ORIGINAL

BEFORE THE

POSTAL RATE COMMISSION

WASHINGTON, D.C. 20268-0001

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POSTAL RATE AND FEE CHANGES, 1997	**DOCKET NO. R97-1**

MAGAZINE PUBLISHERS OF AMERICA
RESPONSE TO NOTICE OF INQUIRY NO. 4

(February 6, 1998)

Pursuant to Presiding Officer's Ruling No. R97-1/95, Magazine Publishers of America provides herewith as its response to Notice of Inquiry No. 4 (issued by the Commission on January 16, 1998) the testimony of Paul Higgins (MPA-NOI-1).

Respectfully submitted,

POSTAL RATE COMMISSION
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James R. Cregan
Counsel
Magazine Publishers of America
Suite 610
1211 Connecticut Avenue, N.W.
Washington, D.C. 20036
(202) 296-7277

MPA-NOI-1

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

POSTAL RATE AND FEE CHANGES, 1997	Docket No. R97-1

TESTIMONY OF PAUL HIGGINS
ON BEHALF OF
MAGAZINE PUBLISHERS OF AMERICA

My name is Paul Higgins. I am a Senior Analyst with Project Performance Corporation. A description of my background is attached to this testimony as Appendix A. I am testifying on behalf of the Magazine Publishers of America in response to Commission Notice of Inquiry (NOI) No. 4.

I. Introduction

The central issue in NOI No. 4 is spelled out in the opening paragraph:

> The 'fixed-effects' model of mail processing labor cost variability proposed by Postal Service witness Bradley in USPS-T-14 restricts the slope coefficients of his explanatory variables to be identical across facilities. Witness Bradley, however, did not formulate this restriction as an hypothesis and test it statistically . . . . Parties are requested to evaluate whether this restriction can be supported statistically.

On its face, the question the Commission raises is fairly narrow: would Professor Bradley's model withstand a formal hypothesis test, such as an *F* test, against a more general model in which all of the parameters are free to vary among facilities? In spirit, however, it points to the broader question of whether Bradley's model is supported by the available data. To answer this, I believe that some additional context is needed. Also, while the *F* test suggested by the Commission is straightforward, and raises no theoretical or methodological difficulties, there are nonetheless several potential issues that must be addressed in formulating an answer. After summarizing my major findings, I address these issues in some detail. I first present the results of the statistical tests and the hypotheses to which they correspond.

Summary of Findings

I formulate and test two hypotheses in this response: one comparing Professor Bradley's fixed-effects model to an unrestricted model in which the slope coefficients and intercepts are allowed to vary across facilities, and another in which the unrestricted model is compared to a still more restrictive (or "pooled") model that forces the slopes and intercepts to be equal at all facilities. The third possible comparison one could make, namely the pooled model versus the fixed-effects model, is unnecessary: Professor Bradley performed such a test, which he referred to as a "GNR test," and presented the results in his direct testimony. The pooled model was strongly rejected in favor of the fixed-effects model. USPS-T-14 at 41-43.

Table 1 presents the results of the former test, and Table 2 the results of the latter. All of the *F* statistics reported in these two tables are statistically significant. Also, F statistics for the pooled models are larger than for those for the fixed-effects models.

Table 1. *F* Tests for Fixed-Effects Model versus Unrestricted Model

Operation	F Statistic	Numerator DF	Denominator DF
Manual Letters	3.82	8,109	16,643
Manual Flats	3.31	7,628	16,332
OCR	2.24	6,182	12,286
BCS	2.43	7,536	15,172
LSM	3.39	6,327	13,378
FSM	2.87	5,731	12,182
SPBS Priority	2.12	622	1,321
SPBS Nonpriority	2.10	1,329	3,306
Manual Priority	3.28	4,291	11,421
Manual Parcels	2.33	5,028	12,293
Cancel/Mail Prep.	2.82	5,226	14,307

Table 2. *F* Tests for Pooled Model versus Unrestricted Model			
Operation	**F Statistic**	**Numerator DF**	**Denominator DF**
Manual Letters	5.70	8,417	16,643
Manual Flats	5.68	7,927	16,332
OCR	4.30	6,415	12,286
BCS	4.12	7,822	15,172
LSM	6.07	6,565	13,378
FSM	4.52	5,949	12,182
SPBS Priority	3.39	651	1,321
SPBS Nonpriority	5.13	1,391	3,306
Manual Priority	5.86	4,491	11,421
Manual Parcels	5.43	5,261	12,293
Cancel/Mail Prep.	5.68	5,478	14,307

