A New Method To Define Accuracy of Appraisals

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Introduction

Most users of appraisal services may presume that the certainty behind market value estimates are greater than reality suggests. What appraisers present is their conclusion of the most probable price when aiming for the traditional definition of market value. In fact, lenders must, by current regulation, provide an estimate of the loan-to-value ratio for each mortgage based on a single point value estimate, not a range.[1] This regulatory practice has resulted in mortgage loans that vary quite a bit in terms of riskiness, simply because the potential uncertainty behind the value estimate is not incorporated into the lending decision in any way.

The inherent uncertainty behind the value estimate could become part of the information used to make a lending decision or to explicitly price the risk. In contrast to manual appraisals that typically do not provide explicit information on the uncertainty behind the value conclusion, Automated Valuation Models or AVMs, commonly report not only the conclusion of value, but also the uncertainty behind the value as indicated by a confidence score which is typically a function of the standard deviation behind the estimate.[2] Industry standards suggest that the better automated value models will generally be within 10% of the true value 65% to 75% of the time or more, and within 20% of the true value 80% to 90% of the time or more. These "success" standards may seem shockingly low, when illustrated with numbers.

Assume that the standard deviation of the value estimate is 10% and the AVM value conclusion is $200,000 for a subject property. Then the reality is that, assuming a normal distribution, an 80% confidence interval suggests the true value lies between $174,400 and $225,600.[3] If a lender wants to rely on this value estimate for the purpose of calculating the loan-to-value ratio of a proposed mortgage, they would prefer a tighter range. An appraiser that comes in with a traditional appraisal at $200,000 without providing the standard deviation of the estimate may have the lender think they have a good estimate of value for the purpose of calculating the loan-to-value ratio or LTV. But no lender yet asks for any measure of uncertainty nor do regulations require such disclosure in manual appraisal forms.[4] Here we propose a methodology for calculating the uncertainty or error inherent in traditional grid method form appraisals, and using this methodology we compare the inherent uncertainty on a few samples of appraisals to those using AVMs.

A Methodology to Measure Uncertainty in Traditional Appraisal

In the traditional sales comparison approach to value that dominates single family residential appraisal practice, the appraiser reports at least three comparable properties or "comps" and then tries to answer the question: *What would this comp sell for, if it were more like the subject property?* To answer this question, the comp is adjusted downward for features that add to value which are absent in the subject property, and upward for features that are absent in the comp but present in the subject property. Other adjustments may include but are not limited to those for size differences, neighborhood price trends since the sale of the comp to the date of the appraisal, property condition, views, etc. When an appraiser has made all of the

[1] See the FDIC 2000 Rules and Regulations, Section 365.2 Real Estate Lending Standards, with a maximum of 80% loan to value ratio without private mortgage insurance.

[2] Confidence ranges are typically reported as the probability the value estimate is within 10% or sometimes 20% of the true value.

[3] From $200,000 less 1.28*$20,000 and $200,000 plus 1.28*$20,000

[4] Like the 1004 of 2055 forms which are very common.

appropriate adjustments he or she reaches a value indication for the subject property.[5] Sometimes an appraiser is lucky and all three or more comps, after all the price adjustments to each, are very close in value. The tighter this range the more confident will be the value conclusion.

Here we propose a simple methodology for revealing the uncertainty behind traditional market or grid adjustment approaches to value. We simply use each adjusted comp price as a micro-appraisal observation and calculate the standard deviation of the range of estimates.

The formula for a standard deviation, S_N, is based on the squared differences between each observation, X_i, and the mean of all X_i, all divided by N, the number of observations, and then last we take the square root of these summed squared differences.

$$s_N = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \overline{x})^2}$$

Here we first calculate the standard deviations of a sample of traditional appraisals based on N, the number of adjusted comparable property observations. We are also assuming equal weight for each comp, even though this assumption can be relaxed. To illustrate, a simple equally weighted comps and equally weighted calculation of the standard deviation is shown below. Then we re-weight both the conclusion of value, based presumably by putting more weight on the best comps, and we re-calculate the standard deviation with these same weights. Note that the weighted calculation results in a slightly lower standard deviation, since more weight is put on those comps which are closer in value to the final conclusion.

