

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

NATCHITOCHEES PARISH HOSPITAL
SERVICE DISTRICT and JM SMITH
CORPORATION d/b/a SMITH DRUG
COMPANY on behalf of themselves and all
others similarly situated,

Plaintiffs,

v.

TYCO INTERNATIONAL, LTD.; TYCO
INTERNATIONAL (US) INC.; TYCO
HEALTHCARE GROUP LP; THE
KENDALL HEALTHCARE PRODUCTS
COMPANY,

Defendants.

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Civil Action No. 05-12024 PBS

JURY TRIAL DEMANDED

**DECLARATION OF DANIEL L. MCFADDEN IN SUPPORT OF MOTION
TO EXCLUDE THE EXPERT REPORT AND OPINIONS
OF PROFESSOR EINER ELHAUGE**

[REDACTED VERSION]

[REDACTED VERSION]

**DECLARATION
OF DANIEL L. MCFADDEN
IN NATCHITOCHE PARISH HOSPITAL SERVICE DISTRICT et al. vs. TYCO
INTERNATIONAL et al.**

Prepared on Behalf of Covidien

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October 17, 2008

I. INTRODUCTION

1. My name is Daniel L. McFadden. I am the E. Morris Cox Professor of Economics at the University of California, Berkeley, and the Director of the Econometrics Laboratory. I am also a principal at *The Brattle Group*. I received a Bachelor of Science degree in physics, with high distinction, in 1957, and a Ph.D. degree in behavioral science, with specialization in economics, in 1962. Both degrees are from the University of Minnesota.
2. I received the 2000 Nobel Memorial Prize in the Economic Sciences for developing methods and theory used in analyzing how consumers and households make choices from sets of discrete alternatives. My work is now a standard tool in analyzing consumer behavior in a wide variety of markets. It is used to determine how people choose one brand of product over others and how they decide to purchase one type of product over another. Discrete choice modeling is used to understand what features consumers value and how they respond to price changes and to product information. My work also is used commonly in making public policy and regulatory decisions.
3. I received the 2000 Nemmers Prize in Economics, awarded by Northwestern University to recognize “work of lasting significance.” In 1975, I received the John Bates Clark medal, awarded biennially to the economist under 40 judged to have made the greatest contribution to the profession. I also have received the Frisch medal (1986), awarded biennially for the best empirical paper in *Econometrica*; the Outstanding Paper Award of the American Association of Agricultural Economics (1995), the Richard Stone Prize for the best paper in the *Journal of Applied Econometrics* (2002), and the Jean-Jacques Laffont Prize (2006) for lifetime achievement.
4. I have served as the James Killian Professor of Economics at the Massachusetts Institute of Technology, the Irving Fisher Research Professor at Yale University, and as a Fairchild Distinguished Scholar at the California Institute of Technology. I have been elected a Fellow of the American Academy of Arts and Sciences, of the National Academy of Science, and of the American Philosophical Society, and have received an honorary LL.D.

degree from the University of Chicago, and honorary doctoral degrees from Huazhong University of Science and Technology, the University of London, the University of Montreal, and North Carolina State University. I have served as President of the Econometric Society and as Chairman of the Berkeley Department of Economics. I served as President of the American Economics Association in 2005. I served as a technical advisor to the Antitrust Division of the U.S. Department of Justice on the analysis of anticompetitive impacts of several proposed mergers beginning (1995-1996).

5. My teaching areas include economic theory, econometrics, and statistics at the graduate level. I have published seven books and more than 100 professional papers. My *curriculum vitae*, which is appended to this report as Exhibit A, includes a list of all my publications within the preceding ten years and my testimony as an expert at trial or in deposition within the preceding four years.
6. I have been asked by counsel for Covidien to review and comment upon the econometric and statistical analysis used in the reports issued by plaintiff's expert, Professor Einer Elhauge, in the current Natchitoches class action case. I have focused on the statistical and graphical analysis that Professor Elhauge relies on to support his conclusions concerning the impact of sole source and share-based contracts on the market share of non-Covidien products and to support his conclusions concerning economies of scale in the production of sharp containers.

II. SUMMARY OF FINDINGS

7. Professor Elhauge's conclusions, from an econometric standpoint, are both unsupported and incomplete. Outcomes in markets, such as the shares of various rivals in the market place, are the result of the balancing of demand and supply factors that determine economic equilibrium. To identify the impact of a single factor such as a contractual provision on market outcomes, a valid economic study must consider and account for other market factors that are competing explanations for economic outcomes. A valid economic prediction of the effect of changing a factor like a contractual provision on outcomes must take account of how this change would alter other market factors and the behavior of

market participants. In estimating the effect of various factors from observed market data, good econometric practice requires that all relevant factors, such as the prices offered by suppliers, be taken into account, and the impact on outcomes of the specific factor of interest be isolated from other possible confounding factors. Good econometric practice also requires that data be discarded only if it can be demonstrated that it is not needed for the analysis, and leaving it out does not introduce statistical bias. These are fundamental principals, and Professor Elhauge's analysis fails on both standards. As a result, his conclusions from an econometric standpoint are both unsupported and incomplete.

8. In this declaration I focus on Professor Elhauge's empirical approach, his statistical analysis, and his interpretation of results. I offer no opinion on the broader economic and legal foundations for his analysis, and do not endorse these broader foundations as appropriate for this case. Examining his analyses at face value, I make two principle findings. First, I find that Professor Elhauge's analysis of the impact of defendant's pricing and contracting practices on the market shares of rivals contains serious fundamental conceptual and statistical errors that render his results unreliable. Incredibly, Professor Elhauge discards over 90 percent of the relevant data before estimating regressions that violate the most basic of econometric standards in numerous ways. By so doing he derives results that are statistically invalid and misleadingly interpreted. As a consequence, his statistical analysis is of no probative value in determining the impact of alleged anti-competitive practices on the market.
9. Second, I find that Professor Elhauge's analysis of whether economies of scale exist for sharps containers also contains serious technical and statistical errors that nullify his statistical conclusions and render them of no probative value. His analysis of economies of scale is invalidated by an apples-to-oranges comparison in which, among other problems, he commits the error of comparing the costs of small containers with larger sales volumes to the costs of large containers with smaller sales volumes. This leads him to the unfounded conclusion that greater production leads to lower costs, while all that he actually observes is that smaller containers cost less to produce than large containers.
10. In short, Professor Elhauge's empirical analysis contains fundamental errors that invalidate his conclusions and render them of no probative value in support of his claims that certain contractual forms have had an exclusionary impact. In the following section, I discuss

some salient features of the sharps container market. I then address the serious deficiencies in Professor Elhauge's graphical analysis of market share, his regression analysis of market share and his analysis of economies of scale. A final section offers a short conclusion.

