LITIGATION ECONOMICS DIGEST

Volume IV Fall 1999 Number 2

An Editorial Farewell

Litigation Economics Digest made its first appearance with its Fall 1995 issue. The new journal was a result of the 1994 NAFE Board of Directors meeting, where the Board decided that the organization should expand the scope and quantity of services provided to its members. In that first issue, we told you that the *LED* would be a companion to the *Journal of Forensic Economics*, but would tend to focus on the "practical/applied" side of forensic economics, leaving the *JFE* to specialize in more "theoretical" and traditional issues. With that goal in mind, we noted that we hoped to publish quality articles on commercial litigation, securities fraud, environmental and employment litigation, and business valuation, among other things, and also to provide a significant number of "how-to" papers and case studies. We also envisioned that short pieces on new software, data bases, and legal developments affecting expert witnesses would be regular features in every issue.

We were relieved, at least initially, when these goals were largely achieved in the first three issues (Fall 1995, Spring 1996, Fall 1996). It was also clear that we were not meeting the original goals set forth for the journal. In the Fall 1998 issue we took stock of the situation, declaring a mixture of success and failure relative to our initial goals. Only about half of our published features could be thought of as applied or practical forensic economics; to a considerable extent, we simply were a supplement to the *JFE*. The short specialized features had appeared frequently, but not with the regularity that had been foreseen at the beginning. We attempted to stimulate the number of case studies by clarifying the criteria for case study submission and publication. In spite of these efforts, the Spring 1999 issue was the slimmest one yet, and we are getting the Fall 1999 issue to you in 2000!

With this issue, we will be leaving our positions as Managing Editors of the *Litigation Economics Digest*. We will be replaced by two enthusiastic and eminently-qualified forensic economists, Patrick Gaughan and Steven Shapiro. As we have noted elsewhere, managing editor performance is largely dictated by the volume and quality of materials submitted for review and publication. Our farewell thought is to wish a happy future for the *LED*, and to hope that the worst headache for the new editors will be to decide which of many outstanding papers should be published in the each next issue, and which should be postponed for later issues!

Carroll B. Foster Robert R. Trout

December 1999

Dear Colleagues:

This issue of the Litigation Economics Digest (LED) will be the last issue produced by Robert Trout and Carroll (Skip) Foster as the editors. As most of you know, Bob and Skip were the first editors of the LED, and took it from a new journal in 1996 to an established journal of NAFE. Forensic economics is slowly becoming a sub-discipline within economics, and the journals published by NAFE, including the LED, have made a contribution towards that end. Bob is now planning to devote more time to his business activities and writing projects, and Skip to his teaching and publishing. I wish them both continued success in those endeavors.

A committee chaired by Robert Thornton made a series of recommendations for the future of the LED and these recommendations were accepted by the NAFE Board during its summer meetings in July 1999. At that time the Board also appointed Steven Shapiro and Patrick Gaughan as co-editors of the LED. They assisted Bob and Skip on this issue of the LED, and will be responsible for all future issues. The focus and orientation of the journal will change, with an increased reliance on "area editors" and the inclusion of practitioner types of articles in each issue. Steve and Pat have a separate letter in this issue providing a more detailed look at the new LED.

Michael J. Piette

Letter from the Incoming Editors

We are honored to be selected by the Board of the National Association of Forensic Economics to serve as the next Managing Editors of Litigation Economics Digest (LED). We are succeeding Robert Trout and Carroll Foster, who have done an outstanding job in establishing LED as a viable journal.

Our plans for Litigation Economics Digest (LED) are very similar to the format for LED that was outlined in the July 29, 1999 Report of the National Association of forensic Economics Journals Committee. Although we do not intend to preclude articles that are related to estimation of damages in personal injury and wrongful death cases, we wish to encourage publication of applied work in other areas of the law, such as commercial litigation, antitrust, intellectual property, employment litigation (including statistical issues), securities law, environmental litigation and the valuation of financial assets and closely held businesses.

We intend to continue having contributed and refereed articles that will appear in every issue. In addition, we are actively soliciting specialists in various areas who will write special contributed articles. Such specialized articles will focus on surveying techniques and methodologies that are being used in a particular area of litigation (e.g., the use of statistics in discrimination cases or methodologies used to value professional practices). In order to solicit articles from specialists in variety of areas, we intend to network with accounting groups (e.g., AICPA), associations that serve business valuation practitioners, and economists who publish in other journals that are devoted to law and economics.

We are also in the process of gathering a team of Associate Editors who will be a source of regularly contributed applied articles in litigation economics. Associate Editors will also be assisting us in the activity of soliciting specialized articles. We are pleased that the following individuals have agreed to serve as Associate Editors: Robert Trout, Kurt Krueger, James Rodgers, Robert Thornton and Armando Rodriguez. Robert Trout (Lit.Econ, LLP) will be focusing on the areas of business valuation and commercial damages. Kurt Krueger (John O. Ward & Associates) will be regularly contributing articles on computer software, data sources and sites on the Internet of interest to litigation economists. James Rodgers (Pennsylvania State University) and Robert Thornton (Lehigh University) will be surveying articles of relevance to litigation economics. Armando Rodriguez (KPMG Peat Marwick) will be specializing in antitrust.

The next issue of LED will be published in Summer 2000. We are actively seeking contributed articles.

Patrick A. Gaughan
Fairleigh Dickinson University

Steven J. Shapiro
University of New Haven

NOTES

The *Litigation Economics Digest (LED)* specializes in presenting applied articles in the discipline of forensic economics, and useful consulting information to the forensic practitioner.

The *LED* is published bi-annually at no cost for NAFE members, and a fee of $60 for non-members. Subscriptions should be sent to the National Association of Forensic Economics, P.O. Box 30067, Kansas City, Missouri 64112.

We are now soliciting articles in forensic economics for publication in future issues. The next issue will be published in the year 2000. The *Digest* contains articles in the following arenas: Applied Forensic Economics, Law and Economics, Data Sources, Computer Programs and Ethics in Economics. Those interested should forward two copies of their article, along with any other pertinent information, and a reviewer fee of $25 (payable to LED), to the Editorial Office at the address shown below:

Litigation Economics Digest
P.O. box 4021
Woodbridge, CT 06525

(203) 397-8935 FAX: (203) 397-8949 email: litdigest@yahoo.com

While the *LED* does not accept advertisements of consulting services, we will accept advertisements concerning computer software, books and consulting support services. Advertising rates are available upon request.

The National Association of Forensic Economics expresses its thanks to the University of Missouri - Kansas City, for technical support in producing the *Litigation Economics Digest*.

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A 1999 SURVEY STUDY OF FORENSIC ECONOMISTS -- THEIR METHODS AND THEIR ESTIMATES OF FORECAST VARIABLES

by

Michael Brookshire and Frank Slesnick*

In March, 1999, 681 surveys were sent to the population of NAFE (National Association of Forensic Economics) members, with libraries and attorneys excluded. The survey instrument covered several topics, including economic methodology, proposed research topics for forensic economists, current consulting practices, and open-ended questions concerning ethics and reaction to the survey instrument. There were 184 usable responses for a response rate of 27 percent. Although a follow-up postcard was sent to all individuals receiving the survey requesting that they complete the instrument, the response rate was only marginally higher than earlier surveys in 1990, 1993, and 1996.

The results of the survey will be examined with a direct comparison to earlier surveys. For this reason, where possible the wording of the questions was taken from earlier surveys. However, for some of the questions it was necessary to add certain options and delete others. Further, there were a few new questions added, such as those related to inflation indexed securities.

Although comparisons are made with earlier surveys, there was no determination of whether the same individuals responded to the different surveys or whether those who responded were representative of the current NAFE population. There were two reasons why questions were not included which could have matched the respondents of the questionnaire with that of the NAFE population. First, at the time the survey was conducted there was not reliable information concerning the NAFE population itself. Since that time, such information has been compiled. Second, questions categorizing individuals can be used to match the respondents to the characteristics of the population, and to categorize specific responses to certain questions. For example, the survey question concerning the net discount rate could have been analyzed as a function of the type of advanced degree attained. The authors felt that respondents may not have completed the survey if they thought their answers would be used in this manner, given the intense discussion within NAFE regarding who is qualified to perform forensic economic calculations.

However, there is some indirect evidence that the survey respondents were representative of the NAFE population. In the "Report of the Committee on NAFE Membership and Participation," the percentage of the NAFE population that has no academic affiliation is 49.8 percent. Question 19 of the survey asked the source of the respondent's income. In that question, 47 percent of the respondents indicated no faculty income. Thus, in terms of academic affiliation, the respondents of this survey are very similar to the NAFE population. Further, even if the survey is not entirely representative of the NAFE population, it is reasonable to assume that individuals with the greatest interest

* Michael Brookshire is at Marshall University Graduate College and Frank Slesnick is with Bellarmine University. The authors wish to give special thanks to Professor Michael Luthy, Associate Professor of Marketing, Bellarmine College, to our research assistant Vandana Malik, and to Marshall University for financial assistance.

and experience in the field completed the survey. In fact, as indicated in Question 15, the average length of experience of the respondents was over eighteen years.

For most of the survey questions, the results will be explained and directly compared to earlier surveys. To simplify the presentation, codes will be used when referring to the surveys.

S1 - Brookshire, Slesnick and Lessne, JFE,Vol III, No 2, Spring/Summer 1990

S2 - Brookshire and Slesnick, JFE, Vol IV, No 2, Spring/Summer 1991

S3 - Adams, Brookshire and Slesnick, , JFE, Vol VII, No 1, Winter 1993

S4 - Brookshire and Slesnick, , JFE, Vol VII, No 1, Winter 1993

S5 - Brookshire and Slesnick, , JFE, Vol X, No 1, Winter 1997

S6 - Current Survey

Complete citations of the surveys are listed in the References at the end of the paper. Since there will be frequent mention of earlier surveys, corresponding questions will be coded in the following manner: (Survey,Survey Question,Page Number). For example, a reference to (S3,16,12) will mean the 16th question in survey S3 on page 12.

In earlier surveys, some questions had answers that were unrealistic, such as a real rate of wage growth of 10 percent. In these situations, the authors made a decision to eliminate such answers based upon their own judgment. In this survey, there were no extreme outliers. The exact reason for this happy result is uncertain, but is likely due to either respondents being more careful, or to more carefully worded questions, or to more experience and better communications among 1999 respondents.

Each question allowed respondents to provide comments. It has been the experience of the authors that the comments are often more valuable than the statistical results. The comments were chosen at the discretion of the authors, who used their judgment in attempting to present "representative comments."

During the development of this survey, several members of NAFE expressed concern that previous survey results were being improperly used by some forensic experts. Because of these discussions, the authors have agreed to the following statement:

> "This article stems from a survey of the NAFE (National Association of Forensic Economics) membership. The views of the respondents do not necessarily represent the view of the National Association of Forensic Economics, or of its Board of Directors, or of all the members of NAFE. The authors have not attempted to determine what biases, if any, exist in the results due to (a) the general composition of all experts who testify about economic damages, (b) the effect of nonresponses, (c) the effects of various state and federal case and statutory laws, and (d) the accuracy and truthfulness of the responses received. To have determined the actual practice of all forensic economists and correcting for these potential biases

was beyond the scope of the research effort. Therefore, the use of this survey in court, deposition, or other litigation settings to buttress or criticize the use of particular parameter values or particular techniques should not be undertaken except as supporting conclusions obtained from other data sources and not unless the individual carefully explains the statistical limitations of the survey as outlined above."

Question 1: Assume that the judge instructs that you MUST incorporate price inflation into a 30-year forecast of economic loss.

Complete the sentence... "I would use _____% as the average annual rate of price inflation (increase in the CPI) over this 30-year period."

The number of respondents was 171. The results of the current survey, S6, are as follows in comparison to earlier surveys:

	(S1,15,22)	(S4,3,27)	(S5,1,2)	(S6)
Mean	5.01%	4.34%	3.98%	3.58%
Median	n.a.	4.0%	4.0%	3.4%

The middle 50% of the responses was between 3% and 4.3%. The answers varied between 1% and 6%. The mean, forecast value of estimated inflation over the next thirty years has fallen nearly one-and-a-half points since the 1990 survey. The 1999 mean is slightly higher than the median value. Further, the distribution is relatively "tight", given that half of the responses are between 3% and 4.3%.

Comments:

3% to the year 2005 and 4.4% thereafter...
Not fixed: varies by year based on social security's most recent forecast.
Past 30 years average.
4.6% is long term inflation rate 1939-1996 stat abstract.
The number would be based on the current yield curve-estimating the implied inflation forward rate embedded in current 30-year yield.
Could review historic increases and justify a higher percent, but juries and laypersons tend to think in terms of the present.
Average annual increase in CPI-U for period 1970-1998. I will use the 1991-1998 period as a comparison, which is 2.60%.
Approximate difference between current long-term treasuries (5.8%) and current long-term inflation indexed treasuries (3.8%).
That's the 20-year average change in the CPI.
The 30-year period is way too long. It is much longer than typical damage periods.
This is the most recent projection from the Philadelphia Fed summary of professional forecasters.

Question 2: Assume that the judge instructs that you MUST incorporate medical cost inflation (increases in the MCPI) into a 30-year forecast of economic loss.

Complete the sentence... "I would use _____% as the average annual rate of medical cost inflation over the 30-year period."

The number of respondents was 160. The results of this survey, S6, are as follows in comparison to earlier surveys:

	(S1,22,25)	(S4,4,29)	(S5,2,3)	(S6)
Mean	7.64%	6.48%	5.71%	5.15%
Median	n a.	7.0%	6.0%	5.0%
Differential Over CPI	2.63%	2.14%	1.73%	1.57%

The middle 50% of the distribution ranged from 4% to 6% with the low and high values equal to 0% and 10%. It is clear that the estimate of the increase in medical cost has fallen over time. The row labeled "Differential" shows the difference between questions 1 and 2. Thus, not only has the estimate of the increase in the MCPI fallen over time, but the difference between the rate of increase in the MCPI less CPI has fallen as well.

As indicated in the comments below, some respondents preferred to assign different rates to different time periods. For example, some believe that the current, relatively low rate of increase in medical costs may not be sustainable over time In fact, assigning different rates to different time periods was mentioned by a few respondents in each of the first four questions.

Comments:

5.5% to the year 2005 & 4.4% thereafter.

The 7% would be for overall medical care. I have found that medical cost inflation rates depend on the medical goods in question. Medical care commodity (prescriptions, equipment, etc.) inflation rates are lower than medical cost service inflation rates, which are lower than hospitalization inflation rates.

As an economist, medical inflation cannot continue to increase indefinitely at above average price.

Rate as of 3/99. Based on medical CPI for past 10 yrs.

This is the 1977-97 annual change. I generally use the commodity rate of 6.585 or 1.59%-real and the medical service rate of 7.49% or 2.50% real. Real difference between general CPI rate of 4.99 and the various medical rates. It's the excess of medical over general inflation.

At a rate much higher than this the great majority of the economy will be medical. It won't happen.

Actually, I would use a weighted average of all the various components of the medical care plan, using CPI subcategories, weighted by their proportionate share of the total costs.

Subject to refinement. Use because this reflects about the experience of the last 20 yrs. During that time substantial changes have taken place in insurance, Medicare, Medicaid that have altered the path from that of CPI.

Medical Services 4.4%; medical commodities 2.8%.

Eventually there will be convergence with CPI and CPI med. I would taper CPI med to 3.16% over 10 yrs. Then hold it constant.

This is the sum of the projected rate of inflation and the geometric difference between rates of increase in the CPI and rates of increase in medical prices (1.0394 - 1.01). If I could use real rates, then 1.9%.

Question 3: Assume that the judge instructs that you MUST forecast the rate of increase in attendant care costs over the next 30 years as part of estimating the cost of a life care plan. The attendant will be relatively unskilled requiring, at most, a certificate as a nurse's aide.

Complete the sentence... "I would use _____% as the average annual rate of increase in attendant care costs over the 30-year period."

163 individuals answered this question, which had not been used in previous surveys. The rationale was that for many life care plans used in lawsuits involving injury, attendant care is a significant proportion of total costs. In the authors' experience, attendant care can often be over 80 percent of total costs.

The mean value for the increase in attendant care costs was 4.079%, while the median value was 4%. The middle 50% of the responses ranged from 3% to 5%. The extreme values were .2% and 8%. An increase of 4% is certainly in the generally accepted range of wage growth for the entire economy. Thus, respondents to the questionnaire generally believe that attendant care will increase at approximately the same rate as occupations in general.

Comments:

Rate as of 3/99. Based on 1) other medical professional services component of CPI for past 10 yrs; and 2) 10-yr. projections by the office of the actuary: Health Care Financing Admin.

I would use wage growth rather than medical cost inflation for this item.

1977-97 annual change in bus-sector compensation. (I do not consider this a medical service subject to general medical or medical service inflation.)

Minimum wage rate of change over last 49 years.

%growth "average annual wage in covered employment" SSA forecast.

Inflation plus 1% real growth of wages.

The prior 30-year increase in costs of nurse's aides.

Nurse's Aid-Hospital Salary Survey, 67-97.

We use a 25-year average of non-farm workers to determine such a calculation.

Historical income tables high school female, full time year round workers, 1991-97.

The demand for personal care attendants is expected to be greater than for other unskilled

workers.

Question 4: Assume that the judge instructs that you MUST estimate a net discount rate in your forecast of economic loss for a 30-year period. The net discount rate may be based upon either nominal or real values. (Please note that for this question the net discount rate is equal to the interest rate minus the general rate of wage increase for all U.S. workers.)

Complete the sentence... "I would use _____% per year as the average net discount rate over 30 future years."

The number responding was 166. Based upon extended discussion with other forensic economists, it was decided that the survey question would determine the net discount rate directly, rather than as the difference between two separate questions concerning the interest rate and the rate of wage growth (where the net discount rate is defined as the interest rate minus the rate of wage increase). In three previous surveys, S1, S4, and S5, the net discount rate was determined by the difference between the real rate of interest and real wage growth, and was equal to approximately 1 percent.

In this survey the net discount rate as defined in the question was 2.13%, a significant increase compared to the estimates from the previous three surveys. Either the method of asking the question in this survey produces different results compared to earlier surveys, or respondents believe that the net discount rate has changed (or possibly a combination of the two reasons). The middle 50% range was 1.5% to 2.5%. The extreme values were -1.2% and 6%. Perhaps the most surprising result was that only 5.42 percent of respondents indicated values less than .5%. One of the rules used by a few states is that the net discount rate should be zero, commonly known as the total offset rule. Clearly such a choice is not popular among forensic economists who responded to this survey.

Comments

This is an average, which will change based on the worker's occupation.

The "ratio" of discount to increase is more accurate than "minus". On a "minus" basis the answer is 2.54%. There are also other ways to measure increase that may be more valid than wage rates. But it's your question...

I do not use this approach and do not think very highly of it. I would base my answer on current nominal rates of return on U.S. government securities. Today, this would produce a negative net rate of maybe 1 percent.

Total offset. If the judge insists on an actual wage number and interest number, I would use 3% for both.

Much ink, some venomous, has been spilled on the forecasting question as if any basis provides the Holy Grail of truth. 2% represents a "satisfying'" value.

Michigan law requires 5% simple interest for discounting future values so net discount rate is not something I worry about.

The 30-year period is way too long. It is much longer than typical damage periods. It biases the survey toward younger-than-typical workers, and thus toward lower net discount rates.

The current expected real rate of interest is approximately 2.9% (US bonds less expected

inflation). The average of real private sector wage increase is 0.7%. The geometric difference is approximately 2.2%.

Question 5: Assume that an injured worker has 30 additional years of worklife expectancy. Regardless of your mix of government securities versus other securities that you might consider, what is the maturity of securities that you would emphasize in selecting an interest rate(s)? (please check only one of the options below)

_____ **Short-term securities (maturing in less than one year).**

_____ **Intermediate-term securities (maturing in one to ten years).**

_____ **Long-term securities (maturing in more than 10 years).**

_____ **A "mixed" portfolio incorporating a variety of maturity lengths.**

_____ **Other (if you select this option, please explain below).**

The number responding was 176. Comparison with previous surveys indicates the following:

	(S2,11,134)	(S4,10,35)	(S5,8,9)	(S6)
Short-term	17.8%	20.1%	20.3%	22.16%
Inter.-term	18.9	20.1	22.6	17.05
Long-term	24.4	26.2	24.9	26.13
Mixed	32.2	23.5	27.1	28.98
Other	6.7	10.1	5.1	5.68

There are two strong conclusions that can be based upon the above data. First, there is consistency in the percentage using the various portfolios of securities over the years of the survey. Second, there is little agreement concerning the appropriate maturity of the portfolio itself.

Comments:

1) For personal damages, short-term securities to eliminate inflation risk or TIIS, 2) For business damages, or valuation of personal assets beyond 10-year time horizon, a diversified portfolio of stocks and bonds returns.
A tax-free annuity
Dedicated portfolio using linear programming.
A judgement call based not only on current rates, but those likely to be available for the early-year reinvestments the fund is likely to make.
Average yield on high-grade municipal bonds over prior 20 years.
I use the 5-year bond for the first 5 years, the 10-year bond for the next 5 years, and the 10-year+ composite yield for the balance.
We must use risk-free rates, including 91-day bill maturities. The tortfeasor cannot be allowed to gain by longer-term maturities.
Need flexibility to adjust to possible high increases in wages. A mixed portfolio of one-three, five year's securities is probably optimum.
Average of 10-yr treas. Bonds and 90 day T-bills. Average based 1953-1997.
A "mixed" portfolio offers the advantages of security and longevity.

Question 6: Do you use Treasury Inflation Indexed Securities (TIIS) in developing an estimate of the interest rate or net discount rate? (check one)

____ YES	____ NO
If you checked "Yes", please explain How you use TIIS in developing an estimate of the interest rate or net Discount rate.	**If you checked "No", please elaborate why you chose not to use TIIS.**

This is a new question. The number responding was 177. The percentage of "Yes" answers was 14.12% while the percentage of "No" answers was 85.88%. As indicated in the "Comments" section, some individuals indicated "No" because they were unfamiliar with these bonds rather than having an objection to their use.

Comments:

ANSWERED NO
1) I do not believe that TIIS represent a true measure of the net difference between nominal interest rates and inflation because of the delay in receipt of the inflation adjustment and the early taxation of same. 2)TIIS are not sufficient short duration to fit my answer to question 5 above, i.e., my preference for examining interest rates on short-term (less than 1 year) securities.
If the public does not accept them, why should I?
I intend to begin using them as soon as enough have been issued to provide a broader range of maturities.
I use the same inflation rate to obtain real interest (discount) rate that I use to obtain real

growth rate.

It is difficult to explain to the court/jury.

Too new. Not enough historical data available to analyze usefulness.

Too complicated: taxes, long periods of loss, etc.

Have not had time to research this security.

I understand from some of the NAFE-L discussion there is a "liquidity" problem with their use.

The real yield has been higher than expected. It is unclear whether this trend will continue or rates will fall. It may take a number of years before these instruments establish a pattern. Therefore, I still favor T-bills.

I use the long-term relationship between wage growth and the interest rate on a portfolio of government bonds.

I use a zero to 2% net discount rate-this range is supported by many empirical studies. We need more empirical analysis on TIIS before we can determine how to use it. For some, it is equal to the real interest rate. For others, it measures the real rate and some risk factors.

Virtually all of my work is done in Pennsylvania, where "total offset" is applied.

May be a possibility in the future, but now they don't have a proven track record; don't have a clearly accessible market for future trading.

Tax complications.

Liquidity considerations and tax considerations.

I prefer to use 20-year average yield on high-grade municipal bonds.

See article in JFE Vol. XI #1 Winter 1998 by Kent A. Jayne entitled "Why Inflation-Indexed Treasury Securities Are Not Well Suited for Discounting a Future Earnings Stream" for salient arguments.

No real gain in accuracy, more complicated to explain to atty's and jury. Be conservative, simple, and clear. Too many economists make this work "intellectually complicated" in a non-academic or intellectual setting. This makes money for the economist and possibly the atty. Seldom results in an improvement of justice, equity, or for that matter accuracy in estimating values in a highly speculative process.

I haven't in a case yet, but the logic of using them is compelling to use in future cases.

I have used TIIS in the past, but have not resolved the tax problem. Further, recent articles in both the Boston 7 Dallas FRE (bulletins) suggest caution about the use of these rates for discounting purposes.

ANSWERED YES

CPI over length of period to be projected into future + current real yield on TIIS nominal interest rate; rate of wage growth - nominal interest rate= net discount rate.

Simply for reference. I look l.t. & s.t. treasury issues, consider range of projections for inflation and compare with TIIS yields (keeping in mind tax disadvantage and reduced liquidity).

Begin with TIPS rate, subtract 0.3% for tax reasons, and subtract about 0.45 for growth in real earnings to get NDR.

I regard this as a market measure of the real rate and I couple it w/a real measure of wage increase.

I use them as a "check" or backup of my own calculation of the real interest rate.

I took the latest TIIS rate from p.c20 of the WSJ and deducted 0.25% to correct for the tax effect, and 1.5% to reflect a forecast of productivity increases over 30 years.

I don't use them via a formula, but I note that their 3.5 to 3.75% range is slightly above (after adjusting for tax effects) the 3% I use. I may move more explicitly to them as their terms structure fills in.

Sometimes. When using a real interest rate approach, instead of a nominal interest rate approach, I check rates on indexed T-bonds and do a rough average over different maturates. Currently around 3.5%.

