are the simultaneous analyses in which different groups of buyers that have made different choices for unobservable reasons are compared. In these analyses (and the regressions without adjustments for differences across buyers) the analyses assume that that the two groups of buyers, selected based on choices made by the buyers, are comparable on all characteristics aside from their contract status with Covidien.

Second there is the Novation study, in which the same group of buyers at one GPO is examined over time as a contract changes. This analysis makes the less strong assumption that the same group of buyers over time has the same unchanging preferences for products offered by Covidien and its rivals over time and that other market factors, such as pricing, are not actually the cause of measured impact.

Finally there are Professor Elhauge's linear share regressions with fixed-effects adjustments for differences between buyers in which many buyers' purchasing behavior is compared to their own purchasing behavior at other times as contracts change. These require

roughly the same set of assumptions as the Novation study. The difference is that there is substantially more data in these analyses.

B. Professor Elhauge's Simultaneous Analyses

Professor Elhauge's simultaneous analysis of direct buyer commitment contracts (definition (1) of burdened) assumes that the effect of the challenged practices can be measured by the difference in rivals' market share between those buyers who sign share commitment contracts with Covidien and those who do not. Both defendants' experts point out that differences in the characteristics of the buyers in the two groups may cause a difference in market shares between the two groups even in the absence of an effect from the challenged contracts.

I will put the problem into the causal inference framework I laid out in Section IV so that the point is clear. To believe that this analysis is a reliable measure of impact, one must consider whether and to what degree, assumptions (1) and (2) are met in this analysis. To believe that assumption (1) is met, one must believe that the group of buyers who chose to sign commitment contracts with Covidien is representative of the entire market in their preferences and in how others deal with them. For one to believe that assumption (2) is met, one must believe that the group of buyers who chose not to sign commitment contracts with Covidien is representative of the entire "but-for" market in their preferences and in how others deal with them. To the extent that these assumptions are incorrect, when Professor Elhauge compares market shares in these two groups, he measures both the effects of the challenged practices (if any) and the effects of the other differences between the two groups (if any)

Professor Elhauge's simultaneous analysis of GPO sole-source agreements (definition (2) of burdened) measures the effect of the challenged practices as the difference in rivals' share between those buyers who purchase through a Covidien GPO sole-source agreement and those who do not. As before, in order to believe that assumptions (1) and (2) hold here, one must believe that buyers who buy through GPO Covidien sole-source agreements are representative of the whole market, and that those who do not are representative of the whole "but-for" market. That is, in order to evaluate this estimate of the impact of the challenged practices, one must decide the degree to which one believes the measured differences in share are due to the challenged practices, *per se*, versus the degree to which the measured differences in share are due to Covidien's and rivals' pricing (and other strategic) behavior that would still exist in the "but-for" world. Professor Elhauge's analysis does not address this issue and, therefore, provides no guidance on this question.

Professor Elhauge's simultaneous comparisons using definitions (3) and (4) of burdened may be analyzed similarly.

The "Access" Approach

As I noted above, Professor Elhauge performs a modified version of his simultaneous analyses in which, rather than use his definition (1) of burdened, he categorizes any buyer as burdened if it ever was a member of a GPO that currently uses Covidien's share-commitment contracts. The effect of this modification within the causal inference framework is to ameliorate to some extent certain concerns about whether assumptions (1) and (2) hold. If the burdened group is defined using the access approach, then it is not true that those buyers have necessarily chosen to sign a contract with Covidien. Similarly, the unburdened group is not a group that has chosen not to sign a contract with Covidien. The argument for definition (2) of burdened using

the "access" approach is similar Those in the burdened group are not necessarily those who have currently chosen to be part of a GPO that has a sole-source agreement with Covidien.

However, Professor Elhauge points out that all buyers actually had access to Covidien's challenged contracts.[39] So one question is what does the "access" approach actually measure? It does not seem to measure the impact of actually having access to the challenged contracts since Covidien made those contracts available to all buyers.

In addition, the measured impacts in these analyses are composed of similar components to those measured in the simultaneous GPO sole-source analyses. The burdened group consists of buyers who, at some time, chose to be part of a GPO that has an affiliation with Covidien. The unburdened group consists of buyers who never were part of such a GPO As a result, the measured difference may reflect differences in characteristics of the buyers, the effects of the challenged practices, or some combination of the two.

