

## AVMs: Unsafe at Any Speed

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### Some of the Questions Needing Answers

- Is the product from an AVM an appraisal?
- If an AVM is used in place of an appraisal, does it have to comply with the Uniform Standards of Professional Appraisal Practice (USPAP)?
- Is the output from an AVM always correct? How do we know when an AVM is correct or when it is wrong?
- Are all AVMs alike? How do we know which one to use?
- Who is qualified to use an AVM? Can anyone use an AVM? Are appraisers qualified to use AVMs? If a designated or licensed appraiser uses an AVM, does that make it an appraisal?
- Are there some AVMs that are better than others? Are there good AVMs and bad AVMs? How do we know?
- Who regulates AVMs? Are there agencies and rules like the Appraisal Boards and USPAP that regulate those who design and sell AVMs?
- Are AVMs based on appraisal theory?
- If an AVM is totally independent from any influence or any manipulation, and the mathematics are infallible, then would prospective home buyers be allowed to run their own AVMs?

These are only a few of the questions that have not yet been answered, or for that matter even addressed, by the Appraisal Standards Board or any other regulatory agency that recognizes AVMs as an alternative to an appraisal. To see if answers to these questions exist, some background of the situation is beneficial.

Advocates of automated valuation models (AVMs) claim that the use of these models saves the consumer money. They also maintain that AVMs are mathematically infallible and that the use of AVMs expedites the lending process. This paper investigates these claims and reveals that there are more inherent problems than benefits with the use of AVMs. Currently the consumer is unprotected from any potential problems that may arise from the use of AVMs. Furthermore, there are no official standards or guidelines regulating AVMs as there are with appraisals. Additionally, the consumer has no legal (or human) recourse against an AVM, as no such applicable regulations exist. In fact, the only authoritative recognition of AVMs states that an AVM is not an appraisal, although AVMs are being used in place of appraisals. Additionally, the mathematical basis for AVMs has inherent logical fallacies and potential ethical ramifications.

## How We Got Here

Statistics first began to play a significant role in the appraisal process in mass appraising, such as in assessor's offices throughout the country. Also, statistics have been firmly established in finance for quite some time.<sup>1</sup> The latter situation appears to have given birth to the latest AVM uses and adaptations.<sup>2</sup> Fannie Mae and Freddie Mac are the biggest players currently using AVMs in place of appraisers. However, as computer-based programs become more comprehensive, computers get faster, and data sources grow more consistent and more compatible, then the use of AVMs and AVM providers will become more prolific. Today there is an indeterminate number of providers, as new ones appear on the Internet daily. Some of these providers offer AVM conclusions for as little as a few dollars. The unchecked uses of AVMs, and the growing number of providers, are directly attributable to the computer.

## A Long Time Ago in a Galaxy Far, Far Away ...

It seems like an eon ago when Charles Babbage conceived the first general-purpose digital (mechanical) computer in 1833. Back then it was known as an *analytical engine* or a *difference engine*. However, it was not that long ago when the first truly electronic computer, named ENIAC (an acronym for Electronic Numerical Integrator And Computer), came into reality. ENIAC was a 1,600-sq.-ft., 30-ton computer containing 17,468 vacuum tubes and 6,000 manual switches. This is very different from the desktop PCs of today. Not only was it big, it literally took days and sometimes weeks to make the same calculations that take only seconds today. The 1950s saw the beginning of the IBM family, and yet only 2,000 were in the business world by 1960. Between 1960 and 1974 the transition went from tubes to transistors to integrated circuits to microprocessors. Apple produced the first desktop PC in 1977. IBM came along big-time in 1981 with its first 8000 series. This series became the infamous 8086, 80286, 386, 486, etc. There is no doubt that the abundant use of AVMs today is entirely due to the state of computer technology. Not only is AVM output available over the Internet for just a few dollars, an entire AVM program can be obtained for just a few hundred dollars. Either way, appraisers and non-appraisers alike can render a value conclusion within seconds and never leave their offices. But the question still remains, is an AVM an appraisal?