Real wage growth = .5%, TIIS = 3.5%. Difference = 3.0% less transaction and management costs 0.5% = net 2.5%.

Question 7: When determining the interest rate for present value purposes over 30 future years, I generally use ... (check one):

_____ **Current interest rates.**

_____ **Some historical average of interest rates.**
I use a historical period of _____years.

_____ **Some other method (please explain in Comments section).**

_____ **Not applicable (please explain in Comments section).**

The number of respondents was 171. This question was slightly different than the comparable question in other surveys. In previous surveys, there was a category "Other or not applicable." In this survey, this option was broken into two separate possibilities. The results are as follows:

	(S1,19,24)	(S4,9,34)	(S5,7,8)	(S6)
Historical Average	57.6%	48.0%	49.4%	49.71%
Current Rates	24.6	34.2	31.4	31.58
Other	17.8	17.1	19.2	14.62
Not Applicable	-	-	-	4.09

Given the last category only applies to the current survey, there is remarkable consistency over the years. Approximately one-half of the respondents use a historical average. The average number of years for the historical period was 28.16 - slightly higher than previous surveys. Apparently, the historical period utilized roughly corresponds to the number of future periods (30) being considered.

Comments:

Rate of return implied by current annuity offers by AAA-insurance companies.
You're investing today, not in the past. Plus the past (e.g. cold war, Carter inflation years, oil crisis, etc.) is very different from now and the most-likely future.
Always discount to present value using a "net discount" approach. Actual interest rate is irrelevant.
I use the maximum of current rates & the historical average.
I use the Congressional Budget Office's forecast for the next ten years and extrapolate from that.
A judgement call based not only on current rates, but those likely to be available for the early-year reinvestments the fund is likely to make.
Real discount rate, on 1 year treasuries adjusted upward for risk associated with labor earnings of the injured (in P.I. cases).
Mix of current and historical with emphasis on current for short-term forecasts and emphasis on historical for long-term forecasts.
I use CBO forecast for 10 yrs. And then revert to the long-term (40-yr) average of 3-yr Treasuries.
Some historical average of interest rates over past 45 years with consideration and highest weighting to most recent 20-year period. Furthermore, consider future expectations.
I cannot understand why anyone would use a historical average. A plaintiff would get a lump sum of money now and invest it now, not over the last 20 years!
Average STRIP current rates over period.
The Dulaney paper at the WEA 1997 indicates that spot interest rates and historical earnings growth rates gave more accurate forecasts.
I use historical, 30-year rates, plus current rates and professional opinion.

Question 8: In determining worklife expectancy, my generally preferred technique involves using (check one):

_____ **Worklife expectancy tables as published by the U.S. Dept. of Labor.**

_____ **Worklife expectancy tables as published in recent articles appearing in the *Journal of Forensic Economics* and *Journal of Legal Economics.***

_____ **Median or Mean age to final labor force separation.**

_____ **LPE (joint probability of life, participation, and employment) approach.**

_____ **Ending loss calculation at age 65 or some other fixed retirement date.**

_____ **Combination of above techniques (please explain in Comments section).**

_____ **Other (please explain in Comments section).**

The number responding to this question was 178. There were three new categories added to this question in this survey as indicated in the table below

	(S2,12,135)	(S4,15,40)	(S5,13,15)	(S6)
BLS Tables	71.6%	52.1%	50.9%	23.59%
LPE Method	11.4	17.6	17.3	9.55
Fixed Period	n.a.	17.6	19.1	8.43
JFE or JLE	na.	n.a.	n.a.	21.35
Yrs. To Separation	n a.	n.a.	n.a.	6.74
Combination	n.a.	n.a.	n.a.	25.28
Other	17.0	12.7	12.7	5.06

It is difficult to compare the current survey with earlier surveys given the additional categories. Clearly, use of the BLS tables has declined significantly, primarily due to out of date information. The worklife estimates presented in the *Journal of Forensic Economics* and *Journal of Legal Economics* have to some extent provided a viable alternative for those forensic economists who wish to continue using worklife tables. The table and comments also reveal that one-fourth of the respondents use a combination of techniques, often LPE techniques in conjunction with other worklife tables.

Comments:

I use Median Age to final labor force separation published recently in the JFE by Hunt, Pickersgill & Ruttemiller.

Give range of retirement ages, after 62 to 65. Problems with other methods is the illusion of scientific accuracy they convey, (e.g., recovery for tort can diminish loss from early death/withdrawal from labor force).

I also show to age 65 and use the retirement age as shown in the article: "Trends in retirement age by sex, 1950-2005", Monthly Labor Review, July 1992.

Worklife expectancy always mentioned even though a greater terminal year is used.

Worklife expectancy tables are based on historical data and are not forward looking with respect to future trends in LPE. They are particularly inappropriate in forecasting female worklives.

Worklife tables produced by Gamboa.

In case not fairly represented in BLS WLE tables I may use a retirement age, especially for

professionals or entrepreneurs with big work incentives.

I generally use BLS tables but shorten or lengthen dependent upon nature of occupation. Literature on retirement is a major source of information needed to make such adjustments, e.g. Male with BLS worklife expectancy of 35 years can be expected not to stay as an oilfield worker or fisher for that long!

I will also include years greater than BLS if economic need possibly exists. Or, I will calculate WLE to age 70 or beyond with line-item identification of present value of loss at every age in-between in case jury wants or selects different year.

Will spread (1) or (2) out over years to age 65 (or 70 in older worker).

I usually use the age the subject must reach to receive full social security retirement benefits. For young workers, this is 67.

I sometimes use Gamboa's revised tables, particularly for women. I also rely on the individual's work record, retirement plans, etc. when appropriate information is available. In some cases, I run the numbers from age 62-67 and provide a range.

I use Ciecka, et al. "a Markov process...." From the JLE because it updates the 1986 BLS study which, using 1979 data, needs updating, particularly for women's LPE's.

In the past we have relied solely on US Dept of labor Tables. We are now prepared to use tables if the injured party has higher levels of education than accounted for by the U.S. Dept of Labor tables.

Government worklife, "LPE", average retirement age.

For most blue and white collar occupations, I use worklife tables plus judgement. For individuals in the professions, I use 65, or older, if personal statements are available.

I use the JLE and JFE materials for total number of years of work and then add components of LPE to establish expected employment in any given year.

Question 9: In determining the dollar value of lost household services per hour (or other relevant time period) for a homemaker not otherwise employed, I generally use (check one):

_____ **The hourly wage this homemaker could have earned in the labor market as a full time worker.**

_____ **The cost of hiring one or more individuals to replace the particular services that were lost.**

_____ **The federal or state minimum wage.**

_____ **The cost of hiring a "housekeeper" whose role is to provide general household services.**

_____ **Combination of above techniques (please explain in Comments section).**

_____ **Other (please explain in Comments section).**

The number of respondents for this question was 174. Like the previous question, Question 9 added an option given that the respondent might use a combination of measuring techniques. Since this was the only option added, comparison to earlier surveys is relatively straightforward.

	(S2,13,136)	(S4,17,43)	(S5,15,18)	(S6)
Wage Earned	6.1%	3.0%	7.8%	4.03%
Replacement Service	48.8	50.4	50.3	51.15
Minimum Wage	6.1	15.8	8.4	6.32
Housekeeper	18.3	17 3	18.0	14.94
Combination	n.a.	n.a.	n.a.	12.07
Other	20.7	13.5	15.6	11.49

There has been relatively little change from previous surveys. Roughly half of the respondents use a technique that values household services equivalent to the cost of replacing a particular service. Next in popularity is the cost of a general housekeeper. Both the wages earned by the individual (opportunity cost method) and using a minimum wage are not used extensively.

Comments:

I use the annual value based on wages paid to workers in like services, as provided by the 1992 study of Bryant, Zick & Kim (Cornell University study).

Use Cornell Univ. table values adjusted by CPI components (housekeeping services).

Often use the "housekeeper" approach if the hours replaced exceeds 20 per week

I now use The Dollar Value of a Day by Expectancy Data, which I think is clearly the best source now available. Adjust for wage differences for years other than 1996 and for different states if it seems material.

I would probably base this cost on data as to earnings of individuals performing these types of services, not the cost of hiring a service company.

Use research on value of HH services-like Douglass, Kenney and Miller JFE Winter 1990.

I'd use a combination of (the hourly wage this homemaker could have earned in the labor market as a full time worker.) & (the cost of hiring one or more individuals to replace the particular services that were lost). The hourly wage this homemaker could have earned in the labor market as a full time worker shows a boundary value persons place on H.S.'s must be as great as earners or would go to work, yet there is a certain

"consumption" value attached to both. So I'd also look at what "had" to be replaced-(the cost of hiring one or more individuals to replace the particular services that were lost.) We use actual wages paid to substitute for lost services when available. More often than not, however, we have relied upon tables provided by Walker-Gauger to estimate such losses after adjusting for inflation. In the future we intend to rely upon more recent studies.

I follow Martin's technique with sample of wage rates for selected activities and construct an average replacement wage.

Question 10: A plaintiff's attorney asks you to calculate lost enjoyment of life (hedonic damages) in an injury case. Would you be willing to calculate such damages?

_____ Yes_____ No (if you checked "No", please explain why you wouldn't do so in the Comments section below).

There were 178 answers to this question. Although earlier surveys asked questions concerning hedonic damages, the authors felt that these questions were not adequately worded to obtain useful information. After extensive discussion with other forensic economists, it is believed that this Question and Question 11 accurately reflect the views of the respondents concerning hedonic damages.

Of the 178 who answered this question, 23.59% answered "Yes" and 76.41% answered "No." It is clear that at this time a significant majority of respondents would not be willing to estimate hedonic damages for a plaintiff's attorney. Based upon the comments provided, the reasons vary. Some believe that hedonic damages cannot be adequately estimated by economists, while others are unwilling because they do not feel they understand the methodology fully.

Comments:

ANSWERED NO

No scientific method of doing so. None of the methods currently used are valid.

I do not believe that economists (or any expert) can testify (in California anyway) on General damages. I do not believe that economics as a science has developed sufficient agreement as to the appropriate methodology for such a calculation. However, I will agree to testify as to how to measure the value of lost leisure time, since economics provide a methodology to do that.

Believe that doing so would diminish credibility of other calculations (such as lost income & future costs).

I am on record contending that economists haven't yet developed a method that is satisfactory. Also, many courts will not allow this testimony.

Would be happy to critique the approach for the defense. I do not believe the methodology is appropriate to the question in litigation cases. The methodology is certainly not "robust"-measures vary too widely to be of much use.

Studies produce too wide a range of figures; most studies are industry vs. occupational: most individuals do not know risks involved nor can they evaluate them; lack economic certainty and acceptability; not individual specific; cannot measure happiness.

Inability to compensate a dead person; inaccurate assumption of linearity in the values for increasing risks to the loss of life; no basis for assigning a particular monetary value to life.

Negative answers to Q10 & Q11 are based more on never having really gotten into hedonics, because of lack of interest by attorneys. I am not necessarily negative in principle.

Primarily because I have not followed the literature adequately. But also because I do not believe there is enough consensus in the profession to provide such an analysis.

I would make the calculations only as a consultant who is not willing to testify on these values, as: 1) they are too speculative; 2) Courts in Iowa do not allow such testimony. 3) I have seen too many vicious attacks on the proponents of "hedonic damages".

1) A value of life to a dead person is not recoverable to a live survivor. 2) Hedonic estimates cover a wide range of values. 3) Hedonic valuations include an "insurance premium" element for the individual's survivors-double counting with lost wages.

The methodology used does not seem applicable to injury cases. Also there is not sufficient data to apply the methodology available to each specific case.

In Ohio hedonic damages have been rejected. Further, I have not done sufficient research, comparable to the work done by Stan Smith, to be sufficiently comfortable with the estimates.

ANSWERED YES

Yes, using benchmarks to assist the court. Because of all the adverse publicity, I've not been asked. In addition, there are plaintiff's attorneys who would rather argue these damages themselves.

I am always willing to do this and mention it in my report.

Calculate only when subject has lost recreational type activity, such as skiing. Then I use amount of time spent before incident at low rates or the cost of the activity lost.

I have done this in earlier years but don't like to. I feel you would have to gather a number of primary source documents in order to do a complete job. I don't have the time or inclination. Also most Michigan courts do not allow.

Fact-finders appreciate info on various ways to estimate hedonic damages, even though the range is wide.

I would do it, but I would have to consult a more experienced person.

Question 11: A defense attorney asks you to critique an economist's report that has calculated the lost enjoyment of life (hedonic damages) allegedly suffered by an injured plaintiff.

Would you be willing to critique such a report?

_____ Yes _____ No (if you checked "No", please explain why you wouldn't do so in the Comments section below).

The number of respondents answering this question was 180. 81.67% answered "Yes" while 18.33% answered "No." Viewing questions 10 and 11 together, it is evident that respondents are far more willing to critique a report concerning hedonic damages than writing a report for the plaintiff's side where they must calculate and defend their own estimates.

Comments:

ANSWERED NO

The critique might lend credibility to the "junk science" report.

Probably not. I don't feel that I have the necessary expertise (if, indeed, anybody has) to provide estimates in this regard.

Not in my area of expertise. Economists should not be in the business of calculating non-economic damage elements. The basis/premise for calculating "hedonic" damages is so weak.

Beyond the scope of my expertise; not admissible in California.

ANSWERED YES

Only if the economist testified with a specific $ amount for specific individual.

I would look at the entire set of approaches used, not simply the hedonic component. Concerning the hedonic component, I would certainly highlight the fact that many forensic economists believe that it is inappropriate to determining damages to a specific person, it is regarded as more appropriate to general cost/benefit analysis of accidents.

Primarily I provide the attorney with anti-hedonic journal articles. (I do check the math, etc.).

I would limit my "critique" to an attempt to reproduce his numbers.

Just to point out the speculation involved. I think the concept of hedonics is ok for a population study of economic behavior but not relevant to an individual.

Question 12: Testimony in courtrooms is stressful to me. (circle one)

Strongly Disagree 1	Disagree 2	Neither Disagree or Agree 3	Agree 4	Strongly Agree 5

180 respondents answered this question. The answers to the question given below are compared to an earlier survey.

	(S2,7,143)	(S6)
Strongly Disagree	3.7%	8.84%
Disagree	6.2	19.34
Neither	17.3	16.02
Agree	49.4	48.62
Strongly Agree	23.4	7.18

The earlier survey was conducted in 1990. Based upon the current survey, there has been little change in the percentage that "Agree" courtroom testimony is stressful. However, the current survey indicates that fewer "Strongly Agree" that testimony is stressful. In the earlier survey, a weighted average was calculated where the above possible responses were numbered one ("Strongly Disagree") through five ("Strongly Agree"). The weighted average for the earlier survey was 3.827 while for the current survey the weighted average is 3.259.

Comments:

It's exciting & challenging, but stress is more related to uncertainty.

I enjoy the give and take and, especially, the "opportunity to teach" the jury.

Being fully prepared and being sure I am fully prepared is more stressful than actual testimony. Actual testimony is fun!

It is far less stressful once the economist has had years of experience in forensic economics.

Cross-examination can obviously be sometimes unpleasant.

Similar to taking a final exam. I will typically prep/cram 2-4 hours in the day or two before. Inability of counsel to precisely schedule testimony time also somewhat stressful/frustrating.

I've been doing it for 30+ years. If it stressed me, I wouldn't be doing it.

A certain level of stress is healthy. It sets one to prepare thoroughly. Once actually on the stand most of the time is not stressful. Every so often one gets a question that hasn't been heard before or anticipated, and then the heart races a bit!

The key is preparation. The hardest part of being cross-examined is to sit there and having

to let all those really good answers go by. I am currently being sued for defamation for exposing fraudulent university research. Not the least bit stressful. Been trying to get accountability for years.

That's what this business is all about! It's the bottom line!

Less stressful than a department meeting at my university!

I very rarely feel any stress when testifying, perhaps because attorneys don't ask questions that I can't answer, except for those that are irrelevant to my area of expertise.

Most attorneys are professional. It is those that are not that create stress.

I charge a separate fee for depositions and courtroom testimony based on the preparation and stress of these activities.

I think it should be! If an expert becomes too comfortable, they may have lost an appreciation for the importance of their role and what is at stake for the litigants.

Question 13: The professional quality of reports that I have reviewed in the field of forensic economics has improved over the last ten years. (circle one)

Strongly Disagree 1	Disagree 2	Neither Disagree or Agree 3	Agree 4	Strongly Agree 5

176 individuals answered this question, which had not been asked in previous surveys

	(S6)
Strongly Disagree	0.57%
Disagree	17.61
Neither	31.25
Agree	46.59
Strongly Agree	3.98

Using the same technique as described in the previous question, the weighted average is 3.357, which indicates that there is slight agreement that reports have improved over the last 10 years.

Comments:

Some reports are rather ridiculous both in method and assumptions. Others have improved and became rather sophisticated.

In my geographic region, my criticisms in earlier years of opposition reports has been taken

to heart. I now have less to criticize than in earlier days.

Most reports give a minimum of explanation; even less than they did years ago. Most have very little narrative.

Many are still a disgrace in that too little specificity and too strongly dictated by assumptions given to expert by attorney. We should not be mere calculating machines.

Some are good. Some are awful. (Data 10-15 yrs old, data not matching subject as precisely as it could.)

I think generally economists are trying to be too technical and fail to use common sense. Results are more and more driven (or manipulated) by the ever-increasing number of assumptions being made.

I see more sloppy work and "big numbers" manufactured for the plaintiff.

More unqualified individuals, largely retired faculty, are entering the market.

Question 14: Please assess the need for forensic economics research in each of these areas (circle one number for each area).

	Low	Somewhat Low	Moderate	Somewhat High	High
Antitrust and Commercial Discounting	1	2	3	4	5
Divorce	1	2	3	4	5
Earnings Base	1	2	3	4	5
Earnings Growth	1	2	3	4	5
Fringe Benefits	1	2	3	4	5
Household Services	1	2	3	4	5
Income Tax Effects	1	2	3	4	5
Lost Enjoyment Of Life (Hedonic)	1	2	3	4	5
Medical Costs	1	2	3	4	5
Personal Consumption	1	2	3	4	5
Testimony Techniques	1	2	3	4	5
Worklife Expectancy	1	2	3	4	5

In the spaces below, please add additional areas you feel are important that are not listed and rate them by circling a number.

1	2	3	4	5
1	2	3	4	5

Some respondents indicated an answer to certain categories and not others, but on average 168 individuals answered this question. The same question was asked in 1990, with the exception that the current survey has added the category "Divorce." The earlier survey asked respondents to rank order all twelve categories. An average score was determined for each category, with the lowest score implying a higher rating. The ratings are given in the column headed (S2,3,147). At the suggestion of several colleagues, respondents were asked

to evaluate each category separately using a five-point scale ranging from "Low" to "High." A weighted average was then calculated and placed in rank order as indicated in the column headed (S6). The results are as follows:

Category	(S2,3,147) Rank	(S6) Weighted Average And Rank	Percentage "Somewhat High" and "High"
Personal Consumption	1	3.725(1)	61.71%
Household Services	2	3.708(2)	64.57
Worklife Expectancy	8	3.596(3)	57.36
Medical Costs	5	3.569(4)	55.81
Fringe Benefits	3	3.391(5)	53.21
Earnings Growth	7	3.248(6)	42.02
Antitrust	10	3.214(7)	41.60
Income Tax Effects	6	2.982(8)	35.12
Divorce	n.a.	2 886(9)	31.65
Discounting	9	2.870(10)	29.41
Testimony Techniques	12	2,804(11)	24.27
Earnings Base	11	2.768(12)	24.27
Hedonic Damages	4	2.682(13)	34.73

Although the two surveys were conducted nine years apart, there is little change. Only three categories changed by three or more places. Antitrust moved up three places and worklife expectancy moved up five places. On the other hand, hedonic damages fell from a ranking of 4th to last place. The last column indicates the percentage of respondents who either agree or strongly agree that the category needs to be researched. The figures follow closely the rankings themselves except for hedonic damages. For all categories except hedonic damages, responses had a bell-shaped curve with the center varying from "Somewhat Low" to "Somewhat High." However, the distribution for hedonic damages indicated that 36.53% of the respondents strongly disagreed and 21.56% strongly agreed that hedonic damages should be researched. There are two peaks at each end of the distribution, indicating that attitudes are bipolar.

The following additional research topics were provided by some of the respondents: employment, disability income factors; follow-up studies on injured and their earnings; displaced workers; child wrongful death; age-earnings profiles; analysis of risk; worklife of self-employed; productivity growth; old folks; ethics in analysis; life care; internet sources; small business valuations; catastrophic care costs; and employment discrimination

Question 15: I have been practicing and earning income in the field of forensic economics for years.

182 individuals responded to this question. The mean number of years was 18.637.

The middle 50% was between 14 and 25 years. Only 18.68% had practiced for 10 years or less. In (S1,2,16) a similar question was asked where the mean number of years was 11.6, with 47% practicing for 10 years or less. The increase in the average number of years is approximately equal to the number of years from one survey to the next. As expressed earlier, it is unknown whether the respondents to this survey are representative of NAFE. However, the results of this question imply that the respondents are "veterans" in terms of forensic practice.

Question 16: Looking back on the total number of cases for which I was hired as a consultant in the field of forensic economics in 1998, I would break down the percentage of cases as follows:

_____% Cases where I did work for the plaintiff's side.

_____% Cases where I did work for the defendant's side.

_____% Other (please elaborate in the Comments section).

Total = 100%

174 individuals answered this question. This is a new question based upon a suggestion to the authors that the consulting dollars received need not be proportional to the actual number of cases. As will be seen, that was a false hypothesis. The results are as follows:

Plaintiff's Cases	66.99%
Defense Cases	32.72%
Other	0.29%

19.54% of the respondents indicated that their caseload was 90% or more for the plaintiff's side, while 43.1% indicated their caseload was 75% or more for the plaintiff's side. The numbers were quite different when examining cases for the defense. The comparable figures for the defense side were 0.57% and 3.45%. Only 10 individuals indicated any cases classified as "Other." Most of these cases were listed as "friends of the court."

Comments:

Recently, I have gotten a higher percentage of defense cases (perhaps 50%).
Occasionally, the court appoints me.
5% arbitration proceedings.
5% is "friend of the court" or arbitrations.
My focus as an economist has been mainly on business strategy. The forensic work has been incidental. I've been involved in about 20 cases over these past 5 years.
Many were divorce cases where there really isn't a meaningful plaintiff but in other cases it

was 100% plaintiff work.
Retained by the court as independent consultant.

Question 17: Looking back on my net income as a consultant in the field of forensic economics during 1998, I would break down the percentage of net income as follows:

_____% Net income on cases where I did work for the plaintiff's side.

_____% Net income on cases where I did work for the defendant's side.

_____% Net income in other capacities. (please elaborate in the Comments section)

Total = 100%

170 responded to this question. The same question was asked in the first survey.

	(S1,4,16)	(S6)
Plaintiff's Cases	66.45%	63.07%
Defense Cases	32.18	33.58
Other	1.37	3.35

Based upon these figures it is evident that the number of cases for plaintiff and defense is proportionate to the income received from each side. Of course, some respondents may have simply assumed this was the case without actually checking their records. Further, the percentage income received from plaintiff and defense has changed little over the last nine years.

Comments:

Since I am unwilling to do a thorough analysis of my invoices, this breakdown is somewhat suspect.
The defense spends more per case, often double.
30% federal and state grant work, as well as economic consulting.
Other-I still do some outplacement counseling, my primary occupation prior to 1995, and I teach one graduate course in the human resources field each autumn.
Usually, the amount of time I devote to a defense case is less because there is often less to do, e.g., react to plaintiff's expert's report versus a full evaluation of a plaintiff.

Question 18: Looking back on my net income as a consultant in the field of forensic

_____% **Net income from consulting where the attorney(s) that hired me were located in my home state.**

_____% **Net income from consulting where the attorney(s) that hired me were located in states contiguous to my home state.**

_____% **Net income from consulting where the attorney(s) that hired me were neither in my home state nor in contiguous states.**

Total = 100%

The number of answers to this question was 175. The results as compared to the first survey are as follows:

	(S1,5,17)	(S6)
Home State	82.04%	78.76%
Contiguous States	10.17	14.44
Other	7.79	6.8

It is evident that the vast majority of cases occur within the expert's home state, and this has not changed in the last nine years. 84% receive over half of their consulting income within the home state and 40.57% receive all of their cases within the home state. On the other hand, only 7.42% get over half their cases from contiguous states, while 2.85% receive over half their cases in non-contiguous states or in other countries.

Comments:

Largely international.
I treat Washington as a contiguous state. (I'm in Alaska.)
I feel I need a passport to cross state lines.
This perhaps overstates the noncontiguous states in that one firm in Minnesota hired me for work. I had previously worked for that firm on several cases in which I was one of five plaintiff's experts on a class action.

Question 19: My total annual, earned income in 1998 (in percentage terms) came from the following sources:

_____% **Faculty salary.**

_____% **Administrative salary.**

_____% **Net income (consulting) in the field of forensic economics.**

_____% Net income in other consulting fields.

_____% Other (please elaborate in Comments section).

Total = 100%

172 individuals responded to this question. Of all the questions in the survey, the answers to this question show the greatest changes from previous surveys. The results are as follows:

	(S1,1,15)	(S6)
Faculty Salaries	45.16%	26.45%
Administrative Salaries	6.36	3.15
Consulting, Forensic Economics	34.28	50.95
Consulting, Other	10.12	14.82
Other	4.08	4.63

It is clear that there is large increase in the percentage of income derived from forensic consulting and a corresponding drop in income from faculty salaries. 47.09% received no faculty salaries whatsoever. On the other hand, 12.79% received all of their income from forensic economic consulting.