III. PROFESSOR ELHAUGE'S ECONOMETRIC ANALYSIS

A. GENERAL CONSIDERATIONS

11. Professor Elhauge has argued in his expert reports that the pricing and contracting practices of defendants have harmed buyers of sharps containers by allowing Covidien to charge buyers supra-competitive prices. In support of his arguments, he has analyzed data on the operation, performance, and market shares of firms supplying sharps containers and concluded that Covidien's contracting practices challenged in the complaint have harmed competition. As background for examining this conclusion, I note that for an empirical analysis to be useful and valid, the methodology employed: (1) must control and account for key, relevant economic and other factors to isolate properly the effect of the challenged contracting practices, and (2) must be estimated using proper statistical procedures. These are the same principles required of any valid scientific experiment without which the experimental results would be biased and unreliable. Professor Elhauge's analyses fail in both of these regards.

B. ANALYSIS OF MARKET SHARE

12. In his liability expert report Professor Elhauge performs two closely related analyses of market share to demonstrate the alleged anti-competitive effects of Covidien's contracting practices on Covidien's rivals in the sharps containers market. Professor Elhauge's Exhibits 5 through 17 in this report, for instance, are graphic exhibits that show market shares for sharps containers by firms at hospitals in various market segments defined by their contracting status. In this analysis, Professor Elhauge displays the differences in market share of annual sales for rivals at hospitals which utilize certain challenged contracts versus hospitals which do not. Professor Elhauge has sought to compliment these exhibits with a closely related regression analysis to measure the difference in rivals'

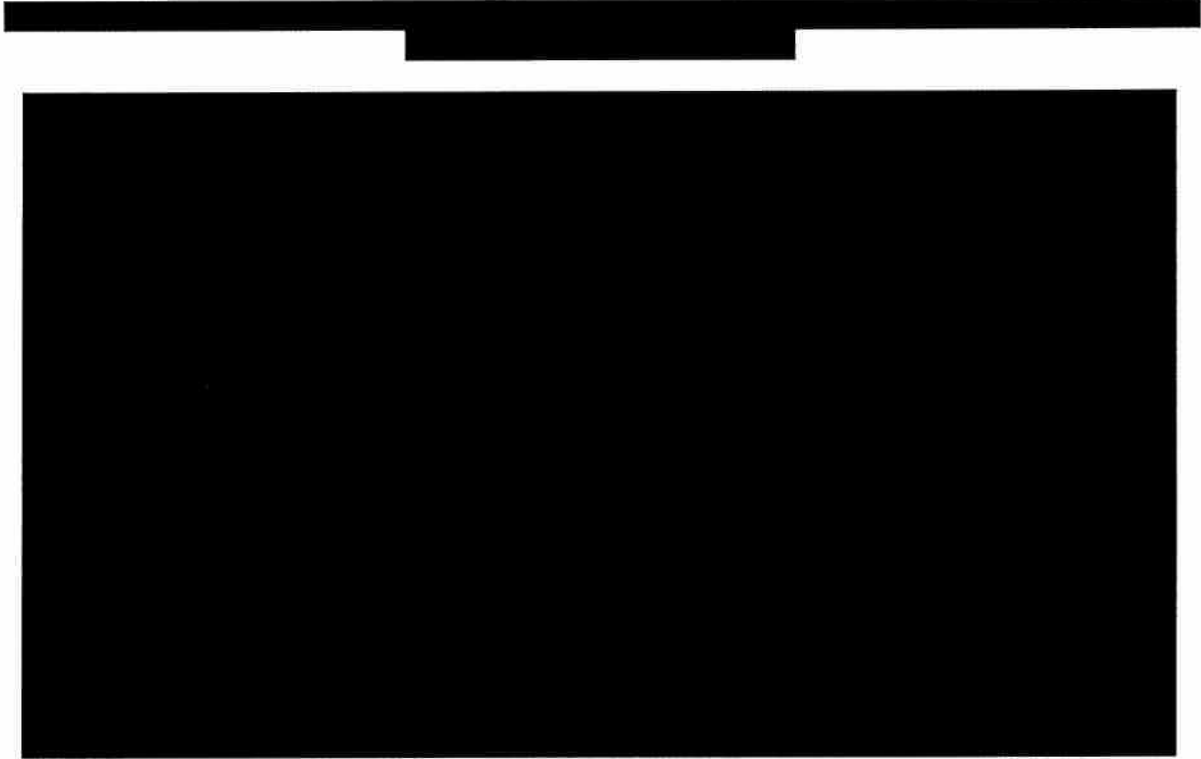
market share at those hospitals which utilize certain contracts versus those hospitals that do not. In the analysis, Professor Elhauge displays the differences in market share for Covidien and its competitors using monthly sales information. For both the graphic and regression analyses, Professor Elhauge claims to establish that Covidien contracting practices have foreclosed rivals from substantial parts of the market for sharps disposal containers and as a result, permitted Covidien to charge supra-competitive prices. For the reasons I discuss below, I find Professor Elhauge's graphic and econometric analysis of no analytic value because of the substantial flaws in methodology and execution.

