“Valuing Our World: Potential Roles for AVMs and CAMA”

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Summary

Automated valuation models (AVMs) and computer-assisted mass appraisal (CAMA) systems represent significant advances in valuation technology (the 4th subtopic of the Congress). Until recently, they have been little used in everyday appraisal practice. Further use of these technologies has implications for valuation standards and appraiser training (other conference subtopics).

Using examples of domestic and international valuation for property tax purposes (an important use of valuation data globally), this paper:

- Summarizes the differences between mass valuation and conventional single-property valuation practices.

- Assesses the state of valuation practice in selected areas around the world. Frequent issues are a lack of access to market data, incomplete and inaccurate descriptive data, and a lack of understanding or agreement on valuation standards and practices. Additionally, property and transfer taxes can promote or impede the development of reliable market data.

- Demonstrates that, while preserving the strengths of conventional approaches, CAMA cadastral databases and AVMs can enhance everyday valuation work and serve a larger set of information needs. The nature of mass valuation provides an objective frame of reference for the defined value of any individual property in emerging and developed economies.

- Summarize the implications of these advances for valuation standards and the professional development of valuers.

Biographies

Richard Almy is a partner in Almy, Gloudemans, Jacobs & Denne, a US-based consulting firm that works exclusively in mass valuation and property tax administration, chiefly for governments and related institutions. He began his career as a valuer for the City of Detroit, Michigan. Later he served as research director and executive director of the International Association of Assessing Officers (IAAO). Mr. Almy is an author of works on mass valuation and property taxation. He teaches for the Lincoln Institute of Land Policy, the Organization for Economic Cooperation and Development, and clients. His work experience spans more than 100 projects in twenty-three countries in North America and the Caribbean, Europe, Africa, and Asia.

Alan Ferguson is an international property tax and fiscal decentralization consultant. After serving as assessor in three Massachusetts communities, Mr. Ferguson has managed or consulted for municipal development and property tax reform projects in the Caribbean, Central Asia, the Balkans, and Africa. He is currently team leader for a mass appraisal program in Mauritius, as part of a land administration project funded by the Government of Mauritius. (Mr. Ferguson recently joined the Appraisal Institute as a trainee member through the Wisconsin Chapter.)

1. Introduction

Valuers can have a difficult time justifying their professionalism and worth to society. Markets and market values existed long before the disciplines of economics and valuation science were developed; experts have not always been—and are not always—needed. So, how have valuers prospered? They have worked to improve and formalize valuation practices. They have worked to demonstrate professional competence and trustworthiness. They have formed professional valuation societies (such as those represented at this congress); they have promulgated valuation practice and conduct standards. Sometimes valuers have acted less nobly—making valuation methods unnecessarily mysterious, attempting to monopolize access to market data, creating "artificial" reasons for paying for valuations, erecting artificial barriers to entry in the field, resisting change, and sacrificing objectivity for financial gain. It can also be difficult for valuers to appreciate fully the breadth of the valuation field and how different user requirements can (or should) affect valuation practices (without sacrificing professionalism, of course).

This paper is about the implications that recent technological developments (the 4th subtopic of this congress)—specifically computer-assisted mass appraisal (CAMA) systems and automated valuation models (AVMs)—have for the real property valuation profession. ("Appraisal" and "valuation" are used synonymously.)

2. Mass Valuation versus Conventional Single-Property Valuation

As testimony to the previously mentioned lack of comprehension, some might not consider mass valuation—especially some of the forms used in property taxation—to be "real" valuation. We contend that mass valuation is a bona fide valuation exercise for the reasons that we discuss below.

Implicit in our discussions is the valuation objective of using data gleaned from markets to estimate the current market value of property. We are not talking about using computers to compute values based on normative ways of thinking about what value should be. We are not talking about using computers to apply outdated valuation models to determine current property tax liabilities. We are, however, very much concerned with variations in how real estate markets work and with the variations in the quantity and quality of market data that exist.