There is an increasing percentage of consultants who are full time and those who are not are devoting more attention to their consulting practice. This can be seen more clearly by breaking the data down for the income derived from forensic economic consulting.

	(S1,1,15)	(S6)
P<=.10	21.4%	11.04%
.10<P<=.20	21.4	15.11
.20<P<=.30	17.6	9.30
.30<P<=.40	8.4	8.72
.40<P<=,50	9.9	12.79
P>.50	21.3	43.02

Over 40 percent of the respondents received at least half of their income from forensic economic consulting.

Comments:

Book sales.
I've retired from university teaching.
The majority of my work is in the areas of forensic accounting and commercial economic damage assessments (non-antitrust).
I am a CPA in a CPA firm. About 45% of my work is forensic economics work. The remainder is traditional public accounting work (auditing, tax planning and preparation, etc.)
I took early retirement from my university position last year. I also serve as a mediator from time to time. I have investment income.
CEO of nonprofit educational foundation on public policy.

Question 20: Looking back over 1998, I would estimate that my net income as a consultant in the field of forensic economics came from the following types of cases:

_____% **Personal injury / wrongful death.**

_____% **Antitrust / commercial cases.**

_____% **Labor cases.**

_____% **Divorce cases.**

_____% **Other types of cases (please elaborate in Comments section).**

Total = 100%

The number responding to this question was 175. As indicated in the table below, there has been relatively little change from the first survey conducted in 1990.

	(S1,8,18)	(S6)
Personal Injury/Wrongful Death	69.24%	66.07%
Antitrust	11 62	12.25
Labor Cases	10.21	11.72
Divorce	5.16	3.42
Other	3.77	6.54

Although Question19 indicated that more forensic economists are no longer teaching, the type of cases for which they consult has changed very little. 71.42% of the respondents earned over half of their income from personal injury/wrongful death cases, while 46.28% of the respondents earned over 75% of their income from these cases. The other four categories had only a small percentage of respondents earning over 50% of their income from that type of case.

Comments:

(Referring to "labor cases") I assumed that "Labor Cases" include wrongful termination and discrimination (employment) cases.
Lender liability cases, labor interest arbitration, utility rate cases.
Service on arbitration panel.
Patents, trademarks, other
Wrongful termination.
Breach of contract, intellectual property, securities fraud.
Divorce frequently involves business valuation on; also perform non-litigation business valuations.
Other work includes wrongful termination, lost profits, business valuation, feasibility studies.
"Labor cases" is vague. Should maybe add "(wrongful termination)" to make it more clear.

Question 21: Please use the space below to outline or discuss any ethical dilemmas or issues you believe to be important for forensic economics practitioners.

Both Questions 21 and 22 were open-ended. The following comments were chosen as representative of those provided by survey respondents.

Comments:

Unprofessional behavior on the part of retaining attorneys who make collection of fees for services difficult.
Attorneys who list expert as witness without advising expert.
"Leaning over backwards" means low-ball for plaintiff & highball for defense. Accept opposing economist's assumptions when your own numbers would be more favorable to the opposing case. (e.g. retirement age, interest rate, etc.)
The practice of using software purchased from outside suppliers or using franchise arrangements presents a serious ethical issue. How can someone who does not perform his own calculations possibly know if he/she has provided a quality product to the client? And does using these purchased products cast the profession in a diminished light?
I have "turned down" a few cases proffered by attorneys for whom I have worked for several years (i.e., good customers) when I felt there was no pecuniary loss. Examples would be death cases of infant children and disabled adults. I would like to know if other forensic economists take such cases and how they derive pecuniary value.
1. Letting personal values interfere with professional judgement, e.g "life cannot be valued because it is so precious"; 2. Making a clear distinction in testimony that certain

"assumptions" are just that-assumptions or alternatives—and not expert "opinion".

I believe economists should stop trying to measure "hedonic" losses. Why not simply tell the jury that life consists of more than money making and let the jury decide the value. That's their job!

Flawed peer review process.

Use of NAFE discussion on the Internet in the courtroom.

I think it might be helpful to collect and distribute to NAFE members the codes of ethics from related professions, such as CPA's, lawyers, etc!

Consistency between analysis performed for plaintiff and defendant.

Defense economists "cherry picking" plaintiff's expert's reports. By changing variables that lower economic damages and ignoring those that don't, the outcome is pre-determined and, hence, one's opinion is corrupt. Reports should be prepared double blind, then compared.

1) Vocational experts sometimes straying beyond their field of expertise. 2) Forensic economists too readily accepting assumptions from the hiring attorney.

It would be useful to see some content put into the NAFE ethics statement. When I see an economist testify to 4% discount (net real) in defense cases and 2% in his plaintiff's case, I say ethics effectively is without content. Published statements/opinions stating examples of unethical conduct (as exist for attorneys and judges) are needed.

I think the great majority of forensic economists are reasonably honest.

Trying to be absolutely honest while countering slanted questions, sometimes posed so as to confuse juries rather than seek truth. This has become something less of a challenge as time has passed, and experience has been gained, and reputation established.

Too many economists work entirely (or almost entirely) for plaintiffs and exaggerate terribly. Not many do a reasonable amount of work for defendants as well as for plaintiffs.

Many economists are willing to carry the accounts of attorneys for unreasonably long times. A billing not paid creates a contingent interest in the favorable outcome of the case for the atty.

Elitism and "turf control" issues between vocational rehabilitation specialists and economists. Those who have successfully bridged this gap should not be castigated by those who have not. Labels should not be used as weapons, and neither should degrees. The only measure of quality should be the quality of the person and their work.

Some defense economists are misusing Earl Cheit's consumption reduction factors by applying them to total joint family income. He never intended that they be applied to joint income. He has told this to me personally. I have yet to see data or convincing economic reasoning for this practice. Furthermore, the outcomes of using joint incomes have perverse outcomes which do not reflect reality for most families.

Sharing information from one case about an opposing expert in another case.

1) Maintaining objectivity and not "working for" a particular attorney/client relative to "their desired outcomes". Very often I must inform client they either do not have a significant loss or their loss is much less than they believe it "should be". 2) Maintaining professional objectives and disclosure when reviewing the work of other forensic analysis, and in responding to various techniques employed by attorneys.

None-I see myself as trying to arrive at the objective truth-more like an agent of the judge than either side.

Still need to constantly remind myself (ourselves) that my conclusions are my conclusions, and that my role is to explain and defend those conclusions, but not to use them to advocate an attorney's viewpoint.

I find that I do not have the wisdom to recognize when I am being led down the "garden path" by an attorney until it is late in the process. At that point I find myself trapped in an analysis that is "weaker than need be or (2) slightly wrong-headed in terms of forensic economics. The dilemma is to "hang in there" with your analysis or to insist on beginning a new analysis.

Criticizing expert work for purposes of Daubert hearings must be restricted.

It is my impression that we are slowly resolving issues relating to the appropriate "rates." and these are becoming less important as ethical issues. Remaining questions include the issue of "limited" assignments, where the expert is asked to consider only a subset of relevant values, e.g., remarriage is not considered in a calculation of lost HHS.

Question 22: Please use the blank space below for any additional comments you wish to make about this survey.

The following comments were chosen as representative of those provided by survey respondents.

Good survey-well done

For Q1-Q5 the source of the information used is more important than the numbers asked for.

I am fully supportive of this type of survey. Maybe we can add some questions on techniques used in other than PI/WD cases, such as techniques used in valuations of pensions, in valuations of business firms, in valuation of business damages, etc. I would suggest that we ask board members and other active NAFE members to suggest such questions.

Q1-Q4 bother me because forensic economists should be educating judges and lawyers that actual rates of inflation, wages, and interest rates are usually irrelevant. What matters for the present value calculation is the relationship between this economic variable, not the level of each one, i.e., the "net discount" approach. There is a much more certainty in the present value of a future earnings stream, than what that actual earning stream will be.

Keep it up! As someone relatively new to the field and not terribly active, I find it very useful. I would like to see more questions on how established people became that way, (e.g. percent of new vs. repeat clients, methods of informing attorneys about your services, type of promotions, etc.)

Why nothing on personal consumption reduction? Why nothing on contribution to household services by a wage earner (Q9 assumes no earnings)? I will continue to rely on past survey results and articles in JFE to sustain my methods in wrongful death cases, but I would have liked to learn what the current practice is by my colleagues' with respect to these issues.

The gradient question on hedonic damages should have had a "none" category.

I appreciate your activities on preparing this questionnaire. I know its not perfect, but I find the results, professional, very helpful especially in judging the assumptions (work life expectancy discount rate, etc.) I incorporate into my methodology when calculating a loss.

There is information in these responses-it's just that it is different from what you think it is. To be truly useful, you need to take non-response seriously and to sample outside of the NAFE membership. Assuming you choose not to do this, you can creatively report your results. For example, report the net discount factors cross-tabulated by % of plaintiffs worked for, so the reader can interpret and eliminate the biases of "plaintiff's economists" and "defense economists".

It would be interesting to establish topical survey questions that could be answered electronically-something like what's done by USA Today online.

Would be interesting to get responses to questions regarding fees, retainers, collections, office w/home vs. office out of home, etc. Good luck!

I have worked with and for forensic economists in other states—this was excluded in my responses, since I didn't deal directly with the attorneys in those matters. Perhaps this would be a category in future surveys.

Being a neubie in this field I find questions on methodology far more interesting than a number, as far as I can tell the values for each case are unique depending upon the profile of the individual. It is the method to build a profile I would be interested in such as Q5-Q9.

It probably would be a good idea to provide question(s) regarding respondent's discipline/occupation: economist, voc educ person, etc.

3 problems with survey questions: 1) It would have been valuable to have a question asking about the primary occupational category of the respondent, so it would be possible to analyze whether the other survey responses vary significantly among occupational categories. 2) In the questions about the Net Discount Rate, specifying a 30 year time horizon biases the answers toward younger plaintiffs, and thus toward lower Net Discount Rates. 3) it would have been useful to include a question asking what percent of the time the respondent uses a Net discount Rate (e.g. never, never in wrongful termination case, only for younger plaintiffs, etc.).

Very valuable!! While it is not perfect, it's the best available.

You have a difficult job given the diversity of members and the anti-survey views of many. One problem is that it can standardize a bad practice by serving as proof that a significant number of consultants use a technique that may be in error. Stats on their use implicitly validate it

On only three or four occasions have I had a worklife of 30 years over the past two years. Most are much shorter. Thus, I wonder whether next year's survey might choose a less controversial example.

Summary and Conclusions

Twenty-seven percent of NAFE members responded to the survey questionnaire, and the authors are most appreciative of the thoughtfulness that was evident in quantitative responses and in descriptive comments; respondents stated an average of 18.6 years in

forensic practice. Many of the results have been compared to results from previous survey studies in 1990, 1993, and 1996.

The 1999 results on values of forecast variables are useful to the forensic economist, especially as they may be compared to past, survey results. For example, the forecast of the differential between MCPI and CPI has fallen from approximately 2.7 percent in 1990 to 1.6 percent in 1999. The net discount rate has increased from a (calculated) 1.04 percent per year to the (directly asked) 2.13 percent in this survey. We also know that most respondents were not considering TIIS rates at the time of this survey, and it seems that there is an 80/20 rule regarding willingness to testify about hedonic damages, for a variety of reasons

Responses about forensic economists, themselves, indicate that practitioners/respondents receive 50.95 percent of their earned income from forensic consulting work. The comparable figure in 1990 was 34.28 percent. The data reveal an increasing specialization of time and effort in the field of forensic economics. Yet, some things have changed little between 1990 and 1999. Respondents remain approximately two-thirds on the plaintiff side of cases and two-thirds in wrongful death/personal injury cases versus other types of cases.

The top three areas for future research, described by respondents, are personal consumption, household services, and worklife expectancy. Responses to this survey are directly relevant to two of these three categories.

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REGRESSIONS, LAGS AND BUSINESS LOST INCOME: A CASE STUDY

by

Allan S. McCausland and Norman H. Sedgley, III

I. Introduction and Overview

This case study demonstrates the use of regression analysis and lags to determine lost revenue to one division of a small public relations firm. The lost revenue resulted from an alleged defamation of the principal of the Company. The Company as a whole continued to prosper and make money. The principal, however, insisted that his Company's investor relations' division had a continuing loss of sales as a result of the alleged defamation.

The first step involved examining the Company's revenue by division. The Company had good financial records demonstrating monthly revenue, by division, dating back to the early 1980's. The Company's records demonstrated a fall off in revenue for the investor relations' division shortly after the alleged incident took place. Revenue for the investor relations' division eventually fell to zero for a period of time after the alleged defamation.

The second step involved specifying a model for the determining factors of the Company's investor relations' revenue. This involved getting a history of the Company's investor relations' division and a firm understanding of its function and clients. This was accomplished by examining the Company's literature and records, as well extensive questioning of the Company's principal and financial manager. This, in addition to statistical testing, allowed us to establish a "neighborhood" for our estimations.

A crucial part of the specification of any model is establishing the appropriate "neighborhood," or time frame, for an estimation. The model is estimating relationships that are occurring at a given time. If the "neighborhood," or time frame, used is too far away from the incident, then the likelihood of achieving a successful result is significantly diminished. The parameters operating on the firm at the time of the incident must be close to those operating at the time the relationship is estimated. If they are not, then the estimation will fail. Specifying the appropriate "neighborhood" requires knowledge of the operations and history of the Company. Statistical testing for shifts in relationships at given times can help establish the appropriate "neighborhood."

The bulk of the Company's investor relations' activity involved Vancouver Stock Exchange listed companies and/or brokerage houses. Our thoughts in specifying a model to determine the Company's investor relations' revenue logically went to the Vancouver Stock Exchange. Our theory being that movements on the Vancouver Stock Exchange would influence expectations regarding the probable results of expenditures on investor relations. Therefore, expenditures on investor relations' by companies and brokerage houses would be influenced by movements on the Vancouver Stock Exchange.

The principal of the Company confirmed for us, after lengthy discussions, that the investor relations division's revenues may be influenced by the level of activity and direction on the Vancouver Stock Exchange. He was not sure of the exact relationship though.

We then set about the task of specifying an econometric fit through regression analysis between the Company's investor relations' revenue and movements in the Vancouver Stock Exchange Composite Index (the Index). The specification assumed that

any impact the Index had would act through lags.

Very few things have an immediate impact on a Company's revenue. Most determinants of business sales act through lags, and/or anticipations. A good analogy is what happens to someone who falls off of a twenty floor building. Nothing really happens while passing through the first nineteen floors. There may be a lot of anticipation and anxiety, but nothing really happens until the person passes through the first floor Lags involving the impact on a business may run from a few days to years, depending on the business practices in the relevant market, and available substitutes.

We, for instance, tested the impact of the stock market "Crash of 1987" on the Company's investor relations' revenue. We did this by putting a qualitative (dummy) variable in for the month of October of 1987. Although the 1987 "Crash" ultimately had a devastating effect on the Vancouver Stock Exchange, and firms located there, its immediate impact on the Company's revenues was negligible and insignificant.

If the "Crash" did not have an immediate, one on one impact, there was no reason to believe the alleged defamation would. Contracts and agreements involve time, therefore, the impact of the event will involve time. We assumed there would be lags, but based on the Company's operations, practices and contracts we expected the lags to be short.

Testing for a one-for-one movement in the Index and the Company's investor relations' revenue, as expected, yielded no significant econometric fit. It confirmed that if there was a relationship here, it would involve some lag between the movement of the Index and its impact on the Company's investor relations' revenue. Further testing involved specifying lags between the movement of the Index and the Company's monthly investor relations' revenue. We had a problem with autocorrelation that had to be dealt with as well.

The regression, in order to estimate losses resulting from the alleged defamation, involved fitting a relationship between the Index and the Company's monthly investor relations' revenue for a period prior to the incident. The Company's monthly revenue from investor relations' activity was econometrically fit to the Index. The pre-incident period chosen was six and one third (6 1/3) years. The six and one third (6 1/3) year period chosen was based on the Company's operational history and statistical testing. The period prior to the six and one third (6 1/3) year period involved a different form of operation and location for the firm. It yielded less significant statistical results. It was outside of the "neighborhood."

The final econometric fit involved one and two month lags between movements in the Index and the impact on the Company's monthly investor relations' revenue. The relationship determined has a ninety-nine percent (99%) confidence level based of the ***F-statistic***, for a seventy-six (76) month period prior to the incident. The relationship also has highly significant ***t-statistics*** for the individual variables (See Appendix A).

The **Final Estimated Equation** is:

IRR = -15837.00 + 14.646 (LVCI) + 20.577 (L2VCI) + e^ **(1)**

Where:

- **IRR** is the Company's monthly Investor Relations Revenue (the dependent variable).
- **LVCI** is the Vancouver Stock Exchange Composite Index lagged one month.

- **L2VCI** is the Vancouver Stock Exchange Composite Index lagged two months.
- **e^** is the residual.

The next step was to test for a statistically significant shift in the function, relationship, between the Index and the Company's monthly revenue due to the alleged defamation. Evidence of a shift in the regression function at the time of the alleged defamation was necessary to validate, statistically, that the defamation had had the dire consequences for the investor relations' division's revenue, as the client had claimed. The econometric fit was tested for the fifty-six (56) month period after the defamation to see if there had been a statistically significant shift in the function.

The result was that not only had there been a shift, but the entire relationship between the Index and the Company's investor relations' revenue had literally disappeared! The fit to the Index with the ninety-nine percent (99%) confidence level had for all practical purposes disappeared. The relationship ceased to have any predictability at all, indicating a major shift had taken place at the time of the defamation, regarding the Company's investor relations' revenue. The econometric fit had become highly insignificant for the period after the alleged defamation (See Appendix B).

Lost revenues to the Company's investor relations' division after the defamation were determined by using the econometric fit based on the Vancouver Stock Exchange Composite Index in existence prior to the incident. Actual revenues received were subtracted from forecasted revenues in order to determine net lost revenues. A lost profit analysis was straight forward once net lost sales had been determined.

The **Prediction Equation** is:

IIR = -15837.00 + 14.646 (LVCI) + 20.577 (L2VCI) + (0.667)^t*(-1894.92) **(2)**

Where additionally:

- **(0.667)** is the error (Rho).
- **t** values run from 1 through 56 and represent the monthly revenues from the month after the incident to the latest month available at the time of the Report.
- **(-1894.92)** is the Residual at time zero. The Predicted **IRR** less the actual **IRR**. This last term is the part of the forecast equation that accounts for the information contained in the specification of the autocorrelation.

II. The Model and Regressions

This section of the paper outlines the statistical models and testing procedures in more detail. The following time series specification was made:

$$y_t = a + \sum_{i=1}^{2} b_i X_{t-i} + e_t \qquad (3)$$

Where y in our model is revenue (IRR) and x is the Index (VCI). Equation 3 is a population

regression equation. It is important to review some issues concerning functional form and estimation before discussing the results and statistical inference.

The basic inference problem is to find estimates of the population parameters in Equation 3 using the sample data at hand. This information is needed for two purposes. First, to test whether or not the defamation had the alleged impact on the plaintiff's business revenue. Second, to forecast the alternative revenue path revenue if it is found that the defamation had an impact.

A popular alternative to our functional specification in Equation 3 is the ***Koyck transformation*** (Koyck, 1954), which involves an infinite geometric lag. A ***Koyck transformation*** would lead to an auto regressive model (a model where y is regressed on itself at a one period lag). There are a number of difficulties with this approach.

First, the basic assumption of the classical regression model of uncorrelatedness between the regressor and the disturbance is violated. This problem of a stochastic regressor is easily handled with the method of instrumental variables, if an appropriate instrument can be found (White, 1984). The lagged value of the Index could be used, as an instrument for the lagged value of revenue, in the present framework.

A more serious restriction of the geometric lag model is the assumption that the impact of the time series x on y declines monotonically as we move further back in history (see Greene, 1990). This does not appear to be a reasonable assumption for the relationship between the Index and the firm's revenues. Appendix A shows that the impact of Stock Market activity is much larger at a two month lag than at a one month lag. The unrestricted finite distributed lag model presented in Equation 3 was chosen as the appropriate functional form for these reasons.

The procedure for determining the appropriate lags to be used involved trial and error. We started by regressing the dependent variable on the contemporaneous value of the Index. We then moved backwards until a statistically significant relationship was found. Lags were added to the model until the t-statistic on the lags became statistically insignificant, suggesting over paramatization of the model and multicolliniarity. We backed the lags off when the model was deemed over paramatized by removing the lag that "broke the camels back." This resulted in a specification of lags in the Index of one month and two months.

Efficient estimates of the parameters are found using ordinary least squares (OLS) under classical assumptions concerning the behavior of the disturbance term. The assumption of interest is $E(ee') = \sigma^2 I$, where e is a vector of error terms, σ^2 is the population variance, and I is a T x T identity matrix. This assumption means that the error terms for fitting each observation, monthly revenue figures, are distributed independently of each other. If the error terms are not distributed independently of each other then they are said to be autocorrelated.

Time series data are, more often than not, autocorrelated. The OLS estimates of the parameters in Equation 3 will be consistent when autocorrelation is present, but not efficient (i.e., minimum variance). More importantly, the estimated standard errors of the parameters will be biased due to the autocorrelation. It is not possible to predict the direction of the bias, but any statistical inference based on OLS will not be valid when the autocorrelation is present.

We tested the model for autocorrelation in each time period using the ***Durbin-***

Watson Test for first order autocorrelation. The null hypothesis is that the error structure conforms to the classical assumptions. The alternative hypothesis is that the errors are autocorrelated such that:

$$e_t = \rho e_{t-1} + u_t \tag{4}$$

Where ***u*** is an error term satisfying the classical assumptions.

The Durbin-Watson statistic is calculated from the OLS residuals:

$$d = \frac{\sum_{t=2}^{T} (\hat{e}_t - \hat{e}_{t-1})}{\sum_{t=1}^{T} \hat{e}_t^2} \tag{5}$$

Where $\hat{e}_t$ is the OLS residual at time t. The distribution of ***d*** under the null hypothesis depends on the specification of the model. Durbin and Watson have calculated convenient values for the test, these values are tabulated in most econometrics texts. A value of ***d*** close to 2 00, as a rule of thumb, is needed in order to uphold the assumption of no autocorrelation. A low value of ***d*** suggests positive autocorrelation ($\rho > 0$). The values of ***d*** calculated for our model are low and strongly suggest positive autocorrelation. See Appendices A, B and C.

It was not appropriate to use the OLS model due to the autocorrelation violating the assumptions of the classical regression model. A ***Praise Winston transformation*** of the model is necessary in order to correct for the autocorrelation.

The ***Praise Winston transformation*** is accomplished by estimating ρ and transforming the model, such that the assumptions of the classical model apply to the transformed model. ρ is estimated by regressing the OLS residuals on themselves at a lag. This estimate, $\hat{\rho}$, is used where the model is transformed such that:

$$y_t^* = (y_t - \hat{\rho} y_{t-1}), \quad x_t^* = (x_t - \hat{\rho} x_{t-1})$$

and

$$e_t^* = (e_t - \hat{\rho} e_{t-1}) = u_t.$$

For the first observation the model is transformed by multiplying the observation by $\sqrt{(1 - \hat{\rho}^2)}$

The parameter estimates in equation 3 are found by estimating:

$$y_t^* = \alpha^* + \sum_{t=1}^{2} \beta_t x_{t-t}^* + u_t \tag{6}$$

An iterative procedure is used whereby the residuals from the corrected model are used to re-estimate ρ. The model is then transformed with the new estimate of ρ and re-estimated. This process is repeated until the estimates converge and change by an insignificant amount from one iteration to the next. The Durbin-Watson test, recalculated after the ***Praise Winston transformation***, suggests the problem of autocorrelation is corrected. See Appendices A, B and C.

Efficient estimates of the coefficients in Equation 3, as well as valid ***t*** and ***F statistics***, are calculated based on the transformed model. The estimates from this model are referred to as ***Feasible Generalized Least Squares*** (FGLS) estimates. The ***R*** squared no longer has a clear interpretation under FGLS, since it measures the proportion of deviation in y^* explained by the variance in the variables x^*. This is not of particular interest, though it may be a useful descriptive measure.

The FGLS estimator was used to test the plaintiff's assertion that the defamation had caused a loss of revenue in the investor relations' division. The data were split into the two time periods: one for the time period before the alleged defamation, and one for the time period after the alleged defamation. The first period spanned the time from January 1985 through April 1991 (the time of the alleged defamation was April 1991). The second time period began in May 1991 and ended with the most recent data on hand at the time of the study, December 1995. Three regressions were calculated: one for each individual time period, and one for the combined time periods.

We calculated a ***Chow test*** (Chow 1960) to test the assertion that the defamation had caused a loss in revenue to the investor relations' division. The Chow test tests whether or not a significant structural shift took place in the coefficients of the variables in the regression at the time of the defamation.