Conclusion of Value	Subject Property	Comp 1	Comp 2	Comp 3	Standard Deviation
Equal Weighted Comps	$108,333	$110,000	$95,000	$120,000	$10,274
Re-weighted as Follows		40%	40%	20%	$ 9,972
Weighted Conclusion of Value	$106,000				

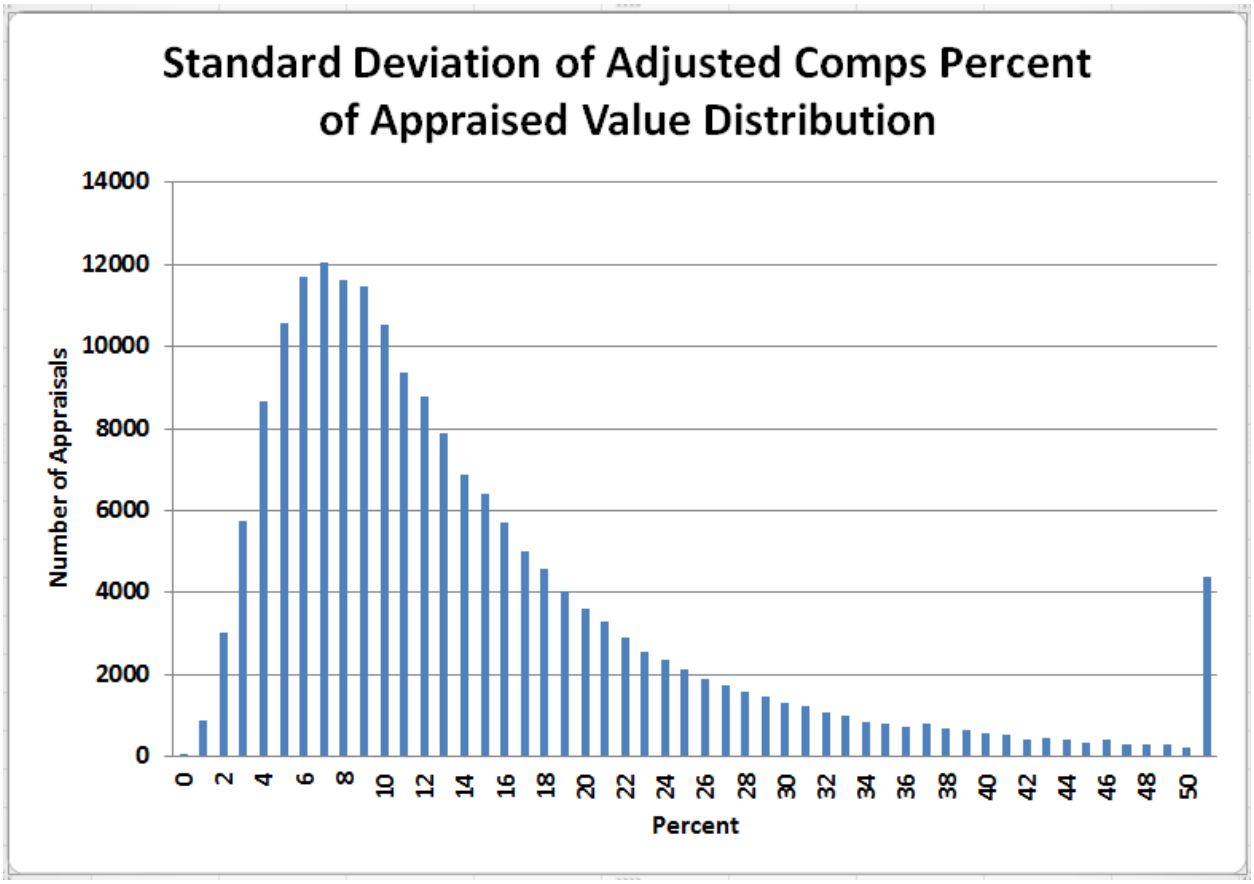
We next apply this methodology to a large sample of appraisals, approximately 170,000 that are from the 1004 or 2055 forms produced from 2012 through mid-2016. These are geographically distributed throughout the US. The results are shown in Exhibit 1 below. The state-weighted average standard deviation as a percentage of the value conclusion is 10.5%. When weighted by the number of appraisals the standard deviation as a percentage of the value conclusion is 10.7%. To the best of our knowledge no one has ever calculated a standard deviation for manual appraisals before. In the case of AVMs, vendors report high confidence score AVMs as generally having a standard deviation of less than 15%, although the standard deviation is based on multiple individual AVM value estimates versus the actual sales prices or appraised values of the subject properties. Here we are comparing the adjusted comp values to the conclusion of value and assuming this conclusion of value to be the true value.[6] One might presume that typical AVM estimates

[5] Appropriate implies the appraiser tries to account for all significant influences on value. Appraisers recognize that they will miss some positive and negative adjustments but the hope is that these cancel out. Stated in statistical terms, the hope is that the mean residual error is zero.

