

Meeting Between Staff of the Federal Reserve Board, Federal Deposit Insurance Corporation, Office of the Comptroller of the Currency, Consumer Financial Protection Bureau, Federal Housing Finance Agency, National Credit Union Administration, and Representatives of The Appraisal Foundation Industry Advisory Council Automated Valuation Model Taskforce
June 22, 2022

Participants: Mandie Aubrey, Carmen Holly, Devyn Jeffereis, Matthew Suntag, Derald Seid, and Andrew Ching (Federal Reserve Board)

Stuart Hoff, Mark Mellon, Patrick Mancoske, and Doug Younger (Federal Deposit Insurance Corporation)

David Adkins, Joanne Phillips, Mitchell Plave, Siddarth Rao, and Joseph Smith (Office of the Comptroller of the Currency)

Thomas Dowell, Joan Kayagil, Nadia Nasser-Ghods, Pedro De Oliveira, Jessica Russell, and Melissa Stegman (Consumer Financial Protection Bureau)

Brian Bieretz, Julie Giesbrecht, La'Toya Holt, and William Merrill (Federal Housing Finance Agency)

Jon Brolin, Simon Hermann, Ariel Pereira, and Lou Pham (National Credit Union Administration)

Paul Chandler (Property Sciences); Michael Coyne and Lee Kennedy (AVMetrics); Kelly Davids, Lisa Desmarais, and Amy Kaufman (The Appraisal Foundation); Andy Krause and Andy Martin (Zillow Group)

Summary: Staff of the Federal Reserve Board, Federal Deposit Insurance Corporation, Office of the Comptroller of the Currency, Consumer Financial Protection Bureau, Federal Housing Finance Agency, and National Credit Union Administration met with representatives of The Appraisal Foundation Industry Advisory Council Automated Valuation Model Taskforce (TAF AVM Taskforce) to discuss issues relating to potential regulations under 12 U.S.C. § 3354, which would implement quality control standards for AVMs within the scope of the statute. The representatives discussed the recently released [TAF AVM Taskforce Report](#) and provided related recommendations for AVM quality control standards.



The Appraisal **FOUNDATION**

Authorized by Congress as the Source of Appraisal
Standards and Appraiser Qualifications

AVM Task Force Report Overview

FFEIC Interagency Working Group on AVMs
June 22, 2022

Setting the Scene

Senior Vice President of The Appraisal Foundation, Kelly Davids



Dodd-Frank Mandate

Automated Valuation Models (AVMs) **shall** adhere to quality control standards designed to –

1. Ensure a high level of confidence in the estimates produced by AVMs;
2. Protect against the manipulation of data;
3. Seek to avoid conflicts of interest;
4. Require random sample testing and reviews; and
5. Account for any other such factor that the agencies determine to be appropriate.

AVM Task Force Members - Two Year Deliberation

Subject Matter Experts on Collateral Valuation and AVMs

- Academics
- AVM Developers & Vendors
- Appraisers

Widely Distributed to Stakeholders for Feedback

Paul E. Chandler, MAI
*Property Sciences**
Chairman

Andrew Martin
*Zillow Group**
Vice Chairman

Michael Coyne
AVMetrics*

George Dell
ValueMetrics.info

Yongheng Deng, Ph.D.
University of Wisconsin

Ernie Durbin
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Robert Edelstein, Ph.D.
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Yan (Sabrina) He, Ph.D.
Bank of America*

Lee Kennedy
AVMetrics*

Andy Krause, Ph.D.
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Katherine Owen
Umpqua Bank*

Josh Panknin
Columbia University

Michael Pratico
Columbia Bank

Scott Schafer
Newmark Valuation & Advisory*

Ryan Vaughn, Ph.D.
Jupiter Intelligence

Michael Zuriff
Royal Institution of Chartered Surveyors

John Cirincione (in memoriam)

**IAC Member*

Valuation Products and Services

Product/Service	Provider
Appraisal	Appraiser Valuation
AVM	Algorithmic Valuation
Evaluation	Bank or Third-Party Vendor
BPO	Real Estate Agent Valuation

Five (5) Stages of Valuation

- Identify Property/Problem
- Determine Market to Study
- Select Predictors/Data Features to Use
- Develop Opinion of Value
- Report and Reconcile the Conclusions

What's in the report?