We use the term “single-property valuation” to contrast conventional valuation work with mass valuation, which until the advent of automated valuation models (AVMs) was largely confined to valuation for property tax purposes. Mass valuation refers to methods that have been developed to solve large-scale valuation problems, such as when many properties must be appraised for the same purpose, often as of the same date, and at low per-property cost.

The central idea of mass valuation is the development of mathematical valuation models that are then applied to groups of properties in a database to produce estimates of the value of every property in the group. The models are developed systematically. The first step is called “specification.” Specification is theoretical or speculative and involves deciding which valuation approach to use, which property characteristics likely have a significant effect on property values, and how those characteristics (or variables based on them) are assumed to affect value. The table below contains a highly simplified model specification. The characteristics in **boldface** are the variables in the model, and the coefficients in *italics* would be determined during “calibration” discussed next. In practice, models would be more complex and may contain ten or more variables. For more details on modeling, see Gloudemans (1999).

Market value = *Neighborhood adjustment factor* × ([*Price per square meter* ×**land area**] + [*Price per square meter* × **building area** × *construction quality factor* × **construction quality rating**]).

After a model is specified, the valuer calibrates it. Calibration is the process of quantifying the coefficients associated with the variables in the model. Calibration is the empirical, analytical work valuers do in developing models. Of interest in this paper are automated calibration methods, most notably multiple regression analysis (MRA). In practice, specification and calibration activities are iterative, as models are evaluated and refined. Appraisal models vary with the type of market evidence used and with the data available.

The differences in practices that we ascribe to the two spheres of valuation work are largely based on our analysis of the nine-step valuation process laid out in the *Uniform Standards of Professional Appraisal Practice* (USPAP). We draw on materials prepared for the International Association of Assessing Officers (IAAO) in its forthcoming treatise, *Fundamentals of Mass Appraisal*.

Some distinctions between mass valuation and single-property valuation are more apparent than real. Both types of valuation produce individual value estimates for each property. What most distinguishes the two branches of valuation is the emphasis in mass valuation on comprehensive, regularly maintained databases; the systematic procedures for developing models, the ways in which the models are applied to generate specific estimates of the market value of the properties of interest, and the statistical tests used to evaluate the credibility of the models and the accuracy of the resultant statistical tests. In contrast to mass valuation, single-property valuation generally involves explicit consideration of fewer comparison properties but of more general market factors. Data and conclusions are reported in more detail. The fact that mass valuations are not made and presented in the same way as single-property valuations do not make them inferior as long as they accurately reflect market values as of the valuation date and meet accepted valuation accuracy standards.

Both mass valuation and single-property valuation are exercises in applied economic analysis. They represent logical, systematic methods for collecting, analyzing, and

processing data to produce intelligent, well-reasoned value estimates. The single-property valuation process is essentially sequential. It begins with accepting an assignment and ends when the valuer delivers the valuation report. In mass valuation many properties are involved in each step. Some steps in the process, such as model calibration, are completed separately for different market areas and property types.

Of course, there are important differences in valuation objectives and approaches. Single-property valuers and property tax valuers typically face different sets of user requirements, which can hinder mutual understanding, as previously mentioned.

Clients and users of valuations are more easily identified in most single-property valuation assignments, and the intended use of the valuation is clear. Particularly in mass appraisal for taxation and in web-accessible AVMs, like the one by Zillow.com, the clients and users of valuations are far from clear. In property taxation, a valuer serves at the pleasure of some appointing authority, but he or she serves the interests of both property taxpayers and property tax revenue recipients. Moreover, the valuer may be under the supervision of a central or regional government that has the power to tax property.

For single-property valuers, discovery and listing are comparatively trivial tasks, except for concerns about environmental risks and hidden defects. They can use the assessor's data on the subject property and on the comparison properties ("comparables") that are selected as the starting point, although a contemporary inspection of each property usually is required. On the other hand, maintaining the property inventory is the biggest challenge a property tax valuer faces.

The scale of mass valuation often requires that several people work on the process—from collecting data through deciding whether to approve the value estimates as a basis for taxation. This requires synchronization of both tasks and valuation judgments. Single-property valuation often involves only one person.