[6] As we discuss below, if we measure the standard deviation for manual appraisals based on differences from the actual sales price of a set of mortgage application properties, we will see extremely low standard deviations. 40% or more will typically match the sales price, according to reports from the Collateral Assessment & Technologies Committee (CATC). See a report in 2005 titled "Systemic Risks in Residential Property Valuations: Perceptions and Reality." The measure being proposed here is more akin to a refinancing application where there is no known sales price.

have slightly larger uncertainty than traditional appraisers, as indicated by the standard deviations, but we will further explore that question below.[7]

Exhibit 1: Standard Deviations Behind Traditional Appraisals Based on Adjusted Comparable Values



In a sub-sample, we selected three appraisals merely for illustration to show how the standard deviations affected the certainty behind the value estimate. On the low end, the standard deviation of one appraisal was .3%, while on the high end it was over 26% and a slightly below average observation came in at 7.8%. If an appraiser were to report both a conclusion of value and an 80% confidence range, the result for these three appraisals might be as follows:

Subject Property Conclusion of Value	Standard Deviation of Adjusted Comps as % of Conclusion	Low Value at 80% Confidence Range	High Value at 80% Confidence Range
$35,500	.3%	$35,379	$35,621
$179,000	7.8%	$161,022	$196,978
$53,000	26.2%	$35,247	$70,753

In the first row above, we observe a very tight range of value. In the last row, we observe great uncertainty as to what the property is really worth. The conclusion of value is not very reliable and to treat any given mortgage loan-to-value estimate as equal in risk is quite the pipe dream.

[7] It is also possible that final appraiser's standard deviations are understated in that appraisers can go back and refine adjustments to comparable properties if the spread and range appear to be too large, while AVMs make no post-appraisal process adjustment.

From our recent paper on adjusting loan-to-value ratios for confidence level, imagine two appraisals with 5% and 10% standard deviations on the adjusted comparable properties and a most probable price or value of $200,000.[8] By definition, the most probable price is one where 50% of the true values could lie above the estimate and 50% could lie below this estimate. If a lender wanted to have 60% of the true values to lie below the estimate and thus be 60% confident, the value estimate is equal to or below the estimate, and correspondingly 60% confident that the true LTV would not exceed 80% LTV, then such a lender would adjust the loan value maximum as follows:

Home Value	Standard Deviation of the Value Estimate	Dollar loan for 60% confidence that the LTV is 80% or less	Max probable LTV at 60% confidence if the dollar loan is $160,000
$200,000	5%	$153,264	83.5%
$200,000	10%	$146,528	87.4%