## Is the Product of an AVM an Appraisal?

Probably the most perplexing question is whether or not the output of an AVM is an appraisal. There is an old saying: If it walks like a duck and talks like a duck, it must be a duck. If we apply this conjecture in the form of the simplest logic, we can answer this first question. Currently, Fannie Mae and Freddie Mac are using AVMs instead of appraisals. If the output of an AVM is used in place of an appraisal (to estimate market value), then it must be an appraisal.

That makes sense. That is, until we read Advisory Opinion 18 of USPAP, which states, "The output of an AVM is not, by itself, an appraisal."<sup>3</sup> That statement not only contradicts the logic just presented, it also contradicts the actual definitions of the words *automated valuation model*. *The American Heritage Dictionary* defines *automate(d)* as "operated by automation."<sup>4</sup> The term *valuation* means "the act or process of assessing value or price; an appraisal." The word *model* has some variations, but certainly not outside the context of its use here. It is "a standard or example for imitation or comparison" as well as "a representation ... to show the structure or serve as a copy of something." In AVMs, the model copies an appraisal. Thus, from a definitional standpoint, an AVM is an automated appraisal.

The question of whether an AVM is an appraisal or not is paramount to the longevity of the appraisal profession as we know it today. As computers get faster and software gets cheaper, the techniques used mostly in the residential arena are being adapted to the commercial forum. In a matter of minutes on the computer clocks, AVMs will be heavily relied upon instead of commercial appraisers. In fact, on February 1, 2000, COMPS.COM introduced *COMPS AVM*. The company's Internet site advertises the following: "COMPS AVM Technology estimates the market value of a given commercial or multi-family property ..." In a live Internet chat room discussion, Vernon Martin, an official of COMPS, Inc. stated, "Our first customers are commercial banks." In addition, he said that he anticipates "the industrial AVM will be priced at \$329 and the multi-family AVM will be priced at \$179 and \$279, depending on the number of units."

Therefore, in addition to the logical look and the definitional review, we can take a reality check in the form of an analogy, and the absurdity of AO-18 becomes even more evident. At the University of California in Davis, scientists have created genetically

engineered tomatoes (let's call them *automated tomato models* or ATMs). When genetically engineered tomatoes (ATMs) are placed next to tomatoes grown by a farmer the old-fashioned way, they are indistinguishable from each other. They look virtually the same and taste the same. As the saying goes, if it looks like a tomato and tastes like a tomato, then it must be a tomato—that is, unless we apply the same doublespeak from AO-18. For this genetically engineered fruit not to be a tomato only requires our declaration that they are not tomatoes; therefore, they are not.

Based upon the preceding reasoning and analysis, there should be no doubt as to whether an AVM is an appraisal. Simply making the declaration that an AVM is not an appraisal, is intentionally ignoring the reality that an AVM is, was, and always will be an appraisal, i.e., an estimate of market value. In fact, this position borders on negligence. When queried, an Appraisal Standards Board member stated that an AVM is no different than a discounted cash flow (DCF) analysis. However, when pressed on how many times a DCF has been substituted for an appraisal, he had no answer. The fact is a DCF is not being used as a substitute for an appraisal because a DCF is not an appraisal. While the question may never be answered, one can look at the organizational chart of The Appraisal Foundation to find a possible reason why this doublespeak is allowed. The top five positions are all the regulatory agencies, the same agencies that are allowing this ruse to exist.<sup>5</sup> These same agencies are chartered to protect and maintain the public's trust in the lending institutions using AVMs.

### Are AVMs Logical?

Now that the fundamental question has been answered—an AVM *is* an appraisal—the question of whether an AVM must meet USPAP can easily be answered. That answer is yes. An AVM used for the purpose of an appraisal should adhere to the same standards applied to appraisers when they perform an appraisal. Why should there be different standards?

The next important question asks whether an AVM is logical. Appraisal literature abundantly points out the necessity of including and following the appropriate appraisal process and the need to include all the relevant information and the appraiser's reasoning in the appraisal report for all to see, follow, and understand. The Uniform Standards mention the

terms *reason(s)* and *reasoning* well over 20 times. What is the logic underpinning an AVM? Is it similar to the reasoning presented by appraisers? The answer is no. The logic (mathematical as it is) is not the same as that presented by appraisers. In fact, the underlying assumptions inherent in AVMs are riddled with logical fallacies—i.e., are arguments that are so weak that the premises (reasons) do not support the conclusion or the conclusion is based on invalid assumptions.

