Property Elite

Research Paper
Valuation and AVMs

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The Digital Transformation of the Valuation Sector in the World of Algorithms

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He is developing algorithms (mathematical models) for Automated Valuation Models (AVMs) based on Big Data, Artificial Intelligence – AI: Artificial Neural Network and Machine Learning.

Executive Summary

Over the years, the concept of digitalisation has rapidly integrated into many sectors. This Research Paper will discuss the valuation sector's digital transformation, predominantly investigating the automated valuation models (AVMs) and their integration in valuation.

Real estate is one of the oldest and the largest asset class in cities (Kok et al., 2017: 202). As explained by (Gilbertson and Preston, 2005: 123), in mature economies, a large proportion of financial decision-making relates to property.

Therefore, if the assets are not correctly valued then an extensive range of stakeholders are exposed. The 1970s property crash prompted RICS to publish the Red Book, setting out standards of valuation and professional conduct expected of valuers (Gilbertson and Preston, 2005: 124).

However, the fluctuation and the relationship between value, worth and risk remain unchanged. The recent paradigm shift to the concept of digitalisation requires a discussion of economic development in relation to social development. This necessitates considering political (the role of governmental bodies concerning smart governance), social (individuals\dwellers in regards to raising the quality of life) and economic (such as real estate markets together with its stakeholders, including government, banks, building societies, insurance companies, and investment firms in regards to the coordination and collaboration) factors.

Introduction

According to (Glumac and Rosiers, 2018: 2), the digitalisation of the valuation sector is an emerging trend. This is confirmed by the RICS Insight Paper, the Future of Valuations (2017), which deemed it to be a trending topic.

A timely and accurate valuation is a complex and challenging task. However, despite the dominance of manual valuations in many countries, recently, there has been a clear shift towards digitalisation in some high-income countries, from manual to automated valuation models (AVMs). However, the accuracy or precision of the valuation has maintained its importance both in popular and academic debates. In addition to the persistent problem of imprecise value measures, time-consuming and costly valuation bureaucracy and non-collaboration between stakeholders are some of the drawbacks.

Most importantly, the current traditional manual valuations are subjective (valuer bias). Some valuers may apply a more relaxed approach by validating a negotiated price rather than estimating the true Market Value of a property (VPS 4, RICS Valuation - Global Standards (2020)), (Al-Akhras and Saadeh, 2010: 905). On the other hand, AVMs ensure valuations' objectivity and facilitates quality control (Al-Akhras and Saadeh, 2010: 909). It also reduces costs and permits the use of larger, more representative samples (Zhang and Chen, 2009). According to Kok et al. (2017: 203), 'AVMs can be used for stress testing under adverse economic scenarios'; they can be accurate, objective and timely.

For decades, the precision of valuation has been argued both in academia and the industry. According to (Cannon and Cole, 2011), 'valuers are more than 12% above or below the subsequent transaction price.' The deviation, according to (Webb, 1999) was 9% to 12.5%. On the other hand, the MSCI June Report (2016) indicated an absolute difference of 7.7%. It is also demonstrated that the model and the actual value are 9.3% for a multifamily asset in California, Florida and Texas (Kok et al., 2017: 202, 203, 210).

However, the credibility of an AVM is still dependent on the dataset used and the valuers' initiative. Current AVMs are based on tribal information known to the groups and subgroups within a particular and segregated network, an obstacle to collaboration and data sharing among stakeholders.

Moreover, the algorithms used in current AVMs cannot reflect a comprehensive knowledge of the physical condition, facilities, and the neighbourhood (such as crime rate, safety, pollution levels, stigma) of the asset being valued. Some AVMs lack the element of Artificial Intelligence. These drawbacks are problematic in today's just-in-time motivated real estate markets, which look for productivity, efficiency and instant real estate valuations. This brings up the concept of big data and integrates different data sources in real estate valuations to fill knowledge gaps in the valuation process and enable online engagement, collaboration and data sharing among stakeholders.

The Shift from Manual Valuations to Automated Valuation Models

Despite manual valuations' dominance, adopting and testing Automated Valuation Models (AVMs) in real estate valuations have been widely spreading both in public and private sectors, as complementary to the traditional manual valuations (Matysiak, 2017: 2). In line with Tretton's (2007) emphasis, AVMs support the process of arriving at more accurate valuation and does not mean replacement for valuers and other key professionals.