- More than just recommendations - but we have those too!
 - AVM Development: Background reference for common AVM models and data use
 - AVM Reporting: Introduction and review of common AVM evaluation metrics
 - AVM Use & Testing: When might AVMs be a sound way to obtain a collateral valuation
 - Recommendations
- Minimal engagement with applying fair housing to AVMs
 - Nature of the fifth factor rulemaking was not known during report development

What is an AVM?

Dodd Frank: *An “automated valuation model” means any computerized model used by mortgage originators and secondary market issuers to determine the collateral worth of a mortgage secured by a consumer’s principal dwelling.*

Report: *AVMs are computer models used to determine the [collateral] value of 1–4-unit residential real estate assets.*

Real Estate Data & AVMs - Highlights

- AVMs rely on large and diverse datasets of varying quality
 - MLS data: sales prices, listing dates & prices, price cuts, etc.
 - County Recorders: Sales prices, transaction type, dates, etc.
 - Homeowner/Agent provided data: Listing images, listing text, etc.
 - Tax Assessment databases: Home facts, land value, structure values, tax exemptions, etc.
 - Appraisal data: comparables chosen, condition & quality, etc.
 - Insurance cost data
- Garbage data in = Garbage valuations out
 - Combining and “cleaning” data to improve its quality a major task for any AVM developer or AVM evaluation

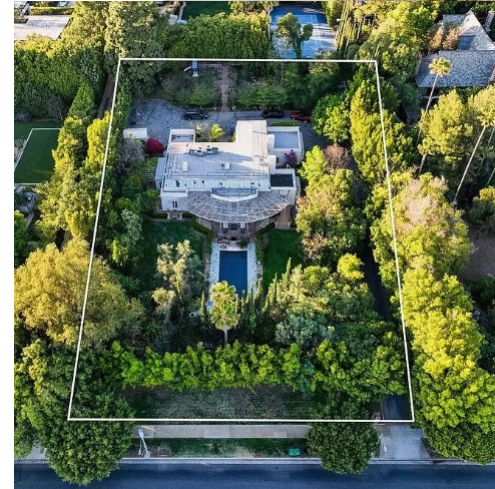
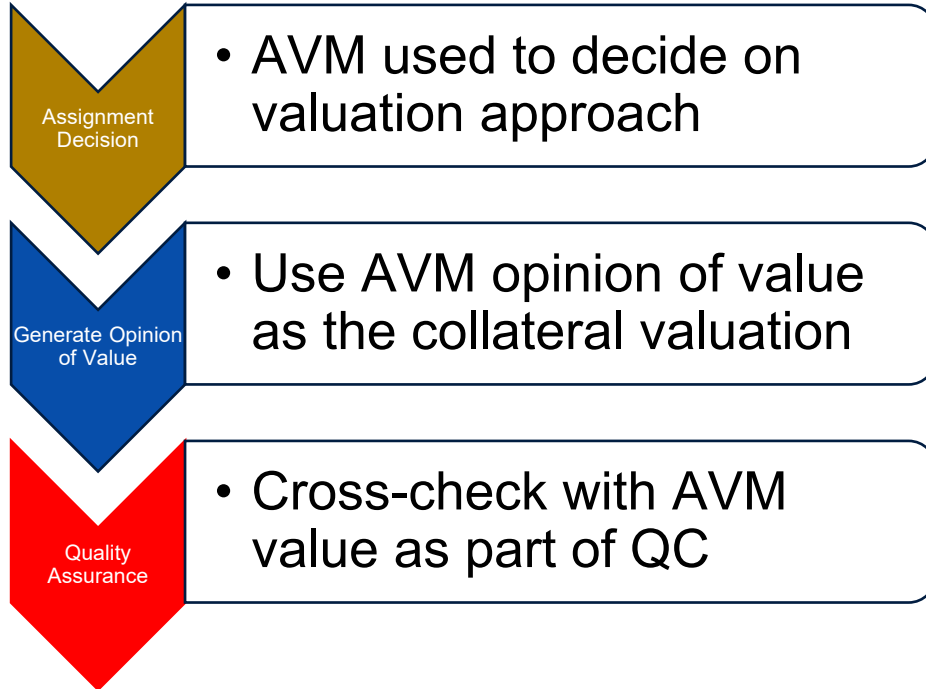
AVM Models - Some Key Ideas

