BEFORE THE TENNESSEE REGULATORY AUTHORITY
NASHVILLE, TENNESSEE

In the Matter of the Petition of Piedmont Natural Gas Company, Inc. to Implement a Margin Decoupling Tracker (MDT) Rider and Related Energy Efficiency and Conservation Programs	))))))	DOCKET NO. 09-00104

PRE-FILED DIRECT TESTIMONY AND EXHIBITS OF

CHRISTOPHER C. KLEIN, PH.D.

ON BEHALF OF THE TENNESSEE ATTORNEY GENERAL
CONSUMER ADVOCATE AND PROTECTION DIVISION

DECEMBER 4, 2009

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DR. CHRISTOPHER C. KLEIN

Q. Please state your name and your current position.

A. My name is Christopher C. Klein and I am an Associate Professor in the Economics and Finance Department at Middle Tennessee State University (MTSU) in Murfreesboro, Tennessee.

Q. What is your educational background?

A. I received a B. A. in Economics from the University of Alabama in 1976 and I received a Ph. D. in Economics from the University of North Carolina at Chapel Hill in 1980.

Q. What is your professional experience involving regulated industries?

A. I was employed as an Economist in the Antitrust Division of the Bureau of Economics at the Federal Trade Commission (FTC) in Washington, D.C., for six years starting in 1980. In 1986, I was hired as the first Economist for the Tennessee Public Service Commission (TPSC). Although my title changed over the years, I functioned as the Chief Economist for the TPSC and, after 1996, the Tennessee Regulatory Authority (TRA), until August of 2002, when I assumed my current position with MTSU.

Q. What were your duties at the FTC?

A. I performed the economic analysis in antitrust investigations involving more than 20 industries and contributed to staff reports on mergers in the petroleum industry, competition in grocery retailing, and the economics of predatory or sham litigation.

Q. What was your primary responsibility at the TPSC?

A. I was an expert witness for the staff of the TPSC in rate cases and other similar proceedings involving telecommunications, natural gas, electric and water utilities As well as motor carriers. I testified in 36 dockets before the TPSC on the issues of cost of capital, rate design, and competitive effects. I also filed testimony before the Federal Communications Commission (FCC).

Q. How did your responsibilities change when the TRA supplanted the TPSC?

A. I oversaw the Utility Rate Division and then the Economic Analysis Division. The TRA staff no longer testified in proceedings before the agency, but provided analysis and advice to the TRA Directors. I was responsible for all such advice and analysis provided to the Directors by these Divisions, either individually or in concert with other TRA staff, in all proceedings that came before the agency for resolution. These proceedings included rate cases and tariff filings by public utilities, as well as those associated with the implementation of the federal Telecommunications Act of 1996.

Q. Were you a member of any regulatory committees or boards while you worked for the TPSC and the TRA?

A. Yes. I was a member of the National Association of Regulatory Utility Commissioners (NARUC) Staff Subcommittee on Gas. I was a member of, and Chaired, the Research Advisory Committee to the Board of Directors of the National Regulatory Research Institute (NRRI). I also served on the State Staff of the FCC's Federal-State Joint Board in CC Docket No.80-286 (the "Separations" Joint Board) and as a Group Leader on the NARUC Staff Subcommittee on Accounts Multi-state Audit Team that produced the 1988 Report on Bell Communications Research.

Q. What is your primary responsibility at MTSU?

A. I teach classes in the general area of applied microeconomics, including Principles of Microeconomics, Intermediate Microeconomic Theory, Managerial Economics, Business and Government, and Econometrics, as well as undertaking scholarly research, participating in various university committees, and serving on dissertation committees.

Q. Have you taught at any other universities?

A. I taught classes in the Economics of Regulation and in Antitrust Economics in the Economics Department at Vanderbilt University for several years while I was employed at the TRA.

Q. Are you a member of any professional organizations?

A. I am a member of the American Economic Association, the Southern Economic Association, the Western Economic Association, the Industrial Organization Society, and Alpha Pi Mu, the National Industrial Engineering Honor Society, as well as Beta Gamma Sigma, the International Honor Society for Collegiate Schools of Business.

Q. Have you published articles in professional or academic journals and presented papers at professional meetings?

A. More than 30 of my articles have appeared in professional or academic journals such as *Energy Economics*, *Utilities Policy*, *The Electricity Journal*, *The Journal of Applied Regulation* and many others. I have made more than 50 presentations at professional meetings.

Q. Have you testified before any other governmental bodies in Tennessee?

A. Yes. I have testified before various committees of the Tennessee General Assembly on regulatory issues, especially telecommunications issues and competition in the telecommunications industry, as well as before the Tennessee Advisory Commission on Intergovernmental Relations and the Tennessee Regulatory Authority. A complete list is provided in my Vita, attached as my Exhibit 7.

PURPOSE OF TESTIMONY

Q. **What is the purpose of your testimony?**

A. I will address Issue 3 (Prior to implementing a decoupling mechanism, should Piedmont's earnings be evaluated?) and Issue 4 (Does the implementation of a decoupling mechanism lower the business risk for Piedmont, thereby justifying an adjustment to its rate of return? If so, what method or evaluation tools should be utilized to quantify an appropriate adjustment to the rate of return?) identified by the hearing officer in this docket.

Q. Can you summarize your testimony pertaining to Issue 3?

A. Yes. I find that Piedmont's decoupling proposal should be examined in a general rate case, or barring that, that substantial adjustments to Piedmont's rate of return are necessary if Piedmont's decoupling mechanism is adopted. Decoupling immediately increases Piedmont's return on equity by nearly 100 basis points and is likely to increase it further in the future, even though Piedmont's return on equity should be reduced to reflect lower risk under decoupling. To adopt such a proposal without any offsetting adjustments, especially when Piedmont is not requesting any rate relief, is clearly inappropriate. Moreover, decreases in the cost of debt since Piedmont's last rate case have further increased Piedmont's return on equity by over 150 basis points, suggesting that Piedmont's earnings should be evaluated or adjusted prior to adoption. Decoupling plus decreases in debt cost together will increase Piedmont's return on equity by over 250 basis points. I recommend evaluating Piedmont's rate of return in a general rate case. If Piedmont's decoupling proposal is adopted without a general rate case, then Piedmont's return on equity should be reduced by 100 basis points. This reduction is over and above any reduction made to recognize reduced risk under Issue 4. If Dr. Dismukes's recommended alternative decoupling proposal is adopted, no adjustment to Piedmont's equity return is required, other than the risk adjustment I recommend on Issue 4. The Authority should consider updating Piedmont's capital structure and cost rates on debt to 2009 values.

Q. Can you summarize your testimony on Issue 4?

A. Yes. I present evidence that decoupling reduces Piedmont's business risk by about 10%, which is worth roughly 50 basis points on Piedmont's return on equity. I recommend reducing Piedmont's return on equity by 50 basis points, if Piedmont's decoupling mechanism is implemented. Under Dr. Dismukes's alternative decoupling proposal, Piedmont's return on equity should be reduced by 25 basis points.

