Accounting & Taxation
Vol. 10, No. 1, 2018, pp. 87-96
ISSN: 1944-592X (print)
ISSN: 2157-0175 (online)

www.theIBFR.com

MODELLING UTILITY FINANCIAL VIABILITY USING LOGISTIC REGRESSION: EVIDENCE FROM FLORIDA

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ABSTRACT

Ratemaking is the mechanism that various state commissions use to establish utility rates for investor-owned utilities. Using logistic regression, this study explains the need for a flexible model to determine the financial viability of such utilities. The study uses 47 Florida investor-owned water and wastewater utilities to assess financial viability from 2002 to 2013. The financial viability results obtained using the National Regulatory Research Institute (NRRI) model are compared to the results of a more rigorous logistics regression model developed in this study. First, the results show that the financial ratios currently used by the NRRI to determine the viability of utilities do not need to be all-inclusive. Second, using data from 2002 to 2013, the logistic regression model categorized the viability of these utilities into groupings different from those of the NRRI model. Third, the study shows that ratemaking is not a uniform process across all states and supports discontinuing usage of the NRRI standard viability model in favor of the logistic regression model that incorporates the same financial ratios used by the NRRI.

JEL: C02, C18, C30, G33, L32, L95

KEYWORDS: Water Utilities, Financial Viability, Logistic Regression, Financial Ratios

INTRODUCTION

There are more than 50,000 water utilities operating in the US, with 82% serving less than 3,300 customers. Developers and existing dilapidated infrastructures do not currently meet the needs of water and wastewater management utilities. Practical steps are required to assess the financial viability of existing utilities and the need for replacement and upgrade of their facilities. The ability to fund the replacement of assets will depend on the financial resources these utilities command (Wardrop, 2000). There are no known industry standards to measure the financial viability of water and wastewater utilities. Current models used in utility regulation focus on: (1) managing and reducing the risks associated with market failures, (2) the ability to perform certain social and political objectives, such as addressing public safety and health concerns and, (3) ensuring the continuity of operations. Given the huge number of utilities operating in the US, there is a need for developing scientific models that bring reliability and accuracy to assessing the financial viability of utilities. The National Regulatory Research Institute (NRRI) financial viability model is the only scientific model currently available to assess financial viability (NRRI, 2009). The purpose of this study is to develop a logistic regression (LR) model to assess the financial viability of water and wastewater utilities. The study employs both the LR and the NRRI models to determine which utilities are financially viable (nonviable) and demonstrates that the LR model uses fewer variables and produces more robust and reliable results.

The NRRI model does not work well with all regulatory environments since different states have different ratemaking approaches. As an alternative, this study develops a two-step process to determine the financial viability of water and wastewater utilities. First, the financial ratios that are best suited for analyzing the financial condition of a particular regulatory environment are determined. Next, a statistical LR model that increases the reliability and accuracy of the financial viability forecast is developed using these financial ratios. Comparing the results of the LR model to the predictions of the NRRI model shows how the former improves the reliability and the accuracy of the forecasts in an efficient (less cost and time) and effective (higher rigor) manner. The next section reviews studies that analyze water utility financial viability; these studies use a variety of ratios to forecast viability. The third section presents a discussion of data sources, methodology and the process of developing the LR model and the fourth section provides a comparison of the LR model and NRRI model results. The fifth and final section includes the summary and concluding comments.