Graphical Analysis of Market Share

13. Professor Elhauge argues that foreclosure of Covidien's rivals from substantive portions of the sharps containers market occurs through Covidien's use of contract terms that contain provisions for discounts to a hospital based on the market share or tailored volume thresholds of Covidien in all purchases of the class of supplies by that hospital. He also asserts that Covidien's sole-source contracts with GPOs improperly foreclosed the GPO brokerage market to rivals, which led to higher prices paid by class members. To illustrate this, Professor Elhauge presents a series of graphs contrasting the market shares of rivals with Covidien's share for different states of his measures of exclusion. Professor Elhauge's Exhibits 9 through 16 in his liability report display rivals' shares at hospitals buying through contracts with challenged provision versus those that do not.
14. These graphs do little more than to indicate that Covidien has a larger market share when it has won a sole-source contract or a contract with share provisions than when it has not. As I stated above, however, 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. These graphs do not isolate the effect of the alleged offending conduct

- on the market. Therefore, they do not support Professor Elhauge's presumption that any observed effect in market share results from alleged anti-competitive conduct by Covidien.
15. Another key criticism of Professor Elhauge's analysis is his failure even to consider relative prices as a factor in the analysis of relative market shares. Economists consider the relative prices of competing products to be a key variable in determining market shares of competitors. Despite having relevant data on product prices, Professor Elhauge has not used these data in any of his statistical analyses and thus has no way to conclude if the share outcomes that he observes under different contractual forms are the result of price competition or other factors.
 16. Table 1 below illustrates why a proper econometric analysis should consider relative pricing. I have calculated average prices for four benchmark sharps containers offered by Covidien. The Covidien products are a 1 Quart Phlebotomy container (SKU 8900SA), a 2 Gallon Rotor Lid container red (SKU 8970), a 5 Quart Sharpstar LA Lid red (SKU 8509SA) and an 8 Gallon Hinged Lid container red (SKU 8980). These products were chosen because there were numerous transactions involving the respective SKUs in Professor Elhauge's data and the four products cover a wide range of the size spectrum of Covidien's sharps containers. Average prices were calculated for sales to hospitals that, according to Professor Elhauge's characterization, purchased under restricted contracts and for sales to hospitals that did not purchase under those contracts. The table below shows differences in prices between challenged and non-challenged sales channels. GPO sales through restricted contracts for these benchmark products are typically lower than the non-restricted channel. Other things equal, these results suggest that the higher share Covidien achieves at hospitals with access to restricted contracts would be due in part or in whole to lower prices. A thorough economic analysis of the competitive effects of prices and contract restrictions would also require data on rivals' prices for competing products.

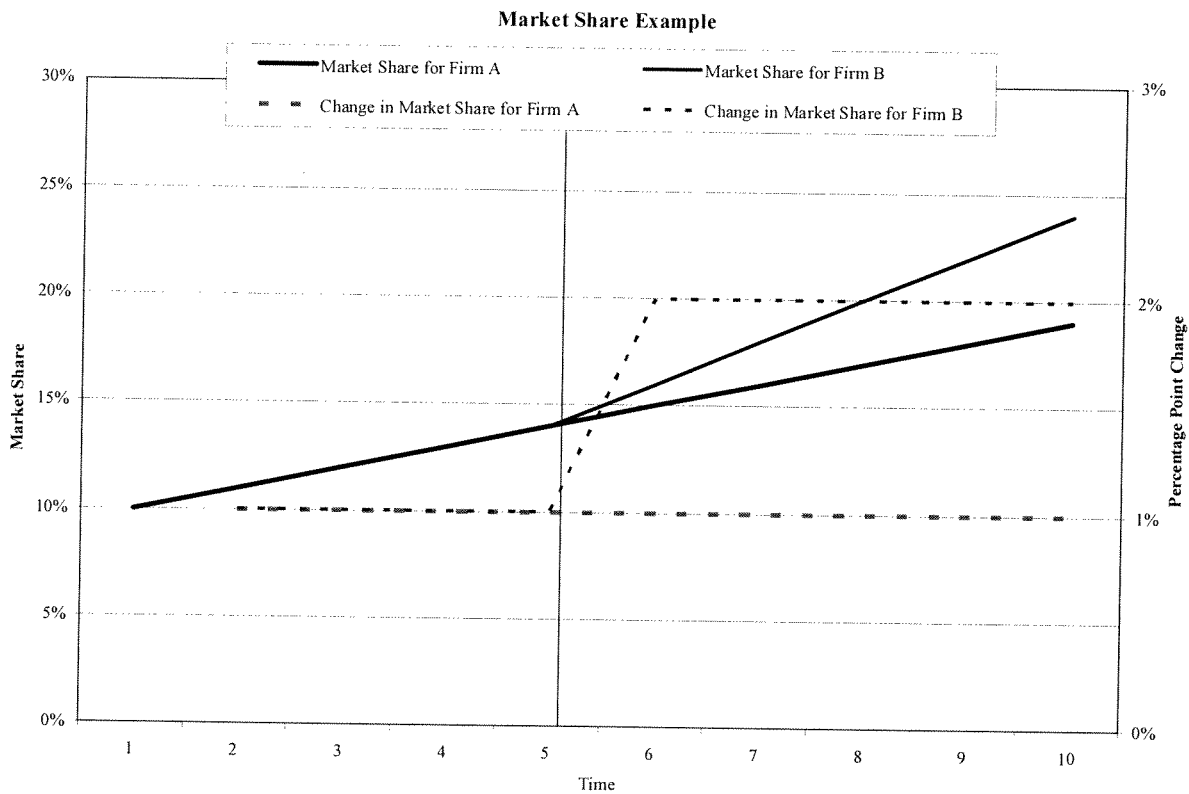
Table 1



17. Exhibit 17 in Professor Elhauge's reply report (and updated at deposition), displays the market share of Covidien's rivals for those hospitals that purchased through the Novation GPO from late 2001 through October 2006. In August 2005, Novation switched from a sole-source Covidien contract to a multi-source contract including both BD and Stericycle. Unlike Professor Elhauge's other exhibits which reclassify GPOs over time depending on whether their terms are challenged in a particular year, Exhibit 17 focuses on a single GPO.
18. Exhibit 17 shows an upward trend in the combined Daniels-Stericycle-BD share beginning in approximately November 2004 and continuing through the end of the period. This seems at first glance to indicate a growing demand among Novation member hospitals for Covidien's rivals' products. Professor Elhauge attributes the difference in average *levels* of market share before and after the change in GPO terms as indicative of the sole-source provision's effect on market equilibrium.
19. However, as with the neglect of relative prices in Exhibits 5-16, Professor Elhauge again makes an improper inference on the cause of differences in market share without