Q. How is your testimony organized?

A. I will address the details on Issue 3 first, followed by Issue 4. I then summarize and conclude.

ISSUE 3: PRIOR TO IMPLEMENTING A DECOUPLING MECHANISM, SHOULD PIEDMONT'S EARNINGS BE EVALUATATED?

Q. What is the effect of Piedmont's decoupling mechanism on Piedmont's return on equity?

A. In response to CAD Discovery Request #28 (CAD#1-28) and #29 (CAD#1-29), Piedmont calculated the return on equity with and without decoupling for each month from November 2008 through July 2009. The results are tabulated in my attached Exhibit 1, where I also calculate the difference between the two. Decoupling raises Piedmont's return on equity in almost all months by 90 to over 100 basis points. This increase in the return on equity can be expected to accelerate over time if Piedmont's decoupling mechanism is adopted.

Q. Why is the return on equity under decoupling expected to continue increasing in the future?

A. The increase in the return on equity is caused by an increase in the margin for residential customers. This is meant to offset the effect on Piedmont's rate of return caused by decreases in consumption by residential consumers below the weather normalized levels in the previous rate case. Gas consumption by Piedmont's residential customers has been decreasing for several years since the 2003 rate case concluded and Piedmont expects this trend to continue (TRA#1-2 and #1-3). Consequently, the residential margin takes a big initial jump to offset several years' worth of declining consumption causing Piedmont's return on equity to increase substantially. If Piedmont's residential customers continue to reduce their consumption, as Piedmont expects, then the residential margin and Piedmont's return on equity will continue to increase.

Q. Do these calculated returns on equity accurately reflect Piedmont's current financial condition and the changes to be expected from decoupling?

A. No. The return on equity figures reported in Exhibit 1 (from CAD#1-28 and #1-29) were calculated using Piedmont's capital structure for June 2009 using the cost rates on debt from the 2003 rate case. If the cost rates on debt for June 2009 are used, then Piedmont's return on equity increases by an additional 150 basis points or more. A representative comparison of the two methods is shown on my attached Exhibit 2. For the same overall return of 8.42%, the use of the June 2009 cost rates increases the return on equity by 180 basis points.

Q. Is it appropriate, then, to adopt Piedmont's proposed decoupling mechanism without evaluating Piedmont's earnings?

A. No. The best solution would be to undertake a general rate case. The outcome of this proceeding would reset Piedmont's expected weather normalized residential consumption for the immediate test year, avoiding the jump in residential margin and return on equity from the adoption of a decoupling mechanism alone. The changes in capital structure and cost of debt since the last rate case could also be implemented and Piedmont's overall rate of return reset to just and reasonable levels. Piedmont's cost of equity would also be revisited and reset to reflect any necessary adjustment for reduced risk due to decoupling. (I discuss decoupling and risk reduction under Issue 4 below.)

Q. In the absence of a general rate case, what alternatives do you recommend?

A. If Piedmont's decoupling mechanism is adopted without a rate case, then an offsetting adjustment to Piedmont's rates should be adopted. This offset should reduce Piedmont's return on equity by approximately 100 basis points. I emphasize that this offset is over and above any adjustment for reduced risk from adoption of the decoupling mechanism. In addition, the Authority should consider updating Piedmont's capital structure and cost rates for debt. This adjustment is equivalent to at least an additional 150 basis point reduction in the return on equity. The effect of both of these adjustments is equivalent to reducing the return on equity by 250 basis points.

Q. If Dr. Dismukes's alternative decoupling plan is implemented, would these same offsets be required?

A. No. Dr. Dismukes's recommended modifications to Piedmont's plan include a reset of customer billing determinants using more recent load and weather information. This prevents the large initial jump in residential margin and return on equity that results from adoption of Piedmont's decoupling proposal. My recommended 100 basis point adjustment to return on equity is then unnecessary. Other aspects of Dr. Dismukes's recommendations reduce the adjustment required to account for reduced risk under decoupling. I discuss these under Issue 4.

Even under Dr. Dismukes's plan, the Authority should consider updating Piedmont's capital structure and cost rates on debt to 2009.

ISSUE 4: DOES THE IMPLEMENTATION OF A DECOUPLING MECHANISM LOWER THE BUSINESS RISK FOR PIEDMONT, THEREBY JUSTIFYING AN ADJUSTMENT TO ITS RATE OF RETURN? IF SO, WHAT METHOD OR EVALUATION TOOLS SHOULD BE UTILIZED TO QUANTIFY AN APPROPRIATE ADJUSTMENT TO THE RATE OF RETURN?

Q. Do you disagree with Piedmont's assessment of whether a decoupling mechanism reduces business risk?

A. Yes, at least in part, but Piedmont's position is not clear. Piedmont seems to suggest that decoupling may reduce some business risks, but that the magnitude of the reduction is small. For example, on page 3 of its Petition, Piedmont states that:

> …Piedmont's ability to recover its operating costs plus its approved return of and on its investment – commonly referred to as Piedmont's "margin" – is highly subject to variations in usage by its customers."

The term "variations in usage" is important because risk is measured in terms of variability – the more variable an item is, the more risk is involved. Later, on page 4, Piedmont elaborates:

> Piedmont's existing volumetric rate structure also puts both customers and Piedmont at risk for variations in usage. Customers are at risk for upward variations in usage which could lead to Piedmont recovering more than the annual margin approved by the Authority. Conversely, Piedmont and its shareholders are at risk for downward variations in usage which could lead to Piedmont's recovery of less than the annual margin approved by the Authority.

This illustrates the connection among variations in customer usage, variations in earnings, and risk. The intended effect of the decoupling mechanism is then laid out on page 4:

> This mechanism will also align the interests of Piedmont and its customers by ensuring that Piedmont recovers only the level of margin on an average per customer basis approved by the Authority, without regard to the individual usage patterns of its residential customers.

That is, the risk due to variations in residential customers' usage patterns, so important a few paragraphs earlier, is eliminated by the proposed decoupling mechanism. For these reasons, I believe Piedmont does intend for the decoupling mechanism to reduce its business risk.

Q. Where does any disagreement on the need to adjust Piedmont's return on equity for this reduction in risk arise?

A. Apparently, it arises over the magnitude of any risk reduction from decoupling. For example, Piedmont states in response to the TRA staff data request (TRA#1-8) that

> The company will continue to face the same business risk factors which determine the overall risk perceived by investors, and in turn, on appropriate return on equity findings; the approval of the margin decoupling tracker by the Authority will not diminish or otherwise change these factors.