LITERATURE REVIEW

Models used to predict general business distress are not suitable for predicting small water utility financial viability. For example, Beecher, Dreese, and Landers (1992) argue the Altman's Z-score model is not appropriate for use in predicting financial distress in small water utilities because most are private, and one cannot determine the market value of their equity capital. Consistent with this argument, Wirick, Barrows, and Goldberg (1997) note that multivariate models have failed in the evaluation of water and wastewater utilities and suggested regulators consider the use of three ratios that measure the utility's ability to repay debt (debt to assets ratio, capitalization ratio, and the burden coverage ration). They argue that other financial ratios or multivariate models are not appropriate since they analyze general business performance not specifically water industry performance. For example, the Altman Z-score model, which predicts bankruptcy within 2 years, uses multiple income streams and financial ratios based on statement of financial position items (i.e., working capital to total asset ratio, retained earnings to total assets, income before income taxes to total assets, market value of equity to total liabilities, and sales to total assets) to measure the financial health of a business. Most water and wastewater systems do not have multiple income streams, and the application of the Altman Z-score model may not be appropriate for the determination of financial distress in water and wastewater systems. Wirick, Borrows, and Goldberg (1997) attempted to use discounted cash flow (DCF) models to determine the viability of water and wastewater utilities; using this method, utilities with a positive net present value are viable. However, DCF models do not capture either revenue or expense accruals, and DCF models treat the entire utility as a capital investment project. Treating existing utilities as new investments are problematic as assessing the appraised values of the assets to be used as the initial investments poses challenges.

In contrast, Beecher, Higbee, Anthony, and Richard (1996) support the use of the Platt and Platt (1991) model and claim that while this model uses viability ratios, it employs industry specific ratios and compares them to the individual firm ratios. Thus, similar to Altman's Z-score model, the Platt and Platt model minimizes data instability over time and integrates the industry-specific ratios to compare a firm's score to the industry score. Platt and Platt (2006) explain that their model is a LR analysis model that predicts outcomes based on a set of variables that may be determined from a larger number of related variables. LR may be binomial or multinomial. The flexibility of this model allows one to incorporate industry standards and individual firm specifics. Platt and Platt described the model as:

$$\mathrm{Pi} = \frac{1}{[1 + \exp.(\mathrm{B0} + \mathrm{B1Xi1} + \mathrm{B2Xi2} + \ldots\ldots\ldots\ldots.\mathrm{BnXin})]} \tag{1}$$

Pi is the probability of financial failure of the ith firm, Xij is the jth industry-relative ratio of the ith firm, and Bij is the coefficient of the Xij term. The model flexibilities allow one to highlight specific variables and compare them to their industry-specific counterparts. However, Beecher, Higbee, Anthony, and Ricard (1996) warn that, when industry data is not available, it is difficult to establish the estimated coefficient Bij for each Xij in the model. The NRRI (2009) outlined seven ratios that may be considered together to determine the financial viability of water and wastewater utilities. The NRRI report (2009) recommended the use of efficiency ratios, solvency ratios, and profitability ratios in assessing the financial viability of water utility systems. The lack of industry standards makes it difficult using multivariate ratio models to analyze the financial viability of these utilities. In addition, the NRRI did not have any known benchmark to measure viability or non-viability. This study suggests a flexible approach that employs the LR model and a 0.5 probability benchmark that is a default cutoff in predicting financial failure versus non-failure. The proposed approach will also be flexible for use by different state regulatory bodies.

All models use financial ratios to predict the viability of the test firms. Wirick, Barrows, and Goldberg (1997) and Beecher, Mann, and Sanford (1993) recommended the use of liquidity ratios or solvency ratios, efficiency ratios, and profitability ratios in viability models. While the NRRI model uses two separate ratios to measure profitability, Beecher, Mann, and Stanford (1993) use three ratios. First, return on sales and profit margin measure the profit earned per dollar of sales revenue and measure operational efficiency. The ratio, which indicates a firm's ability to withstand adverse conditions, such as falling rates, rising operational costs, and declining sales, is determined by dividing the net profit by net sales and. Next, return on assets ratio, which equals net profit divided by net assets, explains how a firm uses its assets to generate economic value and describes how efficiently a firm uses its assets to generate income. Finally, the return on net worth ratio (net profit divided by net worth), measures how management uses net assets to generate profit and an adequate return on owners' investment. However, this ratio may not apply to water utilities because the rate-setting process assures an expected rate of return on invested capital and investors do not own most of these utilities. Beecher, Mann, and Stanford (1993) use the quick ratio, current ratio, current liability to net worth, current liability to inventory, total liabilities to net worth, and fixed assets to net worth as solvency ratios. The quick ratio indicates how well the utility will meet its current obligations as they come due. The current ratio is the total current assets divided by total current liabilities.

