Moving Automated Valuation Models Out of the Box: The Global Geography of AVMs

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The technical standards page of the IAAO website states,

IAAO assessment standards represent a consensus in the assessing profession. The objective of the IAAO standards is to provide a systematic means by which assessing officers can improve and standardize the operation of their offices. The IAAO standards are advisory in nature and the use of, or compliance with, these standards is purely voluntary. (accessed June 23, 2014)

In April 2014, the IAAO Technical Standards Committee discussed whether the *Standard on Automated Valuation Models* should be opened for revision. The committee discussed the purpose of this standard with Research Committee member Gary Snyder, RES, past Research Committee member August Dettbarn, and me. Both the Research Committee and the Technical Standards Committee had indicated that the standard should be updated. It was initially created in 2003, and the use of automated valuation models (AVMs) and related technology has increased significantly since then.

The committee voted unanimously to open the standard for revision and accept comments from IAAO members and private-sector stakeholders. The staff liaison to the Research Committee, Mary Odom, conducted a literature search as part of evaluating the standard. The results of the search provide a valuable resource for updating the draft standard. A list of stakeholders who can contribute to the standard is also being developed.

The *Standard on Automated Valuation Models* is somewhat different from other IAAO standards in that,

…it is intended to provide guidance for both public sector CAMA and private sector AVMs. This standard provides recommendations and guidelines on the design, prepa-ration, interpretation, and use of automated valuation models (AVMs) for the appraisal of property. (IAAO 2003)

There was consensus by meeting participants that in-depth information about AVMs needs to be explored and made available to members through a series of brief articles; this is the first of those articles.

Definition of an AVM

What is an AVM? How is it used? Where are AVMs being used in the world? This article is by no means a holistic coverage of the specific degree of AVM use in all countries, but rather a survey of international scope—ultimately serving to set the stage for the advancement of international standards.

The understood and accepted definition of an AVM varies across professional and geographic boundaries and seems to be contingent upon individual experience with and exposure to AVMs. While each respective definition may vary, the overarching premise is the same: an AVM is a mathematical model created in a computing environment that estimates the value of a property. For consistency, this article assumes the IAAO 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. (IAAO 2003)

AVMs are also commonly referred to as CAMA (computer-assisted mass appraisal) models. The most common AVMs in the appraisal industry are based on multiple regression analysis, although additional types do exist (e.g., machine-learning, fuzzy algorithms).

AVM advancement does not occur in a geographic vacuum. With such readily available data and ever-increasing ease of the global exchange of data and ideas, AVMs are spreading and advancing throughout the world.