controlling for hospital purchasing preferences and relative prices. To analyze the change in the market due to the elimination of the sole source contract while controlling for changing preferences among suppliers and changing relative prices, it is possible to ask whether the rate of change of market share of Covidien’s rivals accelerated when sole-source contracting ended. An example helps to illustrate why the change in the market share is most relevant to the inquiry here. Consider an example in which two firms, Firm A and Firm B, both experience growth in their market share over time. Additionally, assume that the firms’ products are available from a GPO contract from which they were excluded until midway through the class period. Suppose Firm A was unaffected by the restricted GPO contract, but Firm B had sales foreclosed by the restricted GPO contract. The firms’ market shares and changes in market share are shown in Figure 2.

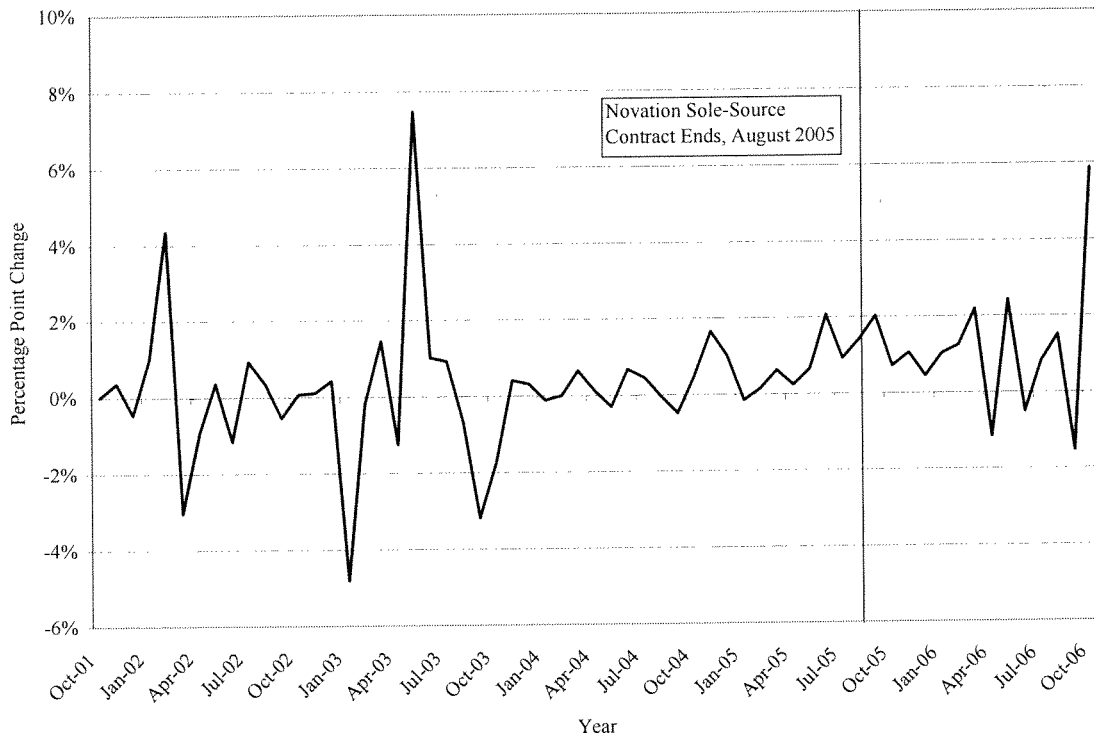
Figure 2
Ignoring Pre-Existing Trends can Create the Appearance of Impact when there is None



20. Looking at the figure, one notices that Firm A's market share increases one percentage point every period. Firm B's market share also grows by one percentage point each period before the switch and grows by two percentage points after the switch. Professor Elhauge's analysis would indicate that the share restrictions hindered both of the firms because their market shares are higher on average after the sole-source contract is removed. However, in this example only Firm A was foreclosed; its growth in share after the contract restrictions were removed is due to a continuation of the trends in hospital preferences and its pricing policies that allowed it to increase market share prior to the lifting of restrictions. Therefore, in order to test if Novation ending its sole-source contract had an impact on the market share of its rivals, while controlling for trends in relative prices and hospital preferences, it is necessary to examine the *change* in market share rather than the level of market share, that is, we must examine not the percentage of the market share of Daniels, Stericycle and BD, but rather look for a change in the trend of their share over the requisite period. This is important because a graph of the level of market share can be visually deceiving. Exhibit 17, as Professor Elhauge characterizes it, appears to show the rivals' growth accelerated after the Novation contract became multi-source in 2005. However, a graph based on the levels of market share will naturally become steeper even when the actual growth rate stays the same. For example, a 5 percent growth at a market share of 1 percent is 0.05 percent while at a share of 20 percent, it is 1 percent. Thus, the rate of market share increase and not the absolute year-to-year growth is the relevant quantity.
21. In order to examine if the Covidien sole-source provision on Novation member hospitals hindered rivals growth, I tested whether the change in Daniels, Stericycle and BD's market share was hindered prior to August 2005. Figure 3 below shows the monthly percentage point change in the Daniels, Stericycle and BD market share calculated from the data used in Professor Elhauge's Exhibit 17. By comparing the changes in rivals share before and after Novation ended sole-source contracting with Covidien, we can get a sense of any change in the trend in growth that accompanied the ending of the contract may have had. I fit a regression model with an indicator for the post-August 2005 period. A test of the effect of the change to a multi-source contract indicates no statistically significant effect on the trend in market share of Covidien's rivals at the standard level of significance. This

result continues to hold when the pre-August 2005 period is compared to a benchmark stretching back to October 2003 when rivals appear to begin to gain market share. While this test is consistent with the proposition that the trend in market share of Covidien’s rivals was unaffected by sole source contracting, it is not definitive because important factors such as variation in relative prices not captured by the trend are missing from the analysis. Thus, Professor Elhauge’s graphical comparisons are not useful for judging the effect of the alleged offending conduct because they do not account for other factors that also affect market shares.