This is an assessment of how the firm can use its current assets to meet its short-term obligations. The total assets ratio is also worth mentioning. This ratio measures the utility's ability to use its total assets to meet its total liabilities that measures the long-term financial risk of a utility to meet interest payments and repayments of debt on a timely basis. Wirick, Barrows, and Goldberg (1997) explain the need for efficiency ratios. They claim efficiency ratios depict how well the utility is managing and controlling its assets to generate revenues. Beecher, Mann, and Stanford (1993) recommended five efficiency ratios for small water systems: Collection period, net sales to inventory, assets to sales, sales to net working capital, and accounts payable to sales ratios. The receivable collection period, which is the average net account receivable, divided by daily sales, measures how efficiently the utility is collecting customer debts. Most small utilities depend on collections to fund their operations; hence, this efficiency ratio should be included in the analyses.

DATA AND METHODOLOGY

This study quantitatively identifies distressed or nonviable utilities using a LR model and compares the results to those predicted by the NRRI utility viability model, using the same financial ratios employed by the NRRI. The study selected 61 utilities regulated by Florida Public Service Commission (FPSC). Out of the 61 utilities selected, 47 had 10 years of annual financial statements (2004 to 2013) while 14 did not. Wirick, Barrows, and Goldberg (1997) assert that there is no specific model design to test for financial distress or viability for water utilities. Methods such as the Z-score model, as well as the Platt and Platt model, are used but are not consistent with conditions or circumstances surrounding water utilities. The NRRI model uses the profitability, liquidity, leverage, debt to equity, profit trend, growth and efficiency, and the efficiency ratios to determine the viability of a water utility. The NRRI model combines the results and categorizes them into three groups. Distressed or nonviable utilities have ratios totaling 3.0 or less. Weak to marginal utilities score between 3.1 and 3.9; if the total score is 4.0 or more then the utility is healthy and viable. The NRRI model represents a positive step towards building a model for a water utility (National Association of Regulatory Utility Commissioners, 1996). However, the model is not reliable;

because of its structure, anyone ratio can unduly influence the results. This study uses a LR model to test the ability of the NRRI model to separate the utilities into viable and non-viable categories based on the probabilities of the financial ratios used by the NRRI model. Using the Platt and Platt (1973) approach, the study LR model is as follows:

$$\mathrm{Pi} = \frac{1}{[1 + \exp.(\mathrm{B0} + \mathrm{B1LQi1} + \mathrm{B2LRi2} + \mathrm{B3DEi3} + \mathrm{B4PTi\$} + \mathrm{B5GEi5} + \mathrm{B6EFi6} + \mathrm{B7PRi7})]} \quad (2)$$

Where Pi is the probability of financial failure of the ith firm, B0-7 are the coefficients specified by the model, and the independent variables are the liquidity, leverage, debt to equity, profit trend, growth and efficiency, efficiency, and profitability ratios as the independent variables (ratio definitions are in the Appendix). The data are from the annual reports of the 47 qualified utilities referenced above. Table 1 reports the sample demographics.

Table 1: Sample Demographics of the 47 Sample Water Utilities

Data Item (in 1,000 dollars)	Total Assets	Common Stock Equity	Current Liab.	Long Term Liab.	Operating Revenues	Operating Expenses	Net Income	Retained Earnings
Mean	1,220.31	(18.89)	104.62	1,268.68	117.70	88.39	(30.85)	(134.10)
High	43,300.00	2,041.65	8,423.05	42,500.00	769.61	348.57	1,405.80	1,584.88
Low	(329.12)	(5,798.26)	(32.92)	-	5.35	0.86	(3,474.25)	(6,615.74)

Model Implementation and Discussion of Results

Table 2 below indicates the predictions of the NRRI model for the 47 qualified utilities. Out of 47, 32 utilities are classified as good to excellent, two are weak to marginal, and 13 are in the distressed category.

