Standard on Automated Valuation Models (AVMs)

Approved September, 2003

International Association of Assessing Officers

The assessment standards set forth herein represent a consensus in the assessing profession and have been adopted by the Executive Board of the International Association of Assessing Officers. The objective of these standards is to provide a systematic means by which concerned assessing officers can improve and standardize the operation of their offices. The standards presented here are advisory in nature and the use of, or compliance with, such standards is purely voluntary. If any portion of these standards is found to be in conflict with the *Uniform Standards of Professional Appraisal Practice* (*USPAP*) or state laws, *USPAP* and state laws shall govern.

Acknowledgments

The AVM Standard was reviewed and completed through the dedicated efforts of an Ad Hoc committee comprising Alan S. Dornfest, AAS, *Chair*, Larry J. Clark, CAE, Robert J. Gloudemans, Michael W. Ireland, CAE, Patrick M. O'Connor, and William M. Wadsworth. The Committee worked closely with Nancy C. Tomberlin, who was chair of the Technical Standards Committee at that time.

Special thanks and appreciation also go to the many individuals who served as reviewers for this standard:

Richard Almy
Richard A. Borst
Man Cho
John S. Cirincione
Robert C. Denne
Brian G. Guerin
M. Steven Kane
Josephine Lim
Mark R. Linne, CAE
Wayne D. Llewellyn, CAE
Ian W. McClung
John F. Ryan, CAE
Ronald J. Schultz
Russ Thimgan
James F. Todora, CAE
Robert Walker

Published by

International Association of Assessing Officers
130 East Randolph
Suite 850
Chicago, IL 60601-6217
312/819-6100
Fax: 312/819-6149
http://www.iaao.org

ISBN 0-88329-180-0

Printed in the United States of America.

Contents

1. Scope 5
2. Introduction 5
2.1. Definition and Purpose of an AVM 5
2.1.1 Definition 5
2.1.2 Purpose 5
2.1.3 Applicability 5
2.1.4 Distinction from Traditional Valuation Applications 5
2.2 Purpose and Use of AVMs 6
2.2.1 General 6
2.2.2 Analysis of Impaired Properties 6
2.3 Steps in AVM Development and Application 6
2.3.1 Property Identification 6
2.3.2 Assumptions 6
2.3.3 Data Management and Quality Analysis 6
2.3.4 Model Specification 7
2.3.5 Model Calibration 7
2.3.6 Model Testing and Quality Assurance 7
2.3.7 Model Application and Value Review 7
2.3.8 Stratification 7
2.3.9 Value Defense 8
3. Specification of AVM Models 8
3.1 Data Quality Assurance 8
3.2 Model Specification Methods 9
3.2.1 Cost Approach 9
3.2.2 Sales Comparison Approach 9
3.2.2.1 Comparable Sales Method 9
3.2.2.2 Direct Market Method 9
3.2.3 Income Approach 10
3.3 Stratification 10
3.4 Location 10
4. Calibration Techniques 11
4.1 Calibration Using Multiple Regression Analysis (MRA) 11
4.1.1 MRA Assumptions 11
4.1.2 Diagnostic Measures of Goodness-of-Fit 12
4.1.3 MRA Software, Options and Techniques 12
4.1.4 MRA Strengths 12
4.1.5 MRA Weaknesses 12
4.2 Calibrating Using Adaptive Estimation Procedure (AEP) 12
4.2.1 AEP Model Structure 13
4.2.2 Variable Control in AEP 13
4.2.3 Results and Goodness-of-Fit Measures 13
4.2.4 AEP Advantages 14
4.2.5 AEP Disadvantages 14
4.3 Artificial Neural Networks 14
4.3.1 The Artificial Neuron 14
4.3.2 Strengths of Neural Networks 14
4.3.3 Weakness of Neural Networks 14
4.4 Time Series Analysis 15
4.5 Tax Assessed Value Model 15
4.6 Calibration Summary 16
5. Residential AVMs 16
5.1 Detached Single-Family 16
5.1.1 Cost Models 16
5.1.2 Comparable Sales Models 17
5.1.3 Direct Market Models 17
5.2 Attached Residential Property (Condominiums, Townhouses, Zero-Lot-Lines) 17
5.3 Two- to Four-Family Residential Property 18
5.4 Manufactured Housing 18
5.5 Time Series Models for Residential Property 18
5.6 Summary and Conclusions for Using Residential AVMs 19