Figure 3
The Rate of Change in Rivals’ Market Share does not Change Significantly after the End of the Novation Sole-Source Contract



Regression Analysis

22. The econometric analogue to Professor Elhauge’s graphical analysis is an empirical regression analysis of the influence of the allegedly exclusionary contracts on the market shares of rivals. Professor Elhauge takes the rivals’ percentage of total monthly sales of sharps container products in selected hospitals as the unit for empirical analysis. For each

hospital and month in his sample, he constructs variables that indicate whether the hospital purchased through a GPO contract that includes a Covidien share or tailored volume discount, or purchased through a GPO contract in which Covidien participates as a sole source. He then attempts to relate hospital purchase shares to these categorical variables. He runs a number of regression analyses that he believes demonstrate that the shares of rivals are diminished when the hospital is covered by an allegedly exclusionary contract. However, these analyses suffer from major econometric defects that invalidate his results.

23. Professor Elhauge carries out a series of regressions of market share on his exclusion variables and monthly dummy variables, of the form

$$\text{Log}(\text{Share}_{jt}) = a_t + b \cdot \text{TypeX}_{jt} + \eta_{jt}$$

In these regressions, j denotes the hospital, t denotes the month, Share_{jt} is the share of Covidien's rivals for sharps container purchases, TypeX_{jt} is a variable for the type of allegedly exclusionary contract (*e.g.*, sole-source contract or restrictive contract) as defined by Professor Elhauge, and η_{jt} is a disturbance. The term " a_t " captures how shares are changing on average from month to month across all contracts. The term " TypeX_{jt} " is designed to capture any differences between allegedly exclusionary contracts and other contracts. Professor Elhauge estimates this model with alternative definitions of an exclusionary contract. Of particular importance is the fact that by taking the logarithm of rivals' share as the dependent variable, he forces the exclusion of all observations where Share_{jt} , the share of Covidien rivals at hospital j in month t , is zero (*i.e.*, that the hospital purchased all its sharps containers in that period from Covidien). He has to exclude these data because the logarithm of a zero share is mathematically undefined, and such undefined observations cannot be included in the regression. Professor Elhauge's specification is both economically and statistically flawed. Economically, zero share outcomes appear as a consequence of market equilibrium, and cannot be disregarded in an economic explanation of market outcomes.

24. Professor Elhauge's regression analysis contains serious technical errors that contravene standard statistical practice. Dropping the observations where the collective share of Covidien rivals is zero seriously biases the resulting estimates. Discarding observations

for each month in which a hospital does not buy a rivals' product removes relevant data from the analysis. This creates an econometric problem called selection bias that will lead to biased estimates of the effects Professor Elhauge is trying to measure, in this case the impact of "burdened" contracts. Professor Elhauge has discarded over 90 percent of the data, meaning his conclusions rest upon a small fraction of the existing data. His procedure introduces severe selection bias. Professor Elhauge has failed to utilize econometric procedures readily available in econometrics textbooks and statistical software to handle selection bias.

25. Second, Professor Elhauge's analysis is flawed by omission of factors due to differences among hospitals in their specific product needs. For example, one hospital may require an exhaustive selection of sharps containers, while another may need only a few common sizes. One hospital may have negotiated a low price for waste hauling of disposable containers while another hospital is keenly focused on practicing "green" processes throughout their supply chain. A proper analysis controls for the individual hospital effects. Professor Elhauge's model does not allow for hospital effects, and this deficiency subjects the estimated results to additional bias.
26. The serious statistical and methodological problems with Professor Elhauge's regression results can be seen by investigating the impact on several of his key conclusions by modifying his regression model so that it can accommodate zero share observations. In the table below, I first replicate the results of Professor Elhauge's regressions. I then show the results of a linear regression in which I use the actual share rather than the logarithm as the dependent variable with the same observations used in the initial analysis, and, second, add back all of the observations involving a zero share that were not included in the initial regression. I undertake this exercise only to demonstrate that Professor Elhauge's results are unreliable and sensitive to selection bias. The variations I present are not proper estimates of the impact of the challenged contracts on rival market share, and are not in themselves best economic and econometric practice for determining the economic source of selection bias and dealing with it econometrically.
27. The results from these regressions show that Professor Elhauge's estimated effects of his alleged restrictive practices on rivals' shares are not reliable. First, using the positive share observations but the linear specification in Professor Elhauge's analysis of

Restricted versus Unrestricted contracts reduces the estimated impact of restrictions by 69 percent. Adding the zero share observations leads to an estimate that the restrictions have no negative effect on rivals' share. The point is not that one of these specifications is the correct one – none are – but rather that the economic and statistical foundations of Professor Elhauge's analysis are so badly flawed that his findings are meaningless.

28. The regression investigating the impact of "restricted and sole-source versus neither" yields a similar pattern. Professor Elhauge's regression yields a significantly negative coefficient that translates into a 54 percent impact. The linear regression on the positive share observations gives an impact that is only 17 percent of Professor Elhauge's estimate. When the number of observations is increased from 21,664 to 388,809 by including all of the data, the regression implies an impact that is only two percent of the impact estimated by Professor Elhauge. The key point here is that coefficients and any percentage impact are highly sensitive to the econometric specification. Further, any finding of a correlation between success in winning contracts and market share is not useful for the court since this also would be observed in markets where there are no allegations of anti-competitive conduct.