Table 2: Results from the NRRI Viability Model

NRRI Model Test	
Summary	**Utilities**
Good to Excellent	32
Weak to Marginal	2
Distressed	13
Total	47

Step 1 of the LR Model

The use of logistic regression (LR) is appropriate when the dependent variable is categorical (Hair, Black, Babin and Anderson 2010); in this study, LR is used to identify independent variables that predict small water utility financial viability. The first step of the viability test is a test for multicollinearity, which occurs when two or more of the ratios (independent variables) are explained by other ratios used in the test. When the variance inflation factor (VIF) is greater than 10 multicollinearity exists, and the variable causing this outcome must be eliminated from the LR model (Mertler and Vannatta 2013). To ascertain the extent of the problem, a collinearity diagnostic test was performed using a stepwise multiple regression on all 470 observations for each independent variable (47 firms over 10 years). Table 3 represents the results from the stepwise multiple regression.

Table 3: Eliminating Multicollinearity from NRRI Financial Ratios Using Stepwise Multiple Regression

Model		Beta In	T	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Liq_Quick	0.069	1.638	0.102	0.070	0.999	1.001	0.999
	Lev_Debit_Eqt	0.098	2.337	0.020 **	0.099	1.000	1.000	1.000
	Prof_Trend	-0.086	-2.056	0.040 **	-0.087	1.000	5.137	1.000
	Grow_Eff	-0.051	-1.205	0.229	-0.051	0.981	1.019	0.981
	Eff_Prof	0.061	1.455	0.146	.062	1.000	1.000	1.000
	Prof_NI_AOR	0.041	0.961	0.337	0.041	1.000	1.000	1.000
	DEBT_EQT	0.045	1.075	0.283	0.046	1.000	1.000	1.000
2	Liq_Quick	0.156	3.253	0.001 ***	0.138	0.754	1.327	0.754
	Prof_Trend	0.011	0.109	0.913	0.005	0.188	10.317	0.188
	Grow_Eff	-0.057	-1.341	0.180	-0.057	0.978	1.022	0.978
	Eff_Prof	0.056	1.321	0.187	0.056	0.996	1.004	0.996
	Prof_NI_AOR	0.039	0.933	0.351	0.040	1.000	1.000	1.000
	DEBT_EQT	0.045	1.072	0.284	0.046	1.000	1.000	1.000
3	Prof_Trend	0.010	0.107	0.915	0.005	0.188	10.317	0.177
	Grow_Eff	-0.040	-0.953	0.341	-0.041	0.963	1.039	0.742
	Eff_Prof	0.084	1.979	0.048 **	0.084	0.961	1.040	0.727
	Prof_NI_AOR	0.041	0.993	0.321	0.042	1.000	1.000	0.754
	DEBT_EQT	0.046	1.109	0.268	0.047	1.000	1.000	0.754
4	Prof_Trend	0.005	0.054	0.957	0.002	0.188	10.321	0.177
	Grow_Eff	-0.074	-1.662	0.097 *	-0.071	0.868	1.152	0.724
	Prof_NI_AOR	0.051	1.226	0.221	0.052	0.987	1.013	0.726
	DEBT_EQT	0.045	1.085	0.278	0.046	1.000	1.000	0.727

** p-value < 0.1 level of significance; ** p-value < 0.05 level of significance; *** p-value < 0.001 level of significance*

Of the seven LR ratios, the profit trend ratio exhibited a high VIF factor; all the other factors were below three. The profit trend ratio unstandardized (B) coefficient equals -5.26 and standardized Exp. (B) coefficient equals 0.0000463, with a z score of -0.11. This is an indication that the profit trend ratio has an inverse relationship in determining the viability or non-viability of a utility. Thus, coupled with high levels of VIF, the profit trend ratio is an outlier among the seven ratios identified by NRRI. After the profit trend ratio was removed from the LR analysis, the other six ratios were analyzed to separate the utilities between the viable and non-viable categories to determine the effectiveness of the predictors.

Step 2 of the LR Model

Table 4 presents the results from the LR using the six ratios with positive (B). The model R^2 is 0.704 indicating a high level of confidence in model predictions. The results from independent variables were tested both at the 0.01 (99%) and 0.05 (95%) probability levels. After removing the profit trend ratio, only the leverage ratio was significant. The rest of the independent variables were not significant, indicating that with the exception of the leverage ratio, the rest of the variables do not independently affect the viability classification.