Piedmont goes on to list many of these risk factors, all of which are legitimate, but neglects to mention the variation in customer usage which figures prominently in the Petition. After noting that equity analysts generally react favorably to decoupling mechanisms, but that Piedmont is unaware of any attempts to quantify a risk value associated with decoupling, Piedmont concludes:

> In light of the *magnitude* of the main factors influencing the risk perceived by investors, a decoupling mechanism for our residential market in Tennessee will not impact the Company's overall risk to investors. [Emphasis added.]

I interpret these statements taken together to say that Piedmont believes the magnitude of the risk reduction from decoupling is too small to perceive. Thus, any disagreement is over the *magnitude* of the effect of any risk reduction from decoupling on the required return on equity, and not on its existence.

Q. How do you propose to measure the effect of Piedmont's decoupling mechanism on its required return on equity?

A. Using the Capital Asset Pricing Model (CAPM), the change in the return on equity due to a reduction in risk after decoupling can be expressed as

$$ROE_1 – ROE_2 = [(\sigma_1 - \sigma_2)/\sigma_{j1}] (\beta_1 r_p)$$

where σ_1 and σ_2 represent the standard deviation in the company's return on equity before and after decoupling, β_1 is the company's "beta" before decoupling, and r_p is the "risk premium" or the difference between the risk-free rate of return and the market return. The derivation of this expression is shown on my Exhibit 3. I then use regression analysis to estimate the change in the standard deviation of Piedmont's Tennessee equity return, $[(\sigma_1 - \sigma_2)/\sigma_1]$, when the variation caused by variation in residential volumes is removed by decoupling. Using this estimate along with the risk premia advocated by the cost of capital witnesses in Piedmont's last rate case, and reasonable values for beta, I calculate values for the change in the return on equity. My regression analysis appears in my Exhibits 5 and 6. The calculated changes in expected equity returns due to the risk reduction from decoupling are shown on my Exhibit 4.

Q. What do these calculations show?

A. My Exhibit 4 shows changes in the expected equity return ranging from 16 to 125 basis points.

Q. Do any assumptions underlie your analysis?

A. Yes. The derivation of the change in the expected equity return using the CAPM assumes that the correlation coefficient between the firm's return and the market return does not change and that the standard deviation of the market return does not change. The calculation of the proportional change in the standard deviation of Piedmont's equity return assumes that decoupling completely removes the effect of variation in residential volumes on the equity return.

Q. Are these assumptions reasonable?

A. Yes. Piedmont is much too small relative to the entire stock market, or the market for all investments, for changes in its earnings to affect the variability of the market return. The correlation coefficient between Piedmont's return and the market return could increase, decrease, or stay the same as the standard deviation of Piedmont's equity return decreases after decoupling. In any event, the change would be an order of magnitude less than the change in Piedmont's standard deviation. That is, if Piedmont's equity risk (standard deviation) falls by 10% after decoupling, then the change, if any, in the correlation coefficient would likely be zero to plus or minus 1%. In this context, the assumption of no change in the correlation coefficient is reasonable. On the other hand, the chance that Piedmont's decoupling mechanism *exactly* offsets the effect of the variation in residential volumes on the equity return is very small. Consequently, I take this into account in choosing my recommended risk adjustment to Piedmont's return on equity.

Q. How do you use regression analysis to measure the change in risk due to decoupling?

A. Linear Regression Analysis is a statistical or econometric technique for estimating the linear relationship among a dependent variable and one or more explanatory variables from data on these variables. It can also calculate the amount of variation in the dependent variable that is "left over" after its relationship to other variables is taken into account. I regress Piedmont's Tennessee return on equity for several years against measures of residential consumption, one at a time, for the same years. I then calculate the standard deviation of Piedmont's return before and after taking the effect of residential consumption into account. This leads me to the proportional change in the standard deviation of Piedmont's equity return that results if decoupling exactly offsets the effect of variations in residential consumption on the equity return. As a check on these results, I perform a similar analysis of gas company returns on equity and residential consumption using national data from the American Gas Association.

Q. What do the regression analyses and accompanying calculations show?

A. I calculate changes in the standard deviation of equity returns, or "risk", ranging from roughly 10% to 21% using Piedmont's data and from 5% to 13% using the national data.

Q. What value of this change in risk do you recommend?

A. I recommend a change in risk of 10% to reflect the effect of Piedmont's decoupling proposal. Using Piedmont's data, a value of 15% would seem reasonable were it not for the uncertainties in the ability of the decoupling plan to exactly offset the risk from variations in residential volumes. Taking this and other factors into account, I prefer to choose a more conservative value of 10%. This is at the low end of my estimates using Piedmont's data and within the range indicated by the national data.

Q. Did you perform any statistical tests on these values?

A. No. Unfortunately, the small number of observations available for the regression analysis, seven years or fewer, renders any statistical tests invalid. This occurs because the test statistics are assumed to follow certain distributions based on underlying normal distributions, the familiar "bell curve." With 30 observations or more, it is generally acceptable to approximate any distribution with a normal distribution; as the number of observations grows, any distribution will approach a normal distribution. With so few observations, however, the normality assumptions are not justified and statistical tests are not valid. In this context, the regressions are best interpreted as merely calculating devices.

Q. How do you use the risk reduction to calculate a change in the return on equity?

A. To calculate the resulting change in the equity return due to a risk reduction, I also need values for beta and the risk premium. As these are often highly contested items in rate cases, I have chosen to use the range of risk premia advocated by the cost of capital witnesses in Piedmont's last rate case and values of beta between 0.5 and 1.0. Public utilities are generally thought to embody less than the average risk indicated by a beta equal to one. I also use values of 5%, 10%, and 15% for the risk reduction due to decoupling. The results shown in my Exhibit 4 thus indicate the sensitivity of the change in the equity return to changes in the underlying values of these items.

Q. What adjustment to Piedmont's return on equity do you recommend if Piedmont's decoupling proposal is approved?

A. I recommend a reduction in Piedmont's return on equity of 50 basis points due to reduced risk under Piedmont's decoupling proposal.

Q. How do you use the figures in your Exhibit 4 to arrive at this 50 basis point reduction?

A. I start with my recommendation of a 10% reduction in risk from decoupling. This leaves a range from 32 to 83 basis points for the change in the equity return, shown in the center table in Exhibit 4. The appropriate beta likely lies near the middle of the range from 0.5 to 1. A beta of 0.75 and a 10% risk reduction yields a change in the equity return of roughly 48 to 62 basis points. I have chosen to err on the side of conservatism with a value of 50 basis points.

Q. How does your recommended reduction of 50 basis points compare to the actions of regulators in other states that have approved decoupling proposals?

A. Dr. Dismukes's Exhibit DED-10 shows reductions in the return on equity in decoupling proceedings in other states that range from 0 to 50 basis points. Of those states that made adjustments, the range is 10 to 50 basis points. This exhibit also shows that the decoupling proposal by Chattanooga Gas that was not adopted in TRA Docket No. 06-00175 included a recommended reduction in the cost of equity of 50 basis points.