- Many different statistical and probabilistic models can be used to create AVMs
 - Hedonic models - linear and nonlinear
 - Substitution models or Appraiser Emulation models - ex. [OpenDoors Deep Neural AVM](#)
 - Too many more approaches to talk through
- Once an AVM model has been created it's very fast and cheap to generate tens of millions of predictions/valuations
- The wide range of models can all be evaluated similarly
 - See Zillow Prize Round 1 [results](#) for example
- Machine Learning approaches are often hard to audit or understand by humans

AVM Users and Use Cases

Intended Use	Users
Marketing/Advertising	Homeowners, Advertisers, Real Estate Search Portals
Investment portfolio tracking & resale	Hedge funds, Institutional Investors
Default servicing & asset review	Loan Servicers, GSEs
Loan origination	Lenders, Secondary Market (GSEs, etc.), Rating Agencies, Homeowners

AVM Uses in Loan Origination



AVM Reporting

- Just as in an appraisal, the point valuation is not the only information an AVM user needs to decide if it meets intended use criteria.
- **Prediction Information:** Date of prediction, point value, date model was trained, prediction intervals PI or FSD*
- **Subject information:** Address, key home facts used by AVM when forming valuation (living area, type, lot size, etc.)
- **Evidence & explanations:** Comparables (if substitution model), other evidence, etc.

Identifying Reliable Models (Testing)

Facts

Model performance changes over time

Model performance varies by geographic location

Model performance varies by price range

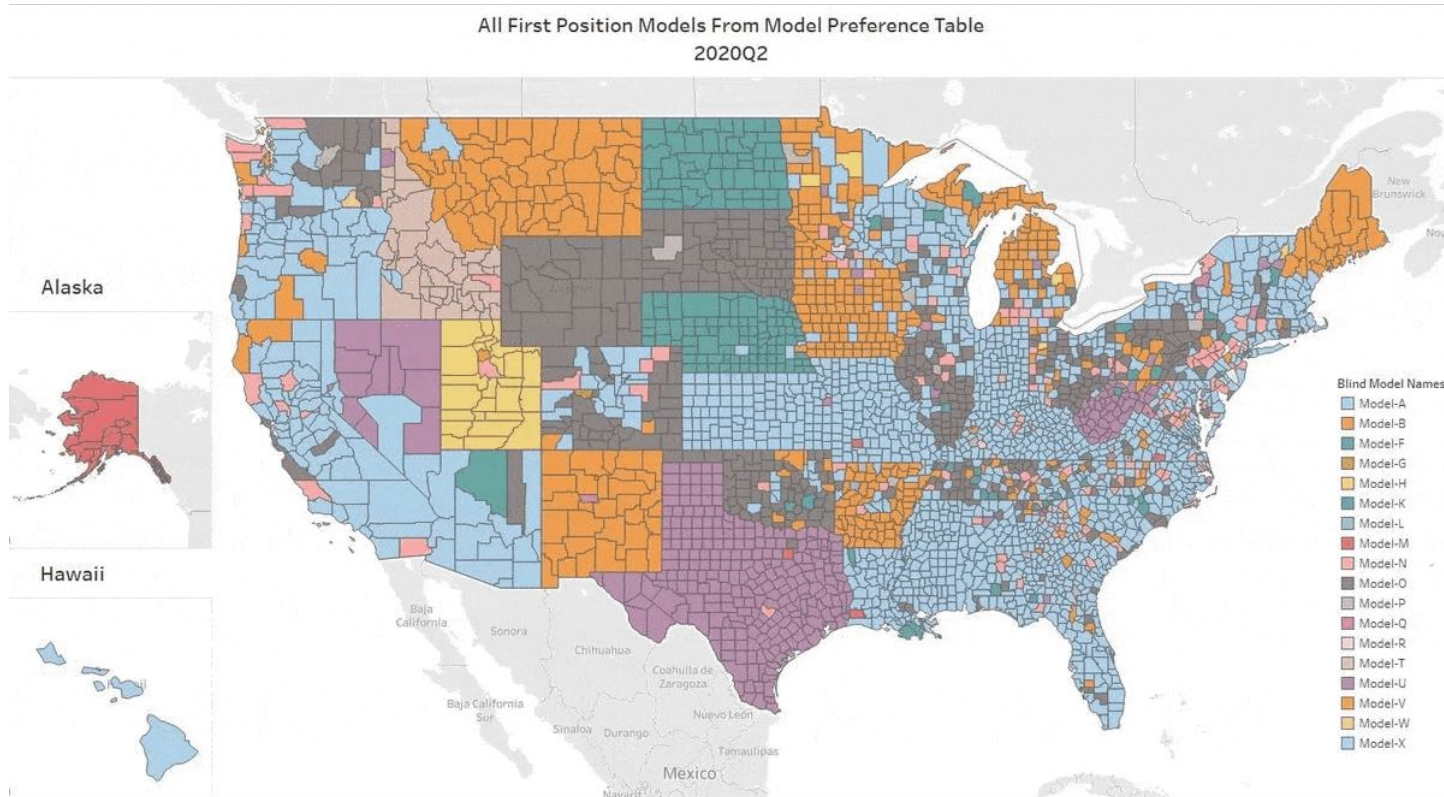
Model performance varies by property type (SFR, Condo, Attached, Detached...)