Table 2
Professor Elhauge's Impact Estimates are Lower When All Data are Included in the Analysis

"Non-switcher" regressions						
	Sample	Specification	Coefficient	T-statistic	Percentage Share Impact	Number of Observations
Restricted v. Unrestricted	Elhauge sample	Log	-1.388	-67.6	-75.05%	39,394
	Elhauge sample	Linear	-0.226	-61.8	-23.45%	39,394
	Complete data	Linear	0.001	2.5	0.08%	1,181,842
Sole Source v. Not Sole Source	Elhauge sample	Log	-0.582	-21.7	-44.15%	21,664
	Elhauge sample	Linear	-0.061	-12.8	-6.47%	21,664
	Complete data	Linear	-0.010	-21.0	-1.04%	388,809
Restricted and Sole Source v. Neither	Elhauge sample	Log	-0.768	-25.3	-53.62%	21,664
	Elhauge sample	Linear	-0.087	-15.9	-9.23%	21,664
	Complete data	Linear	-0.009	-16.5	-0.95%	388,809
Restricted or Sole Source v. Neither	Elhauge sample	Log	-1.218	-47.1	-70.41%	39,394
	Elhauge sample	Linear	-0.167	-36.1	-17.75%	39,394
	Complete data	Linear	0.000	0.8	0.03%	1,181,842
"Switcher" regressions						
Restricted v. Unrestricted	Elhauge sample	Log	-0.987	-39.8	-62.75%	22,395
	Elhauge sample	Linear	-0.185	-42.2	-21.89%	22,395
	Complete data	Linear	-0.041	-63.6	-4.88%	278,709
Sole Source v. Not Sole Source	Elhauge sample	Log	-0.406	-11.5	-33.36%	13,121
	Elhauge sample	Linear	-0.061	-10.3	-10.78%	13,121
	Complete data	Linear	-0.013	-23.5	-2.34%	223,813
Restricted and Sole Source v. Neither	Elhauge sample	Log	-0.512	-13.6	-40.04%	11,964
	Elhauge sample	Linear	-0.070	-11.5	-12.23%	11,964
	Complete data	Linear	-0.015	-25.2	-2.65%	199,594
Restricted or Sole Source v. Neither	Elhauge sample	Log	-0.713	-22.9	-50.99%	17,153
	Elhauge sample	Linear	-0.128	-24.0	-17.09%	17,153
	Complete data	Linear	-0.030	-43.3	-4.07%	219,542

Note: In each linear model, the percentage impact on rivals' share is calculated as the coefficient on the variable denoting inclusion in the "burdened" segment divided by the market share of rivals on the contracts in the unburdened segment.

29. The dramatic changes in the results of the regressions performed by Professor Elhauge that result from addressing deficiencies in his econometric method, particularly his failure to consider all of the data, demonstrate that his statistical results cannot be relied upon to support his contention of an exclusionary impact. Correcting for only one of Professor Elhauge's significant and fatal errors upends his findings of foreclosure. Moreover, the regressions still suffer from issues of selection bias and missing price effects and thus cannot be relied upon. Because of his poor econometric and economic practice, Professor Elhauge's regressions are not valid econometric analyses that a trained econometrician would find acceptable. As such, his results are unsound and of no probative value regarding whether sole-source or what he refers to as restrictive contracts had an impact on the market.

C. ANALYSIS OF ECONOMIES OF SCALE

30. A foundation of Professor Elhauge's argument that the defendants have erected barriers to entry that have harmed the plaintiff is that substantial scale is necessary to supply sharps containers efficiently, and that by foreclosing substantial parts of the market to the plaintiff through their actions, Covidien has prevented its rivals from expanding to efficient scale. As support for the claim that there are substantial economies of scale in the production of sharps containers, Professor Elhauge has produced a regression analysis of Covidien data that relates unit costs to number of units produced, and inferred from this analysis that there are substantial economies of scale at the level of Covidien's production. However, his regression analysis is done incorrectly, and his conclusions do not hold. The regression run has the form

$$\text{Log}(\text{UnitCost}_{st}) = a + b \cdot \text{Log}(\text{Units}_{st}) + c_t + \varepsilon_{st}$$

where s indexes the product (SKU) and t indexes the year. The coefficients c_t capture changes in input costs over time unrelated to the scale of production. The coefficient b indicates how unit costs change with increasing production. Only where b is negative to a statistically significant degree, would such a result support the conclusion that economies of scale exist as a negative coefficient indicates that the average cost of producing a single product unit decreases as more units are produced. Professor Elhauge finds a statistically significant negative coefficient for b , and concludes from this that manufacture of sharps containers at the

observed scale shows significant economies of scale. However, his regression inexplicably confounds cost differences across different container products with economies of scale. Suppose, for example, that we construct a hypothetical involving two products produced at unit costs independent of scale (*i.e.*, the production of additional units does not lower the average per unit cost of production): the first, a generic container produced at a unit cost of \$1 with three million units sold, and the second, a more costly specialty container for chemotherapy sharps, produced at a unit cost of \$2 with 30,000 units sold. Even though neither product is subject to scale economies, the above regression on these two observations would conclude that b is negative because the cost of the higher-sales generic container is lower. Acceptance of this negative coefficient at face value would lead to the erroneous conclusion that there were scale economies for these products, thus demonstrating how the misapplication of basic econometric principles can easily manufacture the appearance of economies of scale where none actually exist. Indeed, the negative coefficient and the “finding” of economies of scale are simply the erroneous result of an apples-to-oranges comparison that confuses scale economies with the effect of cost differences across products. Table 3 below displays the annual costs for the Covidien products I discussed earlier in this declaration.