6. Commercial and Industrial AVMs 19
6.1 Commercial and Industrial Model Specification 19
6.1.1 Property Use 19
6.1.2 Location 19
6.1.3 Physical Characteristics and Site Influences 20
6.1.4 Income Data 20
6.2 Development of the Model(s) 20
6.2.1 Cost Models 21
6.2.2 Sales Comparison Models 21
6.2.3 Income Models 21
6.2.3.1 Modeling Gross Income 21
6.2.3.2 Vacancy and Collection Losses 21
6.2.3.3 Modeling Expenses 21
6.2.3.4 Direct Capitalization 21
6.2.3.5 Gross Income Multiplier 22
6.2.3.6 Property Taxes 22
6.3 Quality Assurance 22
7. Land Models 22
7.1 Land Valuation Model Specification 22
7.1.1 Property Use 22
7.1.2 Location 22
7.1.3 Physical Characteristics and Site Influences 23
7.2 Land Data Collection 23
7.3 Development of the Model(s) 23
7.3.1 Land Valuation Modeling by Sales Comparison 23
7.3.2 Land Valuation Modeling by Income 24
8. Automated Valuation Model Testing and Quality Assurance 24
8.1 Data Quality Assurance 24
8.2 Data Representativeness 24
8.3 Model Diagnostics 24
8.4 Sales Ratio Analysis 25
8.4.1 Measures of Appraisal Level 25
8.4.2 Measures of Variability 25
8.4.2.1 Coefficient of Dispersion 25
8.4.2.2 Coefficient of Variation 25
8.4.3 Measures of Reliability 25
8.4.4 Vertical Inequities 27
8.4.5 Guidelines for Evaluation of Quality 27
8.4.6 Importance of Sample Size 27
8.5 Property Identification 28
8.6 Outliers 29
8.7 Holdout Samples 29
8.8 Value Reconciliation 29
8.9 Appraiser Assisted AVMs 30
8.10 Frequency of Updates 30
9. AVM Reports 30
9.1 Types of Reports 30
9.1.1 Documentation Report 30
9.1.2 Restricted Use Report 30
9.1.3 CAMA or AAAVM Report 30
9.2 Uses of AVM 31
9.2.1 Real Estate Lenders 31
9.2.2 Real Estate Professional 31
9.2.3 Government 31
9.2.4 General Public 31
Glossary 31
References 35
Additional Suggested Readings 35

Standard on Automated Valuation Models (AVMs)

1. SCOPE

This standard is intended to provide guidance for both public sector CAMA and private sector AVM systems. This standard provides recommendations and guidelines on the design, preparation, interpretation, and use of automated valuation models (AVMs) for the appraisal of property. The standard presents market analysis based appraisal applications and aspects of such models. The principles addressed in this standard are considered applicable to all appraisals of real property, which are designed to estimate market value.

The standard does not address appraisal of personal property, such as machinery and equipment, and AVMs are not considered applicable for appraisal of highly specialized or unique property.

As presented in this standard, the development of an AVM conforms to *USPAP* Standard 6 (Appraisal Foundation 2003, 46–56). The appraiser using AVM output should follow *USPAP* standards that relate to their assignment.

2. INTRODUCTION

2.1 Definition and Purpose of an AVM

2.1.1 Definition

An automated valuation model (AVM) is a mathematically based computer software program that produces an estimate of market value based on market analysis of location, market conditions, and real estate characteristics from information that was previously and separately collected. The distinguishing feature of an AVM is that it is an estimate of market value produced through mathematical modeling. Credibility of an AVM is dependent on the data used and the skills of the modeler producing the AVM.

2.1.2 Purpose

The purpose of an AVM is to provide a credible, reliable, and cost-effective estimate of *market value* as of a given point in time. Market value is the most probable price (in terms of money) that a property should bring in a competitive and open market under the conditions requisite to a fair sale—the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus. AVM values reviewed for reliability, and generated in compliance with *USPAP* Standard 6 are considered appraisals.

AVMs are developed and used by both the public and private sector. Assessment officials use AVMs to produce estimates of value as of a common date for purposes of property assessment and taxation. Private sector appraisers and their clients use AVMs to estimate the value of a subject property at a given point in time for a wide variety of purposes.

2.1.3 Applicability

AVMs are applicable to any type of property for which adequate market information and property data are available in the relevant market area. The relevant market area is the area that would be considered by potential purchasers. For residential properties, this is typically all or a portion of a metropolitan area, one or more towns in a geographic area, or a given rural or recreational area. The market area for larger multi-family, commercial, and industrial properties can be regional or even national in scope, depending on the relevant investors and market participants.

The development of an AVM is an exercise in the application of mass appraisal principles and techniques, in which data are analyzed for a sample of properties to develop a model that can be applied to similar properties of the same type in the same market area. These may be either individual properties of interest or all properties that meet the requirements of the model.

Although the same underlying principles are applicable to all AVMs, the specific formulation and calibration techniques will vary with the purpose of the AVM, type of property, available data, and experience and preferences of the market analyst. Sections 3 and 4 discuss the general principles of model specification and calibration. Section 5 addresses residential AVMs. Section 6 focuses on commercial and industrial AVMs and section 7 focuses on AVMs developed for vacant or improved land.

2.1.4 Distinction from Traditional Valuation Applications

Although AVM development requires skilled analysis and attention to quality assurance, AVMs are characterized by the use and application of statistical and mathematical techniques. This distinguishes them from traditional appraisal methods in which an appraiser physically inspects properties and relies more on experience and judgment to analyze real estate data and develop an estimate of market value. Provided that the analysis is sound and consistent

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.