As identified in RICS (2013), AVMs are currently used by;

- Banks in re-valuation for credit decisions, in-arrears assessments, identification of fraudulent activities, full valuation audits, determining capital adequacy ratios, mark-to-market bank's portfolio of properties;
- Government in mass appraisals for local taxes by government, estimating relocation compensation, cost\benefit analysis for potential public expenditure;
- Individuals in capital tax planning.

In addition, individuals can also use AVMs to predict a rough estimate of their property or the property they are interested in through the online portals provided by Zoopla, Rightmove, Redfin, Zillow, etc.

The Drawbacks of On-Site Manual Property Valuation

It is widely acknowledged in the literature that AVMs can overcome some of the disadvantages of on-site manual property valuation.

The disadvantages of on-site manual property valuation are classified as (Bonissone and Cheetnam, 1997; Anderson et al., 2002; Khedkar and Bonnissone, 2002; Bonissone, 1999; cited in Al-Akhras and Saadeh, 2010: 906):

- It is time-consuming, as it may require several days of preparation, and it may take several site visits to give an estimation;
- It costs a lot of money per subject property, and the valuer is charging the customer; therefore, it may become an expensive process;
- Lack of comparable properties forces the valuer to make subjective judgments (valuer bias) regarding the differences in value created by the differences in the original and the comparative properties. Also, valuers with different levels of experience may have different evaluations;
- Some valuers may apply an easier approach by validating a negotiated price rather than estimating the true Market Value of a property.

Thereby, it is claimed that the drawbacks of on-site manual property valuation are that it is 'time-consuming, costly, based on subjective judgments and sometimes based on validation using a negotiated price rather than estimating the true market value of the property' (Al-Akhras and Saadeh, 2010: 905). Some of these drawbacks can be resolved by the adoption of AVMs in real estate valuation processes.

What are AVMs?

AVMs are mathematically based computer software programmes allowing timelier asset valuation. According to (Fortney and Reed, 2005: 452), AVMs are mathematically generated statistical models that undertake a pre-set calculation depending on the type of data input.

AVMs also ensure valuations' objectivity and facilitate quality control (Al-Akhras and Saadeh, 2010: 909). Depending on an automated valuation, human valuers can spend more time gathering the information necessary to value the property. AVMs also reduce costs and permit the use of larger, more representative samples (Zhang and Chen, 2009).

Valuers' View

Despite the adoption and acknowledgement of AVMs, recently used AVMs are still called into question. As seen in Downie and Robson's research (2008), based on the responses of 473 valuers representing both lending and valuation organisations, although 90% of valuers agreed that the ability to evaluate comparables was a major advantage over AVMs:

- 71% of the valuers agreed that AVMs were inadequate for loan valuations as a result of no physical inspection;
- 87% of the valuers agreed that physical valuations were more accurate than AVMs, as a result of local knowledge.

On the other hand, timely asset valuation is still considered as a big challenge. As argued by Al-Akhras and Saadeh (2010: 908), 'timely asset valuation and pricing are a big challenge in the commercial and financial world. The value of stock and bonds can be easily determined; instead, the same precise valuation for real estate assets cannot be performed'. The accuracy or precision of AVMs valuations is still subject to academic debate in today's real estate market (Kok et al., 2017: 202).

Using AVMs for Stress Testing Under Adverse Economic Scenarios

Property valuation should be performed accurately and timely for purposes such as lendering, property tax estimation, insurance estimation and estate planning (Al-Akhras and Saadeh, 2010: 915). As argued by Kok et al. (2017: 203), accurate and timely property valuation is 'critical for real estate investors and lenders to make informed underwriting decisions, where systematic errors or biases in valuation may have adverse effects on the provision of equity or debt'.

Kok et al. (2017: 203) also emphasise that 'AVMs can be used for stress testing under adverse economic scenarios, which remains a much-needed tool for regulators, banks, rating agencies, and investors'.

