BEFORE THE TENNESSEE PUBLIC UTILITY COMMISSION
NASHVILLE, TENNESSEE

Chattanooga Gas Company Petition For Approval of an Adjustment in Rates and Tariff; The Termination of the AUA Mechanism and the Related Tariff Changes and Revenue Deficiency Recovery; and an Annual Rate Review Mechanism	)	DOCKET NO. 18-00017

PRE-FILED DIRECT TESTIMONY OF

CHRISTOPHER C. KLEIN, PH.D.

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

July 3, 2018

BEFORE THE TENNESSEE PUBLIC UTILITY COMMISSION
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PRE-FILED DIRECT TESTIMONY OF
DR. CHRISTOPHER C. KLEIN

Q. Please state your name and your current position.

A. My name is Christopher C. Klein. I am a 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), now known as the Tennessee Public Utilities Commission (TPUC), 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, Economics of Antitrust and Regulation, 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 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 40 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 80 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 issues involving 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 beginning on page 6 of my Exhibit.

PURPOSE OF TESTIMONY

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

A. I will address the Cost of Capital for Chattanooga Gas Company (CGC) and recommend an allowed rate of return for ratemaking purposes. This includes issues regarding capital structure, cost of debt, and cost of equity.

Q. Can you summarize your testimony pertaining to capital structure and cost of debt?

A. Yes. I concur in part with the capital structure presented by CGC's witness Gary Tucker substituting for Rachel D. Johnson,[1] but apply the double-leverage method to account for the parent-subsidiary relationship between CGC, its parent Southern Company Gas (SCG), and SCG's parent holding company The Southern Company (TSC). The resulting capital structure calculated using Mr. Tucker's recommended structure for CGC/SCG and the (CONFIDENTIAL) forecasted parent-only capital structure of TSC for June 30, 2019 is shown on page 2 of my Exhibit.

Q. Can you summarize your testimony on cost of equity?

[1] Direct Testimony of Gary Tucker Substituting for the Direct Testimony of Rachel D. Johnson, filed on May 11, 2018.

A. I recommend a cost of equity of 9.0% based on the Discounted Cash Flow (DCF) and Capital Asset Pricing Model (CAPM) methods shown on pages 3 and 4 of my Exhibit. I recommend no additional adjustments for quarterly payment of dividends or flotation costs.

Q. What overall cost of capital do you recommend for use as the allowed rate of return for CGC?

A. I recommend an overall weighted cost of capital of 5.93% as shown on page 2 of my Exhibit.

Q. How is your testimony organized?

A. I will address the concept of cost of capital first, then capital structure and cost of debt. This is followed by cost of equity. Where appropriate, I will comment on the testimony of CGC's witnesses Gary Tucker and Dr. James H. Vander Weide.

COST OF CAPITAL

Q. What do you mean by cost of capital?

A. I mean the rate of return necessary to induce investors to hold the debt and stock of a company. This rate of return should be equal to that available to investors on alternative investments of similar risk.

Q. How is the cost of capital related to the legal principles of determining the allowed rate of return for regulated utilities?

A. The cost of capital concept embodies the economic principles for determining the allowed rate of return set out by the U.S. Supreme Court in *Bluefield Waterworks &*

Improvement Co. v. P.S.C. of W. Va., 262 U.S. 679 (1973) and *Fed. Power Comm'n v. Hope Natural Gas Co.*, 320 U.S. 591 (1944). For instance, the Court stated in *Hope* that, "…the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital." (320 U.S. at 603). In my opinion, the allowed rate of return on the capital employed by CGC should be set equal to its cost of capital to achieve the goals that the Supreme Court established.

Q. What are the consequences of not setting the allowed rate of return equal to the cost of capital?

A. If the allowed rate of return is set below the cost of capital, then the company's credit rating will fall and its cost of debt will rise. The price of its stock will decline to reflect the lower expected return. Eventually, the company may face difficulties in financing investments in new plant and equipment, causing the quality of its products and services to decline.

If the allowed rate of return is set above the cost of capital, then the price of the firm's stock rises to reflect the higher return and the firm's stockholders realize a capital gain. Moreover, the capital gain is paid for by the firm's customers in the form of excessively high prices.

Clearly, failure to set the allowed rate of return equal to the firm's cost of capital is detrimental to the firm's customers, as well as its stockholders.