C. The Longitudinal Novation Study

Professor Elhauge's first longitudinal Novation study measures the effect of the challenged practices as the difference in rivals' shares at Novation between one year before the end of Novation's sole source agreement with Covidien, and rivals' shares one year after the end of Novation's sole source agreement with Covidien. Assumptions (1) and (2) will hold in this case, if buyers at Novation before the contract change are representative of all buyers in the actual market and buyers at Novation after the contract change are representative of all buyers in the "but-for" market. The group of buyers at Novation before the contract change seems likely

[39] Elhauge Declaration, ¶ 63.

to be similar to the group of buyers at Novation after the contract change. Therefore, the measured impact is unlikely to be affected by differing characteristics between the two groups unless there is some reason to think that the characteristics of these buyers changed over the course of the two-year period that the analysis encompasses. This feature is a strength of this approach relative to Professor Elhauge's simultaneous analyses. Nevertheless, the fact that the contract changed might indicate, for example, that Novation received information from its members that their preferences were shifting towards Covidien's rivals

Visually, Professor Elhauge's Figure 17 and Professor McFadden's Figure 3 make it appear that there may have been a pre-existing trend in rivals' market share at Novation prior to the contract change that continued unaffected after the change [40] While the experts have disagreed about whether the growth rate increased after the change. it seems that there is not enough data to be certain Professor Elhauge finds a statistically significant change in the growth rate, but only if he uses two particular endpoints for his analysis.[41] While he has rationales for those being the proper endpoints, the fact that Professor McFadden, using different endpoints, finds that there is not a statistically significant change suggests that this result is open to debate and interpretation.[42]

Incidentally. Professor Elhauge points out that there is potentially another case like the Novation contract change—a contract change at Consorta, another GPO-- that he chooses not to present data on. His reason for not doing so is that his data only include information on the sales of one rival at Consorta. Given that all the data in this case are far from ideal, it seems that

[40] 12-18-07 Elhauge Report, Figure 17.
[41] Elhauge Declaration, ¶ 28.
[42] McFadden Declaration In Support of Reply Brief, ¶ 18.

presenting the Consorta results would be a worthwhile way to check the representativeness of the Novation results.[43]

D. Longitudinal Share Regressions

Professor Elhauge's longitudinal regressions are quite similar to his other analyses in what they assume about how to measure market shares in the actual and "but-for" worlds. When he performs these regressions including all buyers (not just those who switch contract status) and without adjusting for static differences in characteristics across buyers,[44] he compares depending on which definition of burdened he uses—market share among buyers who have chosen to sign a share commitment contract with Covidien to market share among those who have not, or between those who are members of a GPO with a sole-source contract and those who are not. These are essentially the same comparisons he makes in his graphical simultaneous analyses. The fact that in these regressions he also adjusts for time trends in rivals' share by including monthly dummy variables does not alter the underlying assumptions. One must assume that these measurements are unaffected by differences in buyer characteristics, such as preferences for Covidien's products, or by differences in strategic factors, such as pricing

When Professor Elhauge performs these regressions, but only including buyers who have changed burdened status during the period,[45] the effect he measures combines two effects. The first is the difference in rivals' share between burdened and unburdened buyers at any given time. The second is the difference between rivals' share at the same buyers when they are

[43] Elhauge 12-18-07 report, ¶ 189.
[44] Elhauge 12-18-07 report, Table 9.
[45] Elhauge 12-18-07 report, Table 9

burdened and when they are unburdened. The fact that these two effects are combined into one measurement makes interpreting the results difficult. In any case, the first effect is already measured in his graphical analyses. The second effect is better measured using regressions with buyer-level fixed-effects because fixed-effects automatically account for differences in whatever static preferences buyers have.

When Professor Elhauge adjusts for static differences in characteristics between buyers (that is, when he adds buyer-level fixed-effects to his model) in the "switcher" regressions, his analysis measures the difference between Covidien's rivals' share at the same buyers when they are burdened and when they are unburdened. In this case, each buyer's purchasing behavior is only being compared to its purchasing behavior at other times. The total effect attributed to the contracts is essentially the average of these effects across buyers. In this way, the buyer-level fixed-effects deal with one problem that the defendants have raised: the possibility that buyers would choose Covidien anyway because of a preference for Covidien's products.[46] These analyses have the same basic form as the Novation study, except that they use all four definitions of burdened, and include more buyers and more GPOs. Assuming that buyer characteristics did not change substantially over the analysis period and that other market factors, such as price differences, do not explain the measured difference in market shares, these analyses provide estimates of the impact of the challenged practices at the buyers that switched contract forms.