Table 4: Results from the Six Selected Financial Ratios (All NRRI Ratios Except the Profitability Trend)

Step 1	B	S.E.	Wald	*df*	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Liquidity Ratio	0.024	0.015	2.675	1	0.102	1.025	0.995	1.055
Leverage Ratio	1.639	0.734	4.982	1	0.026 (**)	5.148	1.221	21.706
Debit to Equity Ratio	0.001	0.001	0.955	1	0.328	1.001	0.999	1.002
Growth& Efficiency	1.253	1.104	1.290	1	0.256	3.502	0.403	30.455
Efficiency & Profitability	2.706	3.297	0.674	1	0.412	14.969	0.023	9579.811
Profitability	0.113	0.646	0.031	1	0.861	1.120	0.315	3.974
Constant	-3.070	2.879	1.137	1	0.286	0.046		

(**) 95% or higher probability (liquidity ratio is close to 90% probability but does not make the cut).

Kremelberg (2011) asserts that the most valuable outcome of the logistic regression model is the determination of the significant variables in the equation table. Table 4 shows the test results for both the standardized Exp. (B) and the unstandardized (B) coefficients of the independent variables used in the regression. According to George and Mallery (2010), if an independent variable is significant at the 0.05 or 0.01 probability level, then that independent variable can predict the outcome without the help of the other predictors. The leverage ratio was significant (Sig. = 0.026 or 97.4% probability) at the 0.05 probability level. This means that higher levels of equity as a percentage of total assets will have a direct influence on the viability classification of a utility. In addition, Kremelberg explains that when the beta value (B) is greater than one, the predictor has a positive relationship with the outcome. The results indicate that three of the six financial ratios (leverage, growth and efficiency, efficiency and profitability) used in the analyses have a positive relationship with the classification of the outcomes.

Dutta, Bandopadhyay, and Sengupta (2012) describe the Wald statistic as the ratio of the unstandardized coefficient to the standard error (S.E.). Hence, the Wald statistic signifies the importance of each estimated (B). Higher values in combination with the degree of freedom (*df*) indicate the level of significance of each predictor in the model. All the selected financial ratios had a Wald statistic higher than 0.05, except for the profitability ratio. The profitability ratio had a 0.031 Wald statistic, which indicates that the determination of the viability and non-viability was less influenced by the profitability ratio as compared to the other ratios. Dutta, Bandopadhyay, and Sengupta (2012) recommend the dropping of an independent variable with less than 0.05 probability level. Because both (B) and Exp (B) have a positive relationship with the outcome, the profitability ratio was retained for the viable (non-viable) classification.

Kremelberg (2011) asserts that logistic models prefer the use of the odd coefficients in explaining the predictors' relationship to the outcome. The study adopted Kremelberg's preference in explaining the impact of changes in the financial ratios on the results of the reclassifications. The Exp (B) levels for the selected financial ratios are all greater than 1.0, indicating a direct or positive relationship between the financial ratios and the viability or the non-viability of the selected utilities. Table 5 indicates the results of the logistic regression using all the seven suggested NRRI financial ratios, with on-off decision criteria.

Table 6 results reflect the logistic regression model classification using the six selected ratios. The logistic regression tested the model by using the Hosmer and Lemeshow chi-square test (Steinberg, 2008) to determine the appropriateness of the data. The Hosmer and Lemeshow test indicate a 0.880 significant level with a chi-square value of 3.051. This is an indication that a meaningful logistic regression model with a high accuracy forecast between the predictors and the observed values exists. The logistic regression model reclassified the utilities based on the six selected financial ratios (liquidity ratio, leverage ratio, debt to equity ratio, growth and efficiency ratio, efficiency and profitability ratio, and profitability ratio). Six utilities classified as non-viable were reclassified as viable, while five viable utilities were reclassified as non-viable.