In interpreting these results, we would do well to bear in mind the general notion of an hypothesis test: if the hypothesis being tested were *precisely* true, the value of the test statistic would be zero; as the estimated parameters stray from their hypothesized values, the value of the test statistic rises accordingly. If the F statistic is large enough, then our belief in the likelihood of the hypothesis is challenged. Formally, we choose some value of the test statistic, known as the "critical value," beyond which the probability of observing such parameter estimates if the hypothesis were true becomes vanishingly small. If the test statistic exceeds the chosen critical value, the statistic is said to be "significant," shorthand for significantly different from zero. Given the large number of observations in Professor Bradley's data set, the critical value beyond which we would tend to discount an hypothesis is effectively unity.

It is important to be clear about what my results mean. First, the data provide no support for models more restrictive than Bradley's fixed-effects specification, such as the pooled model or the "between" model suggested by other witnesses in these proceedings. As the results presented in Tables 1 and 2 indicate, pooled models and between models are more strongly rejected by these tests than is Bradley's model. Second, the data do not support the contention that the volume variability of mail processing labor in any of the cost pools is precisely the same at all facilities – indeed, witness Bradley's choice of the translog functional form, which permits elasticities to vary by site, makes rejection of the formal test far more likely than would a more restrictive specification. Third, the data clearly reject the notion that average mail processing variability is anywhere close to 100 percent. Taken together, the results of the analysis underlying these tests shows that variability increases as additional restrictions equating parameters across sites are placed on the model and, as I show below, any reasonable weighting scheme for combining facility-specific variability estimates results in variabilities that are *lower* than Bradley's estimates.

The last point bears directly upon some comments of one of the witnesses quoted in the NOI. Witness Smith asserted, based on his visual inspection of plots of hours versus total piece-handlings by facility for a number of mail processing cost pools, that "[t]he data plots drawn from witness Bradley's data suggest a variability approaching 100 percent for many of the activities." OCA-T-600 at 22. Juxtaposing witness Smith's assertion with the results reported in Tables 1 and 2 illustrates how feeble such arguments are. Visual inspection of 2-dimensional scatter diagrams of multivariate data, while seemingly compelling at times, is at best a weak reed upon which to base an argument, and is often downright misleading. OOne reason statisticians and econometricians developed, and rely on, regression and related techniques is the inability of the human eye to discern accurately the central tendencies of complex, multivariate data from 2-dimensional plots. The analysis I have done for the NOI leads me to conclude that the average mail processing variability is no higher than Professor

Bradley's figure of 76.4 percent. Thus, the Commission should not use the estimates of those witnesses who suggest it is 100 percent or close to it.

Implications

The results presented, while not conclusive, reduce the range of uncertainty significantly, by effectively ruling out a pooled model and by showing that the remaining models produce reasonably consistent results. The Commission, it would seem, is left to choose between two alternatives which, in general, are fairly close: the variabilities reported by Professor Bradley in his direct testimony, or those obtained from a more general, facility-specific model, suitably combined.

Recall Bradley's statement (Tr. 11/5287) that his choice of model specification was guided in part by the need to obtain a single, aggregate variability estimate for each mail processing cost pool, rather than estimates for specific facilities. Estimating the fixed-effects model using mean-centered data was presumably guided, in part, this same goal. In this light, his comment (ibid.) that the fixed- effects model is the most general specification consistent with that goal is well-taken. The need for a single set of system-wide average variabilities is not, after all, a statistical rule, but a practical issue. While statistical techniques have indicated that the best-fitting model is that which allows variabilities to fluctuate among facilities, they are silent on the question of how best to combine variability estimates from individual facilities – facilities that have been shown to differ significantly – when a single, combined estimate is required. Yet some means of combining them appears necessary if an aggregate estimate is required.

Should the Commission not accept witness Bradley's estimates, they would still need to estimate a single variability. If they did so from the unrestricted model, they could combine all of the variability estimates for a given mail processing activity across facilities for each cost pool, using either the simple arithmetic mean or the mean weighted by piece-handlings. The latter would provide the best available estimate of the pool's average, or system-wide variability, given our current state of knowledge. The variability estimates of both approaches are, as it happens, quite similar. Table 3 presents the two sets of averaged variabilities, as well as the variabilities reported by witness Bradley from his fixed-effects model for purposes of comparison.