With respect to AVM establishment, the United States arguably has the strongest reputation across the globe. For more than 20 years, AVMs in the United States have served a wide array of industries, being used for property tax assessment, fraud detection, loan origination, portfolio valuation, and more. Other nations' AVM development (e.g., Canada and Germany) have been significantly influenced by that of the United States (Downie and Robson 2007).
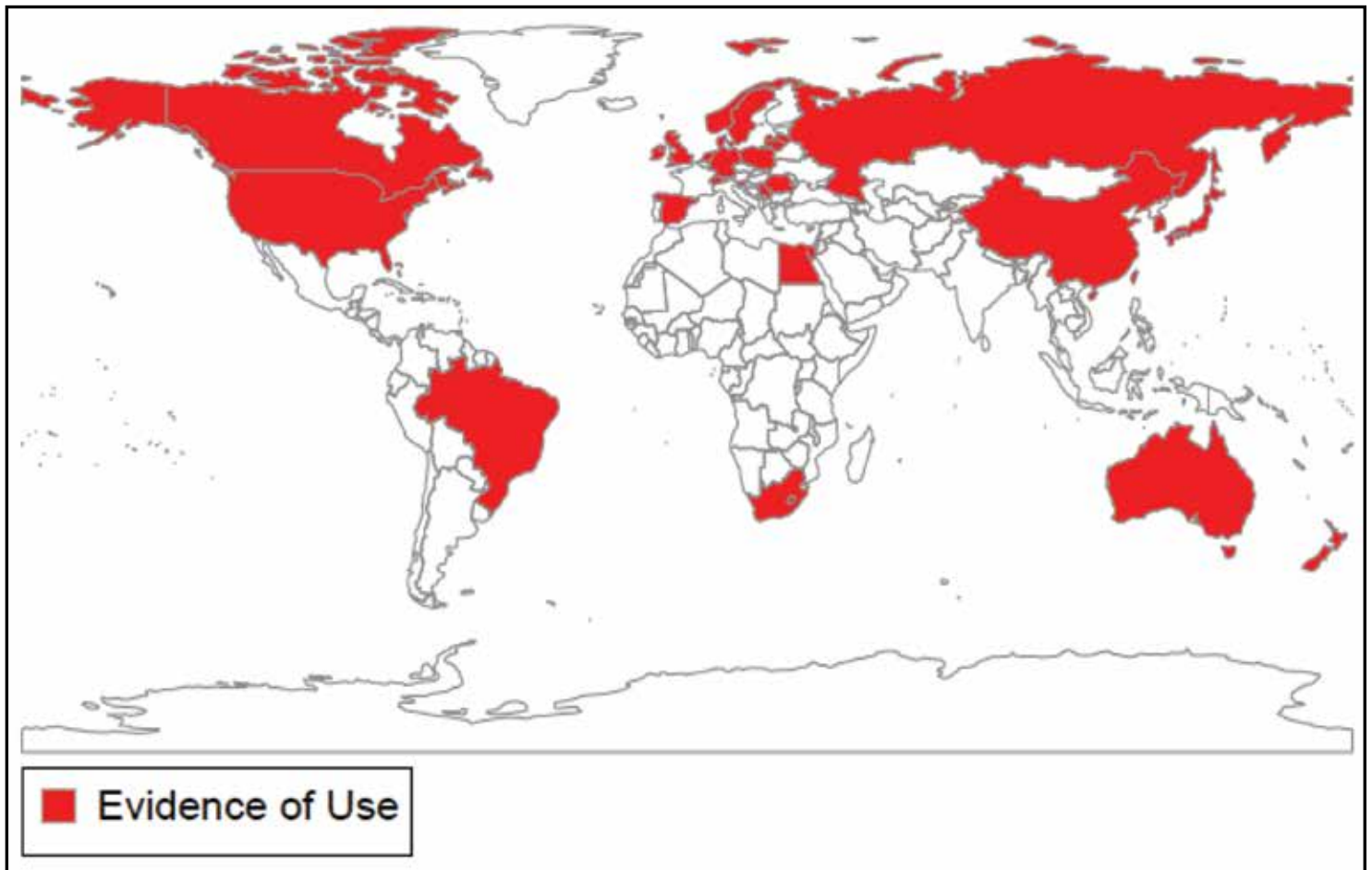
With such profound AVM establishment, expectedly a number of agencies and organizations have arisen to oversee regulations to promote overall AVM accuracy and standardization. Guiding AVM use in the assessment industry are IAAO and the Appraisal Institute. In the lending industry, federal agencies (e.g., the Federal Deposit Insurance Corporation) and membership organizations (e.g., Mortgage Bankers Association of America) also take part in the promotion of fair and accurate AVM use (Federal Deposit insurance Corporation 2014; Downie and Robson 2007).

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Figure 1 illustrates where the majority of AVM use is occurring based on the references cited throughout this article (with additional countries as listed in Almy and Ferguson [2010]). Although this figure does not include all countries using AVMs, it does provide a geographic visualization of the countries most involved with AVM applications.

As Eastern economies continue to grow, more and more countries (e.g., Korea, Japan, Singapore, and China) are turning to AVMs to solve their valuation needs (Downie and Rob-

Figure 1. World AVM Use*

* Created in the R open-source software environment using the 'rworldmap' package developed by Andy South.

son 2007). Valuation models developed in the United States are not always directly applicable to foreign property; the same principles can be applied but models must be calibrated and catered specifically to the respective markets.

Denmark

In Denmark, modeling is one of the central government's valuation approaches. It has amassed a database of sales transactions complete with property characteristics dating back to the 1960s. The multiple regression-based system, which mirrors that of American CAMA systems, has been in place since 1981 and is used to value approximately 75 percent of all properties (Müller 2002). The Danish Financial Supervisory Authority (FSA), or "Finanstilsynet," audits the valuations by mortgage banks, and banks are permitted to use AVMs only for specific types of properties under FSA supervision (Petersen et al. 2014, 273).

