DOCKET SECTION

BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

Postal Rate and Fee Changes, 1997) Docket No. R97-1

ANSWERS OF THE OFFICE OF THE CONSUMER ADVOCATE
TO INTERROGATORIES OF UNITED STATES POSTAL SERVICE
WITNESS: J. EDWARD SMITH, JR. (USPS/OCA-T600-1-8)
(JANUARY 30, 1998)

The Office of the Consumer Advocate hereby submits the answers of J. Edward Smith, Jr. to interrogatories USPS/OCA-T600-1-8, dated January 16, 1996. Each interrogatory is stated verbatim and is followed by the response.

Respectfully submitted,

Kenneth E. Richardson

KENNETH E. RICHARDSON
Attorney
Office of the Consumer Advocate

ANSWERS OF OCA WITNESS J. EDWARD SMITH, JR.
TO INTERROGATORIES USPS/OCA-T600-1-8

USPS/OCA-T600-1. Please refer to page 1 of your testimony.

a. Please provide a list of all published econometric studies that you have performed.

b. Please provide a list of all completed but not published econometric studies that you have performed.

A. a. The DOD-Contractor Relationship, Study 71-4, Logistics Management Institute, 1974, with Dr. Harold Asher. The study was summarized in the press. The study modeled the cost structures of sixteen airframe facilities, encompassing all military and commercial aircraft production in the United States. Publicly available information was restricted due to commercial, competitive, and national security reasons. Accordingly, the methodology of the econometric part of the study will be detailed.

Data Collection: Data on costs, inputs, technologies, and equipment were gathered from 16 fixed-wing aircraft manufacturers. Costs were measured in labor hours as a function of output; a similar limitation occurs in witness Bradley's study. Panel data were collected for a time span of approximately 9 to 15 years from each of the sixteen sites for a variety of activities; the major activity which was econometrically modeled was airframe assembly.

Data Scrubbing: Data scrubbing included the review of data outliers. Extensive data review was conducted through actual contact with the accounting and management personnel at each of the sites. It was determined that statistical data scrubbing would

be highly unreliable, for the outliers usually were indicative not of human error in reporting but, rather, were indicative of changes in operations. The elimination of the data via statistical data scrubbing would have deleted important information. Inadequate data scrubbing has been an issue raised by at least one witness in reviewing witness Bradley's work.

Analysis: The underlying data relationships were examined by plotting the data for each of the sixteen locations. It was found that a simple plotting of hours vs. output provided visually compelling insight on the underlying structure of the data. First, it became clear that each of the 16 regressions would have a different alpha intercept (which is what one would expect—given the differences between sites). Second, it became clear on the basis of a plotting of the data that when a regression equation would be performed beta sub i would not equal beta sub j. Similarly, a plotting of individual site data for witness Bradley's study suggests that the beta sub i do not equal the beta sub j, an assumption made by witness Bradley. Sixteen equations—one for each site—were developed based on the relationship of hours = f(output).

Economic Interpretation: Discussions with industry experts confirmed that both the alpha sub i and beta sub i were highly dependent on the underlying capital, product, and operating procedures at the sites, and that an analysis of labor hours and output was essentially a short term analysis—inappropriate for planning or longer-term costing purposes.

Econometric Conclusions: The equations were generated for each site, involving an estimation of the alphas and betas. The equations were subsequently used to estimate short-term changes in labor requirements based on plant loads.

b. **Work while at General Electric:** Participation in studies on the residential, commercial, and industrial demands for electricity. The models were based on regional data and were based on approaches from the published literature. The modeling of commercial demand required the explicit modeling of technologies rather than a simple extrapolation of trends. The projections, subsequently proven to be accurate, confirmed that the demand for electricity had significantly declined. The sales and profit implications to the $6 billion Power Systems Business were substantial.

Work while at Washington Gas: I managed a variety of demand analysis efforts using standard econometric approaches. The efforts were useful in establishing a basis for improved business planning.

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USPS/OCA-T600-2. Please refer to page 2 of your testimony.

a. Please provide the number of years that you have studied United States Postal Service mail processing costs and operations prior to reviewing witness Bradley's testimony.

b. Please provide complete copies of all studies of United States Postal Service mail processing costs and operations that you have authored or participated in.

A. a. Although I have not studied USPS mail processing costs prior to reviewing witness Bradley's testimony, my experience is immediately applicable to the evaluation of his testimony, which focuses on cost analysis in a factory environment. I have addressed a very similar econometric problem in the fixed-wing airframe industry, involving the estimation of labor hours as a function of output when associated with the Logistics Management Institute.

As a manager in General Electric's Power Transformer Division as well as other GE planning and analysis positions I gained in plant experience with job shop, automated, and mechanized factory processes—the types of processes which predominate in mail processing. During a tour of the Merrifield, Virginia, facility I confirmed the similarity between job shop factory operations and postal processing.

b. None.