The use of standardized procedures in the valuation of all the properties in a valuation set (market area, property type) ensures consistency and facilitates testing the accuracy of the valuations. Thus, valuation models developed for mass valuation purposes represent supply and demand patterns for groups of properties rather than a single property.

Quality is gauged differently in mass and single-property valuation. Statistical methods can be used in mass valuation to evaluate quality. They focus on the ability of models to produce value estimates that mirror patterns in actual sale prices (or rents or other objective indicators of value). Here, the focus is not on the individual property, which is the subject of a value review process. In single-property valuation, quality is reflected in adherence to the valuation standards in force (such as the development and reporting standards of the *Uniform Standards of Professional Appraisal Practice* [USPAP]) and in client satisfaction.

Client satisfaction arguably is more important and straightforward for the single-property valuer: Only a single valuation is in question. As long as it is logical, supported by evidence, and clearly communicated, the result likely will be accepted. Of course, there can be a downstream risk that the valuer's competence will be questioned, should something go wrong. If this happens, the single-property valuer's potential exposure is much greater than an assessor's. The valuer could be exposed to a loss of license or to being held liable for a sum approaching the entire value of the property or the amount for which a mortgage is sought. In contrast, the exposure in property tax administration generally is no greater than the taxes at stake. Moreover, appeal systems ordinarily shield assessors from much of their exposure.

In summary, a greater level of effort (and expenditure per valuation) and commensurate attention to detail often is warranted in single-property valuation assignments than usually is warranted in mass valuations. Assessors, however, face the problem of cost-justifying the expenditures necessary to ensure that the values they produce are accurate and are supportable should they be challenged. Although the favored may not

agree, society benefits when values are accurate because effective tax rates (taxes as a percentage of value) are more uniform.

3. State of Valuation Practice in Selected Areas of the World

Valuation practices vary widely around the world for a variety of reasons. We discuss some of them here. Countries that have advanced, dynamic market economies and that respect the rule of law tend to have more advanced real estate institutions, including the valuation profession. Globally recognized valuation methods and standards are vital where globally marketed properties are concerned.

Land tenure and land title systems—including how property transfers are taxed—also have important implications for valuation. These regimes frequently can work at cross purposes to open and transparent property markets. As one example, high property transfer taxes (tax rates higher than, say, 2 percent) create incentives to conceal real prices and in extreme cases conceal transfers of ownership. Title registration systems that *require* that a valuation be made in order to assess the transfer tax invite attempts to corrupt valuers. In such settings, even if the valuer is not corrupt, it is very difficult to acquire sufficient accurate market data to make an accurate, objective valuation, thereby undercutting the rationale for requiring a valuation in the first place.

So-called “illegal” properties—land that was developed and structures that were built without proper permission—can occupy a kind of limbo. They cannot be entered into the official land title system without the owner seeking to obtain an unobtainable blessing of the illegality, which can be as trivial as enclosing an apartment balcony or as egregious as building a convention center. Often, if they cannot be legally registered, they cannot be legally taxed, thereby encouraging further illegal construction and attendant corruption. Whole city districts can be “illegal.”

In the 1990s, some former socialist countries required taxpayers to purchase a valuation in order to have property taxes assessed. In one, a proposal was made to require a valuation of a family house that would cost USD 250 for a tax that would raise USD 20. This proposal was made by an association of construction cost engineers. Other groups proposed continued use of complex normative models that mathematically ranked properties according to multiple “desirability” criteria, requiring huge environmental databases, when prices would provide the market’s assessment of the desirability of properties.

These examples illustrate how professional valuation disciplines can influence views on proper valuation practices. As is widely known, property valuation can be under the purview of the surveying profession, civil engineering, or architecture, even though knowledge of land economics, finance, and mathematical analysis is crucial to defensible values. Long established professions can be slow to recognize both changing needs and changing technologies. On the other hand, in some transitional countries, valuation can be virtually anarchistic, with different groups of would-be valuers claiming to have a superior, proprietary valuation methodology.