### Logical Fallacy No. 1: Affirming the Consequent

This fallacy contends that if you have enough evidence to affirm the consequent of a conditional and suppose that, as a result, you have sufficient reason for affirming the antecedent, then you commit the fallacy of affirming the consequent.

*Example:* If the price is affected, it is due to the number of bedrooms. The AVM concludes that the number of bedrooms is THE effect on price. So it must be the number of bedrooms.

Obviously, there could be other reasons why the price would vary. Appraisers can make inquiries, interview buyers and sellers, and ascertain from the parties to the transaction precisely what affected the price. AVMs cannot.

### Logical Fallacy No. 2: Post hoc

This is the shortened version of the Latin *post hoc ergo propter hoc*—"after this, therefore because of this." This fallacy is the incorrect assumption that merely because two events occur together, one is the cause and the other is the effect. In other words, just because one event precedes another does not mean that it affects, influences, causes, or relates to the other.

*Example:* If one house has four bedrooms and its price is higher than one with three bedrooms, the extra bedroom is not then necessarily the cause for the higher price.

### Logical Fallacy No. 3: Appeal to the Majority

This fallacy is committed whenever the presumption is made that a fact is true because large numbers of people accept it or large numbers prove it (mathematically speaking).

*Example:* Most lenders use AVMs, so you should use an AVM. This is also known as the "bandwagon appeal." All

AVMs are statistically sound, therefore all AVMs are correct (because everybody's doing it). Yet another slant is the "appeal to authority"—e.g., because the result produced by the AVM is based on 5 million sales, it must be right.

#### Logical Fallacy No. 4: Begging the Question

This involves trying to support a proposition with an argument, in which the proposition is a premise.

*Example:* Self-evident truths, such as "No one can deny," or "Math is never wrong," or "It is obvious by the results of the AVM ..."

Again, based upon the preceding, AVMs are not without fallacy. But even more alarming than the lack of validity is the revelation that as of today there is no way to find out whether a particular AVM is logically sound or not. Currently, no regulatory agency monitors any person or company that uses AVMs. That includes appraisers. Currently, there are no standards, no guidelines, no rules, and no one held accountable for any shape, type, or form of AVM.

If an AVM produced a value that a home owner does not agree with, whom does the homeowner call? The computer? The individual who designed the AVM? Perhaps the person who input the data, which, of course, assumes a human actually input the data. If there is someone to call, what does the home owner ask? "Have you determined whether an OLS regression works better on my data set than a ridge regression or some nonlinear approach such as double log or semi-log, or polynomial regression? Are you sure that Box-Cox transformations are not appropriate? What is your reaction to a Mallows'  $C_p$  that is higher than  $P+1$ ?"<sup>6</sup> Perhaps the home owner can ask, "In your residual analysis of the regression run, do you know what the Durbin-Watson statistic is and its significance for that regression?"<sup>7</sup> Why are there no standards for AVMs like there are for appraisers?

#### Math Versus the Market

In a 1991 article in *The Appraisal Journal*, Bobby A. Newsome, a professor of real estate at Middle Tennessee State University in Murfreesboro, Tennessee, reported that in his town, "appraisers would be warranted in adjusting comparable sales of average-sized houses located in Rutherford County, Tennessee, by adding approximately \$1.30 per square foot for houses with brick veneer rather than vinyl siding."<sup>8</sup> In this article, professor Newsome applied multiple

regression analysis (MRA) to *divine* this adjustment. He very properly provided us with the criteria of his "data and model" and informed us that there were "815 observations." Additionally, he showed us the various tables, which included all the necessary coefficients, *t*-values, significances, as well as the  $R^2$ . Then after presenting all of these mathematical formulae, he concluded, "The hypothesis that whether siding is brick or vinyl has no influence on the sales price can therefore be rejected." The problem here is with the statement at the very beginning of his article where Newsome informed us that "home buyers do not differentiate between prices paid for brick as opposed to vinyl siding." This statement, when considered in conjunction with the application of MRA, or today an AVM, begs the following questions:

- Has not professor Newsome contradicted himself?
- Is it not the appraiser's job to interpret the attitudes of the market participants as to the value or premium of a particular feature or amenity?
- If so, and the results of the MRA/AVM are applied, is that not choosing to ignore the market?