Q. If the Authority were to accept Dr. Dismukes's alternative decoupling proposal, would this change your recommended adjustment to Piedmont's return on equity?

A. Yes. Dr. Dismukes proposes to either restrict overall recoveries to only those amounts greater than the historic average reductions in use per customer, or to cap total revenue recovery balances at some percentage of total weather-adjusted base revenues. Either of these will result in less risk reduction to Piedmont and will preserve more financial incentive for the company to reduce its costs as this will increase its realized return on equity. If one of these alternatives is adopted, the adjustment to Piedmont's return on equity for reduced risk should also be reduced. I recommend an adjustment of 25 basis points in this event.

CONCLUSION

Q. Please summarize your recommendations on Issue 3.

A. I recommend that the Authority evaluate Piedmont's earnings in the context of a general rate case. If a general rate case is not pursued and Piedmont's decoupling mechanism is adopted, then the Authority should take action to reduce Piedmont's return on equity by 100 basis points as an offset to the immediate effect of decoupling. If Dr. Dismukes's alternative decoupling proposal is adopted, no adjustment to Piedmont's equity return is necessary. The Authority should also update Piedmont's capital structure and cost rates on debt to 2009.

Q. Please summarize your recommendations on Issue 4.

A. Piedmont's return on equity should be reduced by 50 basis points to reflect the reduction in risk resulting from the adoption of Piedmont's decoupling proposal. If one of Dr. Dismukes's alternatives is adopted, Piedmont's return on equity should be reduced by 25 basis points.

Q. Does this conclude your testimony at this time?

A. Yes.

Contains information marked as confidential by Piedmont Natural Gas Company.

Klein Direct
Exhibit 2
09-00104

Increased Return on Equity Due to Decreased Cost of Debt

Mid-year 2009 Capital Structure and Cost Rates

	Prop	Cost rate	Wtd cost
STD	0.131	0.8	0.1048
LTD	0.394	6.66	2.62404
C. Equity	0.475	**11.98139**	5.69116
	1		8.42

Mid-year 2009 Capital Structure; Cost Rates from 2003 Rate Case

	Prop	Cost rate	Wtd cost
STD	0.0803	1.47	0.118041
LTD	0.4278	7.72	3.302616
C Equity	0.4919	**10.16333**	4.99343
	1		8.42

Sources: CAD#1-24 and #1-29

Change in Return on Equity Due to Reduced Risk from Decoupling

From the Capital Asset Pricing Model, a firm's expected return on equity is:

$$ROE = r_f - \beta r_p$$

where r_f is the risk-free return, r_p is the risk premium (the difference between the risk-free return and the stock market return), and β is the individual firm's beta. Beta can be written as

$$\beta = \rho_{jm}\sigma_j\sigma_m = \sigma_j\,(\rho_{jm}\sigma_m) \qquad \text{for any firm } j$$

where ρ_{jm} is the correlation coefficient between the firm's return on equity and the market return; σ_j is the standard deviation of the firm's return on equity; and σ_m is the standard deviation of the market return. The change in risk due to decoupling will reduce the standard deviation of the firm's return, σ_j. Assuming that ρ_{jm} and σ_m do not change, then the change in the firm's return on equity as a result of decoupling may be calculated as

$$ROE_1 – ROE_2 = [r_f – \beta_1 r_p] - [r_f – \beta_2 r_p] = [\beta_1 – \beta_2]r_p$$

where subscripts 1 and 2 indicate before and after implementation of decoupling, respectively. Some further algebraic manipulation and substitution of $\sigma_j\,(\rho_{jm}\sigma_m)$ for β, gives

$$ROE_1 – ROE_2 = [(\beta_1 – \beta_2)/\ \beta_1](\beta_1 r_p) = [(\sigma_{j1} - \sigma_{j2})/\sigma_{j1}]\ (\beta_1 r_p)$$

Given values for σ_{j1}, σ_{j2}, β_1, and r_p, the change in the firm's return on equity can be calculated.

Changes in the Expected Return on Equity For Various Values of Beta, the Risk Premium, and the Percentage Risk Reduction from Decoupling

5% Risk Reduction
(Proportional Change in Sigma = 0.05)

		Risk Premium	
		8.35	6.41
	1	0.4175	0.3205
Beta	0.75	0.313125	0.240375
	0.5	0.20875	0.16025

10% Risk Reduction
(Proportional Change in Sigma = 0.10)

		Risk Premium	
		8.35	6.41
	1	0.835	0.641
Beta	0.75	0.62625	0.48075
	0.5	0.4175	0.3205

15% Risk Reduction
(Proportional Change in Sigma = 0.15)

		Risk Premium	
		8.35	6.41
	1	1.2525	0.9615
Beta	0.75	0.939375	0.721125
	0.5	0.62625	0.48075

Source: Risk Premia recommended by Dr. Murray and Dr. Brown in Piedmont's last Tennessee rate case. See Direct Testimony of Steve Brown, TRA Docket No. 03-00313.

**Data, Regression Results, and Calculation
of Proportional Change in Risk from Decoupling
National AGA Data**

Year	ROE	Residential Consumption	Residential Consumption PerCustomer
1995	10.1	5382.9	96.6
2000	7.8	5126.2	83.9
2004	9.3	5006.9	77.9
2005	12.4	4945.6	75.8
2006	6.2	4508.2	68.5
2007	8.8	4868.3	73

Source: American Gas Association, Tables 6-2 and 11-12,
www.aga.org/Research/statistics/annualstats/

Regression Results and Calculations

1) ROE = -8.72039 + 0.003583(Rcons)

Total sum of squares:22.12 Residual sum of squares:16.72183

$\sigma_1 = (22.15/5)$^0.5 = 2.103331 $\sigma_2 = (16.72183/5)$^0.5 = 1.828761

Proportional change in σ = (2.103331 – 1.828761)/2.103331 = 0.13054

2) ROE = 3.819701 + 0.0666(RconsPerCus)

Total sum of squares: 22.12 Residual sum of squares: 19.94217

$\sigma_1 = (22.15/5)$^0.5 = 2.103331 $\sigma_2 = (19.94217/5)$^0.5 = 1.997106

Proportional change in σ = (2.103331 – 1. 997106)/2.103331 = 0.050503

Data, Regression Results, and Calculation of Proportional Change in Risk from Decoupling Piedmont Tennessee Data

	DED-12		CAD#1-41	CAD#1-39		CAD#1-41
Year	**ROR**	**ROE**	**R Cons**	**R Cust**	**Cons/Cus**	**WN C/Cus**
2002	7.3	9.62	10443799			81.15
2003	7.75	10.57	10636222	132975	79.98663	79.9
2004	9.68	14.63	10368512	135759	76.3744	78.79
2005	8.56	12.28	10519596	138512	75.94718	75.58
2006	7.53	10.11	9758579	141257	69.08386	77.23
2007	7.46	9.96	9845495	144134	68.30793	74.63
2008	9.86	15.01	11060913	146568	75.46608	74.4

ROE calculated from ROR using mid-year 2009 capital structure and cost rates, CAD#1-24.