Model performance varies by individual home (FSD and Confidence score)

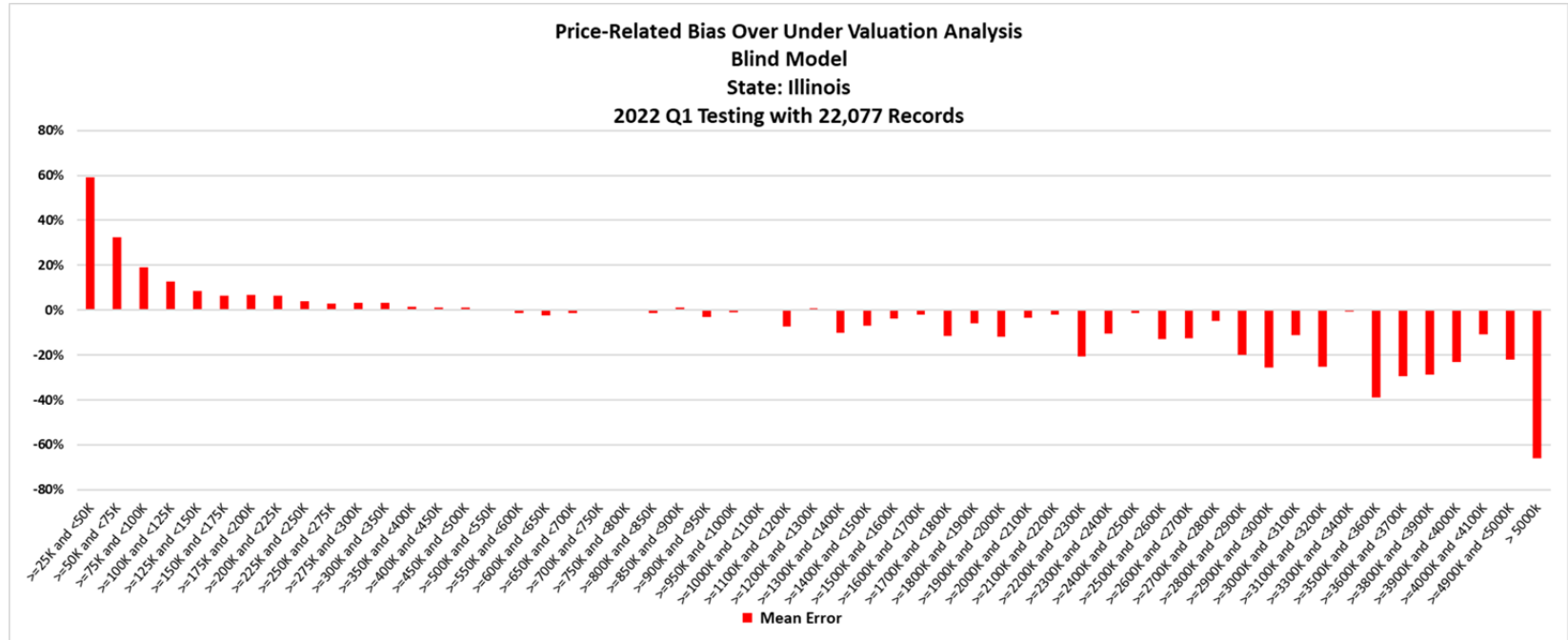
Take Away

Without testing and controls, users can't navigate these circumstances and use AVMs to their best advantage

Things Change – 8 Quarters of Change



Model Effectiveness in Different Price Ranges



AVM Metrics and Confidence Scores

Gross Hit Rate - % of housing for which the model provides estimates

Effective or Qualified Hit Rate - % of hits that meet a minimum set of criteria, i.e. FSD, Confidence Score, Floor and Ceiling set points

Confidence Scores, Prediction Intervals and **FSD** are self scoring metrics provided in the model outputs on a per valuation basis

- Confidence Scores convey uncertainty in inconsistent ways
- FSD and Prediction Intervals are a standardized way of expressing confidence

Application of FSD

- Knowing which “low confidence” estimates to avoid requires rigorous testing, too.
- Each AVM provider has their own methodology for confidence scores and “FSD”.

State	Model	Model FSD	TotalRecords	TotalHits	MAE	PPE10%	RT20%	% of population