Table 3. Alternative Variability Estimates

Operation	Unweighted Mean Variability	Weighted Mean Variability	Witness Bradley's Variability
Manual Letters	0.511	0.462	0.797
Manual Flats	0.562	0.491	0.866
OCR	0.670	0.736	0.786
BCS	0.845	0.795	0.945
LSM	0.805	0.809	0.905
FSM	0.733	0.733	0.918
SPBS Priority	0.681	0.667	0.802
SPBS Nonpriority	0.492	0.472	0.469
Manual Priority	0.307	0.371	0.448
Manual Parcels	0.277	0.295	0.395
Cancel/Mail Prep.	0.358	0.348	0.654

II. Statistically Testing Bradley's Model

When modeling the relationship of labor hours to piece-handlings in mail processing, the availability of panel data, which contains information on both the individual facilities over time and the cross-section distribution of facilities at any given point in time, permits the use of models that allow for both intertemporal dynamics and cross-sectional heterogeneity. With the additional information, however, comes a concomitant burden to statistically test a number of alternative models that would be observationally equivalent in a pure time-series or a pure cross-section model.

General Approach

In the case of mail processing labor costs we have three basic models to consider:

(1) $$y_{it} = \alpha_i + \boldsymbol{\beta}_i' \mathbf{x}_{it} + u_{it} \qquad i = 1, \ldots, N \quad t = 1, \ldots, T$$ slopes and intercepts vary by facility

(2) $$y_{it} = \alpha_i + \boldsymbol{\beta}' \mathbf{x}_{it} + u_{it}$$ varying intercepts, common slopes

(3) $$y_{it} = \alpha + \boldsymbol{\beta}' \mathbf{x}_{it} + u_{it}$$ common intercepts and slopes

where y is the logarithm of hours, $\mathbf{x}$ is the set of K regressors (including the logarithm of total piece-handlings, lagged total piece-handlings, and the other explanatory variables included in the model), the i and t subscripts index facilities and time periods, respectively, the α and β are the intercept and slope parameters to be estimated, and u is a disturbance term. These are "nested" models: they are ranked in order from least restrictive to most restrictive, and models (2) and (3) are special cases of (hence "nested within") model (1).

Model (1) is fully general, assuming that while the parameters of the model (the intercepts and slope coefficients) are constant over time, any or all of them can vary freely from facility to facility.[1] To fit this model, it is necessary to run a separate regression for each facility. Model (2) assumes the slope coefficients are identical across facilities but the intercepts are not – in effect, that facility differences affect the unconditional mean level of hours but not the marginal effect of additional piece-handlings on hours. Model (2) is equivalent to estimating model (1) subject to the set of $(N - 1)K$ linear restrictions $\beta_1 = \beta_2 = \ldots = \beta_N$.[2] Finally, model (3) assumes that both the slope coefficients and the intercepts are identical at all facilities – in other words, that there are no significant differences among facilities other than random noise. In this case a simple linear regression is called for, which is equivalent to estimating model (1) subject to the $(N - 1)(K + 1)$ linear restrictions $\beta_1 = \beta_2 = \ldots = \beta_N$ and $\alpha_1 = \alpha_2 = \ldots = \alpha_N$. For simplicity, I shall refer to the $(N - 1)K$ restrictions that transform model (1) into model (2) as H_2, and the $(N - 1)(K + 1)$ restrictions that transform model (1) into model (3) as H_3, to emphasize that they are testable hypotheses.[3]

Under the assumption that the disturbances u_{it} are independently and normally distributed over i and t with mean zero and a common variance σ_u^2, F tests can be used to test the restrictions imposed by models (1) and (2). The general form of the F test statistic is:

$$(4)\quad F = \frac{(SSE_{Restricted} - SSE_{Unrestricted})/q}{SSE_{Unrestricted}/\mathrm{df}_{Unrestricted}}$$

[1] Strictly speaking, we could entertain an even more general model than equation (1), one in which the parameters vary by time period as well as by facility. For T beyond a relatively small number, however, this is impractical, and other techniques are typically used to control for time-varying effects (e.g., by including lagged piece-handlings and time trends as regressors as witness Bradley has done).