Real estate market operations can affect the availability of market data. In at least one transitional country, rather than helping would-be sellers find buyers, real estate agents tried to help buyers find properties that were for sale. To protect their knowledge of people seeking to purchase property, deals were done very secretively, else the buyer and seller could cut the agent out of the deal. This resulted in a highly non-transparent real estate market. Until recently, much of the data held by real estate brokers in the U.S. was regarded as private. Brokers also sometimes opposed legislative attempts to require buyers and sellers to file a real estate transfer return with assessing officials, because the data would thereafter become public, thereby undercutting their data monopoly. In about ten U.S. states, property price information is not publicly available.

We have suggested that valuation professional bodies can become complacent. The collapse of the Soviet Union is but one example of how a crisis can upset the status

quo. The savings and loan crisis in the United States in the late 1980s can be credited with bringing AVMs onto the scene, just as post-war criticism of property tax valuation practices led to the installation of CAMA systems in some U.S. local authorities.

4. Uses of Mass Valuation now and in the Future

Although the potential of multiple regression analysis in property valuation was recognized much earlier, the advent of third-generation computers in the mid-1970s marked the beginning of today's CAMA systems. Arguably, the first operational use of MRA in property valuation was by the California State Board of Equalization to value single-family houses in about 1968. Other early adopters of the technique included the State of Arizona; Cook County, Illinois; Denmark; and Sweden.

The advent of personal computers (PCs) and general-purpose software suitable for mass appraisal applications in the 1980s made CAMA systems even more feasible. Influential was the introduction of SOLIR, a PC-system for conducting market analyses, developed by the Lincoln Institute of Land Policy. Later advancements included the gradual adoption of general-purpose database management systems to house the data used by CAMA and tax administration systems. This resulted in a movement toward system integration, notably the linking the assessment and CAMA systems with geographic information systems (GIS) and tax administration systems. Advances in processing and storing photographic and video images have opened new opportunities to reduce expensive field inspections.

CAMA models are used in property taxation in at least thirteen countries. These include Australia, Canada, Denmark, Egypt, Finland, Latvia, Lithuania, Mauritius, Northern Ireland in the United Kingdom, Russia, South Africa, Sweden, and the United States. Pilot and demonstration projects have been carried out in numerous other countries, demonstrating feasibility in settings with limited sales data and limited property attribute

data sets. Multivariate model building methods certainly are widely known among academics and forward-looking valuers.

As noted, users and suppliers of valuation services in the sphere of mortgage underwriting began to explore how CAMA techniques could be applied to their needs in the 1990s. A mortgage financing crisis in the U.S. in the late 1980s raised questions about appraisal bias, if not fraud, that resulted in many properties being over-valued. At the same time, there were interests in (1) reducing transaction costs (including lowering the costs of required mortgage appraisals) to make housing more affordable and (2) reaching mortgage-value conclusions more speedily. CAMA models, later called automated valuation models (AVMs), provided partial solutions to these needs. AVMs now are used in other applications, such insurance valuation and in assessment appeals (by attempting to identify properties that the assessor has over-valued.

As with CAMA models, AVMs vary in methodology, market coverage, degree of disaggregation or granularity, attribute data quality, and currentness. A key requirement for an AVM is flexibility in specifying the valuation date, which often needs to be very current.

Although an AVM requires data to calibrate it, it may not sit atop a property attribute database. If an AVM is not linked to a database containing the subject property, data on the property would have to be obtained, and the model would be applied to that data set. There also may be limitations in the data used to calibrate an AVM. The data can be obtained via a consolidator from assessors' offices, with attendant concerns about whether they are useful, accurate, or current. Alternatively, the data may be collected by valuers that use the AVM, or a combination approach can be taken. In any event, the data files now used by AVMs are reported to cover more than 90 percent of the single-family housing market in the United States. The completeness and quality of sales data varies with state laws that govern the reporting of sales data at time of sale and with state and local procedures for processing sales data. AVM's may obtain only raw sales data and not benefit from the assessor's sales validation and screening efforts.

Although private-sector AVMs tend to use proprietary methods, there are several main categories:

- Price index models that update the last known sale price of a property using a repeat-sale methodology
- Hedonic models (usually using MRA), neural network models, and the like
- *Tax assessed value* models, in which an assessed value is factored for changes in price levels since the assessment date
- Hybrid models that blend (or *cascade*) several models or approaches.