IL	b	4	75	75	9.2%	73.3%	0.0%	75% within the green zone
IL	b	5	364	364	4.7%	95.3%	0.0%	
IL	b	6	748	748	6.0%	89.0%	2.0%	
IL	b	7	14,599	14,599	3.4%	95.9%	0.6%	
IL	b	8	12,187	12,187	3.6%	95.0%	0.8%	
IL	b	9	6,074	6,074	4.8%	91.8%	1.3%	
IL	b	10	2,933	2,933	7.2%	81.3%	4.0%	
IL	b	11	2,139	2,139	9.2%	74.8%	6.4%	
IL	b	12	2,016	2,016	10.9%	66.6%	7.4%	79% within Green/Yellow Zones
IL	b	13	1,924	1,924	13.6%	58.4%	10.7%	
IL	b	14	1,475	1,475	14.7%	54.4%	11.9%	
IL	b	15	1,652	1,652	16.3%	50.4%	13.5%	
IL	b	16	1,276	1,276	16.7%	50.5%	14.4%	
IL	b	17	1,013	1,013	17.0%	47.4%	14.9%	
IL	b	18	800	800	18.5%	44.0%	15.6%	
IL	b	19	583	583	17.7%	41.2%	13.6%	
IL	b	20	465	465	19.9%	38.5%	17.8%	
IL	b	21	791	791	23.6%	32.0%	21.6%	
IL	b	22	562	562	26.7%	27.0%	21.9%	
IL	b	23	181	181	20.4%	32.0%	18.2%	
IL	b	24	121	121	24.2%	32.2%	11.6%	
IL	b	25	115	115	24.3%	27.8%	20.0%	
IL	b	26	3	3	78.4%	33.3%	33.3%	21% in the Red Zone

75% of this model’s valuations in Illinois have an FSD <=11 and perform relatively well (shaded in green).

Another 4% we shade in yellow and are arguably acceptable for certain use cases, depending on the risk appetite of the user.