Regression Results and Calculations

1) ROE = -20.4378 + 0.0000031(R Cons)

Total sum of squares: 31.0252 Residual sum of squares: 19.24691

$\sigma_1 = (31.0252/6)^{0.5} = 2.273954$ $\sigma_2 = (19.24691/6)^{0.5} = 1.791038$

Proportional change in σ = (2.273954 – 1.791038)/ 2.273954 = 0.212368

2) ROE = -4.66506 + 0.225872(Cons/Cus)

Total sum of squares: 25.78173 Residual sum of squares: 20.48812

$\sigma_1 = (25.78173/5)^{0.5} = 2.270759$ $\sigma_2 = (20.48812/5)^{0.5} = 2.024259$

Proportional change in σ = (2.270759 – 2.024259)/ 2.270759 = 0.108554

VITA

CHRISTOPHER C. KLEIN

EDUCATION:

Ph. D. (Economics), University of North Carolina - Chapel Hill (1980)
B. A. (Economics), University of Alabama - Tuscaloosa (1976)

EXPERIENCE:

2002-Present **Middle Tennessee State University**
Associate Professor of Economics

2002-Present **Consultant**
Clients included: AGL Resources, Inc.; Tennessee Advisory Commission on Intergovernmental Relations; Tennessee American Water Company, Inc.; Tennessee Department of Environment and Conservation; US LEC of Tennessee, Inc.; Verizon Wireless; West Virginia American Water Company, Inc.; Z-Tel Communications, Inc.

1996-2002 **Tennessee Regulatory Authority**
Chief, Economic Analysis Division, 1997-2002
Chief, Utility Rate Division, 1996-97

1998-2001 **Vanderbilt University**
Adjunct Associate Professor of Economics

1986-1996 **Tennessee Public Service Commission**
Director, Utility Rate Division, 1994-96
Economist & Research Director, 1993-94
Commission Economist, 1986-1993

1990-1994 **Middle Tennessee State University**
Adjunct Faculty, Department of Economics and Finance

1980-1986 **Federal Trade Commission**
Economist, Bureau of Economics - Antitrust Division

PROFESSIONAL ACTIVITIES:

Editor, *Journal for Economic Educators*, 2007 to present.
Member 1994-96, State Staff, Federal-State Joint Board, Federal Communications Commission CC Docket No.80-286 ("Separations" Joint Board).
Chair 1993-95, member 1990-95, Research Advisory Committee to the Board of Directors of the National Regulatory Research Institute at Ohio State University.
Member 1990-95, Staff Subcommittee on Gas, National Association of Regulatory Utility Commissioners.

Group Leader: Economics, Contracts, and Non-affiliate Revenue; NARUC* Staff Subcommittee on Accounts Multi-state Audit Team, 1988 Report on Bell Communications Research.
Referee: *Contemporary Economic Policy, Eastern Economic Journal, Land Economics, Review of Industrial Organization, Social Science Quarterly, Southern Economic Journal*.
Memberships: American Economic Association (AEA, since 1981), Southern Economic Association (1982), Industrial Organization Society (1986), Western Economic Association (2003).

HONORS:

Beta Gamma Sigma, International Honor Society for Collegiate Schools of Business, 2008
Top 30 Score, 2003-2004 Student Evaluation of Faculty Performance, Jones College of Business, Middle Tennessee State University.
Resolution of Recognition, National Regulatory Research Institute, 1995
Listed in various Who's Who publications since 1990
Certificate of Commendation, Federal Trade Commission,1985
First in my class to complete the Ph. D., 1980
Alpha Pi Mu, National Industrial Engineering Honorary, 1973

GRANTS RECEIVED:

MTSU Jones College Summer Research Grant: 2004, 2005, 2007.
MTSU Faculty Research and Creative Activity Academic Year Grant: 2004-2005 (with Reuben Kyle)
MTSU Faculty Research and Creative Projects Committee Summer Salary Grant: 2006, 2009.

TEACHING

At MTSU

ECON 2420, Principles of Economics – Microeconomics
ECON 3520, Intermediate Microeconomic Theory
ECON 4400, Business and Government
ECON 4570, Managerial Economics
ECON 4620, Econometrics and Forecasting
ECON 7121, Seminar in Applied Microeconomic Theory (Ph.D. Program)
ECON 7250, Methods of Outcome Assessment (Ph.D. Program)
Student Internships (ECON/FIN 4890, ECON/FIN 5890, ECON/FIN 6440)

At Vanderbilt University

ECON 252, Antitrust Economics
ECON 283, Economics of Regulation

MTSU Dissertation Committees

Shea W. Slonaker, Chair, *Three Essays on the Recorded Music Industry*, Ph. D. 2009.
Hua Liu, Member, *U.S. Trade Deficit, Productivity Growth and Offshore Outsourcing*, Ph. D. 2006.

Jennifer Wilgus, Member, *A Life-Cycle Approach to Human Capital Investment and Skill-Biased Technological Change*, Ph. D. 2005.
Anealia Sasser, *A Theoretical Examination of Title IV Financial Aid for Higher Education*, D.A. 2004.

Vanderbilt University Dissertation Committees:
Aster Adams, *The Impact of Deregulation and Competition on Efficiency, Financial Performance, and Shareholder Wealth of Electric Utilities in the United States*, Ph. D. 2009.
David B. Sapper, *Trial Selection and the Effects of Sentencing Reform in Criminal Antitrust Cases: A Theoretical and Empirical Analysis*, Ph. D. 2006.
T. Randolph Beard, *Bankruptcy, Safety Expenditure, and Safety Regulation in the Motor Carrier Industry*, Ph. D. 1988

PUBLICATIONS AND WORKING PAPERS

"Identifying the Best Buys in U.S. Higher Education," with E. Anthon Eff and Reuben Kyle, in revision, 2009.

"The Price of Quality: Hedonic Estimation of Implicit Market Models for Higher Education," with Reuben Kyle, in revision, 2009.

"Do State Funded Merit Scholarships Induce Students to Learn more in High school?" with Elizabeth A. Perry-Sizemore, in revision, 2009.

"Chart Turnover and Sales in the Recorded Music Industry: 1990-2005," with Shea W. Slonaker, resubmitted to the *Review of Industrial Organization*, 2009.

"What Can We Learn from Education Production Studies?" with E. Anthon Eff, forthcoming, *Eastern Economic Journal*, 2009.

"Intra-district Public School Funding Equity and Performance in Nashville, Tennessee," *Journal of Education Finance*, Summer 2008.