Table 3

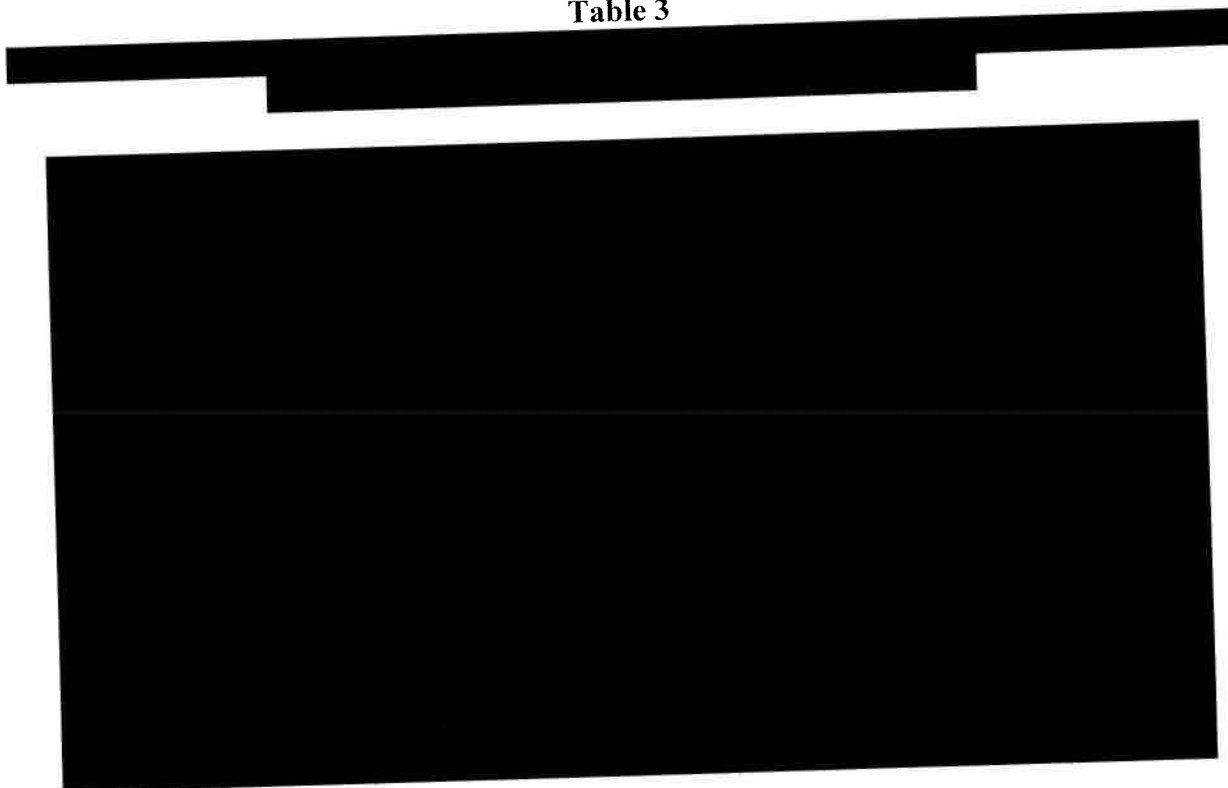
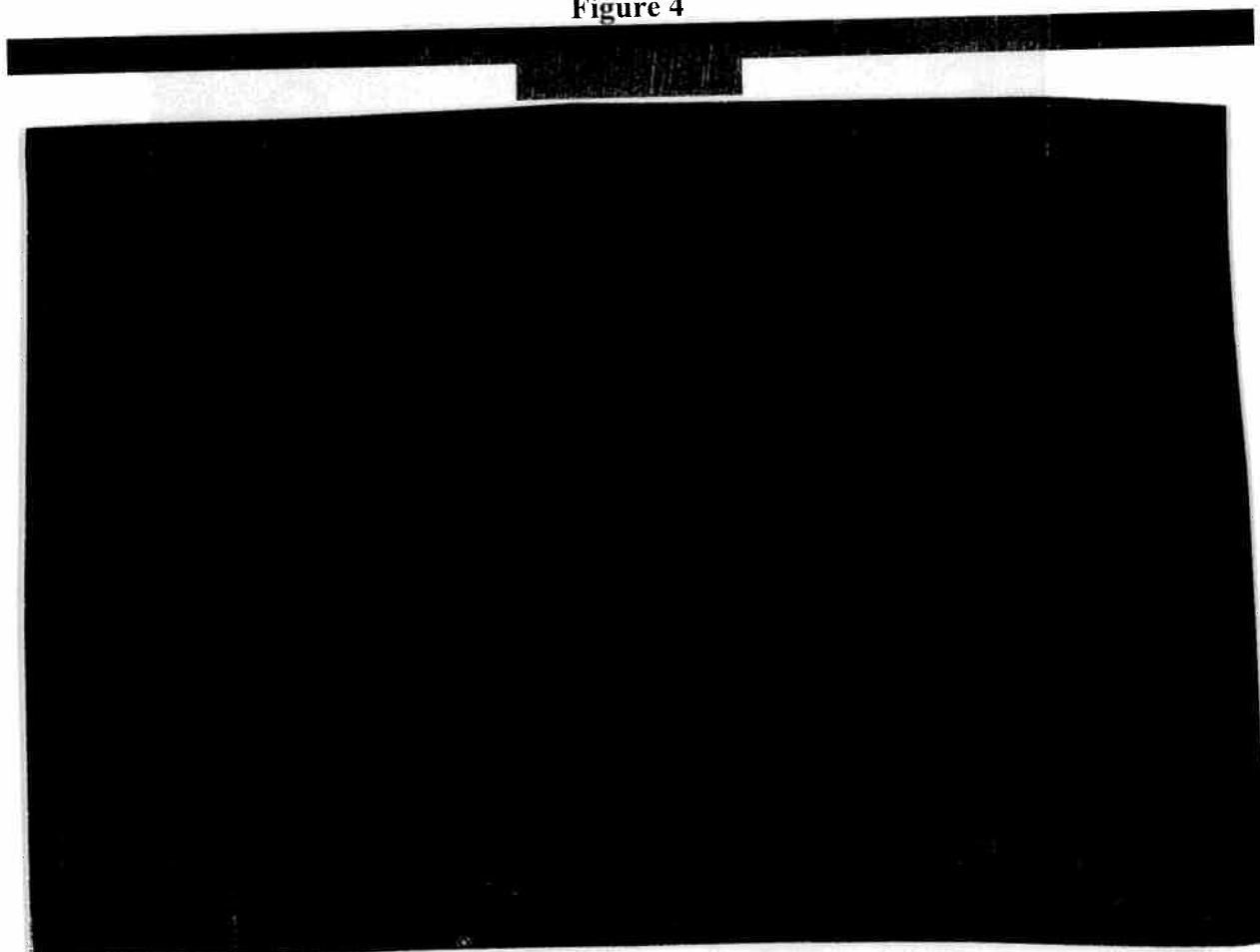