CAPITAL STRUCTURE AND COST OF DEBT

Q. What was your first step in estimating the cost of capital for CGC?

A. My first step was to determine the appropriate capital structure and cost of debt for CGC. I started with the capital structure proposed by CGC's witness Gary Tucker. Mr. Tucker recommends the forecasted capital structure of SCG as of June 30, 2019. Apparently, since the acquisition of AGL Resources, CGC's former parent, by TSC, all of CGC's financing has been arranged through SCG. If CGC's status as a separate subsidiary is actually for the convenience of its parents and indicates no separate financing arrangement, then this seems appropriate. I compared Mr. Tucker's recommended capital structure to the historical capital structures of SCG and AGL Resources. The proportions of debt and equity in the forecasted structure lie within the ranges indicated by the historical structures. The exception is the proportion of short term debt, but the difference is not substantial. Consequently, I find Mr. Tucker's recommended capital structure of SCG and its cost rates to be reasonable, except for ignoring the parent-subsidiary relationship between SCG and TSC.

Q. Why is the parent-subsidiary relationship between CGC, SCG, and TSC important?

A. Mr. Tucker's testimony suggests, and CGC's responses to CPAD Discovery Requests 1-177 and 1-178, claim that CGC is solely dependent upon SCG or other SCG subsidiaries for all of its debt and equity financing. CGC also purchases inputs or services from other SCG subsidiaries or has costs allocated to it from other subsidiaries in the course of providing electricity to its customers, giving rise to several of the issues in this Docket. Obviously, CGC is not a mere arms-length investment for SCG. Even Dr. Vander Weide

quotes TSC's 2016 Form 10-K on environmental regulations as "a significant risk factor for Southern Company and its subsidiaries" (p. 17, lines 7-24). Moreover, SCG obtains its equity financing from its parent, TSC (Response to CPAD 1-186, especially attachment CPAD 1-186). In this context, it is inappropriate to view CGC independently of SCG and SCG independently form TSC.

Q. How have the Tennessee Public Utility Commission and its predecessors, the TRA and TPSC, taken parent-subsidiary relationships into account for regulated public utilities in Tennessee?

A. The Tennessee regulators have applied the double-leverage approach to capital structures for regulated subsidiaries of parent companies to take into account the parent-subsidiary relationship. This approach has been applied to all Tennessee regulated public utility industries since at least the 1970s.

Q. Did you apply double leverage to arrive at your recommended capital structure?

A. Yes. I took the forecast of TSC's parent-only capital structure and cost rates for short term and long term debt for June 30, 2019 (CPAD 1-178) and compared these to the historical figures for 2015, 2016, and 2017 (CPAD 1-177). The forecasted figures generally fall within the ranges established by TSC's recent history. On this basis, I find the forecasted capital structure and cost rates reasonably representative of TSC's parent-only long run capital structure. Then imputed TSC's forecasted parent-only capital structure to the equity portion of Mr. Tucker's recommended capital structure for CGC/SCG. The result is the double-leverage capital structure for CGC shown on page 2 of my Exhibit.

Q. How is double leverage defined?

A. Double leverage "usually refers to a situation where a holding company raises debt and downstreams it as equity capital, or subordinated debt, to a subsidiary, i.e., it is the use of debt by both the parent company and the subsidiary, in combination with the company's equity capital, to finance the assets of the subsidiary." (www.ventureline.com/accounting-glossary/D/double-leverage-definition/, accessed June 3, 2016.) In the regulatory context, "double leverage…as commonly propounded instructs that the weighted average cost of capital of the parent company of a subsidiary be used as a measure of the cost of equity of a subsidiary." (Michael S. Rozeff, "Modified Double Leverage – A New Approach," *Public Utilities Fortnightly*, March 31, 1983.) Or more simply, double leverage states that the equity of a subsidiary is "part equity and part the debt of the parent." (Kolbe, A. Lawrence, James A. Read, Jr. and George R. Hall, "The Cost of Capital," Cambridge:MIT Press, 1984, p. 146.)

Q. What is the purpose of the double-leverage approach to capital structure?

A. The purpose of the double-leverage approach is to recognize the parent-subsidiary relationship by sharing some of the benefits of that relationship with ratepayers. Double leverage also discourages strategic financing behavior aimed only at raising a regulated subsidiary's regulated rate of return by manipulating the subsidiary's capital structure, while recognizing the role of the parent company in providing funds to the subsidiary.