"A Tale of Three Inputs: Cost and Production Duality with Time Utilization of Capital," *Applied Economics Research Bulletin*, 1(1) 2008.

"Telephone Penetration in Tennessee: Are Intrastate Universal Service Policies Effective?" with Aster R. Adams and David B. Sapper, *Journal of Applied Regulation*, 2, November 2004, pp,. 87-108.

"A Switching Regime Approach to Measuring the Effects of Technological Change in Ocean Shipping," with J. David Bass and Reuben Kyle, *Journal of Productivity Analysis*, 22:1-2, July-September, 2004, pp. 29-49..

"The Financial Implications of Unbundling on Bell Company Profits: A Review of the Evidence," with T. Randolph Beard and George S. Ford, *CommLaw Conspectus: The Journal of Communications Law and Policy*, v. 12 n.1, Fall/Winter 2003.

"Bell Companies as Profitable Wholesale Firms: The Financial Implications of UNE-P," with T. Randolph Beard, *Phoenix Center Policy Paper No. 17*, November 2002, www.phoenix-center.org.

"Connecting Tennessee: Bridging the Digital Divide," with Rose M. Gregory, *NRRI Quarterly Bulletin*, vol. 21 no. 3, Spring 2001.

"Regulation vs. Deregulation: It's All in the Externalities," *Tennessee's Business*, Middle Tennessee State University, v. 11, n. 3 (November), 2001.

"The Role of Public Power in a Restructured Electric Power Industry," with David Sapper, *The Electricity Journal*, August/September 2001.

"Regulator Preferences and Utility Prices: Evidence from Natural Gas Distribution Utilities," with George Sweeney, *Energy Economics*, vol. 21, n. 1, 1999.

“Competition in Telecommunications: A Progress Report for Tennessee,” *Tennessee’s Business*, Middle Tennessee State University, Murfreesboro, TN; vol. 9, n. 1, 1999.

"Technological Change and the Production of Ocean Shipping Services," with Reuben Kyle, *Review of Industrial Organization*, December 1997.

“The Haunting of Universal Service: Open Markets, Efficient Funding and the Ghost of the Fair Rate of Return,” *Proceedings of Tenth NARUC Biennial Regulatory Information Conference*, National Regulatory Research Institute, Columbus, OH, 1996.

“Productivity Growth in Telecommunications: The Case of Tennessee,” *Proceedings of Tenth NARUC Biennial Regulatory Information Conference*, National Regulatory Research Institute, Columbus, OH, 1996.

"Capture vs. Compromise: Entry Regulation of Intrastate Trucking," with Reuben Kyle and Jennifer Wilgus, *Logistics and Transportation Review*, v. 32 n. 3, September 1996.

"Price Discrimination: What is 'Undue' for a U.S. Utility?" *Utilities Policy*, vol. 4 no. 4, October 1994.

"Single Service Price Variations and 'Subsidies' in the Pricing of Telecommunications Services," *Proceedings of Ninth NARUC Biennial Regulatory Information Conference*, National Regulatory Research Institute, Columbus, OH, 1994.

"What Is Undue Price Discrimination by a Regulated Utility?" *NRRI Quarterly Bulletin*, March 1994.

"A Comparison of Cost-Based Pricing Rules for Natural Gas Distribution Utilities," *Energy Economics*, July 1993.

"Negotiating a Transportation Rate Under Threat of Bypass: A Case Study," *Proceedings of the Eighth Biennial Regulatory Information Conference*, National Regulatory Research Institute, Columbus, OH, 1992.

"A Multinomial Logit Model of Intrastate Trucking Regulation in Tennessee," with Jennifer Jose and Reuben Kyle, *Papers and Proceedings of the Nineteenth Annual Meeting of the Midsouth Academy of Economics and Finance*, v. 16 ,1992.

"Ramsey Prices for Natural Gas Distribution Utilities," *Proceedings of the Seventh NARUC Biennial Regulatory Information Conference*, National Regulatory Research Institute, Columbus, OH, 1990.

"Intervention as Entry Deterrence: Evidence from Sham Litigation Cases," *Proceedings of the Seventh NARUC Biennial Regulatory Information Conference*, National Regulatory Research Institute, Columbus, OH, 1990.

Book Review, *Changing the Rules: Technological Change, International Competition, and Regulation in Communications*, Edited by Robert W. Crandall and Kenneth Flamm, Brookings 1989; *Review of Industrial Organization*, Fall 1990.

"Double Leverage and Strategic Financing Decisions," *NRRI Quarterly Bulletin*, v. 11, n. 3, September 1990.

"Predation in the Courts: Legal Versus Economic Analysis in Sham Litigation Cases," *International Review of Law & Economics*, June 1990.

"Rate Design for Natural Gas Utilities: A Comparison of Ramsey and Cost of Service Pricing," *NRRI Quarterly Bulletin*, December 1989.

"Dissecting Divestiture: A Telecommunications Book Review Article," *Review of Industrial Organization*, October 1989.

The Economics of Sham Litigation: Theory, Cases, and Policy, Bureau of Economics Staff Report, Federal Trade Commission, April 1989.

"New Agreements, Non-affiliate Revenues, and Economic Issues," with Mike Amato and Francis Fok, in *Report on Bell Communications Research*, National Association of Regulatory Utility Commissioners, 1988.

"Merger Incentives and Cost of Capital Regulation of Subsidiaries," *Midsouth Journal of Economics and Finance*, March 1988.

"Strategic Sham Litigation: Economic Incentives in the Context of the Case Law," *International Review of Law & Economics*, December 1986.

"Is There a Principle for Defining Industries? Comment," *Southern Economic Journal*, October 1985.

"A Note on Defining Geographic Markets," with Ed Rifkin and Noel Uri, *Regional Science and Urban Economics*, February 1985.

"Process Analysis, Capital Utilization, and the Existence of Dual Cost and Production Functions," FTC Bureau of Economics Working Paper No. 116, May 1984.

"A General Theory of Hedonic Pricing of Capital as a Factor of Production," FTC Bureau of Economics Working Paper No. 105, December 1983.

"The International Market for Crude Oil," with Fred Lipson and Harvey Blumenthal, in *Mergers in the Petroleum Industry*, Federal Trade Commission, 1982.

PRESENTATIONS

"The Effect of State Funded Merit Scholarships for Higher Education on Pre-College Academic Performance," with Elizabeth A. Perry-Sizemore, Southern Economic Association Annual Conference, San Antonio, TX, November 2009.

"The Effect of State Funded Merit Scholarships for Higher Education on High School Graduation Rates," with Elizabeth A. Perry-Sizemore, Southern Economic Association Annual Conference, Washington, DC, November 2008.

"Identifying the Best Buys in U.S. Higher Education," with E. Anthon Eff and Reuben Kyle, Southern Economic Association Annual Conference, Washington, DC, November 2008.