The Chow Test statistic is calculated using the sum of squares from the three regressions:

$$F(J,T-K) = \frac{(SSE_R - SSE_U)/J}{SSE_U/(T-K)} \tag{7}$$

SSE_R is the sum of squares in the combined time period model where the parameters are restricted to be equal across the two time periods (equal to .1550E10). SSE_U is the sum of squares in the unrestricted model, and can be calculated by adding the sum of the sum of squares of the models estimated separately across the two sub-time periods (.1627E10+.119E9). ***J***, the numerator degrees of freedom, is the number of restrictions (equal to three). (***T-K***), the denominator degrees of freedom, is equal to the sample size minus the number of parameters estimated in the unrestricted model (130-6=124). See Appendices A, B, and C.

The null hypothesis assumes that the alleged defamation had no effect on the firm's revenues. It assumes there is no difference in the parameters of the model before and after the alleged defamation. A large ***F***-statistic value for the Chow test would lead us to reject the null hypothesis and determine that the defamation did have an impact on the firm's revenues.

The value of the ***F***-statistic associated with the Chow test is 2.65, which leads to a rejection of the null hypothesis, in favor of the alternative hypothesis that the defamation caused the firm to lose revenue. The ***F***-statistic for the Chow test is significant at the 95%

confidence level.

The idea that the firm was damaged by the alleged defamation is further supported by ***F and t-statistic*** values in the regressions for the two sub-time periods. The ***F*** and ***t-statistic*** values associated with the independent variables in the period prior to the alleged defamation are highly significant. The ***F*** and ***t-statistic*** values associated with the independent variables in the period after the alleged defamation are low and insignificant. The ***R*** squared also fell from .85 for the time period prior to the alleged defamation, to .46 for the time period after the alleged defamation. See Appendices A and B.

The relationship of the firm's revenue with the Index for the period prior to the alleged defamation was used to forecast what the firm's revenue would have been in the absence of the alleged defamation. It is important not to disregard any sample information in forecasting what the revenue would have been.

The estimate of $\hat{\rho}$, and the specification of autocorrelation, extend the information available for the purposes of forecasting. Making use of this information leads to the forecasting equation, Equation 2. The last term in Equation 2 accounts for the sample information associated with the autocorrelation. The residual at the time of the defamation is ***–1,894.92***, and ***0.667*** is $\hat{\rho}$. This residual will influence future time periods according to the error structure of the model. The last term accounts for this effect, with the impact of this residual declining as ***t*** (time) increases (0.667^t declines as ***t*** increases).

Values of the Index, lagged one and two months, for the number of time periods since the defamation, ***t***, were used with Equation 2 to predict what the firm's revenue would have been in each time period, from April 1991 through December 1995, without the alleged defamation. The firm's net lost revenues for the time period can be calculated by subtracting actual revenues received from projected revenues that should have been received. Earnings' losses for the firm can be determined based the net lost revenues.

III. Conclusions

Loss cases involve determining hypothetical alternative earnings' paths, on the assumption that a certain event(s) did, or did not, take place. This paper demonstrates the use of regression analysis to determine hypothetical alternative revenue paths with a high degree of certainty. It discusses the ***Koyck transformation***, and demonstrates the use of simple lags in determining influences and forecasting alternatives. It also demonstrates the ***Praise Winston transformation*** for overcoming autocorrelation problems in regressions.

The paper discusses the use of tests for structural shifts in lines of causation and specification of appropriate "neighborhoods" for estimations. It demonstrates the use of the ***Chow test*** to test for structural shifts involving the impact of certain events on the flow of revenue to a firm, and in determining if the appropriate "neighborhood" is being used for estimations.

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Appendix A

SEVENTY-SIX (76) MONTH PERIOD PRIOR TO DEFAMATION

```
MODEL COMMAND:
REGRESS;LHS= IRR;RHS=ONE,LVCI,L2VCI;AR1$

Ordinary    least squares regression.     Dep. Variable      =  IRR
Observations                =       76    Weights            =  ONE
Mean of LHS                 =  0.2233487E+05  Std.Dev of LHS  =  0.1552310E+05
StdDev of residuals=  0.6062203E+04       Sum of squares     =  0.2682772E+10
R-squared                   =  0.8515549E+00  Adjusted R-squared=  0.8474879E+00
F[  2,    73]               =  0.2093822E+03  Prob value       =  0.5782995E-30
Log-likelihood              = -0.7682559E+03  Restr.(A=0) Log-l = -0.8407424E+03
Amemiya Pr. Criter.=  0.3820097E+08       Akaike Info.Crit.  =  0.2029621E+02
ANOVA  Source          Variation     Degrees of Freedom       Mean Square
       Regression      0.1538972E+11          2.                0.7694858E+10
       Residual        0.2682772E+10         73.                0.3675030E+08
       Total           0.1807249E+11         75.                0.2409665E+09
Durbin-Watson stat.=  0.8790417          Autocorrelation    =  0.5604792
Variable  Coefficient  Std. Error   t-ratio Prob|t|>x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
Constant  -18526.        2121.       -8.734  0.00000
LVCI       0.29948       6.781        0.044  0.96489   1080.8        384.19
L2VCI      37.366        6.848        5.456  0.00000   1084.9        380.39

AR(1) Disturbance
Initial Value of Rho =     0.56048
Maximum Iterations   =          20
Method = Prais - Winsten
Iter=  1, Rho= 0.56048, Sum of Squares= 0.16569E+10, Conc. Log-L= -750.132094
Iter=  2, Rho= 0.65599, Sum of Squares= 0.16278E+10, Conc. Log-L= -749.552287
Iter=  3, Rho= 0.66618, Sum of Squares= 0.16275E+10, Conc. Log-L= -749.555892
Iter=  4, Rho= 0.66748, Sum of Squares= 0.16275E+10, Conc. Log-L= -749.557271
AR(1) Disturbance
Initial Value of Rho =     0.56048
Maximum Iterations   =          20
Method = Prais - Winsten
Final Value of Rho =     0.66765
Durbin-Watson: Untransformed Residuals =     0.66170
Std. Deviation of Autocorrelated Error =     6342.3
Std. Deviation of White Noise          =     4721.7
Durbin-Watson for Transformed Residuals=     2.3126
Autocorrelation:  Transformed Residuals=    -0.15631
N[0,1] used for significance levels.
Variable  Coefficient  Std. Error   t-ratio Prob|t|>x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
Constant  -15837.        4303.       -3.680  0.00023
LVCI       14.646        5.140        2.849  0.00438   1080.8        384.19
L2VCI      20.577        5.167        3.982  0.00007   1084.9        380.39
Rho        0.66765     0.8596E-01     7.767  0.00000
```

Appendix B

FIFTY-SIX (56) MONTH PERIOD AFTER DEFAMATION

```
MODEL COMMAND:
REGRESS;LHS= IRR;RHS=ONE,LVCI,L2VCI;AR1$

Ordinary    least squares regression.      Dep. Variable      =  IRR
Observations                =          56  Weights            =  ONE
Mean of LHS                 =  0.4901429E+04  Std.Dev of LHS  =  0.2558739E+04
StdDev of residuals=  0.1903488E+04  Sum of squares     =  0.1920332E+09
R-squared                   =  0.4667123E+00  Adjusted R-squared=  0.4465882E+00
F[  2,     53]              =  0.2319175E+02  Prob value        =  0.5814084E-07
Log-likelihood              = -0.5007997E+03  Restr (A=0) Log-l = -0.5184032E+03
Amemiya Pr. Criter.=  0.3817372E+07  Akaike Info.Crit. =  0.1799285E+02
ANOVA  Source          Variation     Degrees of Freedom       Mean Square
       Regression      0.1680599E+09          2.                0.8402994E+08
       Residual        0.1920332E+09         53.                0.3623268E+07
       Total           0.3600931E+09         55.                0.6547147E+07
Durbin-Watson stat.=  0.8204797        Autocorrelation   =  0.5897601
Variable  Coefficient  Std. Error   t-ratio Prob|t|>x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
Constant   5395.2        268.0       20.133  0.00000
LVCI      -1.9919        0.9801      -2.032  0.04715   236.11        842.51
L2VCI    -0.88680E-01    0.9989      -0.089  0.92959   264.24        826.67

AR(1) Disturbance
Initial Value of Rho =     0.58976
Maximum Iterations   =          20
Method = Prais - Winsten
Iter=  1, Rho= 0.58976, Sum of Squares= 0.12054E+09, Conc. Log-L= -487.975337
Iter=  2, Rho= 0.64824, Sum of Squares= 0.11960E+09, Conc. Log-L= -487.814189
Iter=  3, Rho= 0.65872, Sum of Squares= 0.11955E+09, Conc. Log-L= -487.812997
Iter=  4, Rho= 0.66107, Sum of Squares= 0.11954E+09, Conc. Log-L= -487.813880
AR(1) Disturbance
Initial Value of Rho =     0.58976
Maximum Iterations   =          20
Method = Prais - Winsten
Final Value of Rho =   0.66162
Durbin-Watson: Untransformed Residuals =     0.67876
Std. Deviation of Autocorrelated Error =     2002.8
Std. Deviation of White Noise          =     1501.8
Durbin-Watson for Transformed Residuals=     2.3892
Autocorrelation: Transformed Residuals=    -0.19460
N[0,1] used for significance levels.
Variable  Coefficient  Std. Error   t-ratio Prob|t|>x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
Constant   5157.9        588.5        8.764  0.00000
LVCI      -0.54731       0.7187      -0.762  0.44633   236.11        842.51
L2VCI     -1.0242        0.7263      -1.410  0.15852   264.24        826.67
Rho        0.66162       0.1011       6.544  0.00000
```

not good – autocorrelation

okay

Appendix C

ENTIRE ONE HUNDRED AND THIRTY (130) MONTH PERIOD

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MODEL COMMAND:
REGRESS;LHS=PCICR;RHS=ONE,LVCI,L2VCI;AR1$

Ordinary    least squares regression.     Dep. Variable     =  PCICR
Observations      =          130          Weights           =  ONE
Mean of LHS       =  0.1490797E+05        Std.Dev of LHS    =  0.1478590E+05
StdDev of residuals= 0.6855254E+04        Sum of squares    =  0.5968303E+10
R-squared         =  0.7883756E+00        Adjusted R-squared= 0.7859429E+00
F[  2,   127]     =  0.2365599E+03        Prob value        =  0.1490837E-42
Log-likelihood    = -0.1331205E+04        Restr.(A=0) Log-l = -0.1432146E+04
Amemiya Pr. Criter.= 0.2052622E+02        Akaike Info.Crit. =  0.4807900E+08
ANOVA  Source          Variation     Degrees of Freedom       Mean Square
       Regression      0.2223403E+11          2.                0.1111701E+11
       Residual        0.5968303E+10        127.                0.4699451E+08
       Total           0.2820233E+11        129.                0.2186227E+09
Durbin-Watson stat.=  0.4157744          Autocorrelation   =  0.7916128
Variable  Coefficient  Std. Error   t-ratio Prob|t|>x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
Constant  -21106.        1772.      -11.914  0.00000
LVCI      0.33754E-01    7.270        0.005  0.99630   956.99        349.38
L2VCI      37.570        7.275        5.164  0.00000   957.59        349.14