[2] Note that K is the number of regressors in the model, which corresponds to the number of elements in β, and that N is the number of facilities.

[3] Note that there is no H_1 because model (1) is the most general model being considered.

where *SSE* refers to the sum of squared residuals, q is the number of restrictions being tested, and df is degrees of freedom. While the *"Unrestricted"* subscript always refers to model (1) for the tests I report in this response, the meaning of the *"Restricted"* subscript differs depending on the specific hypothesis being tested. The specific meanings are given in Table 4.

Table 4. Definitions of the Restricted and Unrestricted Models for Each Tested Hypothesis

Hypothesis	Restricted Model	Unrestricted Model
H_2	model (2): fixed-effects	model (1): separate regressions
H_3	model (3): pooled	model (1): separate regressions

A common testing approach[4] is to first test the most restrictive case, embodied in model (3), against the unrestricted model (1) – in other words, H_3. This is consistent with the notion that the most parsimonious model that adequately represents the data is preferred. If the F statistic associated with H_3 is not significant then no further testing is needed, since the pooled model would be preferred. If the F statistic is significant, meaning that H_3 is rejected, the next test is model (2) versus model (1) using the F statistic associated with H_2. This is the test described in the NOI. If the F statistic is significant, meaning that H_2 is rejected, then model (1) is preferred. Otherwise model (2), the fixed-effects model, is preferred.

Issues

Two issues complicate the otherwise-straightforward testing procedure called for in the NOI. The first is the correction for autocorrelation. Professor Bradley reported evidence from

[4] This approach is described in Cheng Hsiao, *Analysis of Panel Data*, Cambridge University Press 1986, pp. 12-16.

a modified Durbin-Watson test indicating the presence of serial correlation in the residuals. On this basis, he transformed his data to purge the serial correlation. USPS-T-14 at 47-51. In constructing the F statistics described above, all of the models to be tested should be run using similarly transformed data. This is important for two reasons. First, the tests must be "fair," in the sense of comparing "apples to apples." Second, and more importantly, F tests are valid only if the disturbances are statistically independent, a requirement that is violated if serial correlation is present. Since the unrestricted model requires that separate regressions be run for each facility, separate autocorrelation coefficients must now be estimated for each facility and cost pool, rather than just once per cost pool in the case of the fixed-effects model.

The F tests are also complicated by the fact that the unrestricted model, which involves estimating each cost equation separately for each facility and operation, raises the possibility that the same regression could have different numbers of regressors for different facilities. This can occur for two reasons. First, the number of observations used to fit each regression is drastically reduced, from tens of thousands in the case of the fixed-effects model to as little as a few dozen for some facilities in the case of the unrestricted model. As the number of degrees of freedom in a regression shrinks (that is, as the number of observations used to fit the regression approaches the number of parameters in the model), the likelihood increases that some of the explanatory variables in the data will become linearly dependent. Exact linear dependencies ("perfect multicollinearity") among the regressors imply that one or more of the regressors contains no independent information of use in explaining variation in the dependent variable, and must be dropped from the model before it is estimated.[5]

[5] This is not optional: it is computationally impossible to fit a regression model to data containing exact linear dependencies. See, e.g., Peter Kennedy, *A Guide to Econometrics* 3rd edition, MIT Press, 1992, pp. 176-187.

Second, for some facilities the available data cover only one of the time sub-periods that Professor Bradley used in his specification.[6] In such cases, the value of one of the time trend variables will be uniformly zero everywhere. USPS-T-14 at 15-16. Since the null vector (a variable containing only zeroes) is always linearly dependent with any other conformable vector[7], this is a special case of the linear dependency problem discussed above, implying that the null time trend variable must be dropped from the model.

In either case, one is left with the problem of how to construct an *F* statistic that best compares "apples to apples." There are three basic solutions to this problem. The first is to purge the data of any facilities that do not have observations in both sub-periods. One could then re-run the fixed-effects model as well as the pooled and unrestricted models using the purged data, and the regressions would be unquestionably strictly comparable. The problem with this solution is that implementing it changes Bradley's original regression by eliminating sites from the data set he used in his fixed-effects estimates, so we are no longer testing the precise result that he reported in his testimony.

The second solution would be to drop the two time trends from the model, substituting a single time trend that runs continuously for the entire period covered by the data set. One could then re-run the fixed-effects model as well as the pooled and unrestricted models using this re-defined trend variable, and the regressions would again be strictly comparable. The problem with this solution, once again, is that it changes Bradley's model, so that the F test would no longer be testing the model that he reported in his testimony.