While Denmark, Germany, Spain, Sweden, and the United Kingdom utilize AVMs for portfolio valuation purposes, Austria, Italy, and Greece do not (Downie and Robson 2007). Greece maintains no public database of property transactions, and this has sufficiently stinted growth of AVMs there (Barańska 2013). And while Iceland has no established official AVM use, private firms are currently developing them (Finnsson 2014). Poland has been utilizing modeling systems for mass appraisal since the early 1990s (Walacik et al. 2013)

Canada

In Canada, AVMs, which began in the late 1990s, are relatively well established—only slightly less so than those of the United States. They are used for online consumer purposes, lending, as well as property tax valuation. The Canadian government has created such a well-maintained database of property transactions that it has begun selling these data to private corporations and individuals, resulting in a healthy private supply of AVMs as well (Downie and Robson 2007).

Sweden

Like Canada and the United States, Sweden has established a strong reputation for widespread AVM systems. It has been using them for property tax assessments since the 1980s—valuing properties every three years—and the banking industry began using them for loan origination purposes beginning in the 1990s (Downie and Robson 2007). Sweden's Land Data Bank System encapsulates an exhaustive history of property transactions and respective characteristics. This, in addition to AVMs' ready-made availability, has fostered a strong environment for both public and private AVM creation (Youngman and Malme 1994; Downie and Robson 2007).

South Africa

General acceptability of AVMs varies greatly from country to country. Despite the fact that AVMs are being used to various degrees, valuation professionals in South Africa are relatively leery of AVM use. In a recent study by Boshoff and De Kock (2013), a "well-balanced profile of the South African valuer profession" was interviewed regarding their knowledge of, experience with, and sentiments toward AVMs. Many of these valuers consider AVMs a threat to their profession. The authors characterize valuation professionals in South Africa as being relatively senior in age and expect that such negative sentiments will likely diminish as these valuers enter into retirement. This attrition will make way for increased AVM use in the public and private markets, and this increased use, in turn, will likely compensate for the decreased supply of professionals. Boshoff and De Kock (2013) do note, however, that both the South African Council for the Property Valuers Profession and the South African Institute of Property Valuers are opposed to AVMs, despite a lack of evidence documenting this sentiment.

Valuation models developed in the United States are not always directly applicable to foreign property; the same principles can be applied but models must be calibrated and catered specifically to the respective markets.

South Africa did not begin storing property transaction data until 1993 (Downie and Robson 2007), but increased information demand and requirements by the government that properties be valued at market value are causing a rise in AVM use in both the public and private sectors. In cities such as Johannesburg automated mass appraisal models are used to value residential properties for tax purposes (Cox 2014).

Australia

Australia has a steadfast optimism to advance and employ AVMs in both the lending and assessment industries. At the 12th Annual Pacific Rim Real Estate Society Conference in 2006, Dr. David Parker (General Manager, Australian Valuation Office; Adjunct Professor of Property, University of Queensland; Adjunct Professor, University of Western Sydney; Visiting Fellow, University of Ulster) presented a paper, "Automated Valuation Models: A Practitioner Perspective." Parker highlighted the increase in popularity and use of AVMs (driven mostly by their increased prevalence in the West) since their introduction into the country in the early 1970s (Fortelny and Reed 2005) and concluded that Australia could benefit greatly from embracing AVMs in the future (Parker 2013). At the same conference, Dr. Peter Rossini and Paul Kersha of the University of South Australia's Centre for Regulation and Market Analysis demonstrated the ability of AVMs to produce valuations of Australian properties in compliance with IAAO standards (Rossini and Kersha 2006).

Since this conference, a focus on embracing AVMs has occurred throughout Australia. With regard to property tax, Southern Australia and Western Australia have used AVMs for many years (unlike their more densely populated eastern counterparts), but an ever-increasing number of private firms are providing AVMs throughout the country for online real estate data, mortgage securities, and loan purposes (Rossini and Kershaw 2008).