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USPS/OCA-T600-3. Please refer to page 11, line 17 of you testimony where you state:

> He [witness Bradley] quotes Dr. William Greene, a noted econometrician, as stating that technological change can be measured with an autonomous time trend. However, I believe that witness Bradley's interpretation of Dr. Greene's comment is incorrect.

And page 12 line 4 where you state:

> Witness Bradley is not addressing a macroeconomic problem. Instead, on the microeconomic issue of technological change, witness Bradley needs to address the fundamental driver of technological change impacting the mail handling process.

And page 12 line 13 where you state:

> An explicit modeling of capital related variables is required in order to explain technological change and other important microeconomic factors driving costs.

a. Please confirm that on page 465 of Econometric Analysis (2nd edition) the same Dr. Greene states:
A study by Greene (1983) examines the cost of electric power generation for a large number of firms, each observed in each of several years. The basic model, for the ith firm in year t,

$$Cost_{it} = C(Y_{it}, P_{it}, t),$$

where Y is output and p is vector of factor prices, provides estimates of the rate of technological change,

$$\delta_t = -\frac{d\ln C}{dt}$$

b. Please confirm that the referred to study is a microeconomic study.

c. Please confirm that the above equation does not include "an explicit modeling of capital related variables."

d. Please confirm that Dr. Greene's model includes a time trend to capture the effect of technological change.

A. a. Confirmed. A review of Dr. Greene's article, "Economies of Scale in U.S. Electric Power Generation," Journal of Political Economy, 1976, vol. 84, no. 4, pages 655-75, indicates at page 657 that he determined to:

limit our attention to conventional steam powered generators by analyzing only the costs of steam generation for each firm examined.

This treatment of technological change highlights a problem of the relevance of the approach. Within a few years of the publication of the article a new form of steam powered generation known as the "combined cycle" (combined gas and steam generator) was substitutable for essentially all base load steam generation, and was in fact more economical. The technological change has had a major impact on the economics of electric generation. Econometric modeling could not have captured this development, being based on existing rather than projected data. Accordingly, for the specific industry at hand, the approach to technical change appears to have been inappropriate.

b. Confirmed. The modeling of technological change in this fashion is also a macroeconomic approach. Although I did not indicate that this approach was not used, the potential limitations of the approach were highlighted in the above discussion on power generation. In the case of the postal business it should be noted that the Postal Service has an elaborate, extensive investment and technological innovation program underway. It is unlikely that the past will represent the future in terms of technological change. Accordingly, other approaches to the modeling of technological change may be appropriate.

c. Not Confirmed. Equipment configuration is essentially determined by fuel type. Turning to page 663 in Dr. Greene's article, "Economies of Scale in U.S. Electric Power Generation," Journal of Political Economy, 1976, one finds the statement:

> Since fuel accounts for a very large share (approximately 65 percent) of the cost of electricity generated by steam power, it is essential to include fuel in the model as a factor of production.

It is well known in the electric business that the choice of equipment type (e.g., nuclear, hydro, or fossil) coupled with equipment specifications are the major determinants of the cost of fuel. For example, among fossil steam plants, the cost of fuel is closely tied to the type of equipment (for example, certain types of coals are suitable for specific plant configurations). Accordingly, a consideration of fuel price is essentially a modeling of equipment selection.

d. I confirm that Dr. Greene has a time trend and that he intends to capture the effect of technological change.

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USPS/OCA-T600-4. Please refer to your testimony on page 20 at line 15 where you state:

> I conclude that each of the "alpha sub i" in witness Bradley's method relates to a short-run, "monthly" facility specific cost relationship.

Please confirm that this comment is based upon the accounting period (monthly) frequency of the data. If you do not confirm, please provide all bases for asserting that the a_i are "monthly" facility specific cost relationships.

A. Not confirmed. The monthly facility specific cost relationship is the regression equation. The alpha sub i, according to witness Bradley, account for all differences between facilities, leaving only monthly data relating hours and output for explanation. I confirm that witness Bradley uses data based on thirteen accounting periods per year, that the alpha sub i are part of a cost relationship based on a fixed effects model, and that the alpha sub i capture facility specific effects. I conclude that witness Bradley has measured short-run labor/output relationships and that a longer-run analysis, as I have advocated, would be appropriate.

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USPS/OCA-T600-5. Please consider the following equation:
Y = X*Z, where X, Y and Z are all variables.

a. Please confirm that lnY = ln X + ln Z where "ln" stands for natural log. If you do not agree, please provide the formula for ln Y.

b. Please confirm that d lnY = d ln X + d ln Z. If you do not agree, please provide the formula for d ln Y.