Q. How does this apply to SCG?

A. CGC witnesses claim that the appropriate capital structure and cost of capital is that of SCG, because all of CGC's financing is arranged through SCG. The double-leverage approach to SCG's cost of equity looks to the parent's, in this case the Southern Company's, cost of capital. The parent's debt and equity is imputed to the equity portion

of the subsidiary's capital structure and the relevant cost of the resulting equity component is that of the parent, TSC.

Q. **Does it matter that CGC is a subsidiary of SCG and not a direct subsidiary of TSC?**

A. No. CGC is dependent on SCG for its financing and SCG is dependent on TSC for equity financing. Thus, CGC is still indirectly dependent on TSC. Further, CGC recommends ignoring the subsidiary relationship between CGC and SCG for cost of capital purposes making the subsidiary relationship between SCG and TSC the relevant one for double-leverage purposes.

Q. What difference does double leverage make to the overall cost of capital for CGC?

A. Using my recommended 9% return on equity, the additional debt introduced by double leverage reduces the overall cost of capital by about 70 basis points.

COST OF EQUITY

Q. How do you estimate CGC's cost of equity?

A. In my recommended double-leverage capital structure, the equity of the parent TSC appears in CGC/SCG's capital structure. Therefore, I look to the cost of equity of the parent enterprise, TSC, to estimate the cost of equity financing. This recognizes that the corporation is financed and managed as a whole from which the piece-parts, such as subsidiaries, cannot be separated. The capital structure of the parent company (not consolidated) supports the financing of all the subsidiaries. Moreover, TSC is the only entity in which outside investors may invest.

Q. How do you estimate the cost of equity of TSC?

A. I use the Discounted Cash Flow (DCF) and Capital Asset Pricing Model (CAPM) methods.

Q. Can you explain the Discounted Cash Flow method?

A. Yes. The DCF method views investors as valuing a company's stock based on the present value of the cash flows a stockholder expects to receive from owning the stock over an infinite time horizon. These cash flows from stock ownership are just the dividends paid by the company. Consequently, some simple mathematics show that the rate of return an investor expects on stock ownership in a company is the dividend yield for the current period plus the expected growth rate in that dividend. The dividend yield is just the expected dividend divided by the current price of the stock.

Q. Have you computed a DCF cost of equity for CGC/SCG?

A. Yes. Page 3 of my Exhibit shows this calculation for TSC and four electric-gas combination utility holding companies of comparable size (total capital) to TSC selected from Value Line. I start with recent dividend yields as reported by Value Line, and by the *Wall Street Journal* for closing prices on June 12, 2018. The June 12 dividend yields are very similar to the yields reported by Value Line earlier in the 2018. I believe these dividend yields are reasonably representative of investor expectations at this point in time.

I use expected growth in dividends per share from Value Line for the growth rate in the DCF formula. For TSC, Value Line projects an annual dividend growth rate of 3.5%. Consequently, the calculated DCF cost of equity for TSC is 9.0%. Using the June dividend yield raises the DCF estimate for TSC by only two basis points to 9.02%. The

average the DCF cost of equity estimates for all five electric-gas utilities range from 10.62% using the Value Line dividend yield to 10.51% using June dividend yields.

Q. How did you select the four electric utilities for your DCF analysis?

A. Since TSC owns both electric and natural gas operations, I looked for utilities offering both electric and natural gas service among those covered by Value Line that were comparable in size to TSC. I limited the companies to those with total capital between 0.5 and 1.5 times that of TSC. I eliminated companies that had significant unusual circumstances, such as those in the process of being acquired by other companies or those facing unusual liabilities. A major example of the latter is Pacific Gas and Electric, which faces substantial liability for the role its lines may have played in starting the wildfires in California last year.

I also examined the "beta," a measure of relative risk, for these comparable companies. Betas for these companies ranged from 0.60 to 0.80, all less than 1.0, and slightly above TSC's beta of 0.5, perhaps indicating slightly higher risk than TSC.

Q. What do you conclude from the DCF analysis?

A. The DCF cost of equity range for TSC about 9.0%, while the comparable firms' DCF estimates range from 8.4% to over 14%, with an average of 10.50% to 10.60%. To try to narrow this range, I turned to the Capital Asset Pricing Model, or CAPM.