AR(1) Disturbance
Initial Value of Rho =    0.79161
Maximum Iterations   =         20
Method = Prais - Winsten
Iter=  1, Rho= 0.79161, Sum of Squares= 0.18868E+10, Conc. Log-L=-1256.845795
Iter=  2, Rho= 0.84852, Sum of Squares= 0.18597E+10, Conc. Log-L=-1256.047923
Iter=  3, Rho= 0.86060, Sum of Squares= 0.18582E+10, Conc. Log-L=-1256.033132
Iter=  4, Rho= 0.86385, Sum of Squares= 0.18580E+10, Conc. Log-L=-1256.038775
AR(1) Disturbance
Initial Value of Rho =    0.79161
Maximum Iterations   =         20
Method = Prais - Winsten
Final Value of Rho =   0.86476
Durbin-Watson: Untransformed Residuals =    0.27049
Std. Deviation of Autocorrelated Error =    7616.5
Std. Deviation of White Noise          =    3824.9
Durbin-Watson for Transformed Residuals=    2.4583
Autocorrelation: Transformed Residuals=    -0.22916
N[0,1] used for significance levels.
Variable  Coefficient  Std. Error   t-ratio Prob|t|>x   Mean of X  Std.Dev.of X
---------------------------------------------------------------------------
Constant  -13214.        4773.      -2.769  0.00561
LVCI       12.405        4.067       3.050  0.00229   956.99        349.38
L2VCI      16.660        4.059       4.105  0.00004   957.59        349.14
Rho       0.86476     0.4422E-01    19.558  0.00000
```

not good - auto correlation

okay

PREJUDGEMENT INTEREST: ISSUES AND CASE STUDIES

by

Tyler J. Bowles and W. Cris Lewis*

I. Introduction

Prejudgment interest can be an important component of a legal claim. For example, Richard Nixon's estate is seeking $213 million as "just compensation" for the Watergate tapes and White House papers—$35.5 million for the property confiscated by the government in 1974 and $177.5 million in prejudgment interest (Jackson, 1999). The law concerning such interest, however, is complex, inconsistent among states, and may contain a bias against plaintiffs. Further, the damage model applied may affect the applicability of prejudgment interest and/or the degree that interest is necessary to make the plaintiff whole.

This paper reviews: (1) prejudgment interest law; (2) the possible bias in prejudgment interest law against plaintiffs; (3) how the damage model used may affect the importance of prejudgment interest relative to total damages; and (4) the appropriate interest rate to use in calculating prejudgment interest. In addition, two cases are reviewed where prejudgment interest was an issue. In this paper, it is argued that as a general principle, prejudgment interest should be paid on an economic loss.

II. Prejudgment Interest Law

It is difficult to summarize state prejudgment interest law given the variations among the different jurisdictions. Rothschild, however, provides the following three broad categories: (1) the traditional approach, (2) the discretionary approach, and (3) the mandatory interest approach. The summary of prejudgment interest law provided by Wilson indicates that although an increasing number of state legislatures and courts are recognizing that compensation is not adequate without prejudgment interest, approximately 20 states still follow the traditional approach, which sharply limits the availability of interest.[1]

The traditional approach tries to make a distinction between liquidated or reasonably ascertainable damages and unliquidated or uncertain damages. Prejudgment interest is available on the former, not on the latter. Utah is among the states that follow the traditional approach. For example, the Utah Supreme Court has ruled as follows:

> Where the damage is complete and the amount of loss fixed as of a particular time, and that loss can be measured by facts and figures, interest should be allowed from that time and not from the date of

* Tyler J. Bowles and W. Cris Lewis are with the Department of Economics at Utah State University, Logan, Utah.

[1] Knoll (1996) has noted that the "lingering reluctance of legislatures and courts to provide prevailing plaintiffs with prejudgment interest [can be traced] to ancient hostility towards interest."

> judgment. On the other hand, where damages are incomplete or cannot be calculated with mathematical accuracy, such as in case of personal injury, wrongful death, defamation of character, false imprisonment, etc., the amount of damage must be ascertained and assessed by the trier of the fact at the trial, and in such cases prejudgment interest is not allowed (*Cornia v. Wilcox*, 1995).

Thus, in Utah, it is the usual practice not to seek prejudgment interest except in cases where the damages can clearly be defined as being "liquidated" (i.e., where they arise out of a specific contractual obligation and can be "calculated with mathematical accuracy"). Idaho also is among the states that limit prejudgment interest to those cases where damages are "liquidated or ascertainable by mere mathematical process." (See e.g., *Ervin Const. Co vs. Van Orden*).[2]

III Inequity of Limiting Prejudgment Interest

Arriving at a judgment in a civil suit often takes a number of years. The delay in achieving justice should not affect the economic position of either the plaintiff or the defendant. In *Procter & Gamble Distribution Co v. Sherman*, Judge Learned Hand wrote:

> Whatever may have been our archaic notion about interest, in modern financial communities a dollar today is worth more than a dollar next year, and to ignore the interval as immaterial is to contradict well settled beliefs about value. The present use of my money is itself a thing of value, and if I get no compensation for its loss, my remedy does not altogether right my wrong.

As a general proposition, if an individual or firm is damaged as a result of the wrongful act of another individual or firm but is not compensated until some future date, which often is several years later, compensation should be paid both for the damage (e.g., the present value of lost profit or wages) plus the foregone return between the time the tort was committed and the date that compensation was paid.[3]

From an economic perspective, there is no basis for trying to distinguish between damages that can be ascertained with some degree of mathematical accuracy and those that cannot. Specifically, excluding interest in personal injury and wrongful death actions seems

[2] Utah and Idaho are selected as representative states of the traditional approach since the authors are more familiar with the prejudgment interest law in these states and the case studies presented later are from these two states. Other states that tend to follow the traditional approach include the following: Alabama, Arizona, Arkansas, Delaware, Florida, Illinois, Indiana, Kansas, Kentucky, Minnesota, Mississippi, Missouri, Nebraska, Oregon, South Carolina, South Dakota, Vermont, Washington, and Wyoming.

[3] That the funds may not actually have been invested at interest is irrelevant; that the injured party would have used them in some other way is *prima facie* evidence that the implicit rate of return in that alternative was higher than the interest rate.

particularly illogical. The damages associated with the lost wage income to an individual rendered unable to work fit the criteria of being "complete," fixed as of a particular time, and capable of being measured by facts and figures. Certainly many injured plaintiffs must borrow at interest to replace lost earnings; it is illogical to preclude their claim to interest on their loss based on some archaic legal notion.[4]

As a general rule, interest should run from the moment the loss is incurred, regardless of the degree of uncertainty surrounding the loss. To fail to provide interest usually means less than full compensation to the injured party. Further, such failure provides a clear incentive for the defendant and/or his representatives to delay the litigation process as the real value of the amount that ultimately has to be paid diminishes with time. Strategically, the defendant may attempt to use delaying tactics to both reduce the real value of any judgment or settlement amount and to put pressure on the plaintiff to settle, as the latter sees the value of a prospective future judgement shrinking.

Also, it is not unusual for the plaintiff to be in financial peril anyway as a result of the damages incurred. For example, an injured person who cannot return to work almost always suffers from a reduced flow of income. To have a law denying prejudgment interest while the plaintiff borrows to maintain his living standard or have that standard reduced appears to tilt the scales of justice in favor of the defendant.

IV. Damage Model and Prejudgment Interest

If an asset of a firm is destroyed, damages could be calculated directly either by assessing the fair market value of the asset destroyed on the incident date or by measuring the present value of future lost profits computed as of the date of injury.

> There is no difference in principle between a claim for a stream of lost profits and a claim for the destruction of an asset. An asset is in fact worth the present value of the profit stream associated with it; to turn the matter around, the possession of a profit stream is the possession of an asset worth the present value of that stream (Fisher and Romaine, 1990).

In theory, the approaches should result in equivalent damage amounts.[5, 6] However, as the

[4] An anonymous referee noted that there may be circumstances where the automatic provision of prejudgment interest would be unfair to the defendant. It was pointed out that at least one state has a 15-year statute of limitations on construction defect claims A defendant could find that years had elapsed before the claim was made, thus exposing him to substantial prejudgment interest that he was totally unaware was accumulating.

[5] This would not be true if the asset were owned for nonpecuniary reasons. For example, few would argue that for the average racehorse, the purchase price equals the present value of future expected profits. The ownership of some farms, ranches, and livestock also may fall into this category. Partly for this reason, a lost profits approach was not pursued in the Idaho case discussed below.

[6] See Joslyn (1982) for a discussion of an analogous issues: i.e., the equivalency of the going concern and lost profits methods of damage calculation. A plaintiff was not allowed

following example illustrates, given the peculiar nature of prejudgment interest law the results can be quite different.

Suppose an asset is wrongfully destroyed that would have earned positive cash flows of $150 at the end of each of the next ten years. The day before the injury, the asset had been purchased for $922. Trial takes place four years later. If an asset-based damage model is used (i.e., assessing the value of the asset on the injury date), damages of $922 would be presented to the court plus prejudgment interest at, say, 10 percent per year for four years of $428. The interest would be 46 percent of damages exclusive of interest. Because the damages do not fit the definition of being liquidated, an Idaho or Utah court (and many others) would reject the claim for prejudgment interest, and the plaintiff would be left with a claim for $922.

If a lost profits approach is taken and the date of trial is the present value date, total damages are $1,349 as documented in Table 1. A summary of these damages is as follows:

Past Lost Profits	$600
Prejudgment Interest	96
Present Value of Future Lost Profits	653
Total	$1,349

to recover for both types of damages, as to do so would be duplicative.

Table 1. Lost Profits Calculation, Trial Date is Present Value Date

Year	Annual Lost Profits	Present Value of Annual Lost Profits	Prejudgement Interest (10%)
1	$150	$200	$50
2	150	181	31
3	150	165	15
4	150	150	0
Totals	600	696	96
5	150	136	N/A
6	150	124	N/A
7	150	113	N/A
8	150	102	N/A
9	150	93	N/A
10	150	85	N/A
Totals	900	653	N/A

Under this lost-profits approach, total prejudgment interest is 8 percent of damages exclusive of that interest. If the court does not allow prejudgment interest, the plaintiff is left with $1,253 (i.e., $1,349 - $96), which is 36 percent more than damages calculated under the asset-based model.

If the appropriate present value date is the date of the injury, rather than the trial date, the present value of future lost profits is $922 and the outcome is the same as that realized under the asset based approach. But courts normally insist that future values be discounted to their present value equivalents as of the date of trial. Hence, when an asset is damaged, the peculiar result is obtained that restricting the applicability of prejudgment interest favors a lost-profits-based approach over an approach that simply appraises the fair market value of the asset on the date of injury.

The fact that the same courts that restrict the use of prejudgment interest require future losses to be discounted back to the present is itself peculiar. The Court of Appeals in Idaho has noted this oddity. In *Bergkamp vs Carrico*, the Court stated that prejudgment interest may be appropriate to fully compensate a tenant as a result of wrongful termination of a lease:

> Because the value of a leasehold is computed at present value on the termination date, it would be illogical—indeed, it would be palpably

> inequitable—to allow interest from the same date until judgment. Such interest simply represents a return upon the imputed use of money during this period.

This court simply is stating the same fundamental principle that Judge Learned Hand noted sixty years earlier—namely, that there is a time value of money. The plaintiff in the Idaho case discussed below cited Bergkamp in its argument that prejudgment interest should be allowed as a matter of equity. The Court did not even address Bergkamp in rejecting the plaintiff's claim for prejudgment interest.

V. Other Prejudgment Interest Issues

If prejudgment interest is allowed, other difficult issues must be addressed that relate to the rates to be used to compound past losses and to discount future losses. Taurman and Bodington (1992) argue that the basis for prejudgment interest arises out of the question of "how much worse is the plaintiff today because he was deprived of funds (i.e., the pretrial losses) in the past?" (p.82). Conceptually, there are several relevant considerations in determining what interest rate to apply to those losses. In cases involving lost profits, if the funds would have been deployed in the ongoing operations of the business, an interest rate that reflected the specific risks of the enterprise and the industry in which it operates would be appropriate. Alternatively, the firm also may have a portfolio of securities, where funds in excess of those needed for business operations are invested. In that case, some weighted average of the two rates of return might be appropriate. A third view (Fisher and Romaine, 1990) is that since the plaintiff did not actually take the risks (as he was deprived of the cash flows due to the tort), he is only entitled to the risk-free rate on pretrial losses. But Taurman and Bodington counter that ". . . the existence of litigation risks undermines the rationale for a risk-free compounding rate" (p.85).

The following example will demonstrate the issue. Assume that a reasonable estimate of the plaintiff's lost profits is $100 per year for each of the ten years following the tort, and that the trial is held five years post-incident. Damages could be computed in at least two ways. In the first, the stream of lost profits is discounted back to the incident date using a risk-adjusted interest rate of, say, 15 percent. The discounted value is $502. Next, following the Fisher-Romain position, interest is added using a risk-free rate of 5 percent for the five years preceding the trial, which amounts to $139, bringing the total claim to $641. Alternatively, interest could be added to the profits for the first five years at the risk-free (i.e., 5 percent) rate to yield a compound value of $553 for the "past loss." Next, profits for the second five years are discounted at 15 percent to yield a present value of the future loss of $335. The total loss is $888 or 39 percent more than that determined under the first approach. The reason for the difference is that profits for the first five years have not been adjusted for risk.[7]

[7] Curiously, in personal injury litigation involving lost wage earnings, both the courts and most forensic economists generally have adopted the convention that a risk-free rate is applied both to past and future earnings; implicitly, it is assumed that the earnings flows are known with certainty and dismisses the possibility that the employer may not be able to

A third approach, and the one that probably makes the most economic sense, is to compound interest on the forgone profits for the first five years at 15 percent interest (i e., yielding $674) and to use that same rate to discount profits projected for the next five years (i.e., $335) for a total loss of $1,009.

VI. Examples

A. The Idaho Case

In the fall of 1995, some 273 high quality Angus beef cows were injured as a result of a supplier's improperly mixed feed. Fifty-eight of these cows were sold at cull (i.e., low quality stock) prices in the fall of 1995, and the balance died over the winter or were sold at cull prices in the fall of 1996. An Idaho Court awarded damages of $140,267 on March 1, 1999, determined as the difference between the fair market value of the cows before and after the injury.[8] The Court ruled that damages were ". . . neither liquidated nor capable of ascertainment by mere mathematical calculations . . ." and, hence, prejudgment interest was denied.

Had compound interest at 10 percent for 3.5 years been awarded, the plaintiff would have received an additional $55,763 or 40 percent of the actual award. Assume the defendant's opportunity cost of money is 10 percent. Had compensation been paid at the moment of the incident, the defendant would have paid $140,267. However, by paying the amount 3 5 years later, the defendant was able to earn a return of $55,763, which reduced the effective payment to $84,504 (i.e., the difference between $140,267 and $55,763). Effectively, prejudgment interest of $55,763 is earned but here it is implicitly awarded to the defendant. This judgment is equivalent to the defendant playing $84,504 on the date of the incident.

The plaintiff argued that damages were ascertainable by mere mathematical process. The value of the cattle after the injury was a known fact since the cattle were indeed sold as culls. Further, the value of the cattle immediately prior to the injury was ascertainable by reference to prices from the same annual cattle auction where the cattle in question were purchased in previous years. It is of significance that the defendant did not dispute the preinjury or postinjury value of the cattle. The damages were easily determined as the number of cattle injured multiplied by the difference between the pre- and postinjury values. Although damages appear in this case to be a product of "mere mathematical calculation," the court did not agree.

B. The Utah Case

make payments in the future or that the plaintiff may not be able to work for reasons other than the injury that led to the litigation. Note that this is not an argument against the application of prejudgment interest in such cases, but rather is an argument for a higher discount rate on future cash flows.

[8] There were other small damage elements. This was the amount awarded for injury to the cows.

In 1987, a business venture was started in Salt Lake City, Utah in which the three owners of the corporation had management contracts that ran from October 23, 1987 through October 22, 1992 and specified very clearly what the annual salary, annual salary increase, and fringe benefits were to be. In 1988, the firm was unable to meet obligations on its debt, and the major creditor forced out the three managers in early 1989. These owner/managers subsequently sued their law firm, who they claimed had violated their duty to represent them by becoming involved with the creditor. Among others, there was a claim for lost salaries and fringe benefits for the period of the contract net of any offsetting salaries that the individuals had earned.

The trial was held in early 1999, ten years after the incident. The plaintiffs' claims for losses associated with the employment contracts are summarized in Table 2. The net lost salaries and benefits were $564,752 and prejudgment interest was $408,147, based on the Utah statutory rate of 10 percent per year simple interest,[9] of the total damages claim of $972,899, the prejudgment interest would have accounted for 42 percent.

Table 2. Summary of Lost Salary and Fringe Benefits and Prejudgment Interest

Individual	Salary and Benefits	Total Lost Plus: Prejudgement Interest*	Total Pecuniary Loss
A	$86,706	$ 64,333	$151,039
B	290,575	212,315	502,890
C	187,471	131,499	318,970
Total	$564,752	$408,147	$972,899

*Computed using 10 percent simple interest.

As indicated above, Utah law provides for prejudgment interest in contract disputes where the damages can be shown to be of the liquidated type. As these were formal written employment contracts in this case, one would think that the prejudgment interest provision would apply. But the court ruled otherwise.

VII. Summary

It seems obvious that when economic damage is done but compensation is not paid until some later date, the only way the injured party can truly be made whole is by the inclusion of prejudgment interest in the damage award. Implicitly or explicitly, a return is

[9] It also is curious that most statutes provide for simple not compound interest. As market returns generally are compounded, this is another dimension of the law that disadvantages the plaintiff. In this case, had the interest been compounded, the total prejudgment interest amount would have been about $200,000 higher. Again, a referee pointed out that the bias toward simple interest simply may reflect the difficulty that the average jury (or perhaps even the average judge) would have in computing compound interest.

earned on the amount ultimately awarded; if prejudgment interest is not given to the plaintiff, it *de facto* is awarded to the defendant.

Unfortunately, the law concerning prejudgment interest in many jurisdictions is obtuse, irrational, and often unfair. Further, there is evidence that the law is not applied consistently. Legal scholars have commented that traditional prejudgment interest law, which makes a distinction between liquidated and unliquidated claims, has its roots in archaic notations about the morality of interest. Given that prejudgment interest law varies among jurisdictions, is in a state of flux, and may influence the choice of damage model to be applied, economists should be aware of the status of prejudgment interest law in the jurisdictions in which they practice. Furthermore, economists could be an important force for change by using their expertise and influence with the courts and legislatures to influence more rational prejudgment interest law [10]

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[10] See Oyos (1988) for an example of a proposed prejudgment interest statute that would replace ". . the anachronistic principles of interest inherited from medieval common law."

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AVERAGE CHANGE IN WAGES: THE ECI ADVANTAGE

by

Kurt Krueger*

I. Introduction

The Bureau of Labor Statistics (BLS) produces three major surveys regarding employment and earnings: the Current Population Survey, Current Employment Statistics, and the National Compensation Survey. All three surveys report average wage information for each week, month, quarter, or year surveyed. In forensic economics, we often use a time series of average wages from one of these surveys to construct a wage growth rate[1]—calculated either by the average of annual percent changes in average wages or the geometric average rate of growth in average wages from a beginning to an ending date. In this paper, we argue that of all the survey-based data resources relied on by forensic economists to construct a wage growth rate, the Employment Cost Index (ECI), a part of the National Compensation Survey, produces advantage over the other surveys. The ECI advantage is that it measures the average change in wages, whereas using the other survey data the only possible wage growth calculation is a change in average wages. The specific design of the ECI survey is to produce estimates of the average changes in wages and its methodology is very different from the other BLS surveys. In this paper, we focus on the differences between BLS surveys and illustrate why the ECI's average change in wages is the relevant statistic in forensic economic analysis that requires a wage growth rate constructed from surveys of wages.

The subject areas of this paper are:

(1) to provide a general description of BLS materials pertaining to its three major wage surveys;
(2) to describe the ECI by summarizing and condensing technical information regarding the ECI that is published by the BLS;
(3) to illustrate that the differences in growth rates calculated using data from these BLS surveys can be quite large; and,
(4) to suggest that the ECI provides the best wage growth rate source in forensic economic situations.

* The author is with John O. Ward & Associates in Prairie Village, Kansas. He would like to thank Michael Piette for helpful suggestions in revising this paper. An earlier version of this paper was presented at the Western Economic Association meetings in San Diego in July 1999.

[1] For purposes of this paper, we define the wage growth rate in its macroeconomic context (i.e., the expected increases in earnings due to economy-wide price inflation and overall increases in labor productivity within a relevant industry and/or occupation grouping).

This paper begins with a short review of the CPS and CES surveys. Next, we describe how the ECI data is collected and how the index is calculated drawing from BLS technical information. We then show some comparable industry data found in the ECI and CES surveys. We conclude with a description of the ECI advantage when analyzing the average change in wages in industries and occupations—the basis for many forensic economic earnings projections.

II. Current Population Survey (CPS)

The CPS is a monthly household survey with origins beginning in 1940 with the Monthly Report of Unemployment. The U.S. Census Bureau collects the CPS data and the BLS analyzes and then publishes the data. Since 1948, the CPS has emphasized the collection of data regarding the employment status of individuals and providing information on the demographic characteristics (sex, age, race, education, etc.) of the labor force. The CPS last underwent a major redesign with data reporting in January 1994.

The CPS is collected each month from a probability sample of approximately 50,000 households containing over 125,000 persons. The selection of households surveyed is by street address. Although the survey is strictly voluntary, refusal rates run only four percent each month. The period covered under the monthly survey is the calendar week that includes the 12th day of the month (called the survey week). In the following week, surveyors ask respondents for their recollection of their activities and earnings during the survey week.