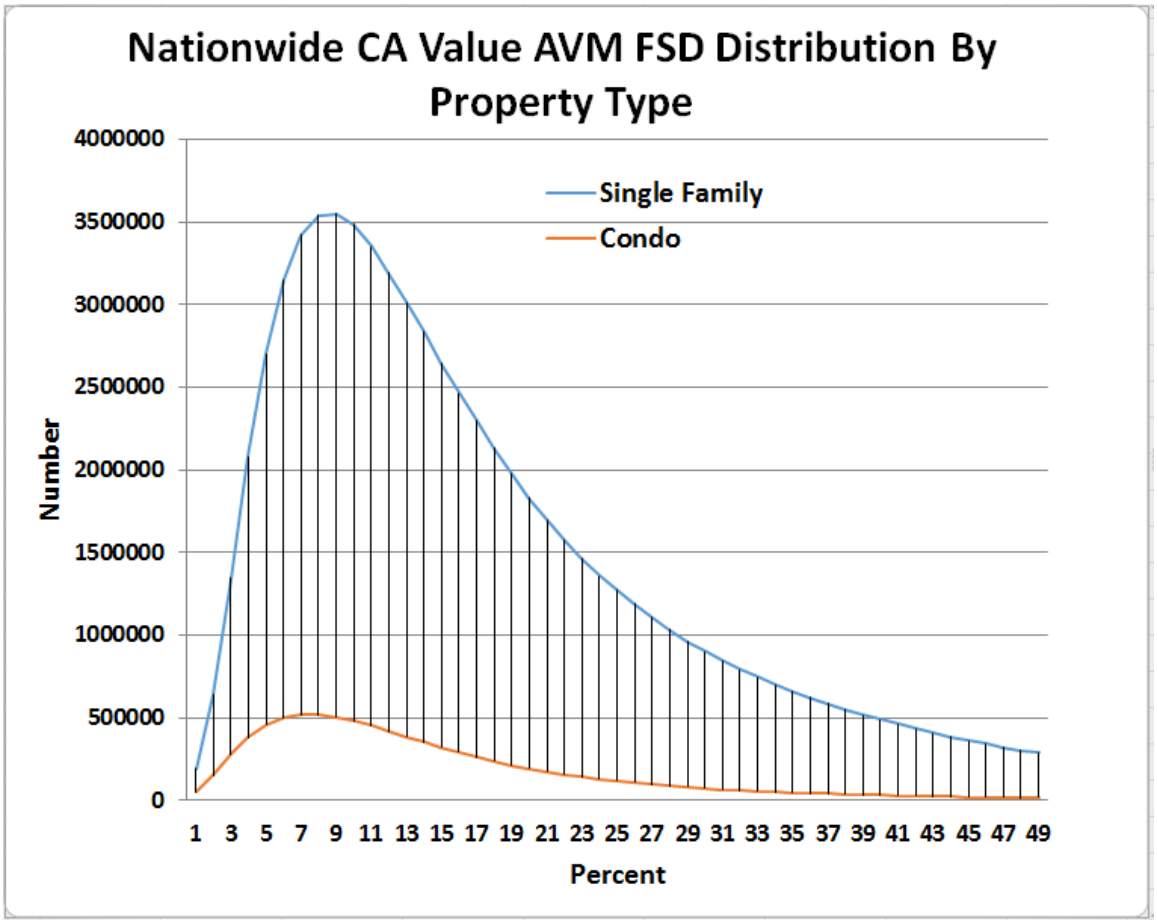
Note that if the standard deviation of the value estimate is 10%, then the true LTV of a $160,000 loan could easily be 87.4% not the 80% presumed when we are 100% sure of the value conclusion. The difference in true equity being 20% or only 12.6% is very significant for assessing default risk and potential loss given default. For example, in the case of buyers, it is also significant in that they think they are putting 20% down on a home worth $200,000 when in fact they may be over paying by several thousand dollars. Thus, the true equity could easily be $23,000 not $40,000. These are the implications and realities behind a standard deviation of just 10%.

Known Standard Deviations in AVM Valuation Results

In Exhibit 2 below, we reveal a large nationwide summary sample of AVM standard deviation estimates on both single family and condominium property types. The single family average standard deviation is approximately 13% with a lower result nearer 11% on the condominiums. These represent the Standard Deviations derived from the AVM sub-models based on the Collateral Analytics (CA) Value AVM. We use these as the basis for our Collateral Analytics Value Forecast Standard Deviations (FSDs) and High/Low AVM values. The standard deviations will be much lower and the confidence range much higher in neighborhoods with a high turnover and high homogeneity in age and physical attributes. This is no different than we would expect to see on traditional appraisals as well. It is harder to estimate value when the comparable properties are significantly different in size and age and features from the subject property.

[8] See Sklarz and Miller in references, “Adjusting Loan to Value Ratios for Value Uncertainty”