Table 5: The Logistic Regression Model Predictions Using all Seven NRRI Ratios

Logistic Regression Model		Percentage of Predictability
Non-viable	20	0%
Viable	27	100%
Total/ Overall percentage of predictability	47	

Table 6: Logistic Regression Model Reclassifications Using Six Ratios (Profitability Trend Dropped)

	Non-viable	Viable	Percentage of Predictability
Non-viable	14	6	73.7%
Viable	5	22	81.5%
Total/ overall percentage of Predictability	19	28	78.3%

Note: The cut value is 0.500

The reclassification table indicates the separation of utilities into both viable and non-viable as compared to the all-inclusive ratios from Table 4. The NRRI model based the classification on three arbitrary categories that did not follow any known benchmarks. The logistic regression model used a default cut value of 0.5 to split the probability into two categories. Utilities with a probability of less than 0.5 were classified non-viable, and utilities with probabilities of 0.5 or greater were classified viable. George and Mallery (2010) explain that the 0.5 cut value is the standard, or the benchmark built into logistics regression to separate outcomes into yes or no and in this case to viable or non-viable. Removal of the profit trend ratio reclassified six utilities previously categorized as viable by the all-inclusive NRRI model into the non-viable category, and another five utilities were reclassified as non-viable.

The test of the model against a constant model was statistically significant, indicating that the predictors categorized the utilities into viability and non-viability with a chi-square = 26.271, $p < .000$ with df =2. Nagelkerke's R^2 of .586 showed a reasonably strong relationship between prediction and grouping (Steinberg, 2008). The prediction overall success was 78.3% (81.5% for viable and 73.7% for non-viable). Thus, the logistic regression model predicts viability and non-viability with fewer variables, higher accuracy, and greater rigor. The statistical tests show that the logistic regression approach, developed in this study, contributes greater efficiency and effectiveness to the analyses. Table 7 summarizes the overall results of the NRRI and logistic regression model predictions.

Table 7: Comparison between the Summary Predictions of the NRRI Model and Logistic Regression

	NRRI Model	Logistic Regression Model	Difference
Viable	34	28	6
Non-viable	13	19	6
Total	47	47	

CONCLUDING COMMENTS

The NRRI model classified 13 utilities as non-viable and 34 utilities as viable. The NRRI model did not remove any outliers from the ratios. The logistic regression removed the profit trend ratio and identified three ratios that significantly influenced the classification of the utilities. The leverage ratio, the efficiency and profitability ratio, and the profitability ratio had a direct influence on the determination of utility viability using all the seven NRRI ratios. The other four ratios (i.e. the liquidity ratio, profit trend ratio, debt to equity ratio, and growth and efficiency ratio) did not have a direct influence and exhibited multicollinearity with the other ratios. Thus, three significant ratios and an outlier (the profit trend ratio) influenced NRRI model outcomes. Employing logistic regression analysis eliminated the discrepancies. The logistic regression model reclassified six of the utilities previously categorized by the NRRI model as non-viable into the viable category and reclassified another five utilities from the viable category into the non-viable category. The NRRI model used simple summary statistics with no known benchmarks to determine the viability and non-viability of water utilities.

This study shows that simply adding the results of analyses may allow a single financial ratio to influence the results. The NRRI model does not test the financial ratios to determine their statistical relationship to the results. The logistic regression model developed in this study uses a two-step approach to eliminate weaknesses in model prediction and to improve the rigor and accuracy of the results. First, the ratios proposed for use in the LR model are tested at the aggregate level to determine which should be included in the model. Those showing multicollinearity are eliminated. The final model includes financial ratios (independent variables) that have positive unstandardized (B) and standardized Exp (B) coefficients. This suggested LR model can be used by different states because it offers the flexibility. The model has its own benchmarks to classify the utilities into viable and non-viable categories based on a widely accepted probability cut value of 0.5. We propose that further studies establishing water and wastewater industry ratios be completed. After an industry ratio standard is established, future studies develop a multivariate model incorporating the steps described in the study.