Areas such as Whittlesea, Victoria—which in 2012 was one of the four fastest growing municipalities in Australia—have experienced success with AVM development. Whittlesea began using MRA-based models for residential valuation about 2000.

It is evident that AVMs are widespread and there exists a strong semblance of similarity in their use throughout the world. One specific area that must be addressed for international standards is that definitions do vary.

Under the direction of Dr. Richard Borst, Sr., Research Scientist of Texas-based Tyler Technologies, an MRA-adjusted-comparable-sales-based AVM was implemented in Whittlesea in 2010 using Spatialest (developed by geopii of Northern Ireland). When applied to a sample of residential sales in Whittlesea, this AVM achieved a COD of 5.17. Gino Mitrione, Manager of Property & Valuation Services at City of Whittlesea, expects to see widespread growth in the use of AVMs throughout Victoria and the entirety of Australia (Mitrione 2012).

United Kingdom
The 2007 valuation of Northern Ireland employed a CAMA modeling team (Barańska 2013). Multiplicative models with logarithmic functions were used (McCluskey 2012). In the United Kingdom, AVMs are an accepted form of valuation for mortgage loan purposes (Petersen et al. 2014, 486–487).

Methodological Advancement
A number of leading experts are bridging the gap internationally between academia and practitioners. Tom Kauko (Norwegian University of Science and Technology) and Maurizio d'Amato (Technical University Politecnico di Bari) published *Mass Appraisal Methods: An International Perspective for Property Valuers*, a book featuring research and case studies on cutting-edge methodologies by leading modelers and valuation specialists from a variety of international markets (Kauko and d'Amato 2009). A follow-up book, *Advances in Automated Valuation Models,* is set to be released by Springer Verlag in 2015.

The School of the Built Environment of the University of Ulster in Northern Ireland continues to have a significant presence in the development of AVM methodology. Industry expert Dr. Richard Borst completed his doctorate at the University of Ulster and has gone on to develop and implement AVMs within governments all around the world, including Brunei and Australia (Borst 2014). Dr. William McCluskey, faculty member at the University of Ulster and editorial board member for the *Journal of Property Tax Assessment & Administration*, has published a wealth of research advancing AVM methodology in numerous international journals.

European AVM Alliance
European countries are continuing to advance the establishment of AVMs. The European AVM Alliance—led by private firms in the United Kingdom, the Netherlands, Switzerland, and Norway—exists to promote a "consistent approach to automated valuations enabling the mortgage lending, investor, rating and regulatory communities to operate in a more transparent and effective way" (European AVM Alliance 2014).

In a development related more to property tax than to the lending industry, the Royal Institute of Chartered Surveyors (RICS) has drafted official guidelines for AVM use specifically in the United Kingdom—citing IAAO standards throughout (Bradford and Crispin 2013). Additional international organizations that have cited the IAAO AVM standards are the Appraisal Institute of Canada and the Republic of Serbia Geodetic Authority.

AVMs are widespread, and there are strong similarities in their use throughout the world. One specific issue that must be addressed for international standards is the variability in definitions. In South Africa, AVMs are commonly thought of as strictly and completely automated, implying no human interaction whatsoever; therefore, any model that is calibrated, for example, would not technically be an AVM to a South African (Boshoff and Kock 2013). Jargon must be evaluated, and definitions should be specific and consistent (Downie and Robson 2007). Other cultural and geographically induced hurdles will likely arise, but further research on the topic will help mitigate and potentially prevent any difficulties encountered.

Conclusion
AVMs are used in multiple industries in countries across the globe. While they are currently more established in the West, the growing economies in the East are experiencing increased ease in the flow of technology and information. This ease of use, coupled with a large number of wary opponents reaching retirement age in countries such as South Africa, indicates that there is a great opportunity for and likely widespread expansion of AVMs. With such momentum, the potential for a globally synergetic AVM movement is evident. It is truly exciting and thus very appropriate timing that the IAAO *Standard on Automated Valuation Models* is being reopened. An evaluation of methodological advancements thus far should follow. The next steps are many, but

should not be daunting. The caliber and dedication of IAAO, its committees, and its members will again be evident—that we, as a community, are capable of rising to this task.

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