[6] Recall that Bradley divided the time period covered by his data into two sub-periods, one covering the period from FY 1988 AP 1 through FY 1992 AP 13, and one covering the period after FY 1992, and created separate time-trend variables for each.
[7] See Shayle R. Searle, *Matrix Algebra Useful for Statistics*, John Wiley & Sons, 1982, p. 162.

The third solution, which is implemented in this response, is to keep all of the facilities in the data set and keep the two trend variables in the model *where it is possible to do so*. For those facilities whose data are entirely contained within one of the sub-periods, the time trend variable corresponding to the other sub-period is dropped and the degrees of freedom adjusted accordingly to reflect the change in the number of regressors.

Appendix A

PAUL A. HIGGINS

3335 Legation Street, N.W.
Washington, DC 20015-1711
phone: 202/362-5236
e-mail: phiggins@clark.net

I. WORK EXPERIENCE

University of Washington, Department of Economics, Seattle, WA, (206) 543-5955.
Graduate Research Assistant, *September 1994 to December 1995.*

Assisted with studies of long-run effects of adolescent childbearing on women's educational attainment, labor force participation, and earnings; and with study of the problem of instrument selection in highly overidentified simultaneous equations models. Wrote programs using SAS and Limdep, performed multivariate statistical analyses, tested hypotheses, and managed large-scale longitudinal data set in Unix (IBM RS/6000 running AIX) and PC/Windows environments. 20+ hours/week.

References: Prof. Shelly Lundberg, Economics Dept. (lundberg@u.washington.edu); Prof. Robert Plotnick, Graduate School of Public Affairs (plotnick@u.washington.edu); Dr. Daniel Klepinger, Batelle Human Affairs Research Institute (kleping@batelle.org).

Cornell Food and Nutrition Policy Program, Ithaca, NY, (607) 255-8093.
Consultant, *June-August 1994.*

Integrated household survey data from four sub-Saharan African countries in support of book-length end-of-project document and major grant proposal to US-AID. Performed comparative analyses of household incomes, employment, earnings, schooling, remittances, and health care utilization. Produced graphical representations (Lorenz curves) of the distributions of household incomes, labor earnings, and value of government-provided services. Performed statistical computing tasks using SAS and Gauss. 40 hours/ week.

References: Dr. Stephen Younger (sdy1@cornell.edu), Prof. David Sahn, Nutrition Division (des16@cornell.edu).

University of Washington, Department of Economics, Seattle, WA, (206) 543-5955.
Graduate Teaching Assistant, *September 1993 to May 1994.*

Assistant-taught Economics 200A, a large (300 student) introductory microeconomics course. Taught two lecture/discussion sections per week, each containing approx. 25 students, for each of three quarters; responsible for lecturing and leading discussions, going over homeworks and tests, answering questions, grading homework, writing assignments and exams, and holding regular office hours. 20+ hours/week.

Reference: Prof. Paul Heyne (Senior Lecturer).

World Bank, Washington, DC, (202) 473-0372.
Consultant, *July-August 1993.*

Managed large survey data set and performed multivariate statistical analyses using SAS in a Unix (IBM RS/6000 under AIX) environment. Produced statistical tables, graphs and figures. 40 hours/week.

Reference: Dr. Harold Alderman (halderman@worldbank.org).

World Bank, Washington, DC, (202) 473-0372.
Consultant, *June-July 1992.*

Wrote Bank working paper on adult female nutrition in Ghana. Performed multivariate statistical analyses using SAS in a mainframe (IBM 3090 under VM/CMS) environment. Developed rolling-panel data set from overlapping rounds of Ghana Living Standards Measurement Surveys. Produced statistical tables, graphs and figures. 40 hours/week.

Reference: Dr. Harold Alderman (halderman@worldbank.org).

Cornell Food and Nutrition Policy Program, Ithaca, NY and Washington, DC, (607) 255-8093.
Research Support Specialist, *May 1988 to September 1991.*

Made major contributions to studies of: (i) impacts of Structural Adjustment program on low income households in Ghana; (ii) child and adult nutrition in Ghana; and (iii) food prices and household food security in Ghana. *In Washington DC:* developed programs using SAS, SPSS and Limdep, to perform multivariate statistical analyses and manage large-scale survey data sets, in both mainframe (IBM 3090 under VM/CMS) and PC/DOS environments. *In Ghana:* supervised surveys of household expenditures, incomes, food consumption, grain storage, and food prices in two regions. Designed survey questionnaires; trained and supervised local enumeration staff; assisted with sampling design; developed and tested data entry software; trained data entry staff. 40+ hours/week.