Q. Can you explain the CAPM?

A. Yes. In the CAPM, an investor's required return on an investment is based on the relative riskiness of the investment. That is, an investor must expect a higher return in order to invest in a riskier enterprise. The CAPM begins by estimating the risk premium required on a broad portfolio of common stocks relative to a risk-free asset. This risk

premium is then adjusted for a particular stock's riskiness relative to the market – that is, the broad portfolio of stocks. This is done by using the stock's beta, which measures the riskiness of the stock relative to the market. The resulting CAPM cost of equity consists of the risk-free return plus beta times the market risk premium.

Q. How do you estimate the risk premium?

A. I adopt the risk premium of 6.9% reported by Dr. Vander Weide based on the difference in the return on the S&P 500 stocks and the 20-year Treasury Bond. U.S. government bills and bonds are widely considered to have the lowest risk of default of all available debt instruments.

Q. How do you choose the risk-free instrument and the appropriate risk premium?

A. Technically, the lowest risk is associated with very short term Treasury bills, because the short time frame provides the least opportunity for default and little chance that the expected inflation rate will not be realized over the life of the investment. Nevertheless, these short term bills also embody short term returns that may not reflect all factors affecting the expected return on a stock for a multi-year period. If one chooses longer term bonds as the "risk-free" instrument, however, then expected returns over multiple years may be better captured, but more risk is also introduced. This is the risk that the actual inflation rate over the life of the bond may differ from expectations. If this occurs, then the real, inflation adjusted, return on the bond also differs from expectations. This inflation risk in a longer term bond raises the necessary return above the risk-free rate. The analyst must then trade-off any bias introduced by higher risk in longer term instruments against capturing the factors affecting the risk-free return over a longer period.

Q. How do you make this trade-off?

A. Since current interest rates on Treasury bills (T-bills) are at historically very low levels, consideration for longer term bonds is appropriate. Further, the low level of interest rates generally also means that the choice of the risk free rate makes less difference to the overall CAPM cost of equity estimate than when rates are high. For these reasons, I merely adopt the risk premium of stacks over 20-year Treasury Bonds used by Dr. Vander Weide.

Q. How do you adjust these estimates for specific companies such as TSC?

A. The risk premium is adjusted using a stock's beta. I use betas for AEP and the four electric-gas utilities previously selected as reported by Value Line. These companies are less risky than the average stock, so their betas range from 0.6 to 0.8, although they are slightly more risky than TSC with a beta of only 0.5. An average stock, or a broad portfolio of stocks representing the market return, has a beta of 1.0. Page 4 of my Exhibit shows the resulting range of CAPM cost of equity estimates. For TSC, the CAPM cost of equity is 6.49%. Since the CAPM for each company is determined by each company's beta, the comparable electric-only utilities all have very similar CAPM cost of equity estimates between 7.14% and 8.56%. The CAPM for a stock with a beta of one, the market average, is 9.94%.

Q. Are there other factors that can affect the CAPM cost of equity estimates?

A. Yes. The pertinent factor at this time is the tendency for the risk premium to expand when interest rates and bond yields are low and shrink when interest rates and bond yields are high. Consequently, because short term interest rates are near zero, the CAPM cost of equity estimates may underestimate the current cost of equity. Also, there is some

evidence that the CAPM underestimates the cost of equity for firms with betas less than one. Nevertheless, it is reasonable to expect that the cost of equity of relatively low-risk utilities is less than the cost of equity of the market portfolio – that is, the CAPM estimate for a beta of one.

Q. How do you get the CAPM cost of equity of 9.94% for a stock with a beta of one shown on page 4 of your Exhibit?

A. This is the market average Beta of 1 multiplied by the 6.9% risk premium with the result added to the current yield on a 20-year Treasury Bond. Use of a long term interest rate infers the effect of higher interest rates in the future, even though higher risk is introduced by the possibility that inflation will differ from expectations over the 20-year term of the bond. This also offsets the possibility that the CAPM underestimates the cost of equity when interest rates are low or for firms with a beta less than one.

Q. What do you conclude on the cost of equity for TSC?

A. My CAPM cost of equity estimate for TSC and the comparable firms averages 7.51%. This is likely a lower bound on the cost of equity due to the previously mentioned tendencies of the CAPM. The average of the DCF cost of equity estimates is around 10.5%. The midpoint of this range is about 9.0%, which is also the DCF estimate for TSC. Further the CAPM estimate for the market (beta = 1) of 9.94% is above this estimate for TSC, as we expect for utilities that are less risky than the average stock. I recommend a cost of equity of 9.0% for TSC in CGC's double-leverage capital structure.