Figure 4 displays the same information in a graph of average unit costs against annual unit sales. The graph appears to show a negative relationship between average costs and sales, but this is not a supply curve. Within products, there is no systematic decline in unit costs with increasing sales. Figure 4 simply shows that larger containers have larger costs than smaller containers, and that smaller containers tend to sell more units.

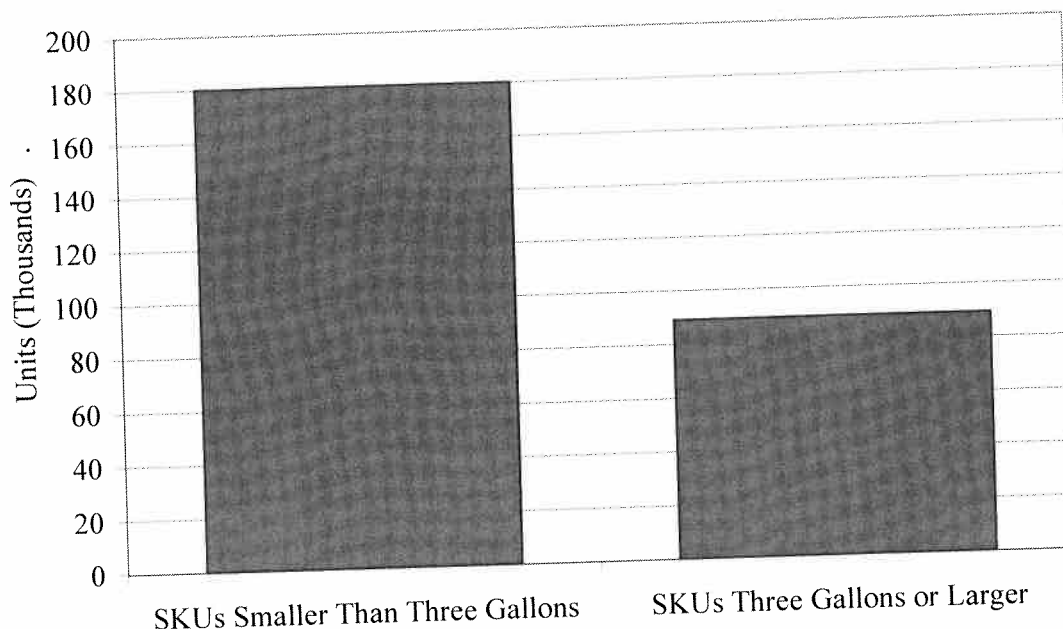
Figure 4



31. Professor Elhauge's analysis does suffer from an apples-to-oranges comparison. His regression does not distinguish between different products. He uses only a single coefficient, b , which applies to all SKUs regardless of size or cost differences across products. To illustrate the error in this regression methodology, I divide sharps containers into SKUs smaller than three gallons, and those three gallons and larger. Figure 5 compares sales of these two groups. Average unit sales of the smaller SKU are about 180,000, while those of the larger SKU are about 90,000. Since larger containers, on average, have higher unit costs than smaller ones, an analysis that ignores the size of containers, as Professor Elhauge's does, will mistakenly attribute the lower unit cost of small containers to economies of scale where none, in fact, may exist.

Figure 5

There are More Units of Smaller Containers in the Data which can Cause Erroneous Economies of Scale Estimates



Source: Elhauge Backup, "Tyco Costs Units.dta"

32. To determine the proper quantitative impact of the confounding of scale and cost differences across SKUs, I have run the following regression:

$$\text{Log}(\text{UnitCost}_{st}) = a_s + b_s \cdot \text{Log}(\text{Units}_{st}) + c_t + \varepsilon_{st}$$

In this regression, unlike Professor Elhauge, I have sought to correct for the confounding problem discussed above by altering the regression and calculating for the coefficients, a_s and b_s , on a product-by-product basis. The term c_t controls for changes in costs of inputs over time and the coefficients a_s and b_s are allowed to vary across products (SKU). This alternative allows the identification of scale economies on a product-by-product basis instead of confounding the measurement by mixing the effects of different products together. The finding from this regression is that only about 10 percent of the coefficients b_s were negative and significantly different from zero, indicating that there is no statistical

evidence for economies of scale for most products. If Covidien increased the production of containers in all SKUs by a fixed percent, the weighted sum of the coefficients b_s measures the percentage change in the average of its unit costs. Then, one can test whether there are economies of scale in Covidien's overall manufacturing of sharps containers by performing a statistical test of whether the sum of the coefficients b_s weighted by total cost for the individual SKUs is statistically different from zero. I have conducted this test, and find that there is no consistent statistical evidence that Covidien had economies of scale at a conventional level of statistical confidence. I do not opine on whether there are economies of scale for Covidien's sharps containers, but point out the Professor Elhauge's regression analysis is incorrectly done and does not support his conclusion.

IV. CONCLUSION

33. I find that Professor Elhauge's empirical analysis contains fundamental technical and statistical errors that invalidate his conclusions and render them of no probative value in support of his claims that certain contractual forms have an exclusionary impact.

I hereby declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Executed on this day October 17, 2008 in Berkeley, California.

Daniel McFadden