"Product Variety and Sales in the Recorded Music Industry: 1990-2005," with Shea Slonaker, International Industrial Organization Conference, Arlington, VA, May 2008.

"Identifying the Best Buys in U.S. Higher Education," with E. Anthon Eff and Reuben Kyle, Academy of Economics and Finance Annual Meeting, Nashville, TN, February 2008.

"Product Variety and Sales in the Recorded Music Industry: 1990-2005," with Shea Slonaker, Academy of Economics and Finance Annual Meeting, Nashville, TN, February 2008.

"Do State Funded Merit Scholarships Induce Students to Learn more in High school?" with Elizabeth A. Perry-Sizemore, Southern Economic Association Annual Conference, New Orleans, LA, November 2007.

"The Price of Quality: Hedonic Estimation of Implicit Market Models for Higher Education," with Reuben Kyle, Southern Economic Association Annual Conference, New Orleans, LA, November 2007.

"The Shifting Appeal of Sham Litigation: Evidence from Appellate Decisions 1971-2006," International Industrial Organization Conference, Savannah, GA, April 2007.

"The Shifting Appeal of Sham Litigation: Evidence from Appellate Decisions 1980-2006," Scholar's Week Poster Fair, MTSU, April 2007

"Causality Tests for Public School Funding and Performance," Southern Economic Association Meeting, Charleston, SC, November 2006.

"The Price of Quality: Hedonic Estimation of Implicit Market Models for Higher Education," with Reuben Kyle, Southern Economic Association Meeting, Washington, November 2005.

"The Price of Quality: Hedonic Estimation of Implicit Market Models for Higher Education," with Reuben Kyle, International Industrial Organization Conference, Atlanta, April 2005.

"Anticompetitive Litigation and the "Baselessness" Standard for Antitrust Liability," Southern Economic Association Meeting, New Orleans, November 2004.

"The Price of Quality: Hedonic Estimation of Implicit Market Models for Higher Education," with Reuben Kyle, Southern Economic Association Meeting, New Orleans, November 2004.

"VoIP: Let's Ask the Right Questions," Tennessee Regulatory Authority Forum on VoIP, Nashville Public Library, April 30, 2004.

"Telephone Penetration in Tennessee: Are Intrastate Universal Service Policies Effective?" with Aster Rutibablira and David B. Sapper, Southern Economic Association Meeting, San Antonio, TX, November 2003.

"Telephone Penetration in Tennessee: Are Intrastate Universal Service Policies Effective?" with Aster Rutibablira and David B. Sapper, International Industrial Organization Conference, Boston MA, April 4-5, 2003.

"A Critique of Educational Production Functions," Southern Economic Association meeting, New Orleans, LA, November 2002.

"Connecting Tennessee: Bridging the Digital Divide," with Rose M. Gregory, American Economic Association meeting, joint session with the Transportation and Public Utilities Group, Atlanta, GA, January 2002.

"Long Term Contracts as Anticompetitive Devices in Telecommunications," Southern Economic Association Annual Meeting, Tampa, FL, November 2001.

"The Role of Public Power in a Restructured Electric Power Industry," American Economic Association meeting, joint session with the Transportation and Public Utilities Group, Boston, MA, January 2000.

"Universal Telephone Service in Tennessee: A Pre-Competition Assessment," with David Sapper, Southern Economic Association meeting, New Orleans, LA, November 1999.

“Trucks, Planes, Trains, and Wires? Short-haul vs. Long-haul Long Distance Rates in Telecommunications,” with Reuben Kyle, Southern Economic Association meeting, Baltimore, MD, November 1998.

“The Economics of Time as a Resource,” Southern Economic Association meeting, Atlanta, GA, November 1997.

“Cost and Production Duality with Capital Utilization,” Department of Economics Seminar Series, Vanderbilt University, February 1997.

“Maximum Impropriety: The ‘Baselessness’ Standard for Improper Litigation,” Southern Economic Association meeting, Washington, November 1996.

“Cost and Production Duality with Capital Utilization,” Southern Economic Association meeting, Washington, November 1996.

"The Haunting of Universal Service: Open Markets, Efficient Pricing, and the Ghost of the Fair Rate of Return,” Tenth NARUC Biennial Regulatory Information Conference, Columbus, OH, September 1996.

"Productivity Growth in Telecommunications: The Case of Tennessee," Tenth NARUC Biennial Regulatory Information Conference, Columbus, OH, September 1996.

"Productivity Growth in Telecommunications: The Case of Tennessee," Advanced Workshop in Regulation and Public Utility Economics, 15th Annual Conference, Lake George, NY, May 1996.

"A Switching Regime Approach to Measuring the Effects of Technological Change in Ocean Shipping," with Reuben Kyle, Southern Economic Association meeting, New Orleans, November 1995.

"Productivity Growth in Telecommunications: The Case of Tennessee," Southern Economic Association meeting, New Orleans, November 1995.

"Local Service Price Variations and 'Subsidies' in Telecommunications," Southern Economic Association meeting, Orlando, November 1994.

"Dynamic Effects of Regulatory Policy on Intrastate Long Distance Telephone Rates," Southern Economic Association meeting, Orlando, November 1994.

"Single Service Price Variations and 'Subsidies' in the Pricing of Telecommunications Services," Ninth NARUC Biennial Regulatory Information Conference, Columbus, OH, September 1994.

"Suit, Countersuit, and Settlement in Sham Litigation," Annual Meeting of the Midsouth Academy of Economics and Finance, Nashville, February 1994.

"New Evidence on the Effect of Regulation on Intrastate Long Distance Telephone Rates," Annual Meeting of the Midsouth Academy of Economics and Finance, Nashville, February 1994.

"What is Undue Price Discrimination for a Public Utility?" Southern Economic Association meeting, New Orleans, November 1993.

"Regulated Utility Prices and the Preferences of Regulators," with George Sweeney, Southern Economic Association meeting, New Orleans, November 1993.

"A Test for Strategic Behavior Under Rate of Return Regulation," Southern Economic Association meeting, Washington, November 1992.

"New Evidence on the Effect of Regulatory Policy on Intrastate Long Distance Telephone Rates," Southern Economic Association meeting, Washington, November 1992.

"Technological Change and the Production of Ocean Shipping Services," with Reuben Kyle, Atlantic Economic Association meeting, Plymouth, MA, October 1992.

"Negotiating a Transportation Rate Under Threat of Bypass: A Case Study," Eighth Biennial Regulatory Information Conference, Columbus, OH, September 1992.

"A Multinomial Logit Model of Intrastate Trucking Regulation in Tennessee," with Jennifer W. Jose and Reuben Kyle, Midsouth Academy of Economics and Finance annual meeting, Mobile, February 1992.

"Technological Change and the Production of Ocean Shipping Services," with Reuben Kyle, Southern Economic Association meeting, Nashville, November 1991.

"Suit, Countersuit, and Settlement in Sham Litigation Cases," Southern Economic Association meeting, Nashville, November 1991.