Recently used AVMs are also questioned in terms of 'the inability to confirm or deny whether a property exists; the limited ability to address a property's condition; the limited ability to account for external influences; limited data coverage in some areas; limited ability to reflect any unique characteristics of a property, and so on' (Matysiak, 2017: 7). Indeed, it is emphasised that recently used valuations are unable to provide a data for features determining the quality of the asset such as the physical condition of the property, its facilities, the neighbourhood demographics and the location of the property within the neighbourhood (Al-Akhras and Saadeh, 2010: 915).

Moreover, despite the fact that AVMs are integrated with lenders, government, regulatory bodies, insurance companies and investment firms, these stakeholders are still reluctant to integrate AVMs into decision-making processes due to the fact that the algorithms are based on tribal data from a specific group. In other words, existing models are based on tribal information known to the groups and subgroups within a particular and segregated network that is an obstacle to both collaboration and data sharing among the stakeholders. As stated by (Henderson, 2010: 12), tribal knowledge is 'any underwritten information that is not commonly known by others'. These criticisms lead to the concept of big data and application of this to real estate valuations, enabling instant valuations and more sophisticated management of real estate financial markets in smart cities.

Earlier and Current Approaches Used in AVMs

The concept of Market Value is central to the functioning of the real estate sector. However, there are opposing arguments into what drives Market Value and whether it can process all variant data (Mooya, 2016). The traditional method of property valuation has been on-site manual valuation by a human expert (valuer). The common methods used by human valuers in property valuation are mathematical models based on the relationship between value and the property's features.

There are three approaches (VPS 5) and five methods of traditional valuation. The three approaches are market (Baum & Crosby, 2014), cost (Osborn, 2014) and income (Baum et al., 2017), and the five methods are comparative, investment, profit, cost and residual.

Mass (advanced) valuation is the process of valuing a group of properties with a set date, data and standardised method (SMARP, 2013). Mass valuation is known as an advanced valuation method. It is focused on accessing an extensive database of accurate property information (i.e. the sale price, date of transaction, size and location). Advanced valuation methods are classified as hedonic, artificial neural networks, fuzzy logic and spatial analysis methods.

Brief History

The interest in AVMs is not new. It dates back to Zangerle, who developed Real Property Mass Appraisal Theory in 1920 (Zhang and Chen, 2009). This earlier model was based on estimations through sampling, which is less accurate when used for a large batch of properties. While it is possible to see Multivariate Regression Analysis (MRA) techniques in valuations, the widely used quantitative model is Multivariate Linear Regression (MLR).

In this early model, illustrates the residential market, it is assumed that variables affecting real estate values are linearly related to variables including price. age, distance to the city centre, bathrooms and square footage (Al-Akhras and Saadeh, 2010: 908). Estimating hedonic price function has a multiplicative function form. This means that as the characteristics increase (or improve), house prices increase but at a decreasing rate.

As argued by Boshoff and Kock (2013: 1), the adoption of AVMs in the field of commercial property valuation is limited. This is due to the fact that commercial property markets are heterogeneous. However, It can be implemented as a useful tool for verification and auditing purposes.

According to Robson and Downie (2008: 2), AVM usage is limited in rural locations as confidence levels are typically low. It is, therefore, predominantly used as a fraud check.

Types of AVM

In general, an AVM is a mathematically based computer software programme. It is also possible to consider AVMs under the concept of Computer Assisted Mass Appraisal (CAMA) techniques (Al-Akhras and Saadeh, 2010: 909). According to the RICS (2013), AVMs 'use one or more mathematical techniques to provide an estimate of the value of a specified property at a specified date, accompanied by a measure of confidence in the accuracy of the result, without human intervention post-initiation'. In addition to accuracy and objectivity, AVMs also shorten the time spent both in information gathering and valuation, reduce costs and allow the use of larger and more representative samples.

Several approaches can be applied for the purpose of automated property valuation (Al-Akhras and Saadeh, 2010: 909). The simplest is the Case-Based Reasoner Reasoning (CBR) approach proposed by Gonzalez and Laureano-Ortiz. This does not use the intuitive imprecision used in the comparable method (manual approach), which include finding the most similar house(s), located near to the subject property, sold not too long ago; and selecting a balanced subset of the most promising comparable properties to derive the final estimate.