This is the logical fallacy Affirming the Consequent. In other words, if we isolate all the other variables commingled in the price of the home, except for the siding difference, then the price difference must be the siding. This can also be referred to as a *hypothetical imperative*, which is used pervasively in ordinary speech and writing to identify relationships of dependence among facts, events, and possibilities. The operative word is *hypothetical*. While the mathematics may be correct, the hypothesis is not. Both the premise and the conclusion are hypothetical. How can this be? Because the buyers stated that it does *not* make a difference.

#### The Ethics

In Newsome's article, the prices used in his model ranged from a low of \$42,700 to a high of \$213,324. Living areas ranged from 892 square feet to 3,600 square feet. These facts again beg a few questions.<sup>9</sup> How comparable are these sales? How many appraisers would include this kind of range and attempt to apply adjustments to them? If an appraiser did include these sales on any kind of typical adjustment grid, the appraiser would be facing serious ethical and standards

violations for choosing incorrect comparables, acting incompetently, and performing negligently. Why are AVMs free to do things that are not lawful for appraisers? How can Fannie Mae decree that an appraiser cannot use comparables that range from 892 square feet to 3,600 square feet, yet at the same time the agency does not place the same restraints on its own AVM?

### What Do the Results of an AVM Prove?

The problem involves the values of mathematics versus the values of social behavior. Should mathematics be the driving force behind social behavior, as with the results of an AVM? Alternatively, should social behavior dictate the bounds of what mathematics attempts to do? In other words, should mathematicians have a free rein in determining value, or does the human factor use math only for those purposes it deems desirable? When an AVM is the *sole* determinate of value, are we, in fact, saying that it does not matter what people think, although buyers say otherwise? Appraisers are trained to interpret precisely what value social behavior places on such components as financing, swimming pools, yield rates, or vinyl siding. AVMs are not.

The use of MRA to value homes for mortgage loans may unintentionally become a disservice to the public, which often relies explicitly or implicitly on appraisals to ensure that they are not paying too much for property. In these litigious times, the reliance by a lender on a computer analysis to value a complex asset such as real estate may prove to be a costly mistake rather than the hoped for savings.<sup>10</sup>

Statistical tools can be useful in deriving estimates of market value; however, they should not be introduced as the foundation on which the definition of an appraised value is based.<sup>11</sup>

Implying both that appraised values are based on recognized probability distributions and that realistic tolerance limits are achievable is less justifiable in scientific theory than the original 'naive' model, which implies that appraisers can interpret the sale information and 'artfully' arrive at a single value estimate of market value.<sup>12</sup>

An article published in *The Journal of Real Estate Research* concludes:

The use of conventional MRA in estimating values ... has two inherent problems. ... (First, p)roper appraisal theory requires a statistical procedure that uses ordinal data as

opposed to the usual cardinal data; conventional MRA (i.e., an AVM) does not do this. Second, the MRA models illustrated in the literature concentrate on larger samples, which permit the internal assumptions underlying the use of MRA to be more easily satisfied.<sup>13</sup>

Appraisers and current appraisal theory, and more particularly appraisal standards and ethics, *do not allow the practitioner the same latitude* when performing a common appraisal assignment. The question for the appraisal profession is then, are we to believe the buyers or are the buyers to believe the math?

### In Conclusion

Again, AO-18 of USPAP states, "An AVM's output is not, by itself, an appraisal and communication of an AVM's output is not, in itself, an appraisal report." Then that means that Fannie Mae, Freddie Mac, and any other lending institution that uses an AVM instead of an appraiser is loaning money on a house *without getting an appraisal*. The Advisory Opinion uses the following example:

An appraiser may be asked to simply enter property characteristics provided by the client, but not alter the input or affect the AVM's output. In this specific instance, the appraiser is not acting in the capacity of an appraiser but, rather, is functioning only as an AVM operator.

