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## **A mathematical model should be in your valuation toolbox**

September 04, 2014 - Northern New England

We can all recite it by heart; "The most probable price that would be paid between a willing buyer and seller in terms of cash, with neither being required to act...." This definition of market value is used in 95% of the assignments we complete, but how often do we really think about the first part of the definition, "the most probable." Last week while explaining my value opinion to a client they really drove this point home to me.

"So what you're telling me," my client said, "is that your value is the peak of the probability curve?"

"In a word; exactly," I responded.

However, for many reasons, a final opinion of value is not purely that at the mathematical peak of the histogram of individual indications. Classically, there are only three indications of value going into a final reconciliation; those by cost, income and sales. A histogram of three data points is no histogram at all and would not result in a credible result if given sole consideration. An appraiser must carefully weigh the applicability of each valuation technique, the reliability and range of the supporting data, the behavior of the market, and finally use their experience and judgment to conclude their opinion of the most probable price. This does not mean that statistical concepts and mathematical probability have no role in an analysis; quite the opposite is true.

My formal training is in engineering. During my career at a major consumer products company statistical analysis techniques were the underlying tool used to improve product performance and manufacturing tolerance. Factorial experiments were designed around those 'elements of comparison' most important to performance, or in other words value. Product was specifically built with careful manipulation of the elements; slightly larger, slightly smaller, slightly wetter, slightly dryer... value was measured in a perfectly economic market, the test rack. Simply put, a wonderfully controlled paired sales analysis unbiased by the often emotional actions of the market. In this system the contribution of each individual element as well as interactions of two or more on value could be resolved to a 95% confidence interval, repeated and used to make billion-dollar decisions. If only real estate were so easily manipulated and measured.

In appraisal practice, elements of "the most probable" underlie every step of the analysis, but are most evident in the sales comparison approach. It is not possible to construct beautiful factorial experiments where elements of comparison; size, quality, condition...; vary in a specific way and their response on value is measured in a perfectly economic system. However, every day the market delivers data on the price of a specific set of elements. This data, pulled together into simple linear regressions based on a single element such as time, size, traffic count..., make it possible to form a statistically sound opinion of their most probable effect. More advanced non-linear regression methods applied to the same data allow the most accurate measure of the response of the market to a specific element of comparison. Finally, formed into matrices and placed under even more sophisticated multi-variate regression analysis it is possible to form statistically sound opinions of an

entire price response surface to multiple elements of comparison. The latter is the basis of the computational valuation models (CVM's) that have taken hold in the residential valuation field over the past 10 years.

Recently the Appraisal Institute responded to the need for appraisers to understand these techniques. They developed and delivered education specific to the use of linear regression in appraisal practice and have developed an Analytics for Valuation professional development program. These courses are a great way to start understanding the value of these techniques in your practice.

In no case should a credentialed appraiser simply allow a mathematical model to determine their final opinion of value; "the computer said" is never a valid reconciliation technique. However, statistical techniques can help explain the behavior of a market, support a proper analysis of value, are inherent in an opinion of the "most probable price," and should be in your valuation toolbox.

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