In the CPS, the survey collects data on earnings before taxes and other deductions. Respondents are asked to report earnings in the time frame which they find easiest, for example, hourly, weekly, biweekly, monthly, or annual. The BLS automatically calculates weekly earnings when persons respond that their pay period is other than weekly. The "wages and salaries" grouping include wages, salary, Armed Forces pay, commissions, overtime pay, tips, piece-rate payments, and cash bonuses earned, before deductions are made for taxes, bonds, pensions, union dues, etc. The survey considers the net earnings of self-employed persons as wage and salary amounts (even if those earnings are negative). Since the CPS is a household survey, it is not industry or occupationally specific. Because the CPS surveys households by address, controls for ensuring consistent industry or occupation representation in the data are not a part of the CPS survey.

CPS weekly earnings from the monthly survey are subject to top coding (or editing of large values given by respondents). Earnings data are top coded by the BLS to avoid potential wide swings in the averages when a number of respondents report large earnings in a survey week. Currently, the BLS top codes earnings based on an individual's usual hours worked variable. If the respondent's edited usual weekly earnings variable is greater than $1923, the topcode becomes in effect. The topcode also becomes in effect when the product of usual hours worked times the usual hourly wage exceeds the annualized wage of $100,000 ($1,923 per week).

Each month, the BLS releases median weekly earnings figures from the most recently completed CPS and the medians from the last full quarter of surveys. In Table 1, we present employment and median weekly earnings for the first quarters of 1997 and 1998

for managerial and professional specialty workers.[2]

Table 1. CPS Results for 1997 and 1998

Managerial and Professional specialty workers	1997:Q1	1998:Q1	% change
Number of workers in thousands	28,164	28,748	2.1%
Men	14,562	14,516	-0.3%
Women	13,602	14,231	4.6%
Median weekly earnings	$740	$741	0.1%
Men	$875	$865	-1.1%
Women	$630	$647	2.7%

A review of the data shows men's median earnings and employment declining while women's median earnings and employment are rising. At the same time, one dollar separates all workers' median weekly earnings from 1997 to 1998. If a forensic economist is working with a male manager, it might make little sense to him or her to reduce plaintiff's earnings from 1997 to 1998 because the median fell. On the contrary, if the economist is working with a female manager, he or she might quickly accept the 2.7 percent growth in median earnings from 1997 to 1998. However, the economist should be ready to answer questions such as were the earnings of the 629,000 new women managers in 1998 greater or lower than the earnings of the 13,602,000 women managers that worked in 1997 and 1998? Or, if the earnings of the new 629,000 women managers were less than the median for the 13,602,000 women managers that worked in 1997 and 1998, might the actual earnings growth of the women managers that worked in 1997 and 1998 be greater than 2.7 percent?

After reviewing the CPS data above, the economist becomes aware of the problems when looking at year-to-year changes in median or average wages. Variation over time in the population that comprises any industry or occupation grouping will determine the resulting median or average earnings statistics. Consistent measurement of average earnings in industries or occupations is not possible in the CPS by methodological design of the survey. Increases or decreases in employment (in a wide range of demographic features such as age, experience, skill, etc.) along with variation in wage levels paid to changing groups of workers has a substantial effect on the year-to-year medians or averages. When calculating changes in averages or medians, substantial error in the CPS is always present as to the expected or actual earnings growth experience of a group of similar workers

[2] "Usual Weekly Earnings of Wage and Salary Workers: First Quarter 1998," U.S. Department of Labor News Release 98-148, April 20, 1998.

performing the same tasks over time within any occupation or industry

III. Current Employment Statistics (CES)

The CES is an establishment survey with origins dating back to 1915. Since 1949, the CES program has been a fully integrated Federal-State project that provides employment, hours, and earnings information by industry on a national, State, and area basis. The BLS asks all firms with 250 employees or more to participate in the survey, as well as a statistical sample of smaller firms. The CES is the largest monthly employer survey in existence. All data is industry specific; there are no occupational data in the CES. Currently, the CES collects data from approximately 390,000 establishments and the survey reports average hourly earnings for 531 industries at the national level and in over 4,500 hourly earnings series at the state and area level.[3]

The CES survey excludes unpaid family workers, domestic workers in private homes, proprietors, and other self-employed persons, all of whom the CPS covers. The CES bases its earnings series on returned reports of the establishments in the survey of its gross payrolls and the corresponding paid hours for production workers, construction workers, or non-supervisory workers. Average hourly earnings series, derived by dividing gross payrolls by total hours, reflect the actual earnings of workers, including premium pay. With this method of calculation, average hourly earnings differ from wage rates, which are the amounts stipulated for a given unit of work or time. Additionally, average hourly earnings do not represent total labor costs per hour for the employer, because they exclude retroactive payments and irregular bonuses, employee benefits, and the employer's share of payroll taxes. The CES estimates do not include the earnings for those employees not covered under the production worker and non-supervisory categories.

The CES collects data for *production workers* in manufacturing and mining industries. In manufacturing, this group covers employees, up through the level of working supervisors, who engage directly in the manufacture of the establishment's product. Among those excluded from this category are persons in executive and managerial positions and persons engaged in activities such as accounting, sales, advertising, routine office work, professional and technical functions, and force-account construction. (Force-account construction is construction work performed by an establishment, primarily engaged in some business other than construction, for its own account and for use by its own employees.) The CES defines production workers in mining in a similar manner.

In construction industries, the term *construction workers* covers workers up through the level of working supervisors, who are engaged directly on the construction project either at the site or in shops or yards at jobs ordinarily performed by members of construction trades. Excluded from this category are executive and managerial personnel, professional and technical employees, and workers in routine office jobs.

In the remaining private sector industries (transportation, communications, and public utilities; wholesale and retail trade; finance, insurance, and real estate; and services), the CES collects data on *nonsupervisory workers*. Nonsupervisory workers include most

[3] Technical Notes to Establishment Survey Data Published in Employment and Earnings" published at the BLS's Internet site at http://www.bls.gov/cestn1.htm.

employees except those in top executive and managerial positions.

In Table 2, we show data from the CES survey for SIC 4011, Class I railroads. Forensic economists often use this data as a basis for forecasting the wage growth for railroad workers. We show this data for the past ten years to illustrate an important problem with CES data. Railroads report the data in Table 2 using BLS form 790H: Transportation, Communication, and Public Utilities, Finance, Insurance, Real Estate, and Services. Each month a railroad records data in the five columns of this form:

Column 1: **All Employees**: Report the number of paid employees who worked during or received pay for any part of the pay period that includes the 12th of the month.

Column 2: **Women Employees**: Report the number of employees from column 1 who are women.

Column 3: **Nonsupervisory employees**: Report the number of employees from column 1 who are non-supervisory employees.

Table 2. CES data for SIC 4011, Class 1 Railroads[4]

Year	Nonsupervisory Employment	Average Hourly Earnings of Nonsupervisory Employees	Average Weekly Hours of Nonsupervisory Employees	Average Weekly Earnings of Nonsupervisory Employees
1989	251,600	$15.68	44.2	$693.06
1990	241,400	$16.08	45.2	$726.82
1991	231,000	$15.68	45.1	$707.17
1992	222,400	$16.66	44.2	$736.37
1993	217,600	$16.93	46.2	$782.17
1994	213,600	$16.76	46.9	$786.04
1995	212,100	$17.48	46.4	$811.07
1996	205,500	$17.71	48.0	$850.08
1997	201,800	$18.10	49.3	$892.33
1998	205,100	$17.95	47.1	$845.45

Column 4: **Nonsupervisory Payroll**: Report the total nonsupervisory employee payroll, including overtime and excluding lump sum payments, for the pay period that includes the 12th of the month.

Column 5: **Nonsupervisory Employee Hours**: Report the total nonsupervisory employee hours paid, including overtime, for the pay period that includes the 12th of the

[4] These BLS data series, respectively across the tables, are EEU41401101, EEU41401106, EEU41401105, AND EEU41401104. We downloaded these data series from LABSTAT at www.bls.gov on the Internet.

month.

The data recorded by the railroads into these five columns form the entirety of our knowledge from the CES concerning wages for non-supervisory railroad employees. To calculate average hourly earnings of non-supervisory workers in the CES survey, the BLS divides the nonsupervisory employee payroll data reported by the railroads in column 4 of the form by nonsupervisory employee hours reported in column 5 of the form. The BLS calculates the average weekly hours of nonsupervisory workers by dividing the data supplied by the railroads in column 5 by column 3, nonsupervisory employees.

Reviewing the railroad data, in 1991 there was a 40 cent drop (-2.5 percent) in average hourly earnings while hours changed 0.1 hours in a week and employment fell by 10,400 workers. Average hourly earnings also fell in 1994 and 1998. Employment fell every year from 1989 to 1997. A plausible explanation for the drop in average hourly wages from 1997 to 1998 is that 3,300 new workers were hired with most likely lower starting pay than tenured workers thereby causing a drop in average pay. However, what caused the wage changes in the other years? Many possible combinations of explanation might exist for each change in average wages. Absent specific knowledge, the economist can only speculate regarding the reasons for movement in average wages.

The CES reports hourly and weekly earnings data by establishments regardless of any division in occupation, responsibility, and task or skill level of the workers in the establishment. The survey combines all workers in an establishment together, from the lowest paid workers such as gardeners maintaining company grounds to the highest skilled computer programmers in the firm responding to the CES survey. The scope of data surveyed is so small that the BLS estimates that it takes the respondent firm an average of 7 minutes each month to complete the CES form including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information on the form. If one month, the example CES respondent firm decides to fire all of the gardeners, hire a landscaping company to tend the grounds, and not give any raises or hire any new workers, the average hourly earnings reported to the BLS in the CES survey will rise from the previous month because the low-paid gardeners are no longer represented in the calculation of the average. However, no worker in the firm received any increase in wages!

While it is very common to find forensic economists using the CES data in making earnings projections for a specific Plaintiff, it is not common to find forensic economists addressing the underlying industry specific information concerning why the average wages change over time. Using the example of railroads, employment has been declining sharply over the past 25 years as the railroads have offered early buy-outs of tenured workers as they downsize employment and capitalize the industry. Nonsupervisory workers in the railroad industry are seniority based in many ways concerning pay and possible earnings levels. If an economist makes a reasonable assumption that railroad workers leaving the industry had earnings on average greater than the average of all workers, the remaining railroad workers most likely had an earnings growth experience entirely different from a calculation of the changes in average railroad wages would reveal.

The problems with using average wage data for an entire industry (or even all workers in a specific occupation) persist no matter the industry selected. We presented the railroad industry as an example because it is small and often analyzed in the forensic

economic literature as a part of FELA litigation. No matter the industry or occupation, changes in average wages are often irrelevant to the calculation of an expected average change in the wages that forms the economist's wage growth rate.

IV. Employment Cost Index

A. Background

The ECI provides a quarterly measure of change in the employers' cost for employee compensation, which includes wages and salaries and employers' cost for employee benefits. For each industry and occupation, the BLS reports a wage and salary ECI and a total compensation ECI. Benefit ECI's are limited to a fewer number of industries and occupations. All data in the ECI program are index values designed to allow the calculation of wage growth rates for industries, occupations, and occupations within industries.[5]

The ECI is a Laspeyres, fixed-weight index. By controlling for employment shifts across 2-digit industries and major occupational groups, the ECI shows how average wages and salaries, benefits, and total compensation paid by employers would have changed over time if the industrial-occupational composition of employment had not changed from the base period. Currently, the ECI contains ninety-one industry and occupation groups and data for private industry, state and local government, and the civilian sectors.[6] The BLS reports ECI's for wages and salaries and total compensation for all groups and benefits for a limited number of groups. While the CES covers 531 industries, the ECI is limited to 47 major industry and 57 major occupation groupings. However, as mentioned above in the CES section, occupational data is unavailable in the CES survey and all workers regardless of job skills or pay levels are combined together in the CES for analysis while in the ECI they are analyzed separately.

The Employment Cost Index has been designated a principal federal economic indicator by the Office of Management and Budget. The BLS states that the ECI "*is the only measure of labor costs that treats wages and salaries and total compensation consistently, and provides consistent subseries by occupation and industry.*"[7] The Federal Reserve Board also uses the ECI as a primary indicator to monitor the effects of its fiscal and monetary policies and in formulating those policies. The ECI enables analysts and policy makers to assess the effect of labor cost changes on the economy—taken together and by sectors. Because the ECI is a fixed-weight index providing consistent representation of jobs and skills, it is particularly important in studies of the relationships between prices, productivity, labor costs, and employment.

[5] Once a year, the BLS releases a report called *Employer Costs for Employee Compensation,* which contains average wage, benefit, and total compensation dollar levels that are a part of the data that forms the ECI.

[6] The current coverage of ECI's can be found at the BLS website at http://www.bls.gov/ectgroup.htm.

[7] Handbook of Methods, Chapter 8, U.S. Bureau of Labor Statistics [http://www.bls.gov/opub/hom/homch8%5Fk.htm].

The initial ECI series, introduced in 1976, was limited to wages and salaries. In 1980, the ECI expanded to cover changes in total employee compensation. In November 1981, the ECI expanded again to include state and local government units. All ECI's have index values equal to 100 in June 1989.

B. Data Collection

There are two separate steps in the ECI data collection process: the initiation and the quarterly update. Initiation occurs the first time a trained field economist visits an establishment onsite to collect data for the survey from the respondent's payroll and personnel files. The update occurs each subsequent quarter the establishment is in the ECI sample. Generally, an establishment is in the ECI sample for about five years before an establishment from a new sample replaces it. The ECI sample rotates such that in any given quarter $1/20^{th}$ of the sample is new and the average time an establishment has been in the sample is 2 ½ years.

At the initiation of each establishment, the field economist informs the respondent face-to-face about the survey, randomly selects from 4 to 8 jobs—the number depending on the size of the establishment—to represent the establishment, and then obtains wage, benefit, and other information required to estimate the cost of the compensation package for each surveyed job. The jobs selected in each establishment at the time of initiation are the same ones for which data are collected in the quarterly updates. The jobs are defined narrowly enough that all workers in the job carry out the same job for which data are collected in the quarterly updates; and, they are defined narrowly enough that all workers in the job carry out the same task at roughly the same level of skill.

The ECI defines wages and salaries as the hourly straight-time wage rate or, for workers not paid on an hourly basis, straight-time earnings divided by the corresponding hours. Straight-time wage and salary rates are total earnings before payroll deductions, excluding premium pay for overtime and for work on weekends and holidays, shift differentials, and non-production bonuses such as lump-sum payments provided instead of wage increases. Production bonuses, incentive earnings, commission payments, and cost-of-living adjustments are included in straight-time wage and salary rates.

The employer provided benefits covered by the ECI for the benefits and total compensation series are: paid leave—vacations, holidays, sick leave, and other leave; supplemental pay—premium pay for work in addition to the regular work schedule (such as overtime, weekends, and holidays), shift differentials, non-production bonuses, and lump-sum payments provided in lieu of wage increases; insurance benefits—life, health, short-term disability, and long-term disability; retirement and savings benefits—defined benefit and defined contribution; legally required benefits—Social Security, Federal and State unemployment insurance, and, workers' compensation; and other benefits—severance pay and supplemental unemployment plans. To measure benefit costs, the field economist first identifies the ECI benefits existing for each surveyed job in the establishment, and then collects information required to estimate their cost per hour worked. Benefit costs are measured using a current cost approach—annual costs based on the current price of the

benefit under the current plan provisions.[8] Once the annual cost is determined, that cost is divided by annual hours worked, that is, the annual work schedule (for example, 34 hours per week times 52 weeks per year) minus annual hours for vacations, holidays, and other leave, plus annual overtime hours.

The BLS performs the quarterly update of information using a combination of mail and telephone surveying. The BLS sends forms to each respondent firm describing and listing the information recorded by the field economist at the initiation or the previously reported wage and salary rates and benefit provision for each survey occupation. The respondent identifies any changes from the previous quarter's data. A change in wages and salaries occurs if wages change, regardless of whether it is due to pay increases, longevity payments, changes in commissions, or changes in the workers in the occupation. While wages may change, the jobs surveyed do not change. From our previous example of gardeners and computer programmers, no change in wages would be reported by the firm responding to the ECI survey when in a following quarter it fires all of their gardeners and does not give pay increases to its computer programmers. However, the same firm responding to the CES survey would report a false increase in average wages. Again, at this example firm, the average change in wages is zero, but the change in average wages is positive.

As defined by the ECI, benefit costs in an establishment can change for any of the following reasons: (1) the cost for an unchanged benefit plan may increase or decrease (for example, the cost of a 2-week vacation changes because of a wage-rate increase); (2) a benefit plan may be added or eliminated (for example, a dental plan may be added to a medical policy); (3) the provisions of a benefit plan may be modified (for example, the type of work covered by a dental plan is enhanced); or (4) usage of the benefit may change because changes in the plan (for example, more employees elect health insurance because of improved dental benefits).

C. Data coverage

The ECI provides data for the civilian economy, which includes the total private economy and the public sector—excluding farms, households, and the Federal government. The private industry series and the State and local government series provide data for the two sectors separately. The BLS collects quarterly data from a probability sample of approximately 17,300 occupations within about 4,200 sample establishments in private industry and approximately 4,100 occupations within about 800 sample establishments in state and local governments.[9]. The ECI classifies sample establishments in industry categories based on the 1987 Standard Industrial Classification (SIC), as defined by the U.S. Office of Management and Budget. The ECI collects data for the pay period including the 12th day of the survey months of March, June, September, and December.

[8] See Felicia Nathan, "Analyzing Employers' Costs for Wages, Salaries, and Benefits," *Monthly Labor Review*, October 1987, page 6-7, for a complete discussion of how benefit costs per hour worked are calculated.

[9] Employment Cost Index-September 1999", U.S. Department of Labor, Bureau of Labor Statistics news release 99-306.

D. ECI Interpretation

The ECI index is a measure of the employers' cost for employee wages and salaries, benefits, or compensation depending on the ECI series analyzed. It shows changes in the "rate" of a given wage and salary, benefit, or compensation package assuming constant usage. Theoretically, absent such changes, the snapshot of the characteristics of the labor force at the time data from the establishment are first collected for the survey (i.e., overtime, tenure, longevity, and insurance and leave usage) remains unchanged throughout the duration of the series.

E. ECI Error Rates

Average standard errors for all ECI series (excluding seasonally adjusted series) are regularly available. The published standard errors—for both 3-month and 12-month percent changes—are a 5-year moving average through the current quarter. Standard errors provide the user an additional tool to judge the quality of the estimate to ensure that it is within an acceptable range for their intended use.

Because standard errors vary from quarter to quarter, the ECI uses a five-year moving average of standard errors to evaluate published series. Currently, in the higher level aggregate series of industries and occupations, the standard errors for 3-month changes are generally 0.1 percent or less; for 12-month changes, standard errors are generally 0.25 percent or less. Currently, in the lower level series, standard errors are generally 0.3 percent or less for 3-month changes and 0.6 percent or less for 12-month changes. Since standard errors for series may vary from quarter to quarter, the BLS examines ECI series once a year to determine if they should be footnoted in the ECI published tables.

F. Analysis

Economists using the ECI do not have to speculate regarding upward or downward movements in an ECI data series. *When the ECI moves up (down) its because it costs more (less) to employ a worker in a industry performing a specific occupation or job task at a specific level of skill.* The ECI is a fixed-weight index where other surveyed wage data has no control of its composition.

Suppose an industry in March 1998 has 200,000 workers and 100,000 were paid $14.00 per hour and 100,000 were paid $6.00 per hour. In March 1998, the total payroll was $2,000,000 and the average hourly pay was $10.00 per hour. Suppose that in March 1999, all workers in the industry get a 10 percent pay increase but now only 50,000 of the workers who were paid $6.00 per hour in March 1998 are employed in the industry. Using the pay increase, industry payroll is now $1,870,000 and the average wage is $12.47 per hour, or a change in average wages of 24.7 percent from 1998 to 1999; however, the average change in wages was only 10 percent per worker. The forensic economist is only interested in the 10 percent change in wages. In the example, the observed 24.7 percent change in average wages in the industry is irrelevant to a forensic economic analysis of either group of workers. Similar distortions of the actual wage growth experience of workers persist in the CPS and CES surveys.

Sometimes economists use long time-series to base their projections of a future

wage growth for a plaintiff performing a specific job (i.e. a plaintiff remaining an administrative support worker for the rest of his or her working life). If an industry has undergone changes in composition, changes in average industry wages might not be appropriate for use in making earnings projections for a specific plaintiff's anticipated future experience. There are many industries in the United States that have had a change in worker composition from abundant low-paid tender workers and few machine-operator workers to few low-paid tender workers without much change in machine-operator workers.[10] Even if machine operators and tender workers each received the same percentage wage increases over time, the reliance on historical average industry wages to calculate a wage growth rate will cause error in the calculation of the average change in workers' wages in that industry. The problem compounds if each class of worker in the industry had differing wage growth due to a variety of economic reasons over time. Since the ECI uses the fixed weight measurement system, distortions are minimal. The average change in the laborer and machine operator earnings can be consistently measured over time. If the occupation breakout is not available within the industry, the industry ECI will still present a consistent estimate of the average changes in the wages of all workers in that industry as they do the same types of jobs across time.

