Statistical Methods in Valuation Analysis: Coefficient of Variation

This third installment of the six-part Health Capital Topics series on the application of statistical methods by valuation analysts will provide a brief overview of the coefficient of variation (CVAR) and its utilization on various valuation techniques and methodologies. The (CVAR) is a convenient measure of dispersion, i.e., the amount of spread in the data, which describes the variance of data relative to its mean. It is calculated as the standard deviation of the subject sample divided by the mean of such sample, as demonstrated in the equation below:

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CVAR = \frac{Sample \ standard \ deviation}{Sample \ mean}
\]

The size of the CVAR can be interpreted as a measure of the relative spread of the sample data. As the calculated CVAR approaches zero, this indicates less relative dispersion within the sample; inversely, a CVAR moving away from zero signifies a greater level of dispersion. When the sample standard deviation is greater than the sample mean, this will produce a CVAR with a coefficient greater than one. If this occurs, it indicates that both positive and negative values exist within one standard deviation of the sample mean; the interpretation of this result varies depending on the data and how they are measured. For instance, when conducting a valuation analysis, suppose the estimated value of a company – the sample mean – is a positive number, but the standard deviation is greater than that estimated value. Thus, one standard deviation below the estimated value has to be a negative number; depending on the data being analyzed, the switch in sign may be significant, e.g., if analyzing measures of profit, the potential for a negative profit may indicate significant risks as compared with a data set indicating a CVAR below one (1).

However, because the sample mean is the denominator of the equation, one limitation of the CVAR is that the mean can never equal zero. Therefore, if zero is the expected value when conducting a valuation, the CVAR is a not useful statistic to calculate. Simply one advantage of using the CVAR in contrast to other measures of dispersion, such as standard deviation and variance, is that it is independent of units of measurement, i.e., the calculated CVAR is a percentage that can be compared across data sets, regardless of whether they use different units of measurement. For example, if one set of data is measured in pounds and another in kilograms, the CVAR would allow a researcher to compare the dispersion between the two sets without having to perform unit conversions. Additionally, the CVAR is also useful in the comparison of dispersion between multiple sets of data that have the same unit of measurement, yet different means and standard deviations.

CVAR is a popular statistic in research across the medical, physical, and social sciences, and has been in use since the early twentieth century. One way the CVAR has been used in valuation analysis, in particular, is to compare how accurately different models can arrive at an estimate. For example, in the case of valuing the welfare of environmental quality, one researcher used the CVAR as a way to compare the results of two regression models (see the fifth installment of this six-part series for more information on regression analyses) to determine which fit the data best. Further, the CVAR may also be useful in the measurement of risk, i.e., the degree of uncertainty for an entity. For example, an entity’s risk stems from fluctuations in both consumer sales and its level of fixed costs. Thus, it is important from a valuation perspective to estimate risk in order to understand the reliability of the future income flow of the entity, which forms the basis of value. The CVAR provides insight into the relative certainty of performance indicators that will influence an analyst’s perspective on the riskiness of the investment in the subject property.

A CVAR calculation may also support the development of defensible financial forecasts in a valuation analysis. Opining on the value of a healthcare enterprise, asset, or service is a function of many variables, many of which are unknown and/or may be influenced by events that have not yet occurred. In light of this reality, valuation analysts may find it prudent to conduct sensitivity analyses to determine the level of uncertainty associated with their estimates. For instance, if two companies have a forecasted growth of two percent for the following year, yet one company has grown exactly two percent for the past ten years and the other has grown between 0.5 and four (4) percent for the past ten (10) years, the forecast for the latter company may be subject to increased variation, which may decrease the confidence of the forecast for the latter company relative to the former company. A valuation analyst may measure his or her
confidence in the forecast by calculating the CVAR, with a lower figure indicating greater certainty that the forecast will be accurate. For the purpose of a valuation analysis, the confidence of a forecast is important because increased certainty means a lower perceived risk, which may translate into a lower risk premium and, thereby, a lower discount rate.

Determining an appropriate discount rate is among the essential components of a defensible valuation opinion, as it allows the value of an enterprise, asset, or service to be calculated more accurately as the researcher estimates into the future.