Appendix: Description of the Financial Ratios Used in this Study

SPSS_CODE	Description of Ratios	Formula
Liq_Quick	Liquidity (LQ)	$\frac{Cash\ +short-term\ investments\ +\ net\ account\ receivables}{Current\ Liabilities}$
Lev_CS_TA	Leverage Ratio (LR)	$\frac{Common\ Stock\ Equity}{Total\ Assets}$
Lev_Debit_Eqt	Debt to Equity (DE)	$\frac{long-term\ Debt}{Common\ Stock\ Equity}$
Prof_Trend	Profit Trend (PT)	$\frac{Retained\ Earnings}{Common\ Stock\ Equity}$
Grow_Eff	Growth and Efficiency (GE)	$\frac{Annual\ Operating\ Revenues}{Total\ Assets}$
Eff_Prof	Efficiency and Profitability (EF)	$\frac{Annual\ Operating\ Revenues}{Annual\ Operating\ Expenses}$
Prof_NI_AOR	Profitability Ratio (PR)	$\frac{Net\ Income}{Annual\ Operating\ Revenues}$

REFERENCES

Altman, E. (September 1968). Financial ratios, discriminate analysis, and the prediction of corporate bankruptcy. *Journal of Finance*, 23, 589-609.

Beecher, J. A., Dreese, G. R., & Landers, J. R. (1992). *Viability policies and assessment methods for small water utilities.* Columbus, OH: National Regulatory Research Institute Report 91-17, 1-290.

Beecher, J. A., Higbee, J., Anthony, M., & Richard, D. (1996). *The regionalization of water utilities: Perspectives, literature review, and annotated bibliography.* Columbus, OH: National Regulatory Research Institute Report 96-21, 1-158.

Beecher, J. A., Mann, P. C., & Stanford, J. D. (1993). *Meeting water utility revenue requirements: Financing and ratemaking alternatives.* Columbus, OH: National Regulatory Research Institute Report 93-13, 1-217.

Dutta, A., Bandopadhyay, G., & Sengupta, S. (2012). Prediction of stock performance in the Indian stock market using logistic regression. *International Journal of Business and Information, 7*(1), 105-129.

George, D., & Mallery, P. (2010). *SPSS for windows step by step: A simple study guide and reference.* Boston MA: Allyn & Bacon.

Hair, J. F. (2010). Black, WC, Babin, BJ, & Anderson, RE (2010). Multivariate data analysis, 7.

Hosmer, D., & Lemeshow, S. (1989). Applied logistic regression. New York, NY: Wiley Interscience.

Kremelberg, D. (2011). *Practical statistics: A quick and easy guide to IBM SPSS statistics, SATA and other statistical software.* Thousand Oaks, CA: Sage Publishing.

Mertler, A. C., & Vannatta, R. A. (2013). *Advanced and multivariate statistical methods: Practical application and interpretation.* Glendale, CA: Pyrczak Publishing.

National Association of Regulatory Utility Commissioners. (1996). *Uniform systems of accounts for class C water utilities.* Washington, DC: NARUC.

Platt, H., & Platt, M. (2006). Understanding differences between financial distress and bankruptcy. *Review of Applied Economics*, 2(2), 141-157.

Platt, H., & Platt, M. (May 1973). Development of a class of stable predictive variables: The case of bankruptcy prediction. *Journal of Finance*, 28, 389-396.

Steinberg, W. J. (2008). *Statistics alive*. Thousand Oaks, CA: Sage Publishing.

Wardrop, A. (2000). Investor-owned utilities in financial distress: Re-organization options and the public interest. *University of Queensland Law Journal, 21*(1), 42-66.

Wirick, D. W., Borrows, D. J., & Goldberg, S. (1997). *Evaluating water utility financial capacity with ratio analysis and discounted cash flows*. Columbus, OH: National Regulatory Research Institute Report 97-18, 1-60.

BIOGRAPHIES

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Ara G. Volkan joined the FGCU faculty in August 2004 as Eminent Scholar and Moorings Park Chair of Managerial Accounting. He served as the Chair of the Accounting Department and the Associate Dean and Interim Dean of the Lutgert College of Business during 2006-2014. He received his doctorate in accounting from the University of Alabama in 1979. Dr. Volkan is a member of the FICPA and AAA. He serves as reviewer for several journals. He published numerous articles in academic and professional accounting journals and in other publication outlets. Email: avolkan@fgcu.edu