In Table 3, we provide a comparison of ECI and CES data for the Transportation and Public Utilities industries. Annual ECI data for wages and salaries is now available from 1976 to 1998. Annual ECI data for total compensation is available from 1985 to 1998. The average annual growth in the CES average hourly and weekly earnings series is 4.0 percent per year[11] over the 1976 to 1998 period. However, the ECI average annual wages and salaries growth is 4.8 percent per year over the same period. The fixed employment-weighted ECI results in a growth rate 20 percent higher than the CES growth in average wages. Since 1985, the ECI growth in total compensation has been nearly 50 percent greater than the growth in CES wages. Without exhaustive analysis of this industry's labor force composition, a plausible explanation for the ECI/CES differences may be the relative substitution of a greater number of lower paid workers into this industry driving the average wage to fall over time causing the change in average wages to be less than the average change in wages.

As a comparison across all production and nonsupervisory workers, using the beginning ECI time period of 1976 through 1998, the CES average annual change in the average weekly wages of all private industry production and nonsupervisory workers was 4.3 percent, average hourly CES earnings changed at an average annual rate of 4.5 percent, and the ECI for the wages and salaries of all private industry production and nonsupervisory workers changed at an average annual rate 4.8 percent.[12] Illustrating these CES and ECI

[10] A good example industry experiencing this trend is the railroad industry as they now use heavy machinery for track repairs as opposed to the past when labor gangs performed track repairs with their physical labor.

[11] We use the geometric mean formula for all average annual growth rate calculations. As a comparison, the average of the annual changes in average wages from 1976 to 1998 is 4.05 percent and for average weekly wages, the average from 1976 to 1998 is 4.00 percent.

[12] These BLS data series, respectively, are EEU00500004, EEU00500006, and ECU21012I. We downloaded these data series from LABSTAT at www.bls.gov on the Internet.

averages in a possible forensic economic situation, the difference between base earnings of $30,000 increased per year for 30 years of working life at 4.3 percent and 4.8 percent is a 9.4 percent difference in lifetime earnings.

Table 3. ECI and CES data for Transportation and Public Utility Industries[13]

	ECI Wages & Salaries in Transportation & Public Utilities	ECI Total Compensation in Transportation & Public Utilities	CES Average Hourly Earnings Transportation & Public Utilities	CES Average Weekly Earnings Transportation & Public Utilities
1976	48.0		$6.45	$257
1977	52.3		$6.99	$279
1978	56.5		$7.57	$303
1979	61.5		$8.16	$326
1980	67.9		$8.87	$351
1981	74.5		$9.70	$382
1982	80.0		$10.32	$402
1983	85.0		$10.79	$421
1984	88.4		$11.12	$438
1985	91.4	88.9	$11.40	$450
1986	93.8	91.6	$11.70	$459
1987	95.7	94.0	$12.03	$472
1988	98.1	96.9	$12.24	$468
1989	100.4	100.2	$12.57	$481
1990	103.6	103.9	$12.92	$496
1991	107.0	108.1	$13.20	$503
1992	110.8	112.4	$13.43	$514
1993	114.3	116.3	$13.55	$533
1994	118.0	120.6	$13.78	$547
1995	122.5	125.3	$14.13	$557
1996	125.6	129.0	$14.45	$572
1997	129.6	132.5	$14.93	$593
1998	133.6	137.7	$15.34	$606
1976-1998	4.8%		4.0%	4.0%
1985-1998	3.0%	3.4%	2.3%	2.3%

V. The ECI Advantage in Forensic Economics

In forensic economics, we project plaintiffs' earnings over a remaining working

[13] These BLS data series, respectively across the table columns, are ECU225021, ECU125021, EEU39100006, and EEU40000004. We downloaded these data series from LABSTAT at www.bls.gov on the Internet.

life. Depending upon the characteristics of the plaintiff, the economist might expect earnings to change as result of individual productivity changes, industry productivity changes in which the plaintiff is employed, or a combination of industry/individual productivity changes. Suppose a plaintiff was a forklift driver and had planned to remain a forklift driver until retirement. The future earnings of a fork lift driver are more than likely to have a closer relationship to the future anticipated costs to employ fork lift drivers than to the change in the average wages of all workers, regardless of wage or skill level, in the plaintiff's industry in which he was employed as a fork lift driver.

As an alternative example, assume that a young Assistant Professor of Economics is injured. The evidence of the case provides information that this young professor had an excellent academic future and it was expected that he or she would move up through the ranks to become a Full Professor. The forensic economist is working with the current salary schedule for Assistant, Associate, and Full Professors. Individual productivity drives the estimates of future expected earnings through the age-earnings-professor level profile of earnings. However, at each stage within the profile, the average changes in the wages and salaries paid by state and local governments to college and university employees (ECI series ECU22993I) is the relevant wage growth estimate to increase the current earnings levels of assistant, associate, and full professors at each future date within each assumed age-earnings-professor level profile.

A variety of economic factors will affect average wages in any industry (are there more or less Full Professors of Economics today as there were 30 years ago effecting the change in the average wages of Professors of Economics at any level?). The ECI is specifically designed by the BLS to minimize distortions created by a changing mix of workers in any industry or occupational grouping and allows for the analysis of consistent wage histories for workers performing the same job over time. Growth in wages does not equate to the change in average wages in a firm or in an industry. Forensic economic analysis begins with a plaintiff in an occupation performing a specific task or at a specific skill level (or at other specific tasks or skill levels in the future) with a current wage rate known for each task and skill level. The ECI advantage results because the Employment Cost Index is a fixed-weight measure tied to a similar base—exactly the base level calculation that is performed in many forensic economic situations: earnings of a specific plaintiff performing a specific job or staying within a specific industry for the remaining of working life.

VI. Conclusion

We began this paper with a description of the major BLS wage surveys. We pointed out that in the CPS and CES surveys, looking at the data alone, the economist knows little about the changes in earnings that consistently represented groups of workers in any industry or occupation would likely experience as they continued in that industry or occupation at a specific job or skill level. The CPS and CES data reveal little about individual anticipated earnings growth because changes in employment and wage mixes alter changes in average wages over time. We described the ECI methodology and pointed out its economic superiority as a measure specifically designed by the BLS to analyze average changes in wages. We showed the ECI and CES data can result in largely different annual rates of wage growth. While we provided examples for the Transportation and

Public Utilities and all private industry workers, future research could compare average growth in all CES and ECI industries or all CPS and ECI occupations.

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TIME SERIES ANALYSIS OF GASOLINE PRICING IN AN ANTITRUST CLAIM

by

Robert R. Trout and Carroll B. Foster*

I - The California Gasoline Market and the Antitrust Suit

A. Introduction

The State of California, through the California Air Resources Board (CARB), mandated that oil refiners produce cleaner burning gasoline by early 1996. The major oil companies invested more than $4 billion to make the necessary changes to their refineries in order to produce this new reformulated gas, which quickly became known as "CARB" gas. The higher variable production costs of this cleaner burning fuel, coupled with the necessary return on invested capital, suggested that pump prices for gasoline in California would rise anywhere from 5 to 15 cents per gallon as a result of these changes. The new CARB gas was to be available by March 1996, and used solely in California beginning June 1, 1996.

Coincident with the availability of the more expensive gas, other events caused oil prices, and therefore gasoline prices, to rise significantly in the early months of 1996. These other events included macroeconomic events, such as higher crude oil prices, and a relatively colder winter in the United States, which meant that oil companies were delayed in switching over most of their productive capacity from fuel oil to gasoline. Also, local events had an effect on gasoline prices, such as the April 1996 fire at Shell's Martinez plant, which temporarily removed about 14 percent of the state's CARB gasoline production capacity, and problems at other producer's operations which temporarily affected the supply of CARB gas.

Taken together these events created a spike in the wholesale and retail prices of CARB gas, beginning in March 1996 and lasting about three months. The trend in retail prices prior to and during this time period is shown in Exhibit 1. Not surprisingly, some commentators found other reasons to explain the rise in the pump prices of gasoline in California during this time period. Numerous articles in newspapers throughout California alleged that somehow the gasoline producers were responsible for the rise in prices, and that they had somehow acted together to bring about these events. This theory reached a natural culmination when a civil antitrust law suit was filed on behalf of all consumers in California against the major gasoline producers in California. The case was filed in San Diego County in June 1996, claiming causes of action under the Cartwright Act, California's basic antitrust statute.[1]

* Robert Trout is with Lit.Econ LLP in San Diego, California and Carroll B. Foster is with the Economics Department at The University of California, San Diego.

[1] Los Angeles Times, June 8, 1996, Section D.

The crux of the plaintiff's case was the following set of claims:[2]

1. Refiners limited the amount of petroleum produced in California to influence prices;
2. The major oil companies sold excess gas to each other to balance supply, rather than sell to independent producers;
3. Company executives studied price surveys compiled by OPIS and Lundberg in order to know competitors' prices; and,
4. The oil industry used the introduction of cleaner-burning fuel (i.e., CARB gas) to drastically raise prices.

The assault on the oil industry did not stop with the filing of the civil antitrust suit. Legislators aimed their weapons at the oil industry as well. State senators Steve Peace and Quentin Kopp each introduced legislation that they believed would curb the ability of the major oil companies to determine the pump price of gasoline in California. Both of their measures later were defeated by votes in the California State Senate.[3] Also, the San Diego City Council and San Diego County Supervisors both held hearings on the matter of the high prices San Diegans had to pay for gasoline. Their primary displeasure was the relatively higher prices local drivers were paying for gas compared with those in Orange County and Los Angeles County.[4]

The purpose of this article is to demonstrate that the gasoline producers in California provided the necessary supply of CARB gas to meet the demands of consumers, even when temporary dislocations created supply problems in the state. This article also presents evidence explaining how the changes in wholesale gasoline prices and margins can be accounted for by economic realities of the oil business and the impact of exogenous events on oil and gas prices.

B. Analysis of California Gasoline Markets in 1996

Gasoline is a commodity, and commodity market behavior primarily explains gasoline prices at both the wholesale and retail levels, in much the same way that commodity markets determine prices of crude oil, wheat, beef, etc. Supply and demand ultimately determine final prices; however, in the short run buyers, sellers and market traders react to all types of information that they believe could affect the supply/demand balance in determining their investment positions.

CARB gas is a somewhat unique product in that it was designed to be produced and sold only in California, thus creating a unique geographic and product market with definitive boundaries. Nonetheless, CARB gas is still basically a commodity, much like federal reformulated gasoline (RFG), or conventional gasoline.

[2] San Diego Union-Tribune, November 12, 1996, Section C.

[3] San Diego Union-Tribune, June 4, 1997.

[4] San Diego Daily Transcript, May 13, 1997; and, San Diego Union-Tribune May 2, 1997.

The primary determinant of wholesale and retail gasoline prices is the cost of crude oil. Exhibit 1 shows the variation in wholesale prices of gasoline in California from 1990 through 1996.[5] A number of events occurred during this time period that affected the wholesale price of gasoline; however, the graph strongly suggests that the underlying price of crude oil could always be linked to gasoline price changes. On average, the cost of crude oil alone accounts for 64 percent of the wholesale price of gasoline in California.[6] The simple statistical relationship between the wholesale price of gas and the price of crude oil can be expressed in the following ways:

Wholesale Price of Gas [¢/gal] = 36.1 + 0.708 ANS Price [t=7.6, R^2 = 0.64]

Wholesale Price of Gas [¢/gal] = 46.9 + 0.45 * ANS Price Lagged 1 month [t=4.1, R^2 = 0.41]

While the model expressing the current price of gas as a function of the prior months crude oil price is strong, the model relating the price of gas to the current price of oil is even stronger, suggesting a very quick pass-through of oil price changes to wholesale gas prices. Of course, other factors also affect wholesale gas prices; these will be investigated later in this article. The equations above simply point out the importance of crude oil prices in determining wholesale gas prices. The addition of other explanatory variables has some additional effect on the explanatory power of the models (i.e., the R-squared), but with a single variable (crude oil) accounting for up to 64 percent of the price variation, it is obvious that other factors play a more modest role in explaining gas prices.

The particular increase in CARB gasoline prices in 1996 can be explained by a variety of events that could similarly affect any commodity. The most important events, mostly unforeseen by the industry or the gas traders, are the following:[7]

o The El Paso Effect: An outage at Chevron's El Paso refinery in March 1996, coupled with scheduled turnarounds at two other refineries serving Arizona, caused conventional gasoline (i.e., non-CARB) prices to shoot up rapidly due to a supply shortage. This event also affected CARB gas prices in California.

o The Shell Effect: A fire at the Shell Martinez plant on April 1, 1996 caused an outage at a single refinery that accounts for about 14 percent of the state's CARB gas

[5] Gasoline prices were obtained from OPIS, and crude oil prices were obtained from PLATTS.

[6] The average wholesale price of Alaska North Slope (ANS) gas over the seven years was 65.94 cents per gallon, while the average price of crude oil over the same seven years was 42.07 cents per gallon. Thus, crude oil as an input to refined gasoline accounted for 64 percent of the wholesale gas price during 1990-1996.

[7] Both the industry and the traders would have anticipated at least some increased prices due to the relatively colder winter in the US, which would have delayed converting some refining capacity from heating oil to gasoline, thereby restraining supplies somewhat during the Spring of 1996.

production. Fear of a supply disruption, along with the actual disruption, caused wholesale prices to escalate rapidly.

o The Iraq Crude Effect: The failure of Iraq to reach an accord with the United Nations on exports on March 18, 1996, caused 750,000 barrels per day of crude oil to disappear from the world crude market expectations. This had an immediate effect on ANS prices through April.

These unexpected events were compounded by the usual spring effect, when prices increase because of higher driving demand while crude oil is still being used to provide heating oil in the colder climates. The effects of these events on California gasoline prices in 1996 are explained more fully in the following sections.

C. Economic Analysis of Wholesale Gasoline Prices

Exhibit 1 shows a rather rapid increase in the price of wholesale gasoline prices in the early part of 1996. To examine how economic factors affect gasoline factors, one needs to look at a longer term picture of the relationship between wholesale prices and, particularly, crude oil prices. Generally speaking, examining data from a longer time period will provide more reliable estimates of the relationship among economic variables.

To determine the causes of the 1996 wholesale gasoline price changes, we examined prices for several years prior to the events that happened in 1996. Specifically, we collected pricing information beginning in 1990 through the end of 1996. Data were collected on wholesale gasoline prices and wholesale margins in California, as well as Alaska crude oil prices. Other data that were incorporated in the time series model included exogenous events that affected wholesale gasoline prices during this time period, such as the Gulf War in Kuwait in 1991, the Shell Martinez fire in 1996, the introduction of RFG gasoline in 1995, and the introduction of CARB gasoline in 1996.

It often takes time for changes in prices of productive input factors to affect the prices at the next level. Sellers in a competitive market are usually reluctant to change prices until necessary. Thus, there is often a lag between price changes in crude oil and the wholesale prices of gasoline, just as their is a lag between a changes in wholesale prices of gasoline and the price of gasoline at the pump (i.e., the retail price). Therefore, we included in our model lag values for wholesale price or margin to reflect the fact that it takes time for prices to change.

In a competitive market, supply and demand determine prices. The supply of gasoline at any point in time is what is being produced and what is stored in tanks and elsewhere. To capture the supply effect on price, we included in our models a "stock" variable which measured the level of gasoline being stored in California at the end of each of the months we included in our time series analysis.

We included indicator (or dummy) variables in the time series model to capture the effect of the Gulf War on gasoline prices, and the effect of the Shell fire on gasoline prices. The introduction of RFG did not seem to influence gasoline prices dramatically in California, perhaps because it only affected Los Angeles, and also perhaps because it affected other parts of the United States, whereas the CARB gas effect was solely within California.

Finally, we included an indicator variable to capture the effect of the introduction of CARB gas in California. The additional cost of producing CARB gas has been estimated to be in the 5 to 15 cent per gallon range, with about 8 cents per gallon being the most consistent estimate.[8] Evidence from wholesale prices in California indicated that prices and margins, on average, increased about 5 cents per gallon after March 1996, when CARB gas was first sold. This is demonstrated in Exhibit 2, where average wholesale prices before and after the introduction of CARB gas are compared with monthly average wholesale prices. The increase in average prices after the introduction of CARB gas appears to be about ten cents per gallon, excluding the effects of other variables on wholesale prices.

An analysis of any alleged price manipulation by the oil producers can also be conducted with wholesale margins. The wholesale margin for gasoline is the arithmetic difference between the wholesale price per gallon to the retailer and the cost of crude oil, expressed in cents per gallon. Excessively high wholesale prices should also be reflected in high wholesale margins. Also in in Exhibit 2, average wholesale margins before and after the introduction of CARB gas are shown in conjunction with monthly wholesale margins. This data indicates that the average wholesale margin after the introduction of CARB gas increased about three cents per gallon, largely the effect of the one month increase in margins in April 1996. Thus, on average, producers were able to pass on about 5 cents per gallon to their buyers, who in turn passed this higher cost on to customers through the retail pump prices.

The conclusions one can draw from Exhibit 2 is somewhat simplistic because other factors are not considered in examining the CARB effect on prices and margins. However, the initial conclusion is that wholesale prices and margins increased about the amount one would expect to cover the increased cost associated with producing CARB gas. The next section takes the analysis the additional step by using more sophisticated models to examine gasoline pricing in California during the period 1990 through 1996.

II - Data and Preliminary Analysis

A. Data Base

The data used in this analysis consist of 84 monthly observations, from January 1990 through December 1996, on the variables listed in the table below. Monthly (seasonal) dummy variables FEB, MAR,...,DEC are also employed.[9]

[8] The estimated economic incremental cost of CARB gascould be computed as follows: The total investment state-wide is about $4.6 billion. Using a 22% carrying cost, the annual fixed cost to the producers amounts to about $1 billion. When this is allocated over 13.6 billion gallons of fuel consumed each year in California, the average additional cost per gallon is about seven cents.

[9] COF, the crude oil commodity futures price for contracts expiring the following month, is taken from the *Wall Street Journal* on the Wednesday closest to the 15th of each month. Observations on other variables (other than dummies) are recorded from *Platt's Oilgram* and from Oil Price Information Services (OPIS).

Table 1. Data Base

Symbol	Definition	Units	Mean	St. Dev.
WPU	Wholesale unleaded gasoline price (Los Angeles)	¢/gal	65.94	9.417
ANS	Alaska North Slope crude oil price	¢/gal	42.07	8.528
MARGIN	Unleaded Gasoline Margin (WPU - ANS)	¢/gal	23.87	7.642
COF	Crude oil price (one-month futures)	¢/gal	48.71	9.410
INV	Gasoline stock (CA)	10,000 bbls	2124	2,05.1
SALES	Gasoline sales (CA)	mill. gals	1,108	47.35
WAR	Gulf war period dummy	1 for Aug 90 - Jan 91; 0 otherwise		
SHELL	Refinery fire dummy	1 for Apr 1996; 0 otherwise		
CARB	CARB period dummy	1 for Mar - Dec 96; 0 otherwise		

Exhibit 1 plots the wholesale price of unleaded gasoline, the price of Alaska North Slope crude oil (a cost benchmark for west coast refineries), the 1-month crude oil commodity price future, and the unleaded gasoline margin (WPU - ANS). Exhibit 3 plots gasoline sales and gasoline inventory stocks. These exhibits also indicate the period associated with the Gulf War, the time of the Shell Oil refinery fire, and the period in which CARB gasoline appeared.

B. Sales

From Exhibit 3 it is evident that gasoline sales remained nearly constant (apart from recurring monthly "seasonal" variation), in spite of the considerable fluctuation in wholesale price and the other time-series variables. Statistical analysis of SALES began with the following Ordinary Least Squares (OLS) regression:

$$SALES_t = \beta_0 + \beta_1 t + \beta_2 CARB_t + \beta_3 SHELL_t + \beta_4 WAR_t + \beta_5 FEB_t + \ldots + \beta_{15} DEC_t$$

Wald F-tests confirmed that CARB, SHELL, WAR and the linear trend were jointly insignificant. Lagrange Multiplier tests suggested the presence of third-order serial

correlation in the error term.[10] The regression was re-estimated using the generalized Cochrane-Orcutt procedure (with three lags) and CARB, SHELL, WAR and time omitted. The resulting R^2 revealed that 82 percent of the variation in gasoline sales is due solely to recurring seasonality. The relative constancy of sales over the entire period is consistent with the low price elasticity of demand for retail gasoline. SALES were never significant in the models of inventory, wholesale price, or margin behavior discussed below.

C. Inventory Stocks

Exhibit 3 also reveals substantial variation in California gasoline inventories, with some evidence of a seasonal pattern. Inventory stocks appear to have been unusually low from the summer of 1994 until just before CARB gasoline was introduced. On the other hand, inventories did not drop to their usual spring and summer lows in 1996, in spite of the Shell fire in April.

Analysis began with a simple curve-fitting exercise using the following OLS regression model:

$$INV_t = \beta_0 + \beta_1 t + \beta_2 CARB_t + \beta_3 SHELL_t + \beta_4 WAR_t + \beta_5 FEB_t + ... + \beta_{15} DEC_t$$

Testing showed that SHELL and WAR were jointly insignificant, and that first-order serial correlation was present. Re-estimation of the reduced model with a first-order autoregressive term yielded $R^2 = 0.675$. (The actual and predicted values of this regression are plotted in Exhibit 4, along with the regression residuals.) Seasonality and a declining linear trend ($\hat{\beta}_1 = -4.829$) were very statistically significant. The coefficient of CARB ($\hat{\beta}_2 = 268.1$, $t_2 = 2.51$) is especially interesting. Gasoline inventories rise by production and imports and decline by exports and deliveries (sales). One allegation of the antitrust case was that the oil companies artificially reduced gasoline supplies in 1996 to force prices higher. However, monthly gasoline stocks during the CARB period were about 2,681,000 barrels higher than average, while the amount of gasoline reaching motorists (SALES) was roughly the same in 1996 as it was in earlier years. It seems that refiners were increasing imports and production, or reducing exports, to maintain or raise potentially available gasoline supplies during all of 1996.

D. Wholesale Gasoline and Crude Oil Prices

Exhibit 1 shows that wholesale gasoline prices fluctuated dramatically over the 1990-96 time period, reaching a high of 95.70 cents/gallon in October 1990 (during the Gulf War), and spiking again at 93.06 cents/gallon in April 1996 (the month of the Shell Oil refinery fire). Alaska North Slope crude oil prices shot up during the Gulf War, dropped

[10] Wald F-tests and Breusch-Godfrey and other Lagrange multiplier tests referred to in this paper are discussed in Ramanathan (1998), especially chapters 6 and 9. These tests are easily performed in the regression software program used in this paper: *Econometric Views* (EViews 3.0), by Lilien, Startz, Ellsworth, Noh and Engel (available from Quantitative Micro Software, Irvine, CA).

to unusual lows during early 1994, and were rising unsteadily during 1996. The unleaded wholesale gasoline margin (WPU - ANS) at first rose, then plummeted, during the Gulf War. During the remainder of the period the wholesale margin hovered between 15 to 30 cents a gallon, spiking to over 44 cents in April 1996.

It is evident that WPU and ANS track each other fairly consistently, as one would expect, considering that crude oil is the major input in the refining of gasoline. The plot of MARGIN, on the other hand, shows that the tracking is anything but exact. Zyren (1995) notes that, for the period 1984-94 and for U.S. refiners as a whole, crude oil price represents about 2/3 of the resale price of gasoline, which would leave one third of the variation in WPU to be explained by other factors. (As reported in Footnote 6, our data base indicated that crude oil amounts to 64 percent of the wholesale price of unleaded gasoline).