Q. How does your cost of equity of 9.0% compare to that recommended by CGC's witness Dr. Vander Weide?

A. Dr. Vander Weide recommends a cost of equity for "comparable" firms to CGC of 10.3%. He then applies an adjustment that he claims corrects for CGC's higher risk capital structure. He concludes that 11.25% is a fair rate of return on equity for CGC after this adjustment. His analysis is based on several items with which I disagree, especially an adjustment for quarterly payment of dividends, an adjustment for flotation costs, the choice of comparable firms, and a novel method to adjust CGC's cost of equity so that CGC and his list of comparable firms have the same weighted average cost of capital (WACC).

Q. Do you agree with Dr. Vander Weide's choice of comparable firms?

A. No. These firms are too large to be comparable to CGC, although one might argue that they are comparable to SCG. Since CGC proposes the use of SCG's capital structure, it should be SCG's cost of equity that is at issue, not CGC's. Further, Dr. Vander Weide's comparable firms are all natural gas utilities, which is inconsistent with the double-leverage approach that I use. I look to the cost of equity of SCG's parent, TSC, to estimate the appropriate cost of equity in the double-leverage context. This means I look for electric and natural gas combination utilities for firms comparable to SCG. Natural gas utilities are clearly inappropriate for this purpose.

Nevertheless, I computed DCF cost of equity estimates for Dr. Vander Weide's comparable firms on page 5 of my exhibit. The result is an average cost of equity of 8.6% using Value Line dividend yields and growth rates.

Q. Do you agree with Dr. Vander Weide's adjustments for flotation costs and quarterly dividend payments?

A. No. These adjustments, properly conceived, are offsetting and can be ignored for ratemaking purposes. The quarterly dividend payment adjustment is an adjustment to the DCF cost of equity based on the idea that the firm has to pay these sums out over the course of the year, rather than all at once at the end, requiring the firm has to borrow that money at a cost that should be recognized in its cost of equity. The problem with this is that it ignores the profits the firm will earn over the course of the year. The profits of the firm for regulatory purposes are not calculated in this way, but we all know that the firm's profits are not earned all at once at the end of the year. Consequently, a firm earning profits over the course of the year will have the money available to pay quarterly dividends out of those profits and still have profits left to invest to earn an additional return before the end of the year. The end result is that the firm earns higher profits, even after paying quarterly dividends, than those calculated for regulatory purposes when these timing issues are taken into account.

I should point out that I am not advocating trying to capture these timing effects for regulatory purposes. Assuming that profits for return purposes are earned all at once at the end of the year is a convenient fiction that removes countless small and difficult to resolve issues from rate proceedings. If one were to try to account for the time-value of profits earned over the course of the year, then one would have to decide how often to measure them (daily, weekly, monthly, or quarterly) – shorter periods will require much finer measurement of costs and revenues – and at what rate to value them over time. The timing of rate cases could also become issues for companies affected by weather. As I have suggested, many of these timing effects will be offsetting, very difficult to measure accurately, or to some degree arbitrary, making them best ignored for most purposes.

Moreover, CGC and SCG do not issue stock to the public, making any adjustment for flotation costs unnecessary. Even TSC has not issued stock to the general public in more than fifteen years (CPAD 1-186).

Q. Do you agree with Dr. Vander Weide's CAPM estimates of the cost of equity?

A. No. While I generally prefer to use shorter-term government bonds to calculate the risk premium, the main source of Dr. Vander Weide's higher CAPM estimates is his use of a long-term T-bond yield *forecast* of 4.2% for the risk-free rate. If he used the current 20-year bond yield of about 3.0% for the risk free rate, his CAPM estimate, without adjustment for flotation costs, would fall to about 8%. The current 20-year T-bond yield already reflects investor expectations for interest rates over the life of the bond. A further forecast is not necessary.

Q. Do you agree with Dr. Vander Weide's risk premium methods?

A. No. He applies the risk premium method to equity returns compared to returns on corporate bonds. The CAPM employs similar methods, but measures the risk premia of stocks relative to government instruments that are risk-free in that there is little chance of default. Moreover, short term government bills are preferred because the chance that inflation and interest rates will diverge from investor expectations over the life of a short-term bill is virtually nil. The difference between stock or equity returns and a risk-free rate of return reflects *only* the added return required for the risk embodied in stocks over and above the return required to offset the time value of money.