References: Dr. Harold Alderman (halderman@worldbank.org), Prof. David Sahn, Nutrition Division (des16@cornell.edu).

Fundacion para el Mejoramiento Humano (PROGRESSIO), Santo Domingo, D.R.
Consultant, *December 1987-January 1988.*

Designed multistage random sampling methodology for agrarian survey of the Nizao watershed region of Dominican Republic, as part of a comparative study of agroforestry techniques in Haiti and the Dominican Republic. Assisted with survey design.

Reference: Sr. Merilio Morell (director, PROGRESSIO).

Cornell University, Department of Agricultural Economics, Ithaca, NY, (607) 255-2191.
Graduate Teaching Assistant, *September 1985 to December 1987.*

Assistant-taught Agricultural Economics 240, a large (200 student) undergraduate survey course in food and agricultural marketing. Taught periodic lecture/discussion sections, each containing approx. 40 students, each semester; responsible for lecturing and leading discussions, going over homeworks and tests, answering questions, grading homework and exams, and holding regular office hours. Assisted instructor in leading special discussion sections for non-departmental graduate students taking the course. Responsible for managing and operating a futures market simulation game (written in Fortran on an IBM 3090 under VM/CMS) in which all students enrolled in the course were required to participate. 20+ hours/week, Fall semesters.

Reference: Prof. Gene German.

World Bank, Washington, DC, (202) 477-1234.
Intern, *May-September 1986.*

Provided research support to the Kenya Forestry Subsector Review. Wrote background paper on roles of forestry and smallholder agriculture as contributors to deforestation, soil erosion, and land degradation in Kenya, portions of which were incorporated into final project documents. Developed farm budgets and models of smallholder agriculture for various agroecological zones and technology levels. Prepared cost tables for Kenya Forest Department investment project in plantation development and charcoal production. Compiled statistical tables and annotated bibliographies.

Reference: Dr. Pamela Cox (Senior Economist).

Cornell Institute for Social and Economic Research, Ithaca, NY, (607) 255-4801.
Technical Consultant, *September 1984 to August 1985.*

Provided statistical computing and data base management support to the CISER data archive and Cornell social science researchers. Managed, pulled data extractions from, and performed statistical analyses of a variety of large, machine-readable data sets, including US Census, PSID, NLS, and ICPSR data sets. Consulted with Cornell and visiting researchers on data and tape management, data cleaning, database design, and statistical computing. Wrote programs in SAS, SPSS, JCL and REXX for CISER staff, Cornell researchers, and commercial clients. Held regular drop-in consulting hours (mostly on SAS programming issues and data extraction/cleaning/management).

Reference: Mr. Thomas Boggess (tdb1@cornell.edu).

Sobotka and Company, Inc., Washington, DC.
Consultant, *June 1983 to July 1984.*

Under the supervision of a senior associate, provided economic analysis and computing support to US Environmental Protection Agency, Office of Toxic Substances and Office of Solid Waste, in support of several proposed and existing regulations. Assisted in the preparation of cost-benefit and cost-effectiveness analyses of alternative regulatory options for the synthetic polymer products industry. Assisted in preparation of expert testimony, cross-examination, and redirect testimony on behalf of the Third Class Mail Association in the 1983 Omnibus Rate Hearings of the US Postal Rate Commission.

Reference: Mr. Lawrence Buc, (301) 601-1835.

Congressional Budget Office, Natural Resources and Commerce Division, Washington, DC, (202) 244-3121.
Intern, July *1982 to May 1983.*

Prepared study of the chlorofluorocarbons industry and proposed market-based regulatory options at request of Senate Committee on Environment and Public Works. Surveyed alternative approaches to environmental regulation in Japan, Canada, the UK, Germany and the US. Assisted with analysis of regulatory reform options in the electric utility and natural gas industries. Wrote programs in SAS and TROLL to perform statistical analyses.

Reference: Dr. Everett Erlich, Washington DC, (202) 482-3727.