"Implementing Third Best Pricing Rules for Natural Gas Distribution Utilties," Southern Economic Association meeting, Nashville, November 1991.

"Trucking Regulation in Tennessee," with Jennifer Jose and Reuben Kyle, Southern Economic Association meeting, Nashville, November 1991.

"Research and Development in Regulated Markets: The Case of Bell Communications Research," Southern Economic Association meeting, New Orleans, November 1990.

"Incentives for Trial and Settlement in Sham Litigation," Southern Economic Association meeting, New Orleans, November 1990.

"Ramsey Prices for Natural Gas Distribution Utilities," Seventh NARUC Biennial Regulatory Information Conference, Columbus, OH, September 1990.

"Intervention as Entry Deterrence: Evidence from Sham Litigation Cases," Seventh NARUC Biennial Regulatory Information Conference, Columbus, OH, September 1990.

"Funding Research and Development in Regulated Industries: The Case of Bell Communications Research," Ninth Annual Conference of the Advanced Workshop in Regulation and Public Utility Economics, New Paltz, NY, May 30 - June 1, 1990.

"Incentives for Trial and Settlement in Sham Litigation," Bureau of Economics Seminar, Federal Trade Commission, February 1990.

"Estimating Ramsey Prices for Natural Gas Utilities," Southern Economic Association meeting, Orlando, November 1989.

"Incentives for Trial and Settlement in Sham Litigation," Department of Economics Seminar Series, Auburn University, November 1989.

"Natural Gas Rate-Making: Now and In the Future," Associated Valley Industries Natural Gas Seminar, Nashville, October 1989.

"Estimating Ramsey Prices for Natural Gas Utilities," Advanced Workshop in Regulation and Public Utility Economics, Eighth Annual Conference, Newport, RI, May 29-31, 1989.

"The Role of Bell Communications Research in the Telecommunications Markets," Midsouth Academy of Economics and Finance Annual Conference, Nashville, February 1989.

"The Organizational Structures of Public Utilities Under Different Regulatory Regimes," Southern Economic Association meeting, San Antonio, November 1988.

"New Agreements, Non-affiliate Revenues, and Economic Issues," Report on Bell Communications Research, NARUC Multi-state Audit Team, presented to NARUC Staff Sub-committee on Accounts, Kalispell, Montana, September 1988.

"Predation in the Courts: Empirical Analysis of Sham Litigation Cases," Joint Session of the Industrial Organization Society and the American Economic Association, Chicago, December 1987.

"Rate of Return on Equity," National Conference on Unit Valuation Standards, Nashville, December 1987.

"Merger Incentives and Organizational Structures Under Cost of Capital Regulation," Southern Economic Association meeting, Washington, November 1987.

"Merger Incentives and Cost of Capital Regulation of Subsidiaries," Midsouth Academy of Economics and Finance Annual Conference, Mobile, February 1987.

"The Incidence of Predatory Sham Litigation," Southern Economic Association meeting, New Orleans, November 1986.

"A Welfare Analysis of the Department of Justice Merger Guidelines," Southern Economic Association meeting, Dallas, November 1985.

"A Duality Approach to Labor Costs and Shiftwork," Southern Economic Association meeting, Atlanta, November 1984.

"Strategic Sham Litigation: Economic Incentives in the Context of the Case Law," Southern Economic Association meeting, Atlanta, November 1984.

"A General Theory of Hedonic Pricing of Capital as a Factor of Production," Southern Economic Association meeting, Washington, November 1983.

ECONOMIC TESTIMONY

In the United States District Court for the Middle District of Tennessee: Owner-Operator Independent Drivers Association Inc. v. Keith Bissell, No. 3-90-0251, March 1992, (Affidavit).

Before the Federal Communications Commission: Represcribing the Authorized Rate of Return for Interstate Services of Local Exchange Companies, CC Docket No. 89-624, March 1990.

Before the Tennessee General Assembly: various Committees, 1994 - present.

Before the Tennessee Advisory Commission on Intergovernmental relations:
“Report on Pole Attachment Rate Study,” with Reuben Kyle, January 18, 2007.

Before the Tennessee Regulatory Authority (docket numbers in parentheses):

Tennessee Rural Coalition Petition for Suspension and Modification Pursuant to 47 U.S.C. 1251(f)(2), (06-00228), May 2007.

Complaint of US LEC of Tennessee, Inc. against Electric Power Board of Chattanooga (02-00562), Feb. 2004.

Before the Tennessee Public Service Commission* (docket numbers in parentheses):

BellSouth D/B/A South Central Bell (95-02614) October 1995.**
United Telephone - Southeast (95-02615) September 1995.
United Telephone - Southeast (93-04818) January 1994.**
Chattanooga Gas Company (93-06946) December 1993.
South Central Bell Tariff 93-039 (93-03038) May 1993.**
South Central Bell (92-13527, et al) April 1993.**
Kingsport Power Co. (92-04425) October 1992.
United Cities Gas Co.(92-02987) Sept. 1992.
L & L Trucking, Inc. (91-06786) February 1992.**
Chattanooga Gas Company (91-03765) October 1991.
GTE South (91-05738) August 1991.**
Nashville Gas Company (91-02636) August 1991.
Intra-LATA "Competition" (89-11065, et al) Feb. 1991.
United Intermountain Tel. Co.(90-07832) Dec. 1990.**
Kingsport Power Company (90-05736) Nov. 1990.**
AT&T - South Central States (90-07460) Oct. 1990.**
L & L Trucking (90-03514; 90-04786) August 1990.**
South Central Bell Tel. Co. (90-05953) August 1990.**
GTE South (90-01273) June 1990.
Radio Common Carriers (89-11234) Nov. 1989.**
Nashville Gas Co. (89-10491) Oct. 1989.
United Cities Gas Co. (89-10017) Sept. 1989.
Crockett Telephone Co. (89-02325) May 1989.
ALLTEL Tennessee (89-02324) May 1989.
West Tennessee Telephone Co. (89-02323) May 1989.
Peoples Telephone Co. (89-02322) May 1989.
Ooltewah-Collegedale Telephone Co. (89-02321) May 1989.
Kingsport Power Co. (89-02126) March 1989.**
Chattanooga Gas Co. (88-01363) February 1989.**
Tennessee-American Water Co. (U-87-7534) March 1988.
Tellico Telephone Co. (U-87-7532) February 1988.
Claiborne Telephone Co. (U-87-7508) November 1987.**
Nashville Gas Co. (U-87-7499) October 1987.**
Kingsport Power Co. (U-86-7472) May 1987.**
United Cities Gas Co. (U-86-7442) February 1987.**
General Telephone of the South (U-86-7437) Nov. 1986.**

* Written (prefiled) testimony on cost of capital, rate design, competitive effects, and/or other issues.
** Oral testimony as well as written.