



# The basics of regression analysis

By *Ernie Durbin*, member of the Appraisal Practices Board of The Appraisal Foundation

It's no secret that residential appraisers increasingly are encountering regression analysis in their day-to-day work. Regression analysis is a statistical tool that assists appraisers in providing valuation conclusions. In particular, regression uses data to show how different property attributes, such as square footage, might impact the value of a property within a specific set of properties, geographic area or marketplace.

Through this analysis, a regression model can provide the estimated contribution of individual property attributes and predict the final value of a home. Properly applied, regression analysis can serve as an effective form of "checks and balances" for appraisers to compare to their own opinions and conclusions. It also can help appraisers get a better sense of how certain property attributes are viewed within a particular marketplace. While regression analysis is a useful tool, there are a number of considerations an appraiser should take into account before employing it in an appraisal practice.

Regression analysis is a common statistical tool used for predictive analysis in a number of professions. At its most basic level, a regression model predicts how a set of independent variables will impact one single, dependent variable. To do so, a model will take into account the relative impact of each independent variable on the dependent variable by assigning different coefficients. One can then place a set of unique variables into the model to arrive at a predicted dependent variable.

In the case of appraisal-related regression analysis, the independent variables are the different property characteristics, and the dependent variable is the sale price of the property. There are a number of different software programs and methods appraisers can use when conducting regression analysis. However, in all cases, the first step is to have a credible set of data. That means compiling sales data of properties within the marketplace being analyzed. It also means using a data set large enough to create credible results.

Although there are many types of regression, most models use a multivariable approach, in which each property characteristic is given a coefficient based on how strongly it correlates to the final sale price. The ones that most strongly impact sale price are weighted to a greater degree than those that have less of an impact. This allows the creation of a model in which a unique set of independent variables for a property can be inputted to arrive at an estimated value.

There are several potential advantages to regression

analysis. Perhaps most useful to appraisers is the ability to use it as a form of checks and balances to better assess their own opinions and conclusions. To do so, an appraiser compares their opinion of the value contribution of property characteristics with the coefficients derived by a regression analysis. It also may assist appraisers in identifying the relative importance of certain property characteristics within a particular marketplace. For instance, a regression model for homes within a neighborhood in the San Francisco Bay Area may show that solar panels and other green features have a significant impact on the final sale price of a home. However, a similar analysis in a neighborhood of North Dakota might show that those same features are not nearly as relevant in determining value. This can help appraisers understand the unique marketplace in which they work and changing consumer preferences on a broader scale.

Regression analysis cannot replace an appraisal completed by a licensed or certified appraiser. There are many qualitative factors that an appraiser must evaluate, which are difficult to quantify and represent in a regression analysis model. For instance, an appraiser might take into account a highly desirable kitchen remodel in a particular home. Regression models can be designed to account for new attributes and eliminate statistical outliers. Despite these advances, however, regression analysis remains reliant upon meaningful data, and appraisers are better equipped to evaluate more qualitative considerations such as the example above. Inaccurate or incomplete data in a regression analysis will lead to flawed results.

It is critical that an appraiser has the proper training and competency for the regression analysis they are performing. An appraiser employing a regression model should consult the Appraisal Standards Board's (ASB) Advisory Opinion 18, "Use of an Automated Valuation Model (AVM)," which explains the steps an appraiser needs to consider when using these methods. Alternatively, if an appraiser uses a regression model through a software package to identify relevant property characteristics and how to evaluate them, a different level of competency may be required. Appraisers can evaluate the accuracy of the coefficient values given to property characteristics by using sensitivity analysis and other traditional appraisal methodologies, such as paired-sales analysis. It is important that appraisers do not simply "accept" the values provided by a regression analysis software package without further analyzing those values.

Overall, regression analysis is a useful tool for appraisers, serving as an additional valuation methodology to be applied in an appraisal. Regression analysis can provide further insight into which property



characteristics are most valued within a particular marketplace. However, an appraiser using regression analysis must be competent in the application of the analysis. Picking up a hammer does not make a person a carpenter. There are many educational resources and textbooks that are written specifically for appraisers on regression analysis. Appraisers availing themselves of these resources can gain competency in using this modern valuation technique.

Regression analysis is an emerging valuation technique that forward-thinking appraisers should not ignore.

Many clients and intended users of the appraisal reports are applying regression-based systems in evaluating the veracity of appraisal reports. That being said, most users of appraisal reports know regression analysis cannot replace an appraisal completed by a licensed or certified appraiser. Professional appraisers have the ability to take into account a number of qualitative and quantitative factors that regression cannot capture. These same appraisers, however, utilizing regression methodologies can better support their opinions and valuation conclusions.

## Getting on the same page with valuations

**Mark Stockton**, managing partner at MR Technology Holdings LLC, helped launch automated valuation technology in the early 1980s. He spoke with **Valuation Review** about how different valuation methodologies are at the heart of miscommunication in the appraisal industry.

**Q.** You've been involved with valuation analytics for a long time. What, in your opinion, is the biggest misconception about automated valuation products?

**A.** I developed the first commercially marketed automated valuation technology in 1981. Soon after the introduction of this technology, people began trying to fashion it into a "silver bullet" capable of curing all valuation needs. That isn't ever going to happen.

**Q.** Why not?

**A.** Even the best valuation technology, fueled by the very best available data, will produce a significant percentage of value estimates that are incorrect or indefensible. Valuation technology is neither infallible, nor is it capable of taking into account unknown factors, such as property condition and the impact of locational influences.

**Q.** What, then, is the best approach to ensure accurate property valuations in the age of analytics, automation and enhanced appraisal technology?

**A.** First, you must have all of the "key ingredients," as I call them. These include:

- A lender who is more concerned about the accuracy of every valuation, and adherence to responsible lending guidelines, than about loan volume.
- An impartial appraiser who is well-trained, and who has access to — and a working knowledge of — good valuation analytics.

- Good analytics are interactive analytics that are capable of producing defensible value estimates, and are fueled by real estate information that is reasonably complete, accurate and current.

**Q.** What is the recipe for combining those key ingredients?

**A.** Let me answer that question by first explaining how they should not be combined. Here's how it generally works today: An individual goes online and gets a home value. They apply for a loan, and the lender orders an AVM to determine whether to proceed with the application. If the lender is somewhat satisfied that the residence might support the loan, a request goes out to an appraiser who prepares an appraisal. The appraisal is reviewed by the AMC, and perhaps the lender, to determine whether the value justifies the loan amount.

At each stage, different data is used and different methodology is applied — and the parties all express surprise when the results don't line up exactly right!

**Q.** So how would you propose the process be improved?

**A.** In my opinion, all parties would optimally have access to the same valuation technology fueled by the same data. There are a lot of available options; the essential aspect is that they all have access to the same technology/fuel. While the presentation of the output and the degree of interactivity might differ for the consumer, the lender, the appraiser, etc., the methodology should be consistent.

Imagine how seamless the process would become if the consumer, searching for a home value, could go to a site that offered a good valuation "engine" that allowed a reasonable degree of interactivity (giving the homeowner the opportunity to correct errors and omissions in the data about his or her home) and provided meaningful results in a transparent presentation. Imagine how beneficial it would be if a potential lender could share that information — the corrected property information and 100 percent of the valuation detail. The