II. EDUCATION

University of Washington, Department of Economics, Seattle, WA, (206) 543-5955.
PhD student, September 1993 to present. (Withdrew December 1995 due to birth of child. Remain doctoral candidate in good standing, having passed all preliminary and field examinations required for the PhD.)

Coursework included 7 quarter hours of microeconomic theory, 4 quarter hours of macroeconomic theory, 3 quarter hours of advanced mathematical economics, 9 quarter hours of econometric theory, 6 quarter hours of demography, and 11 quarter hours of other economics courses (see attached course list).

References: Prof. Shelly Lundberg, dissertation advisor (lundberg@u.washington.edu); Prof. Anil Deolalikar (anil@u.washington.edu); Prof. Elaina Rose (erose@u.washington.edu), Prof. Paul Heyne.

Awards: Demography Fellowship, 1995-96 (NICHD Traineeship administered through the UW Center for Studies in Demography and Ecology); Graduate Research Assistantship, 1994-95 (Economics Dept., Prof. Lundberg, supervisor); Graduate Teaching Assistantship, 1993-94 (Economics Dept., Prof. Heyne, supervisor).

Research Interests: Labor Economics; Economic Development; Economic Demography; Econometrics and Statistics. Major fields: Labor, Development. Minor field: Econometrics. Working dissertation title: "Female Wages, Job Mobility, and Fertility Timing: Adolescent Childbearing and the Determinants of Adult Earnings in a Life-Cycle Framework."

Tulane University, Department of Economics, New Orleans, LA, (504) 865-5321.
MA/PhD. student September 1991 to May 1993. Master of Arts in Economics awarded May 1993. (Withdrew May 1993, in good standing and having passed all preliminary examinations required for the PhD, in order to transfer to the University of Washington in Seattle — see above.)

Coursework included 9 semester hours of microeconomic theory, 6 semester hours of macroeconomic theory, 3 semester hours of mathematical economics, 9 semester hours of econometrics and statistics, and 6 semester hours of other economics courses (see attached course list).

References: Prof. Insan Tunali, advisor (itunali@ares.ku.edu.tr); Prof. Mark Kennet (KennetM@ore.psb.bls.gov); Prof. Noel Gaston (ngaston@economics.adelaide.edu.au).

Awards: Regents Fellowship, 1991-92 and 1992-93.

Fields of Concentration: Economics of Development, Econometrics.

Cornell University, Department of Agricultural Economics, Ithaca, NY, (607) 255-2191.
MS student September 1985 to May 1988. (Withdrew, in good standing and having completed all course requirements for MS degree, did not submit thesis.)

Coursework included 12 semester hours of microeconomic theory, 4 semester hours of mathematical economics, 8 semester hours of econometrics and statistics, and 9 semester hours of other economics courses (see attached course list).

Awards: Herbert H. Lehman Graduate Fellowship, 1985-86, 1986-87, 1987-88.

References: Prof. Christine Ranney, advisor (ckr2@cornell.edu); Prof. Insan Tunali itunali@ares.ku.edu.tr).

Field of concentration: Economic Development.

University of California, Santa Cruz, CA, (408) 459-2743.
Enrolled September 1976 to May 1977, January 1979 to May 1982 (gap due to illness.) Bachelor of Arts in Economics, minor in Politics, awarded May 1984.

References: Prof. Alan Richards, Economics (advisor); Prof. Tibor Scitovsky, Economics.

Awards: Honors; Research Assistantship in Comparative and International Studies, 1981-82 (Prof. Richards, supervisor); Chancellor's Undergraduate Award 1982; and Merrill College Service Award, 1982.

III. OTHER TRAINING

"Introduction to SAS programming and the SAS language" (40 hour mini-course, September 1982, Congressional Budget Office, Department of Computer Services)

"Basic SAS Programming" (10 hour mini-course offered by Cornell Computer Services, October 1984)

"Advanced SAS Programming" (8 hour mini-course offered by Cornell Computer Services, November 1984)

"Introduction to SAS Graph" (6 hour mini-course offered by Cornell Computer Services, January 1985)

"Introduction to Gauss" (8 hour mini-course offered by Tulane Economics Dept., November 1991)

"Dynamic Programming" (3 semester hour course offered by Tulane Economics Dept., Spring semester 1992)

IV. PUBLICATIONS

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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.

James R. Cregan

Washington, D.C.
February 6, 1998