Bonissone et al. (1995) proposed a fuzzy CBR system in which the input features of the properties (address, date of sale, living area, lot area, number of bathrooms and bedrooms) in the data set of previous properties are assigned a fuzzy membership value (between 0 and 1) based on their closeness to the subject property to be evaluated. The closest 4-8 properties are then selected for further computations such as averaging and adapting to estimate the price of the subject property. The price is then adjusted according to other factors such as construction quality, condition and specification.

Khedkar et al. (1992) proposed another method in which a generative Artificial Intelligence (AI) method trains a fuzzy-neural network using a subset of cases from the case-base to produce a run-time system to provide an estimate of the subject's value.

As argued by Kok et al. (2017), AVMs can take different approaches to compute a property value. According to Kok et al. (2017: 204) 'the model does not depend on the use of a capitalisation rate, which is critical in traditional property valuation techniques. Such a cap rate is simply derived from the net operating income (NOI) of an asset divided by its transaction price. For valuation purposes, the cap rates of three to five recently transacted, nearby buildings are typically used, adjusting for difference between the appraised property and the transacted properties. In contrast, an AVM incorporates all transactions in a given market, assuming a relationship between value and independent variables that is consistent across locations'.

As mentioned by Kok et al. (2017: 204), AVMs based on regression (hedonic) models are widely used (e.g., O'Neill [2004]; Schulz, Wersing, and Werwatz [2014]). 'However, some more modern algorithms use adaptive estimation models or neural, self-learning network models (Crosby et al. [2016])'.

Among these models, Hedonic AVMs are well recognised in the real estate sector. Hedonic AVMs are based on information about basic property attributes and locational characteristics. 'These models typically include a search engine that compares the attributes of the subject property with comparable properties using a radius search pattern or other logical search parameters over a predetermined period' (Kok et al., 2017: 204).

According to Kok et al. (2017: 204), 'hedonic AVMs are widely used as they are based on simple regression models easy both to implement and understand. The main disadvantage is that regression models are global models, which means that they generate a single predictive formula that is constant across the entire range of variables. However, many variables have a non-linear relationship relative to the predicted value. Consequently, one single model might not be successful at predicting property value in the most accurate way'.

As an alternative to hedonic models, Decision Tree Models, also known as a Machine Learning Approach, can be integrated into AVMs. In this model, the data set is divided into subsets in order to apply a regression model to each subset. There are two types of decision trees, depending on the type of target variable: classification trees, which are aimed at predicting categorical variables, and regression trees, which predict continuous variables (Breiman et al. [1984]).

As explained by Kok et al. (2017: 204), 'a regression tree algorithm finds the best predictors from the set of independent variables by first minimising the variance of regression between each combination of the dependent and an independent variable. This yields the order of importance of the variables. Each of the explanatory variables then represents a node in the decision tree'.

Limitations

Although these approaches enable the operation of AVMs, the data sources used in these models are predominantly based on tribal information only known by local experts valuing within the segregated networks. This is an obstacle to both collaboration and data sharing among the stakeholders.

Although the distinguishing features of an AVM are being accurate, objective and timely, the reliability of an AVM is still dependent on the dataset used and the initiative of the valuers. The accuracy and validity of publicly-accessible data used by current AVMs are also questionable; hence why current AVMs give a range of values rather than a single valuation figure.

Moreover, each AVM method discussed above is operated under unique, segregated systems which limits consistency in the valuation process.

As stated by Boardman et al. (2001), the problems with hedonic models are that there are a number of limitations, which include;

- Information; the model requires that all individuals have prior knowledge of the potential positive and negative externalities they may face having purchased a house;
- Measurement validity; the quality of the measures used in independent 'explanatory' variables is of key importance;
- Market limitations; the model ideally requires that a variety of different houses are available so that individuals are able to obtain the particular house of their choosing, with a combination characteristics they desire;
- Multicollinearity; it may be the case that large houses are only found in green areas with low pollution, and small houses are only found in urban areas with high pollution;
- Price changes; The model assumes that market prices adjust immediately to changes in attributes.

Moreover, no matter which model is taken, there is an emerging need to establish a large and continuously updated database or dataset, enabling real-time and instant valuations in today's just-in-time motivated real estate markets.

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