Of the analyses Professor Elhauge presents, these are the ones the Defendant's experts are likely to consider the most reliable because they compare share at the same set of buyers over time and they take into account static buyer preferences. Assuming that buyer preferences are

[46] For example, Professor Ordover's testimony in Daubert Hearing, 01-08-2009, 136-4-22.

static and that the explanatory power of strategic factors aside from the challenged practices is low, then these regressions might provide an estimate of the impact in this part of the market.

Professor Elhauge, on the other hand, states that using the fixed-effects version of his model provides an "extraordinarily conservative" estimate of the effect of the challenged practices because the model measures this effect from changes in market shares at buyers when those buyers switch contract forms and takes no account of differences in shares between buyers with and without contracts with the challenged provisions.[47] As I have explained, this assumes that differences in market shares between buyers with and without the challenged contract provisions do not reflect other differences between those groups of buyers that would exist even in the "but-for" world.

E. Conclusion

It is useful to consider two different issues when providing a critique of an econometric analysis. First, are there technical errors? Second, of what value are the results in terms of their credibility for the key questions under discussion?

Regarding the first question, the Defendant's experts have not asserted that Professor Elhauge has made any technical errors in his analysis and I have not found any either.

Regarding the second question, although the Defendant's experts do not make specific claims that any particular analysis of Professor Elhauge's is reliable, it is apparent that they find some of his analyses more credible than others. I have tried to explain the basis, or set of

[47] Elhauge Declaration ¶ 57.

assumptions, that are needed to provide validity for each of the analyses that Professor Elhauge has undertaken.

Table 1 collects in one place the various estimates of the percentage effect of the challenged practices on rivals' shares. It is apparent that these differ quite substantially depending upon the assumption the analyst makes. However, there is nothing in the econometric analysis by itself that compels any particular estimate to be chosen. The final decision about the credibility of these estimates depends on the ultimate fact finders determination of what is most appropriate based on the totality of the evidence available.

If we accepted the GPO sole-source fixed-effects regression as it stands and we accepted that the buyers were representative of all GPO sole-source Covidien buyers, it would imply that within the set of buyers who buy through such agreements with Covidien (13%-28% of the market[48]), Covidien's rivals' share was 9% lower than it would have been in the "but-for" world.[49] This would imply that overall, rivals' share would be 1.2-2.5% higher in the "but-for" world, depending on the year.

Adopting more of Professor Elhauge's assumptions and assuming that the fixed-effect regressions also accurately measured impact for share commitment contracts implies that that part of the market that the plaintiffs claim is foreclosed by share commitment contracts (32-39%)[50] would have rivals' shares 10% higher in the "but-for" world. It also implies that that part of the market that plaintiffs claim is foreclosed by GPO sole-source contracts and not already

[48] Singer Revised Damages Calculation March 2008.
[49] Elhauge Declaration, Table 1C.
[50] Singer Revised Damages Calculation March 2008.

accounted for by share commitment contracts (5-11%)[51] would have rivals' share 9% higher in the "but-for" world. Overall this would imply that rivals' share would be 4.1-4.6% higher in the "but-for" world, depending on the year.

[51] Singer Revised Damages Calculation March 2008. Obtained by adding the "overall foreclosure" from Table R1 and R2 and subtracting "overall foreclosure" from R3, then subtracting that result from "overall foreclosure" in Table R2—hence giving the part of the market claimed to be foreclosed by GPO sole source contracts that is not also claimed to be foreclosed by share commitment contracts.

Table 1: Professor Elhauge's Estimates of Impact of Challenged Practices on Rivals' Share

		Not accounting for buyer-level variation in fixed characteristics		Accounting for buyer-level variation in fixed characteristics
		Excluding buyers with 100% or 0% rival share	Including all buyers	
Definition of burdened	1	-41%	-32%	-10%
	2	-78%	-47%	-9%
	3	-48%	-41%	-6%
	4	-72%	-34%	-13%

Notes:

Estimates in left hand column are from Elhauge 12-18-07 Report, Table 9.

Estimates in middle column are from Elhauge Declaration, Table 1A

Estimates in right hand column are from Elhauge Declaration, Table 1C

Burdened definitions from Elhauge 12-18-07 Report, ¶ 159

(1) buyers that either have a contract with Covidien for an agreed-upon share of sharps containers (a "share commitment contract"), that designate Covidien as their "prime vendor," or that sign a letter of commitment with Covidien

(2) buyers who are a member of a GPO with a sole-source agreement with Covidien

(3) buyers who fall into category (1) and (2)

(4) buyers who fall into category (1) or (2)