Closer examination of Exhibit 1 reveals a number of times when turning points in WPU were reached a month in advance of turning points in ANS. Causality testing showed that WPU "Granger causes" ANS and not the other way around.[11] This is perplexing. If it is the case that the market for Alaskan crude oil is "demand driven" (by the demand for gasoline), then it can't be driven by the California market alone, because a substantial amount of the oil is sent elsewhere. Similarly, ANS cannot be an internally-dictated transfer price of vertically integrated refiners because ownership of the oil is not contiguous with ownership of California refinery facilities.

Our conclusion is that the California wholesale price of gasoline should be treated as markup on crude oil costs, but that the markup is highly sensitive to crude oil price expectations. Since wholesale price behavior was central to the questions raised in the antitrust case, a number of expectations and adjustment models were entertained. To these we now turn.

III - Models of Wholesale Gasoline Price and Margin

A. Adaptive Expectations Model

A textbook adaptive expectations (AE) model would specify that WPU depends on expected crude oil cost ANS*:

$$WPU_t = a + b\ ANS^*_t + u_t$$

where b = 1+markup. In order to allow the markup term to change during the CARB gasoline period, the specification becomes:

$$WPU_t = a_1 + a_2\ CARB + b_1\ ANS^*_t + b_2\ CARB \times ANS^*_t + u_t$$

Crude oil cost expectations are updated as:

$$ANS^*_t - ANS^*_{t-1} = \lambda(ANS_{t-1} - ANS^*_{t-1})$$

[11] The Granger Causality test is derived in Granger (1969). See Ramanathan (1998), pp. 546-47, for a brief description.

If allowance for the impact of the Gulf War period and the Shell refinery fire are included, the following lagged dependent variable model is implied:[12]

$$WPU_t = \beta_1 + \beta_2 CARB_t + \beta_3 SHELL_t + \beta_4 WAR_t + \beta_5 ANS_{t-1} + \beta_6 (CARB \times ANS)_{t-1} + \beta_7 WPU_{t-1} + v_t$$

where $v_t = u_t - (1-\lambda)u_{t-1}$, a 1-period moving average of residuals u_t.

Table 2. Adaptive Expectations Model Results

Dependent Variable: WPU_t; n = 83 (FEB 90 - DEC 96)

Variable	Coefficient	|t-ratio|
Constant	52.50	
$CARB_t$	2.72	0.74
$SHELL_t$	20.58	5.42
WAR_t	22.80	9.11
ANS_{t-1}	-0.2368	2.43
$CARB \times ANS_{t-1}$	0.1218	1.32
WPU_{t-1}	0.3123	4.01
$\bar{R}^2 = .850$; Durbin-Watson = 1.78; AIC = 5.52		

Estimation of this model yielded the results shown in Table 2. Wald tests showed that CARB and CARB×ANS were jointly significant in spite of their low individual t-values. The addition of monthly seasonal dummies was rejected by Lagrange Multiplier testing. Exhibit 5 plots actual and estimated (fitted) values of WPU from this regression.

The predicted monthly increase in wholesale price during the CARB period which is unexplained by other regressors is:

$$E_t = 2.72\ CARB_t + 0.1218\ (CARB \times ANS)_{t-1}$$

Over the CARB period, E averaged eight cents per gallon. This result is consistent with basic engineering estimates of the CARB effect on wholesale prices.

[12] See Ramanathan (1998), pp. 504-506 for details.

B. Generalized Expectations Model

An alternative approach to an expectations model of wholesale gasoline prices does not specify the crude oil price expectations formation and revision process. Rather, it assumes that financial markets, thought to be efficient processors of relevant information, will reflect current expectations in the current price of crude oil commodity futures contracts. With this approach, WPU depends on current crude oil futures, and possibly on current and lagged values of actual crude oil prices.

Simple pairwise correlation of WPU, ANS, and 1-month, 2-month and 3-month ahead crude oil commodity futures (COF, COF2, COF3) are shown in Table 3. Because these correlations suggest that 2-month and 3-month futures add little to the information set, only COF is employed in the models derived below.

Table 3. Correlations

	WPU	ANS	COF	COF2	COF3
WPU	1.000	0.641	0.738	0.736	0.725
ANS		1.000	0.887	0.868	0.844
COF			1.000	0.992	0.976
COF2				1.000	0.995

This "generalized expectations" (GE) model imposes no particular structure. Our procedure was to select a configuration to obtain a good fit conditional on well-behaved (approximately white noise) residuals and low Akaike information criterion (AIC).[13] Our best results were obtained from the model reported in Table 4, where a first-order serial correlation and third-order moving average correction were applied and coefficient standard errors were corrected for heteroscedasticity using White's procedure.[14] The addition of interaction terms (CARB×ANS or CARB×COF) and seasonal dummies was rejected by Lagrange multiplier specification tests. The goodness of fit of the GE model is shown in Exhibit 6. The GE model predicts a 6.085 cent/gallon increase in wholesale unleaded gasoline price during the CARB period, which cannot be attributed to other market or expectations variables. This is within the expected range for the CARB effect on marginal production cost.

[13] The Akaike measure imposes a higher penalty on additional regression coefficients than the more familiar Adjusted R-square.

[14] See White (1980) and Ramanathan (1998), chapter 8.

Table 4. Generalized Expectations Model Results

Dependent Variable: WPU_t; n = 82 (MAR 90 - DEC 96)

Variable	Coefficient	|t-ratio|
Constant	64.02	
CARBt	6.085	1.98
$SHELL_t$	14.31	5.09
WAR_t	9.221	2.94
COF_t	0.5116	5.52
ANS_{t-1}	-0.1806	2.21
INV_{t-1}	-0.0080	3.01
$\bar{R}^2$ = .865; Durbin-Watson = 1.78; AIC = 5.40		

C. Error Correction Models

The GE model achieves a surprisingly good fit, but it's lack of economic or statistical structure is somewhat disturbing in a model whose purpose is to explain and measure, rather than merely to forecast. This will not be a criticism of the error correction models (ECM) derived next.[15]

An error correction model of wholesale gasoline price begins by positing a long-run equilibrium markup relationship between price and crude oil cost:

$$WPU = K \bullet ANS$$

Converting to natural logs, this implies that $p = k + a$ and $\Delta p = \Delta a$, where $p = Ln(WPU)$, $k = Ln(K)$, and $a = Ln(ANS)$. Suppose a common short-run lagged dependent variable model (in logs) is specified:

$$p_t = b_1 + b_2 a_t + b_3 a_{t-1} + b_4 p_{t-1} + u_t$$

In LR equilibrium, $p_t = p_{t-1}$, $a_t = a_{t-1}$, and the SR model becomes:

$$p_t(1-b_4) = b_1 + (b_2+b_3)a_t + u_t$$

[15] The ECM approach in this paper is based on material in Ramanathan (1998), ch. 10. See also Engel and Granger (1987).

This can be consistent with the LR relation $p_t = k + a_t$ only if $1-b_4 = b_2+b_3$ and $k = b_1/(1-b_4)$. Making these substitutions results in the following ECM regression specification:

$$\Delta p_t = \beta_1 + \beta_2 \Delta a_t + \beta_3(a_{t-1}-p_{t-1}) + u_t$$

In general, $\Delta p_t \neq \Delta a_t$ until long-run equilibrium is reached; the β_3 term captures the average rate of adjustment or "error correction." Note that no lag structure is superimposed on the original error u_t.

The explanatory power of the error correction model increases if COF replaces ANS. The model, with WAR included, was estimated over the period February 1990 - February 1996. The regression results appear in Table 5, where f = Ln(COF). The results were used to predict *ex post* the values of WPU for the CARB period (March - December 1996). Exhibit 7 shows the plot of the fitted and predicted values.

Table 5. Error Correction Model Results

Dependent Variable: Δp_t; n = 73 (FEB 90 - FEB 96)

Variable	**Coefficient**	**|t-ratio|**
Constant	.0540	
WAR_t	-0.0668	2.34
Δf_t	0.5272	6.39
$f_{t-1} - p_{t-1}$	0.1486	2.01
$\bar{R}^2 = .359$; Durbin-Watson = 2.18; AIC = -2.73		

For the entire 1990-96 period, an $R^2 = 0.819$ value was calculated from the correlation between fitted and actual values of WPU_t. Exhibit 7 reveals that the forecast of WPU for March - December 1996 is basically on track with the actual historical values. For the CARB period, the average actual wholesale price was 74.5 ¢/gallon, while the average price predicted by ECM is slightly higher at 75.4 ¢. The basic conclusion is that the error correction model explains the behavior of wholesale prices during the CARB period wholly in terms of a long-run equilibrium markup on expected crude oil costs and a short-run adjustment-to-equilibrium or error correction term. There is no unexplained part of the CARB period prices to be attributed to either increased production costs of CARB gasoline or to the exercise of monopoly power by the suppliers in the industry. Put another way, wholesale gasoline prices during the CARB period were generated by the same markup structure as prices earlier in the decade, and were not anomalously high.[16]

[16] ECM estimation over the full period with the addition of CARB, SHELL, and interaction terms $CARB\times(f_{t-1} - p_{t-1})$ and $WAR\times(f_{t-1} - p_{t-1})$ (to allow the rate of error correction to vary in

Part IV - Summary and Conclusions

The plaintiffs in the antitrust case alleged that the oil companies conspired together to restrict supplies in some fashion to allow them to drive up wholesale and retail prices of gasoline in California. Our analysis shows that the demand for CARB gas was met by the producers, despite certain outside events that occurred during 1996 that made it difficult for producers to do so. Our time series analysis found that after controlling for all of the relevant economic and exogenous factors affecting gasoline prices in California, the CARB "effect" on wholesale margins and prices was only about 6 to 8 cents per gallon; the error correction model showed no CARB effect whatsoever. This increase in margins does not even cover the additional production cost for CARB gas according to industry experts. If a conspiracy among the refiners had occurred concurrently with the introduction of CARB gas, then the CARB effect in the time series model would have to be considerably greater than 6 cents per gallon. Our results show that there is virtually no unexplained wholesale gasoline price or margin variation in Spring 1996 to allocate to any alleged price manipulation by the oil companies in contravention of antitrust laws.

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these time periods) did nothing to improve fit. The coefficient of CARB was negative and not significant at even the 10% level. A Wald F-test indicated that CARB and both interaction variables should be dropped.

Exhibit 1. CA Wholesale Unleaded Gasoline Price, Crude Oil Cost, and Gasoline Margin

January 1990 - December 1996

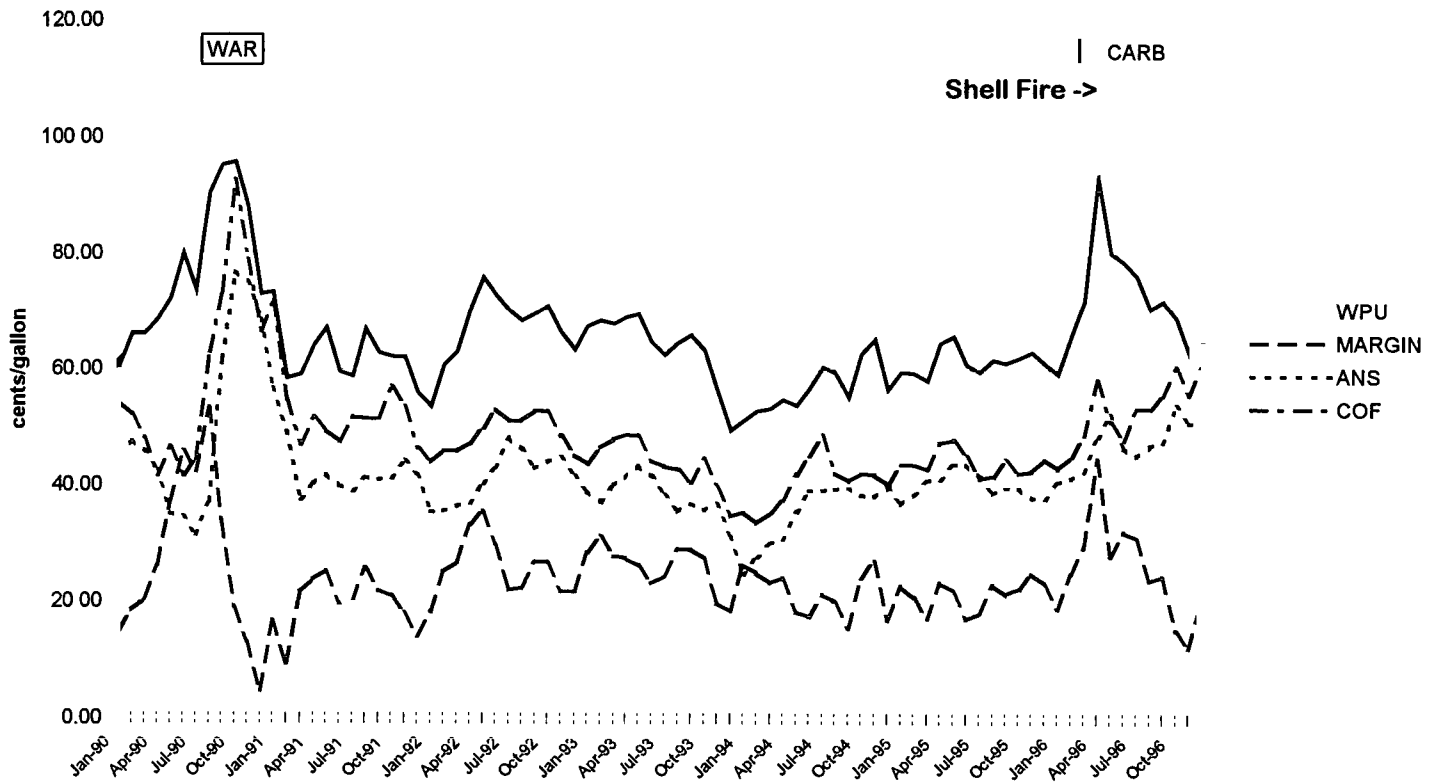
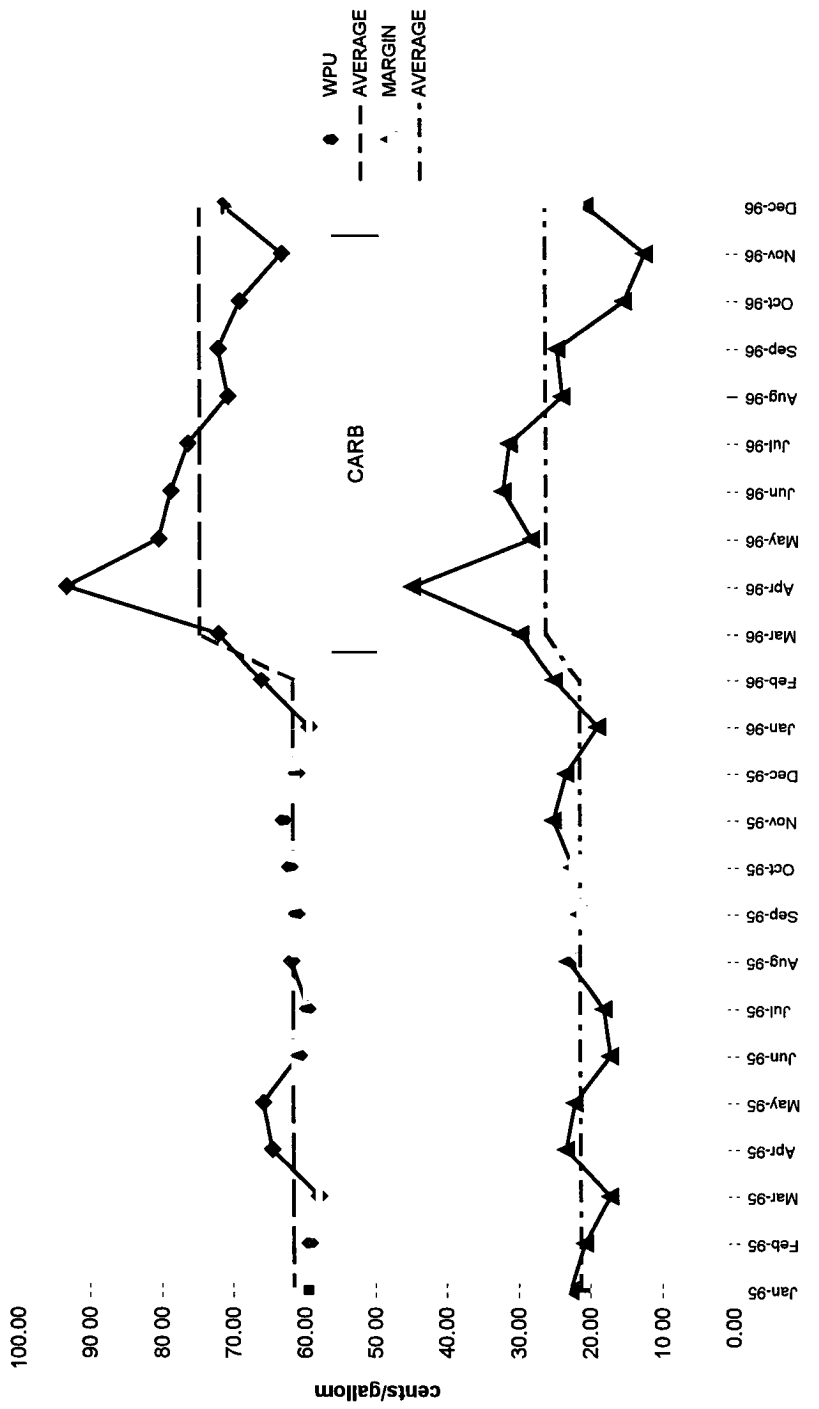


Exhibit 2 . CA Wholesale Unleaded Price and Margin Averages

January 1995 - December 1996



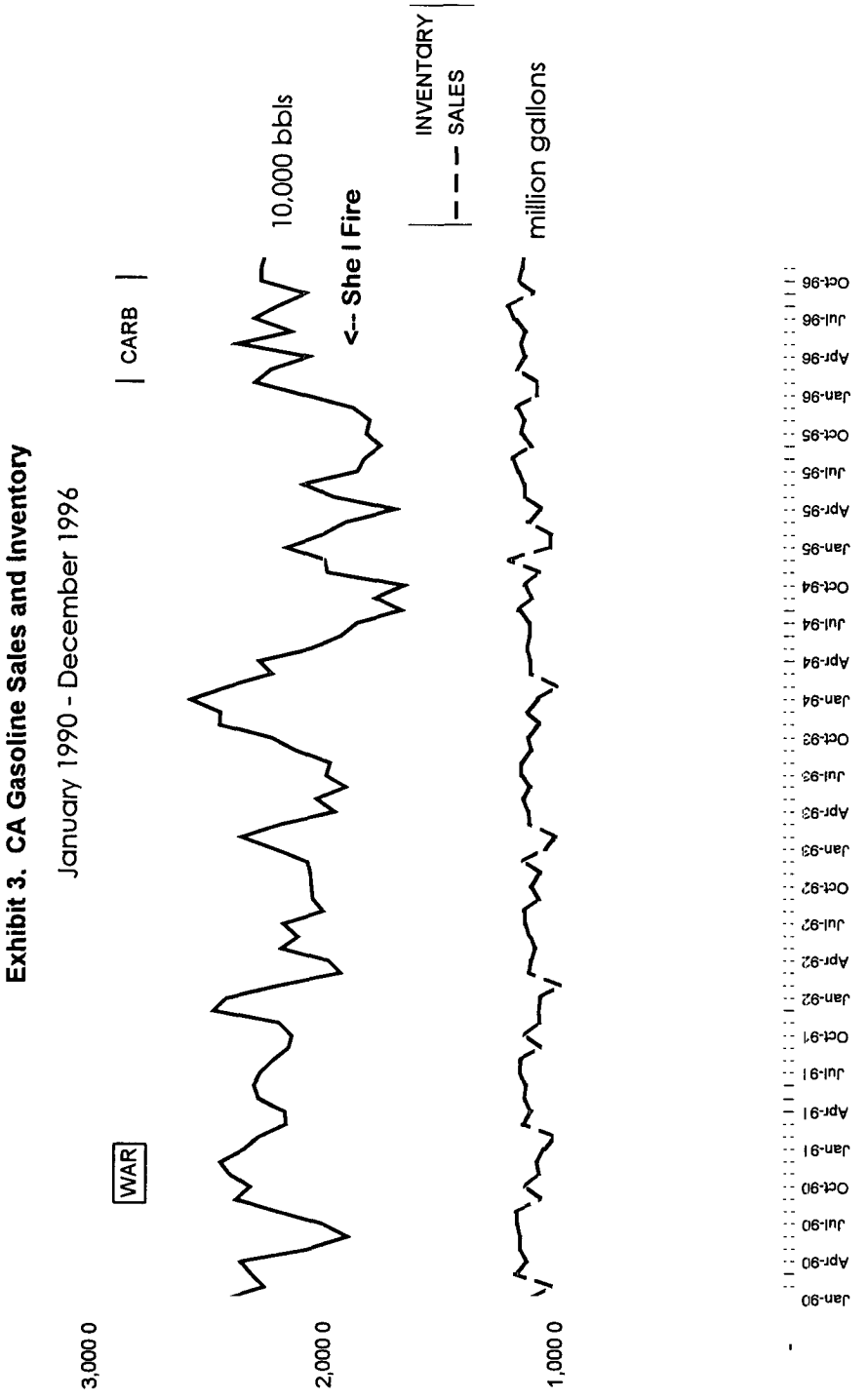
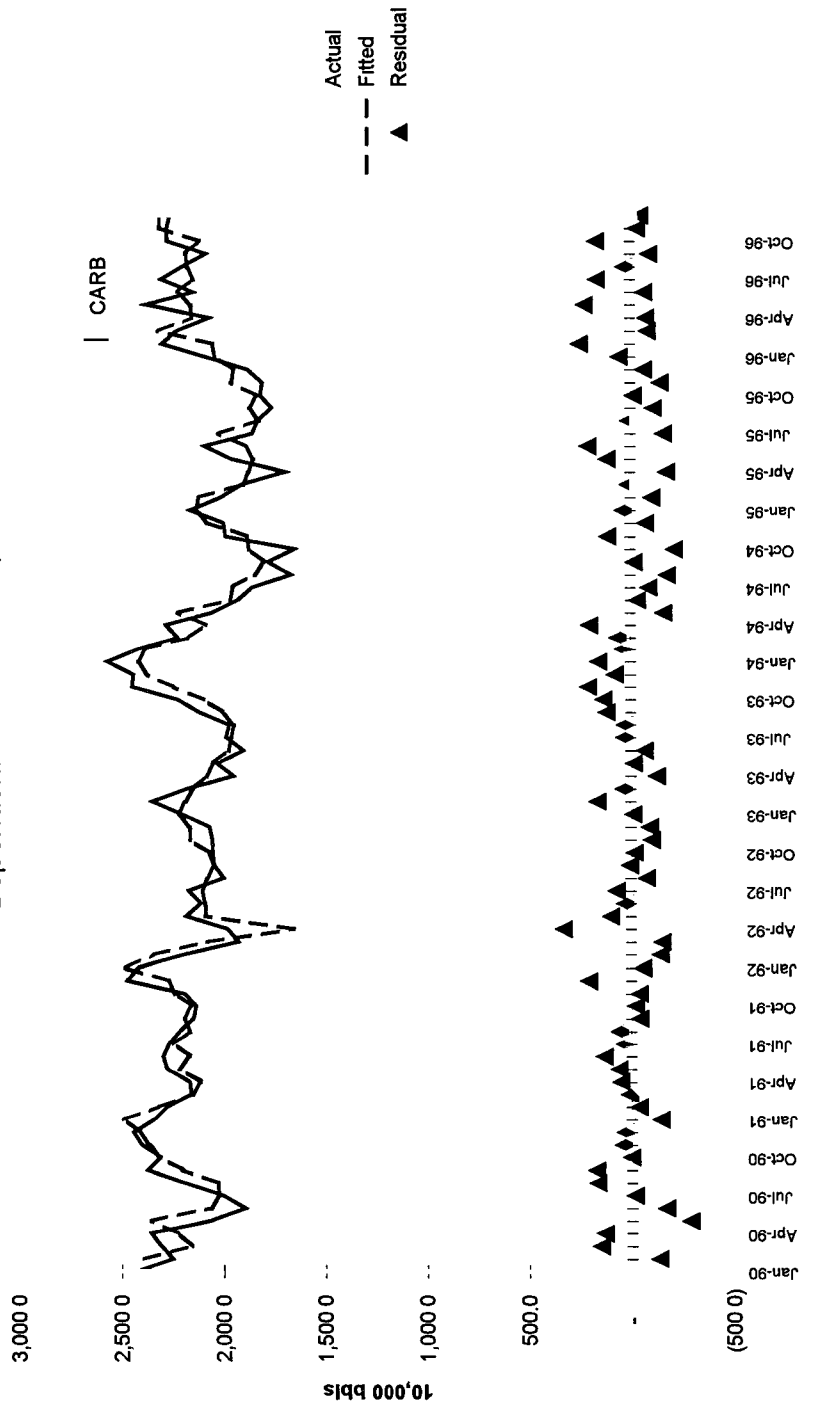


Exhibit 3. CA Gasoline Sales and Inventory
January 1990 - December 1996
WAR
CARB
10,000 bbls
<-- She l Fire
INVENTORY
SALES
million gallons
3,000 0
2,000 0
1,000 0
Jan-90
Apr-90
Jul-90
Oct-90
Jan-91
Apr-91
Jul-91
Oct-91
Jan-92
Apr-92
Jul-92
Oct-92
Jan-93
Apr-93
Jul-93
Oct-93
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
Apr-95
Jul-95
Oct-95
Jan-96
Apr-96
Jul-96
Oct-96

Exhibit 4. Gasoline Inventory Trend and Seasonality

Dependent variable = INVt; n = 84



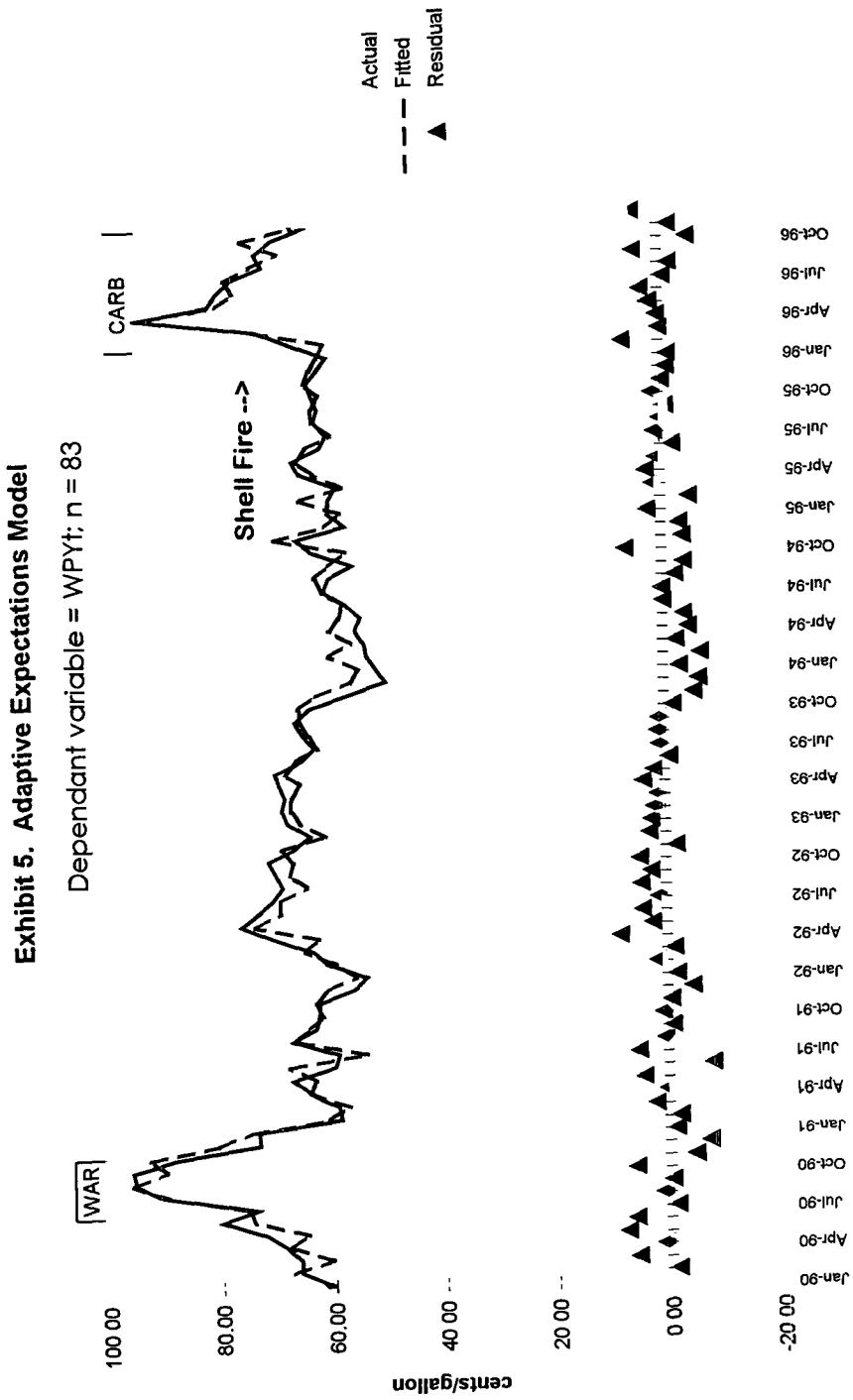


Exhibit 5. Adaptive Expectations Model
Dependant variable = WPYt; n = 83
WAR
CARB
Shell Fire -->
Actual
Fitted
Residual
cents/gallon
100 00
80.00
60.00
40 00
20 00
0 00
-20 00
Jan-90
Apr-90
Jul-90
Oct-90
Jan-91
Apr-91
Jul-91
Oct-91
Jan-92
Apr-92
Jul-92
Oct-92
Jan-93
Apr-93
Jul-93
Oct-93
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
Apr-95
Jul-95
Oct-95
Jan-96
Apr-96
Jul-96
Oct-96

Exhibit 6. Generalized Expectations Model

Dependent variable = WPUt; n = 82

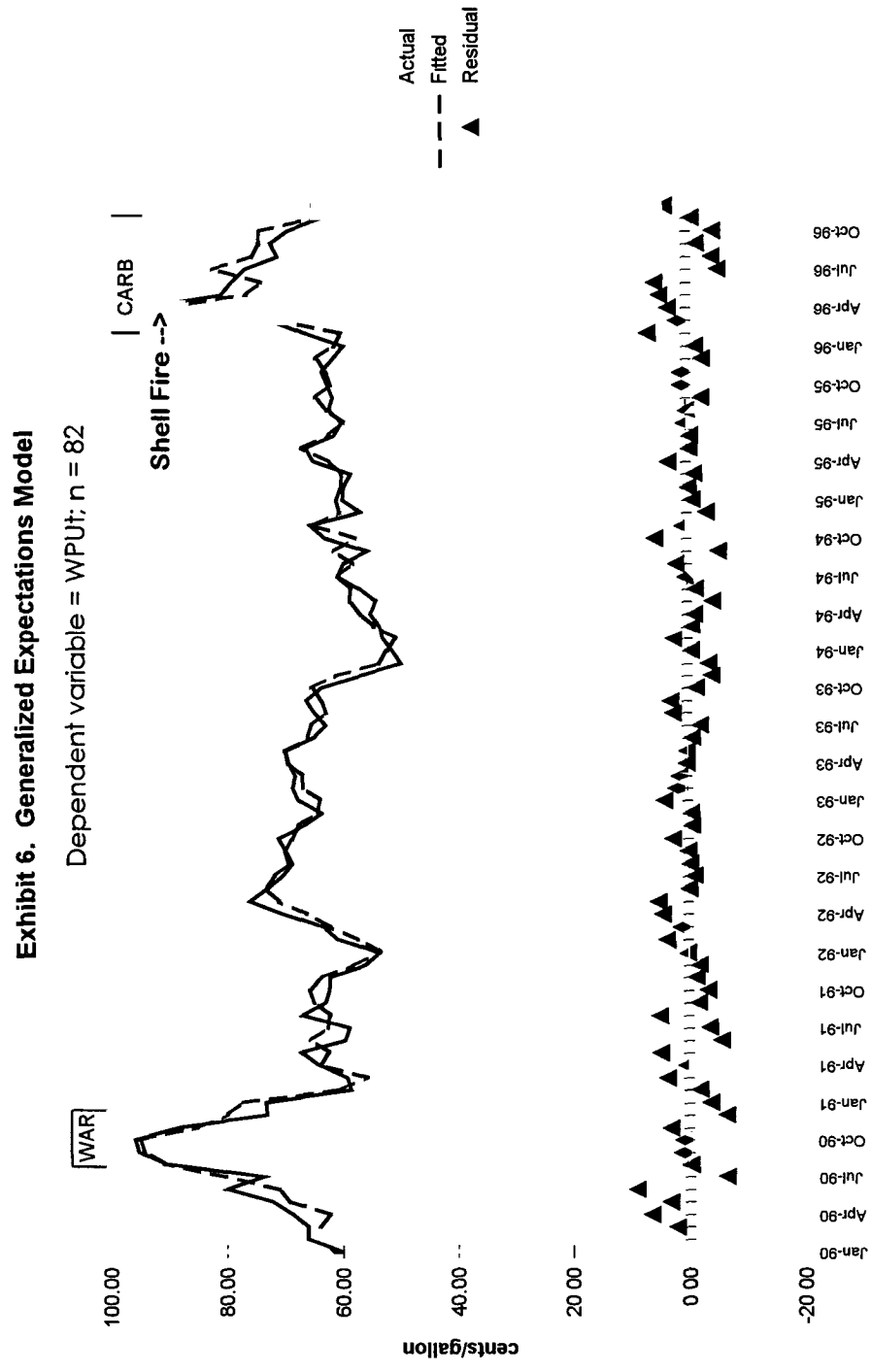
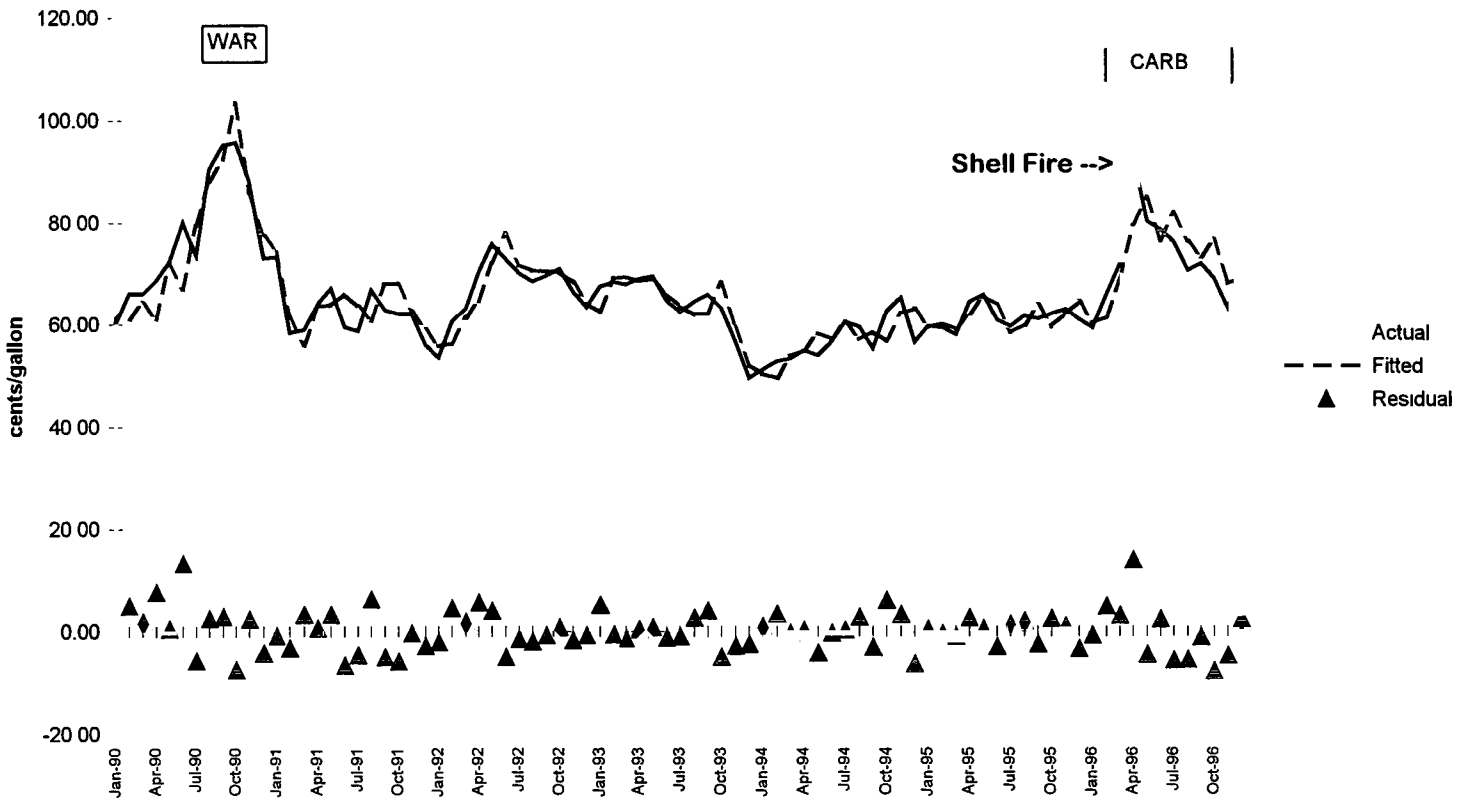


Exhibit 7. Error Correction Model

Estimation through FEB 96; forecast MAR-DEC 96



SOME ISSUES CONCERNING RISK ADJUSTMENTS IN DAMAGE CALCULATIONS

by

Edward B. Bell and Allan J. Taub*

In an otherwise illuminating discussion concerning inflation-indexed bonds, Ireland in a recent issue of this Journal presents several arguments that we believe are misleading and inaccurate[1]. Specifically, he claims that discounting projected earnings with an interest rate that includes a premium to account for the possibility of default is incorrect. Since damage calculations, generally, include reductions for probabilities that the individual will not survive, be a labor force participant or be employed, using a non-default free interest rate would be a form of double counting the risks that the worker would not have earned projected incomes.

Ireland also differentiates between default risk and inflation risk explaining that default risk contains only a downside risk since a bond never pays more than the scheduled amount. Inflation risk, however, has both an upside and a downside risk in that future inflation may be greater or less than expected. Ireland then makes the claim that the present value calculation would be unaffected by the inclusion of inflation risk since the upside and downside variances are equal. Increasing inflation risk increases the variance without changing the expected value of the result. With default risk, however, since the distribution is truncated, a change in the risks of the negative outcomes will reduce the expected rate of return and the present value of the asset.

We believe the accuracy of these statements to be questionable and we are, furthermore, unsure as to the relevance of some of these assertions. We present our arguments in what follows

Ireland argues that the reason one should not use a discount rate containing a premium for possible default is that since damage calculations already include a reduction of future earnings for the probabilities of not surviving, not being in the labor force or not being employed, this would be double counting. Once the forensic economist has reduced projected earnings to account for the probabilities that the victim might not earn the projected income in the future, one should not use a non-default free interest rate to further reduce the present value of future earnings. Using a non-default free interest rate reduces the present value to account for the future uncertainties that have already been accounted for by reducing the projected earnings. Thus, it is a form of double counting.

There are a number of problems with this argument. First, the risks of not earning projected income in the future and the risk of default on the bonds are not necessarily equivalent. While it is true that the probability of default along with the probabilities of non-survival, non-participation in the labor force and unemployment are superficially equivalent in that they are all downside risks which can only lead to a reduction of the

* Edward B. Bell and Allan J. Taub are with the Department of Economics at Cleveland State University, Cleveland Ohio.

[1] See Thomas R. Ireland, "Forensic Implications of Inflation Adjusted Bonds," Litigation Economics Digest, Summer, 1997, Vol.II, No. 2, pp 92-102.

future cash flows, it is, nevertheless, not necessarily true that the size of the probabilities or the states of nature in which they occur are the same. Therefore, reducing projected earnings by the appropriate probabilities is not equivalent to raising the interest rate to incorporate the probability of default. They should be treated as separate issues.

Second, even if the risks were equivalent, reducing the future earnings flow by the probabilities of non-survival, non-participation in the labor force and unemployment has still not resolved all the uncertainties associated with projecting future cash flows. For example, one factor that might influence the projection of earnings growth would be the growth of future productivity. Typically, no adjustment is made to recognize the uncertainty of future productivity growth by reducing projected earnings as we do for non-survival non-participation and unemployment. One could reasonably argue that the basis for employing a non-risk free discount rate would be to account for this uncertainty.

Third, and most importantly, even if one ignores any additional uncertainties associated with future earnings growth (i.e., productivity) and even assuming that using a non-risk free discount rate to discount future earnings is equivalent to reducing future earnings by the probabilities of non-survival, non-participation in the labor force and unemployment, theoretically, one should still not use a risk free discount rate to discount future earnings. It is a well known proposition in finance that only certainty equivalents are discounted with risk free interest rates[2]. Multipling future earnings by the probabilities of non-survival, non-participation in the labor force and unemployment simply converts projected future earnings into expected values, not certainty equivalents. Consider two cash flows. One flow is risk free while the other cash flow is risky. Assume that the values in the risk free cash flow are equal to the expected values of the risky flow. Clearly, if a market exists for each of these cash flows, the market would not value them equally. The cash flow with the risky values will have a market price (present value) below the cash flow with the non-risky values. This is another way of stating that the market discounts the risky flow with a larger discount rate than the risk free cash flow. Therefore, when the forensic economist reduces the projected earnings of the victim by the probabilities of non-survival, non-participation in the labor force and unemployment, the resulting projection of future earnings should still be discounted by a non-risk free discount rate. Since the resulting projection of future earnings after adjustment by the probabilities is simply an expected value of future earnings the appropriate discount rate is some non-risk free discount rate.

Ireland could have argued that the discount rate derived from the pricing of risky bonds is not the appropriate rate with which to discount adjusted projected earnings since the implied discount rate on these bonds is associated with the maximum values paid on the bonds and not the expected values. It would be inappropriate to employ a discount rate that is derived from the pricing of the maximum values of a cash flow to discount a cash flow whose values are not maximum values but rather expected values. But conceding this point does not imply that the relevant discount rate is a risk free rate. The court's decision in this matter is not based on economic principles[3].

Ireland differentiates in his paper between inflation risk and default risk explaining

[2] For example, see A. A. Robicheck and S. C. Myers, Optimal Financing Decisions, Prentice Hall, Inc., 1965, pp 18-19.

[3] The case cited by Ireland is *Jones & Laughlin v. Pfeifer 1035.ct 2541* (1983).

that default risk contains only a downside risk since a bond never pays more than the scheduled amount. Inflation risk, however, has both an upside and a downside risk in that future inflation may be greater or less than expected. Ireland then makes the claim that the present value calculation would be unaffected by the inclusion of inflation risk since the upside and downside variance are equal. Increasing inflation risk increases the variance without changing the expected value of the result. With default risk, since the distribution is truncated, a change in the risks of the negative outcomes will reduce the expected rate of return and the present value of the asset.

In our opinion, both of Ireland's arguments are incorrect. First, Ireland's argument that since the bond never pays more than the scheduled amount there is only a downside risk with respect to default is irrelevant. A bond that is subject to a probability of default can become more or less risky without changing the expected return as Ireland argued with respect to inflation risk. This is easy to show using Ireland's example with respect to the probability of default. His example assumes an 8 percent return with probability of .8. He, furthermore, assumes that the bonds offer returns of 6, 4, 2 and 0 percent each with a probability of 5 percent. A simple calculation of the expected return and variance shows an expected return of 7.0 percent and a variance of 5.00. Now consider the same potential returns of 8, 6, 4, 2 and 0 percent. However, now assume that the probabilities of attaining these returns are .75, .133333, .05, 0, and .066667, respectively. The expected value of the returns is still 7.0 percent, however the variance of the returns has now decreased to 4.60333. Thus, even though the bonds cannot pay more than the scheduled amount on the bonds, nevertheless, the bonds have a lower risk with respect to default. A risk averse individual would prefer the bonds with the lower variance of returns, ceteris paribus, and they should, therefore, sell for a higher price in the market.

The second argument made by Ireland is also incorrect. If there is a change in the "variance" of inflation without affecting the expected return on the bonds, there clearly will be a change in the value of the bonds. The value of the bonds are not only affected by the expected rate of inflation. The value is also subject to the "variance" of the inflation rate. This is also true with respect to default risk. The value of the bond is subject not only to expected default but also to the "variance" associated with default.

As a general proposition, the nominal rate of interest on treasury securities consists of three components, the real rate of interest, the expected rate of inflation and the inflation risk premium[4]. Often the inflationary risk premium is incorporated in the real rate of interest. However, the point to be made is that any changes in the riskiness of the inflation rate, independent of any changes in the expected inflation rate will affect the nominal interest rate and, thus affect the market value of outstanding bonds. In a similar fashion, any change in the riskiness of default (even with no change in the expected return) will cause the value of the bond to change and, thus cause a change in the implied discount rate.

[4] This is most explicitly stated in Jeffrey M. Wrase, "Inflation-Indexed Bonds: How Do They Work?" Business Review, July-August, 1997, pp. 3-16. Also see John Cambell and Robert Shiller, "A Scorecard for Indexed Government Debt," National Bureau of Economic Research Working Paper 5587, May 1996.

RESPONSE TO BELL AND TAUB, "SOME ISSUES CONCERNING RISK ADJUSTMENTS IN DAMAGES CALCULATIONS"

by

Thomas R. Ireland*

Bell and Taub criticize my 1997 paper in this journal on two grounds: First, that I am wrong that a discount rate for projecting a lost earnings stream should be free of default risk; Second, that I have supposedly made some errors in my discussion of differences between default risk and inflation risk. I will deal with each issue in turn.

I. The Default Risk Issue

The primary reason that I do not advocate use of an interest rate containing a premium for the possibility of default is case law, not the double counting argument that I mentioned in my paper. The key decision is *Jones & Laughlin Steel Corp V. Pfeifer*, 103 S.Ct. 2541 (1983). Bell and Taub mention this case, but suggest that "the court's decision in this matter is not based on economic principles." That is a rather sweeping statement given that Pfeifer contains an extensive and complex consideration of all elements that must be considered in a personal injury loss calculation, but it is obvious that Bell and Taub think that the *Pfeifer* court was wrong in not allowing use of a discount rate containing a default risk premium. The important point is that *Pfeifer* sets a standard that is applied in many legal venues, both state and federal, regardless of the "rightness" or "wrongness" of the *Pfeifer* court's opinion regarding discount rates.

The real problem here is one of accounting for all factors that might limit a future earnings stream. That accounting can be made either in terms of projecting the stream itself or in choosing a discount rate which contains default risk characteristics exactly matching the intended earnings stream. If you account for all of the risks by probability discounts to the earnings stream itself, you should not also account for them by using a discount rate containing premiums to compensate for those risks. Bell and Taub point out that there are other default-like risks than the risks of non-survival, non-participation and unemployment. They give as an example the fact that productivity increases in the projected earnings stream may turn out to be higher or lower than projected. This may be an argument for including a productivity variance risk factor in projecting the earnings stream, but it is necessarily an argument for using a discount rate containing a default risk premium to account for this productivity variance factor.

Certainly, it seems logical to account for all risks to the earnings stream itself or to account for all risks with premia in the discount rate. Bell and Taub seem to be recommending some mix of accounting for some risks in the earnings stream directly and accounting for other risks using default risk premia in the discount rate, which would be almost impossible for any jury to understand. Their point about variance in productivity projections is well taken, but that does not lead to an argument in favor of mixing up both

* Thomas R. Ireland is with the Economics Department at the University of Missouri, St. Louis, Mo.

the earnings stream and the discount rate with risk factors. Given that the case law tells us that we must account for risks in the earnings stream and not in the discount rate, it seems reasonable to comply with the case law.

II. The Default Risk vs. Inflation Risk Issue

Bell and Taub did not understand my points of distinction between default risk, which is based on the risk that a certainty equivalent will not occur, and the various types of inflation risks that are often lumped together in discussions of "inflation risk." Bell and Taub are simply wrong when they say: "the nominal rate of interest on treasury securities consists of three components, the real rate of interest, the expected rate of inflation and the inflation risk premium." In reality, the nominal rate of interest on treasury securities actually consists of the *expected* real rate of interest, a premium for the expected variance in the expected real rate of interest, a premium for the unexpected variance in the expected real rate of interest, a premium for the risk of inflation that is equal to the expected rate of inflation, a premium for the known variance in the expected rate of inflation, a premium for the unknown variance in the expected rate of inflation, and various premia for the special tax characteristics of the securities involved. It does not seem useful for me to proceed further to try to figure out and explain what Bell and Taub were trying to say so that I can explain why it is incorrect. Much of the purpose of my paper was to try to explain the complexity of the various risks involved with inflation, which Bell and Taub seem not to have understood.

References

Ireland, Thomas R. 1997. "Forensic Implications of Inflation-Adjusted Bonds." This journal, 2(2):92-102.