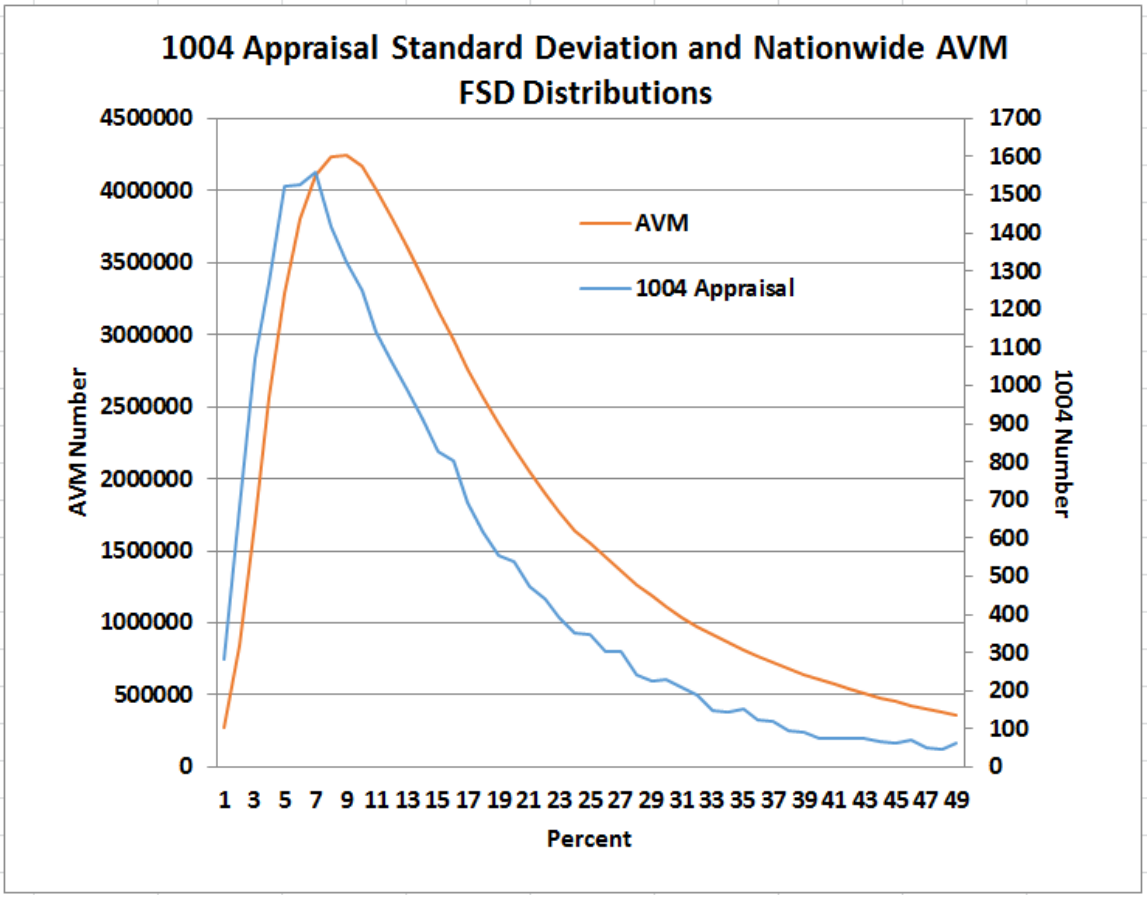
Exhibit 2: Bulk Estimates of Standard Deviations on AVMs