The problem with Dr. Vander Weide's risk premium analyses is that the returns on corporate bonds do not embody only the time value of money, but also include some return for inflation or interest rate risk, as well as the risk of default. Stocks are not

subject to inflation risk, because stock prices and stock returns will adjust for changes in inflation as firms adjust their prices for their products, nor are they subject to default risk in the same way that bonds are, since stocks returns can rise when profits far exceed default levels even if the probability of default does not change. Consequently, there is no reason to expect this difference in returns on corporate bonds and stocks, either utilities or the S&P 500, to be stable over time and this can introduce bias or inaccuracies into the risk premium estimates.

Q. Do you agree with Dr. Vander Weide's adjustment to CGC's cost of equity for the higher risk of CGC's capital structure?

A. No.

Q. How does Dr. Vander Weide perform this adjustment?

A. Dr. Vander Weide calculates the cost of equity necessary for CGC to attain the same weighted average cost of capital as his comparable firms. This is apparently based on the idea that the weighted average cost of capital must be equal for all firms with cash-flows of similar risk regardless of their capital structures. This is equivalent to a method in which an unlevered cost of equity is calculated that takes into account the capital structure and debt cost of the comparable firms. This unlevered cost of equity is equal to each firm's weighted average cost of capital (WACC). To get a cost of equity based on comparable firms' WACC involves "levering" the unlevered cost of equity estimates (or WACC) using the specific capital structure and debt cost rates for the firm in question, CGC.

Q. What are the problems with Dr. Vander Weide's adjustment?

A. There are several. These fall into two groups. First, what one might call academic issues and, second, practical issues.

Q. What are the academic issues?

A. The adjustment for a common WACC apparently derives from theoretical analysis of the proper discount rate to apply to the so-called tax shield on debt. This tax shield refers to business income tax that does not tax interest paid on debt, but does tax returns to equity, giving debt a tax advantage. The adjustment is somewhat controversial in the Finance community, because the issue of valuing the debt tax shield remains unresolved (for example, see Massimiliano Barbi, *On the risk-neutral value of debt tax shields*. 22 J. OF APPLIED FINANCE 251-258 (2012)).

Even if one ignores this issue, the theory underlying the approach is untestable, because the unlevered cost of equity for a levered firm (one that has debt) is unobservable. Thus, even if one believes the theory underlying the calculation of the unlevered cost of equity as the WACC, there is no way to confirm it, because the true unlevered cost of equity is unknown.

Q. What are the practical issues with Dr. Vander Weide's adjustment?

A. There are several practical issues in a regulatory context. First, this approach to the cost of equity has never been adopted in Tennessee before. The companies regulated by the TPUC and its predecessors remain financially viable despite this. Hence, there seems to be no necessity for taking into account a common WACC and calculating an adjusted cost of equity as Dr. Vander Weide proposes.

Secondly, his calculation of the WACC for his comparable firms requires some estimation of the capital structure and debt costs of these firms. To the extent these

approximations are not accurate, his estimates of the WACC for his comparable firms may be inaccurate or biased. Consequently, his adjusted cost of equity for CGC is also inaccurate.

CONCLUSION

Q. Can you summarize your recommendations for the cost of capital of CGC/SCG?

A. Yes. I recommend the double-leverage capital structure shown on page 2 of my Exhibit. I recommend a cost of equity of 9.0% resulting in an overall cost of capital of 5.93%.

Q. Does this conclude your testimony at this time?

A. Yes.

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July 3, 2018

Capital Structure and Cost of Capital

Chattanooga Gas Company
Double Leverage Capital Structure and Cost of Capital[1]

Component	%	Cost Rate	Wtd. Cost
Short Term Debt	6.30%	3.01%	0.19%
Long Term Debt	44.47%	4.73%	2.10%
Common Equity	49.23%		
Parent Short Term Debt	[redacted]	[redacted]	0.08%
Parent Long Term Debt			0.44%
Parent Common Equity		9.00%	3.12%
Total			5.93%

[1] Southern Company Gas debt proportions and cost rates from Direct Testimony of Gary Tucker Substituting for the Direct Testimony of Rachel D. Johnson, Exhibit RDJ-3, Schedule 1, as of June 30, 2019. Three-year Average Southern Company Parent-only debt and equity proportions and cost rates on debt calculated from response to CPAD Discovery Request 1-177.

