How to Determine Which Market Multiple to Use

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Choices that Range from Arithmetic Mean to Linear Regression

How should valuation analysts go about selecting a transactional multiple? There are a host of multiples and options for deriving these. In this article, the author shares his thoughts on what to consider when selecting a multiple.

Resources:
Regression Analysis—Construction and Interpretation

The Use of Regression Analysis in the Market Approach

Regression Analysis as a Tool for Validating Valuation Methodology

The Market Approach: Ways to Tame the Beast

What's that Mean? Five Principles to Avoid Overvaluing a Company

Even though I know that the weighted harmonic mean is theoretically the correct measure of central tendency for a series of ratios where neither the numerator nor the denominator is constant, I still ask myself the following question when I work with the transaction databases: "How do I know what proper measure of central tendency to use in any given situation?" I thought, perhaps other analysts might need some help in choosing the best driver of a valuation multiple—is it always the weighted harmonic mean, or perhaps the arithmetic mean, the median, or the harmonic mean might be more appropriate for a data set? What about a

regression-derived multiple? One way to answer this question is to suggest that the best measure of central tendency with which to create a valuation multiple is that measure that is the best predictor of past value. The best predictor of value would be that multiple, however derived, which when applied to revenue or cash flow, produced valuation results that best matched up with the actual selling prices as listed in that data set. We could implement this procedure in the following way:

For example, after removing the obvious classification errors, I found 40 transactions in the Bizcomps retail pet store NAICS code. I set up a separate worksheet for each measure of central tendency—arithmetic mean, weighted harmonic mean, harmonic mean, and the median, as well as a simple linear regression model. On each worksheet, I inserted revenue and selling price in two columns, and computed the individual pricing multiple in a third column. I then calculated the appropriate measure of central tendency, e.g., the mean, and then multiplied that measure of central tendency times the individual revenues of the 40 transactions. This gave me 40 predicted selling prices.

I then computed the root mean squared error (RMSE) of the difference between the 40 actual selling prices and the 40 predicted selling prices. This is accomplished by subtracting the predicted selling price from the actual selling, squaring that difference, summing the 40 differences, dividing that sum by 39 (40 – 1) to obtain the average variance, and then taking the square root of the variance. This gives me an approximation of the standard deviation of the differences between actual and predicted selling prices. Next, I accounted for and removed outliers by standardizing the differences between actual and predicted selling prices by dividing each of the 40 differences by the RMSE, and then eliminating those transactions that exceed one's cut-off point of choice—mine happens to be 2.5 standard deviations. For some measures of central tendency, no transactions were eliminated and for others, up to as many as three transactions were eliminated. The result for the revenue multiple showed that the harmonic mean, not the weighted harmonic mean, was the best predictor for this data set as measured by minimum RMSE.

Of course, none of these models could hold a candle to a linear regression model, which will always produce the lowest RMSE. In this case, the regression model showed a 45.5% improvement over the arithmetic mean RMSE while the harmonic mean, weighted harmonic mean, and median showed 21.2%, 8.2%, and -.4% differences, respectively, from the arithmetic mean as shown in the following table, along with computed selling prices when subject company revenue is $594:

	WHM	Harmonic Mean	Arithmetic Mean	Median	Regression
RMSE	111.5	95.82	121.51	121.96	66.24
Delta—Avg.	8.2%	21.1%		-.4%	45.5%
Count	40	39	38	40	37
Subj.—$594	$162	$133	$210	$181	$157

Note that the weighted harmonic mean (WHM), while only an 8.2% improvement over the average RMSE, is only $5 more than the price calculated by the regression model; while the harmonic mean with a 21.1% improvement over the average RMS is $24 less than the price calculated by the regression model.

The following table shows similar results for Seller's Discretionary Earnings (SDE) for the same 40 retail pet stores:

	WHM	Harmonic Mean	Arithmetic Mean	Median	Regression
RMSE	82.68	75.29	81.57	83.82	68.33
Delta—Avg.	-1.36%	7.69%		-2.76%	16.24%
Count	39	38	38	39	38
Subj.—$86	$139	$119	$157	$146	$151

Note again that the harmonic mean has the lowest RMSE, but for the regression model; and that the arithmetic mean comes closest to the regression model using SDE as the value driver. But more importantly, the regression model not only has the lowest RMSE of either value driver, but it also delivers almost the same price when applied to median revenue and median SDE.

Take away: Always use a regression model if you can. If not, do not rely only on theory when choosing a measure of central tendency. Each data set has its own quirks, so test each multiple using the technique described above.

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