In addition to utilizing the CVAR in financial forecasting, this measure also supports the valuation analyst’s synthesis of benchmark comparisons. Benchmark comparisons allow a valuation analyst to determine how an individual company varies from industry norms. For example, if a hospital in Missouri sought to determine whether the compensation paid to its hospital-based physicians is in accordance with industry norms in the state, the analyst may either: (1) locate compensation data for this population across Missouri and compute a mean and standard deviation for the data; or (2) utilize previously collected survey data on this metric. CVAR is important in this scenario, as this technique provides the analyst with an indication of the relative volatility within the industry. A higher CVAR denotes a wider relative variation among the studied population for the metric at issue, whereas a lower CVAR signifies relative stability for this metric. If the hospital determined that compensation fell outside of the industry normative benchmark or survey data, the CVAR may be a useful tool in determining where the researcher should focus their concern. If the CVAR for industry compensation is high (indicating high volatility in the industry relative), falling outside of the normative benchmark may be a sign of industry/survey volatility, rather than the individual hospital being a potential outlier. However, if the CVAR for industry compensation is low (indicating low volatility in the industry), the hospital may be paying its physicians more or less than the market for hospital-based physicians in a geographic area.

Although the CVAR has wide applications in valuation analyses, utilization of this technique is subject to certain limitations. As mentioned earlier, for a sample mean that approaches zero, the CVAR approaches infinity and eventually becomes undefined, rendering this metric ineffective. Further, the CVAR works better with large sample sizes and is subject to the same biases as its underlying measures: the standard deviation and mean. The presence of certain abnormalities in a sample, such as outliers, could introduce bias into the CVAR by affecting the accuracy of the underlying data. This potential problem highlights the importance of utilizing sufficiently sized data sets and avoiding sample bias.

Analysts should consider the utility of the CVAR described above when conducting valuations of an enterprise, asset, or service. In particular, the CVAR may support the defensibility of a particular financial forecast or benchmark comparison depending on the needs set forth in the engagement and the data being studied, so long as the statistic is not misused or misrepresented in the analysis. The fourth installment of this six-part series will discuss data sets and samples, their impact on valuation analyses, and potential pitfalls or mistakes in their interpretation.

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3 Ibid.
5 Ibid.
10 Ibid, p. 347.
14 Ibid, p. 36.
15 Ibid.
16 Ibid, p. 89.
17 Ibid, p. 119.
19 Ibid, p. 119-120.
20 Choi, 1978, p. 68.
22 For more information on sample bias, see Part Two of this series entitled, “Statistical Methods in Valuation Analysis: Descriptive Statistics.”

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Mr. Cimasi holds a Master in Health Administration from the University of Maryland, as well as several professional designations: Accredited Senior Appraiser (ASA – American Society of Appraisers); Fellow Royal Institution of Chartered Surveyors (FRICS – Royal Institution of Chartered Surveyors); Master Certified Business Appraiser (MCBA – Institute of Business Appraisers); Certified Valuation Analyst (CVA – National Association of Certified Valuators and Analysts); and, Certified Merger & Acquisition Advisor (CM&AA – Alliance of Merger & Acquisition Advisors). He has served as an expert witness on cases in numerous courts, and has provided testimony before federal and state legislative committees. He is a nationally known speaker on healthcare industry topics, and is the author of several books, the latest of which include: “The Adviser’s Guide to Healthcare – 2nd Edition” [2015 – AICPA]; “Healthcare Valuation: The Financial Appraisal of Enterprises, Assets, and Services” [2014 – John Wiley & Sons]; “Accountable Care Organizations: Value Metrics and Capital Formation” [2013 – Taylor & Francis, a division of CRC Press]; and, “The U.S. Healthcare Certificate of Need Sourcebook” [2005 - Beard Books].