Discounted Cash Flow Analysis
Electric-Gas Utilities

Company	Beta	Total Capital	VL Div Yield	Growth Rate Dividends	VL DCF	6/12/2018 Div. Yield	DCF
Southern Co.	0.50	$71.9b	5.5%	3.5%	9.0%	5.52%	9.02%
Electric-Gas Utilities							
Dominion	0.65	$53.3b	5.6%	9.0%	14.6%	5.15%	14.15%
Duke	0.60	$101.5b	4.7%	4.5%	9.2%	4.91%	9.41%
Exelon	0.70	$65.7b	3.6%	5.0%	8.6%	3.41%	8.41%
Sempra	0.80	$39.9b	3.2%	8.5%	11.7%	3.06%	11.56%
Averages					10.62%		10.51%

Sources: 1) Beta, Total Capital, Dividend Yield and Growth Rates from Value Line, www.valueline.com .
2) Dividend Yield, *Wall Street Journal* (WSJ.com), June 13, 2018, for closing prices on June 12, 2018.

Capital Asset Pricing Model
Electric-Gas Utilities

Company	Beta	Risk Premium	Weighted RP	Current_Yield 20-year T-bond	CAPM
Southern Co.	0.50	6.9%	3.45%	3.04%	6.49%
Dominion	0.65	6.9%	4.50%	3.04%	7.54%
Duke	0.60	6.9%	4.10%	3.04%	7.14%
Exelon	0.70	6.9%	4.80%	3.04%	7.84%
Sempra	0.80	6.9%	5.52%	3.04%	8.56%
Average					7.51%
Market	1.0	6.9%	6.9%	3.04%	9.94%

Sources:

Beta: Value Line, www.valueline.com .

Risk Premium: Return on S&P 500 less the income return on 20-year Treasury Bonds as reported by Dr. Vander Weide.

Current Yield on Treasury Bond Maturing on 5/15/2038 as of 6/6/2018; *Wall Street Journal* (WSJ.com).

Value Line DCF Cost of Equity
For Dr. Vander Weide's Gas Companies

	VW Growth	VW DCF	VL Yield	VL Growth	VL DCF	VL Beta
Atmos Energy	7.0%	9.5%	2.4%	7.0%	9.4%	0.70
Chesapeake Utilities	7.05	9.0	2.0	9.0	11.0	0.70
New Jersey Resourcs	6.0	8.9	2.5	4.0	6.5	0.80
NiSource	7.9	11.1	3.2	9.0	12.2	0.60
Northwest Nat. Gas	4.5	8.0	3.2	2.5	5.7	0.70
ONE Gas	5.5	8.0	2.7	10.0	12.7	0.70
South Jersey Industries	6.0	9.5	3.6	4.0	7.6	0.85
Spire	4.47	7.9	3.2	4.0	7.2	0.70
UGI	7.95	10.2	2.1	3.0	5.1	0.90
Average		9.1%			8.6%	

Sources: www.valuline.com ; Direct Testimony of James H. Vander Weide, Ph. D.

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**
Professor of Economics, 2013-Present
Associate Professor of Economics, 2002-2013

2002-Present **Consultant**
Clients included: AGL Resources, Inc.; Reseller Coalition; Tennessee Advisory Commission on Intergovernmental Relations; Tennessee American Water Company, Inc.; Tennessee Attorney General, Consumer Advocate and Protection Division; 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: *Applied Economics, Contemporary Economic Policy, Eastern Economic Journal, Land Economics, Management and Decision Economics, Media 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).

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, 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, 2012.
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, Economics of Antitrust and Regulation
ECON 4570, Managerial Economics
ECON 4620/5620, Econometrics and Forecasting
ECON 4720, Economic Issues in the Music Industry
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, *U.S. Trade Deficit, Productivity Growth and Offshore Outsourcing*, Ph. D. 2006.

Jennifer Wilgus, *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

"The Music Industry as a Vehicle for Economic Analysis," *Journal of Economic Education*, 46(4),403-411, 2015.

"Education Production Functions," *Encyclopedia of Educational Theory and Philosophy*, D. Phillips ed., Sage: Los Angeles, 2014.