Comparing AVM Variance to Traditional Appraisal Variance

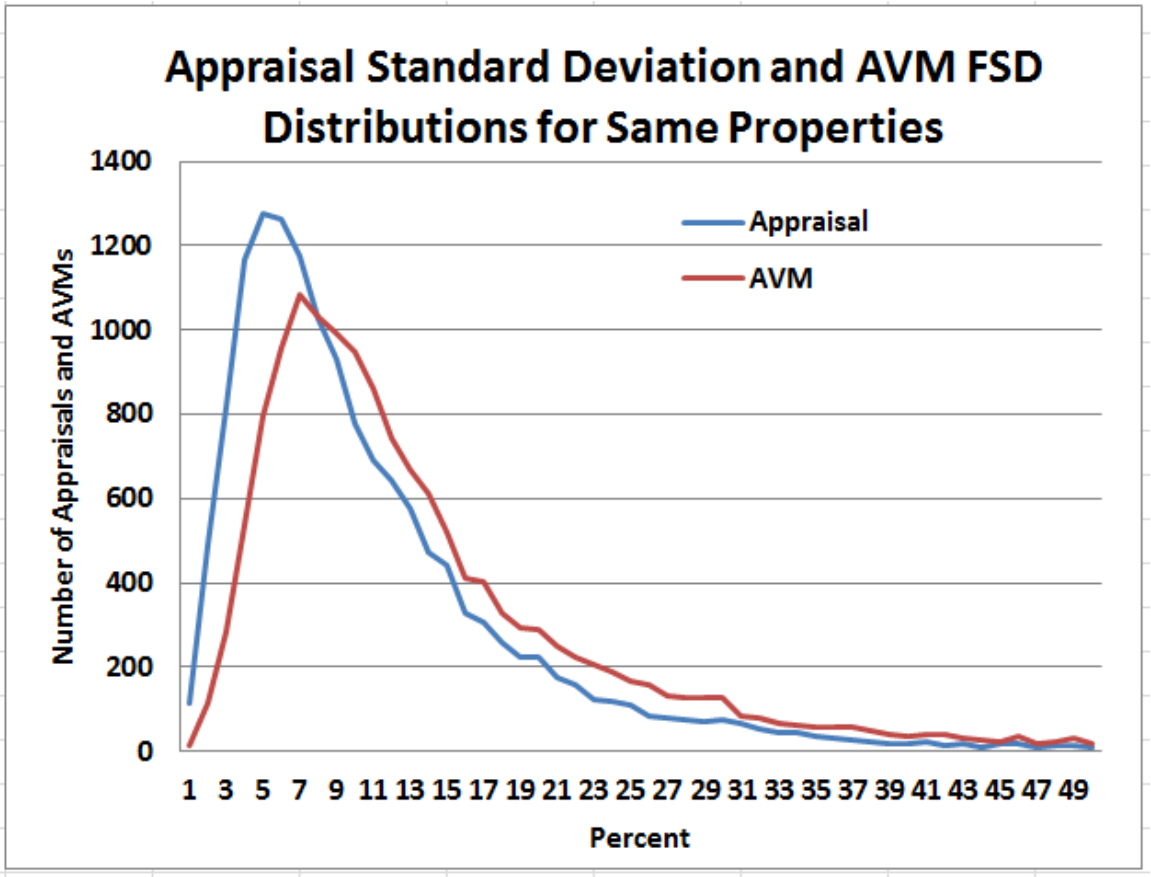
Below in Exhibit 3, we compare a sample of appraisals and AVM results from around the US. The appraisal implicit standard deviations are shown in the blue line and are slightly to the left of the AVM standard deviations. The modes of the errors are about 2% higher for the AVMs and the average standard error is around 13%, some 2.5% higher than for the manual appraisals. These are not the same properties so care must be applied prior to generalizing these results. We repeat the comparison for a similar set of properties below in Exhibit 3 over a more limited time horizon.

Exhibit 3: Bulk AVM and Appraisal Samples from 2012 Through Mid-June 2016



In Exhibit 4 below, we tighten up the comparison so that we have the same sample of properties, all from Texas. Here we still have a large sample of approximately 16,000 observations. Again the AVM standard deviations are based on the AVM sub-models and the appraisal standard deviations are based on final adjusted comparable property values which may or may not have been tweaked to be closer in range from the low to high indicator of value. In fact, many lenders have limits on feature adjustments and total comp price adjustments that implicitly restrict the potential standard deviation of the estimate of value. Here the average standard deviations run about 14.3% for the AVMs and 11.7% for the manual appraisals. The tails are cut off in the graphs which help explain the higher standard deviations than what one might expect by simply estimating from visualizing the graphs.

Exhibit 4: Texas Only Sample of Standard Deviations for Single Family Value Estimates



The Information Value in Valuation

Several authors have argued that one cause of the housing bubble was easy credit facilitated by appraisals that justified purchase prices. For example, Agarwal, Ambrose and Yao (2011) argue that over valuation was a central cause of the financial crisis. During the 2001-2007 time-period appraisals were said to hit or exceed purchase prices over 95% of the time. Agarwal, Ambrose and Yao went on to review some of the new regulations aimed at curbing appraisal bias and concluded that the Home Valuation Code of Conduct reduces bias by some 36% but does not eliminate the bias. In a more recent article by Calem, Lambie-Hanson and Nakamura (2015) they argue that appraisals hitting the exact purchase price amounted to "information loss" for the lenders. In data since 2012 Calem, Lambie_Hanson and Nakamura find that approximately 92% of the appraisals hit or exceed the purchase price, and continue to be biased upward. They suggest that the appraisals, if unbiased, should be under the purchase prices 50% of the time and above it 50% of the time. Appraisers that do not hit or exceed the purchase price more than 50% of the time are not likely to be re-hired by lenders and this economic incentive to hit the required value for financing or refinancing has not been eliminated by any new regulations.[9]