There is an active and competitive AVM industry globally, with AVMs being used in Australia, Canada, South Africa, and the United Kingdom, in addition to the United States and probably other countries.

Of course, many are critical of mass valuation—some on visceral rather than intellectual grounds. “How can a computer value my property?” Ongoing issues that pertain to AVMs include:

- The “hit rate” (the percentage of properties in an area that an AVM can value). Hit rates are higher in homogeneous areas, suggesting that greater valuer involvement is warranted in heterogeneous areas and in thin markets.
- The accuracy of AVM estimates generally. Accuracy often is measured by the percentage of value estimates that fall within, say, 10 percent of sale price, and the forecast standard deviation, or FSD, which is defined as the expected standard deviation of the AVM value relative to the true price of the property. Certainly, there is a lively debate over the accuracy of Zillow’s estimates. (CAMA models conventionally are gauged by the coefficient of dispersion (COD), which is a measure of the average valuation error.)
- Professional acceptance by conventional appraisers and brokers, who can feel threatened by new technology. They naturally focus on errors, not successes. They forget that there is no easy way to evaluate the overall accuracy of their work.

For an accessible overview of AVMs internationally, see Downie and Robson (2007).

Conventional single-property valuation and mass valuation should not be viewed mutually exclusive. Any computer-generated value estimate would benefit from critical scrutiny of a knowledgeable valuer. IAAO's three-pillar educational philosophy recognizes the importance of both types of skills. At the same time, many conventional single-property valuation analyses could benefit from the richer set of market data that AVMs draw on. As with automating the production of valuation reports, computer assistance can be used in routine number crunching, freeing the valuer to apply her or his skills to important nuances that broad-brush valuation models cannot take into account.

Success will come to the individuals and organizations that consider valuation service needs from the perspective of clients and users, not from their supply-side perspective and that embrace new technologies in their practices. History demonstrates over and over that innovators prosper more than most who resist change.

5. Implications

It is widely recognized in the valuation profession that valuers need to continuously develop their skills to meet evolving needs. In the sphere of property taxation, there always will be a tension between the need for more accurate and defensible values, on the one hand, and the need for economy in valuation, on the other. In principle, the amount spent on property tax administration—including valuation—should be a small percentage of revenues collected. If a property was valued at USD 100,000, and it was taxed at 1 percent of its value (USD 1,000), the amount spent on administration should be on the order of USD 10 to USD 20 (property tax rates globally generally are much lower—on the order of 0.1 percent). A conventional single-property appraisal of the above example probably would cost USD 250 to USD 500. The valuation problem

should be seen in the light of such financial realities, not in the light of a best practices standard that ignored client needs. We suspect that from a value for money perspective, the costs of conventional appraisals need to be lower, especially in the light of policies that try to make houses affordable. Thus, AVMs and CAMA system likely will become more prevalent.

Such an outlook clearly has implications for valuation standards, valuer training, and valuation practice. Happily, at least three valuation standards bodies—the International Valuation Standards Council (IVSC), the International Association of Assessing Officers (IAAO), and the (U.S.) Appraisal Standards Board, the developer of the Uniform Standards of Professional Appraisal Practice (USPAP) have recognized the validity and importance of mass appraisal. The IAAO standards essentially are in the form of guidance notes. USPAP Standard 6, Mass Appraisal, lays out general requirements for credible mass appraisals. Arguably, all of these standards are in their infancy. A search of other leading English language standards reveals at most a passing mention of mass appraisal. Clearly, there is work to be done.

The availability of mass appraisal training also is problematic. Several academic institutions in Europe and North America offer courses in mass appraisal as part of their degree or certificate programs. The IAAO and the International Property Tax Institute (IPTI) offer short courses in mass appraisal. In addition, the International Center for Land Policy Studies and Training in Taiwan offers short courses in mass appraisal. The IAAO and the Appraisal Institute have published treatises in mass appraisal (see the references). A number of professional and academic journals publish articles on developments in CAMA systems and AVMs.

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