A. a. Confirmed. Having not directly testified to this, I examined the programs in the Library References which I filed to determine any possible source of misunderstanding. Certain parts of the computer programs presented in my Library References contain logarithmic expressions. A review of the SAS code will show that the logarithmic expressions are inoperative—either because of an asterisk or because of code order. My testimony inadvertently states that the results are in log form. They are not, but none of my conclusions are changed. For clarity, an errata to my testimony is being filed.

b. Confirmed.

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USPS/OCA-T600-6. Please refer to page 6, line 23 of your testimony.
Assume that the cost function for a firm facing fixed factor prices w >> 0 is defined as:

$$\mathbf{c(w,y) \equiv \min_x\ w^*x\ s.t.\ x \in V(y)}$$

where x is the input into production, y is the output of production and V(y) is the input requirement set, and X(w,y) solves the firm's cost minimization problem.

a. Please confirm that for this cost function:

$$c(w,y) \equiv \min_x\ w^*x(w,y)$$

If you do not confirm, please provide what you think is the correct expression.

b. Please confirm that x(w,y) is known as the conditional factor input demand equation. If you do not confirm, please provide what you think to be the correct interpretation of X(w,y).

A. a. Confirmed. I examined whether the equation is in the form of a cost estimation relationship as found in operations research (for example, labor hours as a function of output, price not being present), or a cost equation (meeting the theoretical requirements of economics). In order to determine the correctness of the expression, I have reviewed the equation using two sources: Microeconomic Theory (C. E. Ferguson, R. D. Irwin, 1969), and Econometric Analysis (W.H. Greene, Second Edition, Prentice Hall, 1993). The relevant pages in Professor Ferguson's exposition are pages 202-205. The relevant page in Professor Greene's exposition is page 465. Professor Greene (consistent with Professor Ferguson) defines a cost function as follows:

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Cost sub (i,t) = C(Y sub i,t, P sub i,t, t).

The equation presented by Dr. Greene contains Y, the output; P, a vector of prices; and t, denoting time. The equation presented in the interrogatory would also appear to contain the variables and a minimization process. Assuming that the notation, minimization process, and specification in the interrogatory are consistent with Dr. Greene's presentation, I confirm.

b. Confirmed.

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USPS/OCA-T600-7. Please refer to page 15 line 15 where you state: "I am unable to confirm that the signs are consistent with a correct methodology."

a. Please define the term "correct methodology."
b. Please provide the exact criteria by which it can be determined whether a methodology is correct or incorrect.
c. Please confirm that in a panel data regression, a time trend variable will capture the effects of all factors which vary over time, including but not necessarily limited to, technological change. If you do not confirm, please explain.

A. a. A correct methodology would include the following:

1. An adequate data base, appropriately verified and complete.

2. A discussion of the modeling approach and how it is consistent with the underlying data.

3. An adequate model and analysis of functional properties.

4. A correct estimation procedure which is suitable to the estimation needs at hand.

5. A discussion of results in which the values, signs, and other outputs are fully explained.

6. Additional criteria as presented in Dr. Bonbright's evaluation factors, are presented in my testimony.

b. Whether the methodology meets the above criteria.

c. Assuming that a panel data regression is the appropriate estimating technique, the time trend variable captures the effects of all factors which have varied over time, including but not necessarily limited to technological change. However, I believe that the choice of a fixed effects approach is incorrect and that the time variable does not solely estimate technological change.

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USPS/OCA-T600-8. As an econometrician, is it your testimony that in general (without reference to witness Bradley's testimony) the methodology of estimation constrains the "correct" signs for estimated parameters?

A. My comments must be taken in the context that I am only testifying on witness Bradley's testimony.

No. I believe that the methodology of estimation is secondary to the underlying economics problem. In addressing an economic issue, the first requirement is the specification of a model and theory. Such a specification should yield testable hypotheses. The quantification and estimation would then follow. Some theories yield hypotheses that put some constraints on the reasonableness or veracity of conclusions. For example, based on various assumptions one would expect demand, supply, and cost curves to take on the forms presented in textbooks. Associated with these forms are predicted signs. Accordingly, one would be suspicious of unexpected signs, absent an explanation.

One is then faced with the problem of estimation. In arriving at a conclusion, the quantities and signs should be understandable. In some cases in witness Bradley's testimony they are not. Dr. Bonbright cited "understandability" as one of the requirements generally met by regulatory standards. On the sign issue witness Bradley's work appears to lack understandability. Accordingly, the issue becomes one of whether the modeling effort is correct.

DECLARATION

I, J. Edward Smith, Jr., declare under penalty of perjury that the answers to interrogatories USPS/OCA-T600-1-8 of the United States Postal Service are true and correct, to the best of my knowledge, information and belief.

Executed January 30, 1998

J. Edward Smith, Jr.

CERTIFICATE OF SERVICE

I hereby certify that I have this date served the foregoing document upon all participants of record in this proceeding in accordance with section 12 of the rules of practice.

KENNETH E. RICHARDSON
Attorney

Washington, DC 20268-0001
January 30, 1998