Certification of AVMs

Will add confidence in AVMs

Similar to how appraisers are credentialed through licensure, AVMs could be certified by an independent authority (government, private entity or non-profit).

Certification could be limited to models that meet minimum performance standards based upon rigorous testing.

Certification could take the form of different levels. E.g., certified for lending, or certified for appraisal quality control, etc.

USPAP Framework for AVMs

USPAP has been an effective standards framework for appraisals
AVMs need an analogous framework with parallel structure

1. Developing AVMs
2. Reporting AVMs
3. Reviewing (and testing) AVMs

USPAP Framework for AVMs - Developing

- Proprietary methods but disclose theoretical approach
- Clarity about objective and benchmarks
- Clarity about supporting data
- Prevention of manipulation of data

USPAP Framework for AVMs - Reporting

Data Point or Metric	Explanation	Example
Address		2785 Rockcliff Rd SE Atlanta, GA 30316
Value Estimate		
Point Estimate of Value	Single point estimate of value for this home	\$285,000
Valuation Date	Effective date of valuation (in the case of retrospective AVMs this date could be different from the report date)	11/25/2021
Report Date	Date of the AVM output	11/25/2021
Model Date (version or calibration date)	Date the model was last updated or calibrated	11/1/2021
Low Estimate (50% PI)	Lower bound of 50% prediction interval	\$256,043
High Estimate (50% PI)	Upper bound of 50% prediction interval	\$312,941
Lower Estimate (80% PI)	Lower bound of 80% prediction interval	\$227,594
Higher Estimate (80% PI)	Upper bound of 80% prediction interval	\$341,390
Confidence score	Explanation of methodology used to determine score. e.g. If FSD, provide time and market segmentation. If another approach, classify approach as: 'model-based', 'data-based', 'inference-based' or 'hybrid/other'	11 Type: FSD Time: 90 Days Segmentation: Zip Code
-- If FSD approach, give time window and submarket segmentation		

Key Home Facts			Source
Home Size (sqFt)	Size of home in square feet	1,216	Agent/MLS
Lot Size (sqFt)	Size of lot in square feet	13,068	Public Records
# Beds	Number of Bedrooms	3	Public Records
# Baths	Number of Bathrooms	2	Public Records
Home Built	Year Built	1957	Public Records
Effective Year Built	Year Remodeled	1994	Agent/MLS
Last Sale Date	Prior Sale Date	2005-03-21	Agent/MLS
Last Sale Price	Prior Sale Price	\$250,000	Agent/MLS
Is Currently Listed	Is the home currently listed in your data	No	NA
Current List Price	If so, at what price	NA	NA
Evidence and Explanations			
Comparable Properties	List of comparable homes, if applicable		
Other Evidence	Other potential evidence given in support of the valuation. Might be the prior sale price * a price index, etc.		
Other Model/Performance output	Any other model assumptions or process that would enhance the understanding of the output provided. e.g. In a rapidly changing market, it might include a monthly price appreciation % being assumed by the model.		

Reporting should use standardized metrics, including PIs, FSD and physical characteristics.

USPAP Framework for AVMs - Reviewing

- Standardized common metrics
- Independent third party
- Using arm's-length transactions
- Broad geographic coverage
- “Blind” to sales and listing prices
- Continuous or high cadence

Task Force Recommendations

- A standardized measure of confidence or uncertainty must be developed.
- A standardized list of minimally required reporting elements must be developed.
- Standardized testing and auditing must be adopted.
- A certification for AVMs used by regulated financial institutions should be required.
- GSEs should release all appraisal report data to stakeholders for use in AVMs and other valuation products and services.
- Regulators should leverage USPAP and the Appraisal Foundation to bring together the necessary stakeholders and subject matter experts to develop and update as needed, appropriate AVM Standards.

Next Steps

- Finalize and Circulate Definitions for adoption.
- Develop a List of Standardized Reporting elements.
- Identify Key Elements of a Risk Based Effective Usage Framework.
- Seek Stakeholder Feedback on Certification Elements
- Seek Consensus on Standardized Confidence Metric

THANK YOU

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