"Econometrics as a Capstone Course in Economics," *Journal of Economic Education*, 2013.

"Identifying the Best Buys in U.S. Higher Education," with E. Anthon Eff and Reuben Kyle, *Research in Higher Education*, 2012.

"Chart Turnover and Sales in the Recorded Music Industry: 1990-2005," with Shea W. Slonaker, *Review of Industrial Organization*, 36:351-372, 2010.

"What Can We Learn from Education Production Studies?" with E. Anthon Eff, *Eastern Economic Journal*, 36:450-479, 2010.

"Public Transportation Ridership Levels," with Christopher R. Swimmer, *Journal for Economic Educators*, 10(1): 40-46, Summer 2010.

"Analysis of U.S. Foreign Aid Determinants for 2003," with Joshua M. Hill, *Journal for Economic Educators*, 9(1): 48-52, Summer 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

"Do State Funded Merit Scholarships for Higher Education Improve High School Graduation Rates?" with Elizabeth Perry-Sizemore, Southern Economic Association Annual Conference, New Orleans, LA, November 2015.

"Sequence of MBA Core Course Completion and Student Performance in an MBA Program," with E. Anthon Eff, Southern Economic Association Annual Conference, New Orleans, LA, November 2015.

"The Music Industry as a Vehicle for Economic Analysis," Southern Economic Association Annual Conference, Atlanta, GA, November 2014.

"The Music Industry as a Vehicle for Economic Analysis," American Economic Association National Conference on Teaching Economics, Chicago, IL, May 2013.

"Supply Innovation and Sales of Recorded Music: 1990-2010," Southern Economic Association Annual Conference, New Orleans, LA, November 2012.

"Econometrics as a Capstone Course in Economics," American Economic Association National Conference on Teaching Economics, Boston, MA, May 2012.

"Music Supply, Chart Turnover, and the Random Copying Hypothesis in the Digital Age," with Shea Slonaker, International Industrial Organization Conference, Arlington, VA, March 2012.

"Econometrics as a Capstone Course in Economics," Southern Economic Association Annual Conference, Washington, DC, November 2011.

"Do State Funded Merit Scholarships for Higher Education Reduce High School Dropout Rates for All Students?" with Elizabeth A. Perry-Sizemore, Southern Economic Association Annual Conference, Washington, DC, November 2011.

"Do State Funded Merit Scholarships for Higher Education Improve Pre-College Academic Performance?" with Elizabeth A. Perry-Sizemore, Southern Economic Association Annual Conference, Atlanta, GA, November 2010.

"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

Testimony before the Public Service Commissions of Alabama, Louisiana, North Carolina, and South Carolina on behalf of the Reseller Coalition, various docket numbers, August 2010-May 2011.

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):

Petition of Atmos Energy Corporation for a General Rate Increase (14-00146), April 2015.

Petition of Piedmont Natural Gas Company, Inc. for Approval of a CNG Infrastructure Rider to Its Approved Rate Schedules and Service (14-00086), December 2014.

Petition to Revise Performance Based Ratemaking Mechanism Rider in Atmos Energy Corporation's Tariff (13-00111), November 2013.

Petition of Atmos Energy Corporation for an Adjustment of Rates (12-00064), September 2012.

Petition of Berry's Chapel Utility, Inc. to Change and Increase Rates and Charges (11-00198), April 2012.

Petition of Piedmont Natural Gas, Inc. for an Adjustment to Its Rates, Approval of Changes to Its Rate Design, Amortization of Certain Deferred Assets, Approval of New Depreciation Rates, Approval of Revised Tariffs and Service Regulations, and Approval of a New Energy Efficiency Program and GTI Funding, (11-00144), December 2011.

Petition of Tennessee American Water Company to Change and Increase Certain Rates and Charges so as To Permit It to Earn a Fair and Adequate Rate of Return on Its Property Used and Useful in Furnishing Water Service to Its Customers, (11-00189), April 2011.

Petition of Chattanooga Gas Company for General Rate Increase, Implementation of the EnergySmart Conservation Programs, and Implementation of a Revenue Decoupling Mechanism, (09-00183), April 2010.

Petition of Piedmont Natural Gas Company, Inc. to Implement a Margin Decoupling Tracker (MDT) and Related Energy Efficiency and Conservation Programs, (09-00104), December 2009.

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.**

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

** Oral testimony as well as written.

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.**