Automated valuation models, unlike appraisers, are agnostic about any subject property sale price and they are modeled to be unbiased with a much more even distribution of low and high value estimates around the observed purchase prices. We are not here negating the possibility that manual appraisals are inherently biased based on current economic incentives and regulations. We are only addressing the question of error

[9] Appraisal Management companies (AMCs) hiring appraisers does reduce the bias but lenders are not required to use AMCs.

or uncertainty behind the value estimates and it appears that there is potentially significant uncertainty in manual appraisals, just as there is in AVM reporting ever since the genesis of their use in valuation and valuation risk management. Industry pundits have assumed that AVMs had higher standard deviations and uncertainty than traditional appraisals, but no one has ever empirically compared the two approaches to value until now.

Strategic Lending

There are several ways lenders could use information on value uncertainty, aside from screening out risky loans on the basis of this uncertainty, for example:

1. Target marketing programs towards borrowers on homes that have less uncertainty behind the value estimate.
2. Make larger loans and accept higher LTVs when the value certainty is higher, subject to regulatory constraints.
3. Charge higher interest rates on loans that have less certainty on the LTV, what we call "risk based pricing."
4. Adjust maximum loans to reflect the degree of certainty required.

Third party insurance companies could also, based on value uncertainty, generate price downside risk protection products for home-owners and lenders as well as mortgage insurance companies. The key to enabling innovation in the market is first to make such information available. It could be provided by running AVMs in parallel as one alternative that accompanies traditional appraisals. Alternatively, appraisers could report standard deviations and uncertainty behind their valuations as one additional piece of information that lenders could use to assess risk.

Conclusions

An appraiser's dream world would be three virtually identical properties to a subject, all selling yesterday, for an assignment to generate a value today. No adjustments would be required and the uncertainty behind the value conclusion would be nil. Alternatively, if perfect adjustments were possible on all the factors considered important by the market, an appraiser would still get three or more very similar adjusted sales prices from which to derive value. That would be the second best scenario for an appraiser. These worlds do not exist and yet, for all of history, we have relied on traditional estimates of value as if this single point were highly probable. In some markets, it is possible and in others, it is not, but we have no information about such uncertainty. In some markets, there are not enough recent sales. In other markets, the properties are all too unique and customized making comparison and property characteristics adjustments difficult.

For the first time, we provide here some evidence that value estimates from traditional appraisals may have a great deal of uncertainty behind them. Such information could be used for strategic lending and or better risk management by buyers of mortgages or portfolio lenders. It may require new regulation to force disclosure of valuation uncertainty and some training of appraisers, but the process suggested here is not technically difficult, nor is it that much extra work for appraisers.

When appraisers recognize that such information is being utilized or disclosed, it is very likely that the standard deviations of the appraisals will decline. This is because it is fairly easy to re-think prior adjustments and reconcile them towards a tighter range of value indicators using the large range of subjective adjustments available to appraisers.[10] Still, greater disclosure behind value estimates would enhance and improve the

[10] Such re-tweaking might also improve the quality of appraisals.

working of the mortgage markets for buyers, lenders and investors and perhaps mitigate the extent of the next housing bubble burst.

References

Agarwal, S., B. Ambrose and V. Yao, "The Limits of Regulation: Appraisal Bias in the Mortgage Market", NABE, December, 2011.

Calem, P., L. Lambie-Hanson, and L. Nakamura, "Information Losses in Home Purchase Appraisals" Federal Reserve Bank of Philadelphia, Working Paper 15-11, March, 2015.

Griffin, J. and G. Maturana, "Who Facilitated Misreporting in Securitized Loans?" The Review of Financial Studies, September, 2015.

Sklarz, M. and N. Miller, "Adjusting Loan to Value (LTV) Ratios to Reflect Value Uncertainty" Working Paper, August 1, 2016 See http://collateralanalytics.com/adjusting-loan-to-value-ltv-ratios-to-reflect-value-uncertainty/

Appendix: National Sample of Manual Appraisal Standard Deviation by State