Mr. Cimasi is the author of numerous additional chapters in anthologies; books, and legal treatises; published articles in peer reviewed and industry trade journals; research papers and case studies; and, is often quoted by healthcare industry press. In 2006, Mr. Cimasi was honored with the prestigious “Shannon Pratt Award in Business Valuation” conferred by the Institute of Business Appraisers. Mr. Cimasi serves on the Editorial Board of the Business Appraisals Practice of the Institute of Business Appraisers, of which he is a member of the College of Fellows. In 2011, he was named a Fellow of the Royal Institution of Chartered Surveyors (RICS). In 2016, Mr. Cimasi was named a “Pioneer of the Profession” as part of the recognition of the National Association of Certified Valuators and Analysts (NACVA) “Industry Titans” awards, which distinguishes those whom have had the greatest impact on the valuation profession.

Todd A. Zigrang, MBA, MHA, ASA, FACHE, is the President of HEALTH CAPITAL CONSULTANTS (HCC), where he focuses on the areas of valuation and financial analysis for hospitals, physician practices, and other healthcare enterprises. Mr. Zigrang has over 20 years of experience providing valuation, financial, transaction and strategic advisory services nationwide in over 1,000 transactions and joint ventures. Mr. Zigrang is also considered an expert in the field of healthcare compensation for physicians, executives and other professionals.

Mr. Zigrang is the co-author of “The Adviser’s Guide to Healthcare – 2nd Edition” [2015 – AICPA], numerous chapters in legal treatises and anthologies, and peer-reviewed and industry articles such as: The Accountant’s Business Manual (AICPA); Valuing Professional Practices and Licenses (Aspen Publishers); Valuation Strategies; Business Appraisal Practice; and, NACVA QuickRead. In addition to his contributions as an author, Mr. Zigrang has served as faculty before professional and trade associations such as the American Society of Appraisers (ASA); the National Association of Certified Valuators and Analysts (NACVA); Physician Hospitals of America (PHA); the Institute of Business Appraisers (IBA); the Healthcare Financial Management Association (HFMA); and, the CPA Leadership Institute.

Mr. Zigrang holds a Master of Science in Health Administration (MHA) and a Master of Business Administration (MBA) from the University of Missouri at Columbia. He is a Fellow of the American College of Healthcare Executives (FACHE) and holds the Accredited Senior Appraiser (ASA) designation from the American Society of Appraisers, where he has served as President of the St. Louis Chapter, and is current Chair of the ASA Healthcare Special Interest Group (HSIG).

John R. Chwarzinski, MSF, MAE, is Senior Vice President of HEALTH CAPITAL CONSULTANTS (HCC). Mr. Chwarzinski’s areas of expertise include advanced statistical analysis, econometric modeling, as well as, economic and financial analysis. Mr. Chwarzinski is the co-author of peer-reviewed and industry articles published in Business Valuation Review and NACVA QuickRead, and he has spoken before the Virginia Medical Group Management Association (VMGMA) and the Midwest Accountable Care Organization Expo.

Mr. Chwarzinski holds a Master’s Degree in Economics from the University of Missouri – St. Louis, as well as, a Master’s Degree in Finance from the John M. Olin School of Business at Washington University in St. Louis. He is a member of the St. Louis Chapter of the American Society of Appraisers, as well as a candidate for the Accredited Senior Appraiser designation from the American Society of Appraisers.

Jessica L. Bailey-Wheaton, Esq., is Vice President and General Counsel of HEALTH CAPITAL CONSULTANTS (HCC), where she conducts project management and consulting services related to the impact of both federal and state regulations on healthcare exempt organization transactions and provides research services necessary to support certified opinions of value related to the Fair Market Value and Commercial Reasonableness of transactions related to healthcare enterprises, assets, and services. Ms. Bailey is a member of the Missouri and Illinois Bars and holds a J.D., with a concentration in Health Law, from Saint Louis University School of Law, where she served as Fall Managing Editor for the Journal of Health Law & Policy.

Kenneth J. Farris, Esq., is an Associate at HEALTH CAPITAL CONSULTANTS (HCC), where he provides research services necessary to support certified opinions of value related to the Fair Market Value and Commercial Reasonableness of transactions related to healthcare enterprises, assets, and services, and tracks impact of federal and state regulations on healthcare exempt organization transactions. Mr. Farris is a member of the Missouri Bar and holds a J.D. from Saint Louis University School of Law, where he served as the 2014-2015 Footnotes Managing Editor for the Journal of Health Law & Policy.