By the same logic, the professor who created the tomato at UC-Davis is not a farmer but rather is functioning as an ATM operator. Lastly, the Advisory Opinion states, "The appraiser should take steps to ensure that communication of the AVM's output is not misconstrued as an appraisal." Does that mean that when asked by the home buyer/borrower "What is the value of my home?" Fannie Mae can simply say, "Oh, sorry, we didn't do an appraisal"?

"The sad thing about artificial intelligence is that it lacks artifice and therefore intelligence."<sup>14</sup> The sad thing about AVMs is the blatant action by the major residential lenders to replace appraisers with this artificial intelligence and then blatantly deny that an AVM is an appraisal. Worse than that, however, is the Appraisal Standards Board's rhetoric, which conveniently supports the position of the lenders. At the beginning of this paper there were several questions that asked whether AVMs are regulated or are required to adhere to a set of standards, whether some are better than others, and who is qualified to use an AVM, and so on. Unfortunately, these questions have

no answers now. *Artificial intelligence* is not an oxymoron. No agencies currently oversee AVMs. There are no standards, aside from the mathematics itself, which must be followed. As it stands today, anyone can produce or operate an AVM, and they can call it “the best model ever made” without having to meet any preset standards.

One automated valuation model, which at first is thought improperly named, may in fact be cleverly named after all—the “hedonic” model. The term *hedonic* means “of, relating to, or marked by pleasure.” It comes from the Greek *hedonikos*, which was coined by the Greek philosopher Aristippus, who founded the Cyrenaic (the coastal Mediterranean home of Aristippus) school of hedonism. The school’s credo is, *If all pleasure is good and all pain is bad, then we should strive for the maximum pleasure and avoid any pain.* This must be the intent for replacing appraisers with AVMs.

## Notes

1. This does not disrepute the information presented by Austin J. Jaffe, PhD, where he points to the 1920s as the first use of multiple regression analysis for the valuation of farmland. (“Is There a Future for Real Estate Valuation after the Microcomputer Revolution?” *The Real Estate Appraiser and Analyst*, Summer 1986, published by the Society of Real Estate Appraisers) The reference in this paper to the use of statistics in valuation and this paper’s intended context is as the “most widely used” and “most widely known.”
2. The term AVM as used in this paper is to be representative of all AVM models as described in Advisory Opinion 18, including regression, adaptive estimation, neural network, expert reasoning, and artificial intelligence. Also included, but not limited to, are rule-based, heuristic, econometric and repeat sales, and expert systems.
3. *Uniform Standards of Professional Appraisal Practice* (Washington, D.C.: The Appraisal Foundation, 2000), 144.
4. *The American Heritage Dictionary of the English Language*, 3d ed. (Boston: Houghton-Mifflin, 1996).
5. The five agencies are the Federal Reserve Board, the Comptroller of the Currency, the Office of Thrift Supervision, the Federal Deposit Insurance Corporation, and the National Credit Union Administration.
6. Gene Dilmore, MAI, SRA, “Appraising with Regression Analysis: A Pop Quiz,” *The Appraisal Journal*, Notes and Issues (October 1997): 403–404
7. Ibid.
8. Bobby A. Newsome, PhD, “Comparable Sale for Vinyl Siding,” *The Appraisal Journal* (January 1991): 92–95.
9. This is not an isolated case. Every statistical endeavor requires *x* number of observations, and the experts will tell you that the more observations the more reliable the conclusion.
10. C. David Matthews, MAI, SRA, “Pros and Cons of Multiple Regression Analysis in Appraising,” *The Appraisal Journal*, Letters to the Editor (January 1995): 129.
11. Theodore Reynolds Smith, PhD, “Statistical Implications of the Most Probable Price,” *The Appraisal Journal* (January 1995): 81.
12. Ibid.
13. Cronan, Eply, and Perry, “The Use of Rank Transformation and Multiple Regression Analysis in Estimating Residential Property Values with A Small Sample,” *The Journal of Real Estate Research*, vol. 1, no. 1 (Fall 1986).
14. Jean Baudrillard (French semiologist, b. 1929), *Cool Memories*, ch. 4 (London: Verso, 1987, tr. 1990).