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About this Series

The series “Studies in Systems, Decision and Control” (SSDC) covers both new developments and advances, as well as the state of the art, in the various areas of broadly perceived systems, decision making and control- quickly, up to date and with a high quality. The intent is to cover the theory, applications, and perspectives on the state of the art and future developments relevant to systems, decision making, control, complex processes and related areas, as embedded in the fields of engineering, computer science, physics, economics, social and life sciences, as well as the paradigms and methodologies behind them. The series contains monographs, textbooks, lecture notes and edited volumes in systems, decision making and control spanning the areas of Cyber-Physical Systems, Autonomous Systems, Sensor Networks, Control Systems, Energy Systems, Automotive Systems, Biological Systems, Vehicular Networking and Connected Vehicles, Aerospace Systems, Automation, Manufacturing, Smart Grids, Nonlinear Systems, Power Systems, Robotics, Social Systems, Economic Systems and other. Of particular value to both the contributors and the readership are the short publication timeframe and the world-wide distribution and exposure which enable both a wide and rapid dissemination of research output.

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Maurizio d’Amato · Tom Kauko
Editors

Advances in Automated Valuation Modeling
AVM After the Non-Agency Mortgage Crisis

Springer
Foreword

The recent financial crisis has lead researchers to argue that existing valuation methods or the application of these techniques are inadequate to cope with the complexities of today’s property market. This latest contribution from d’Amato, Kauko and guest authors presents new research examining current practice and providing examples of new methods and adaptations to improve the reliability of valuation and mass appraisal techniques. As such, it is a valuable addition to the literature on automated valuation and mass appraisal.

The book is divided into five parts with contributions from several experts in this field who focus on the different aspects associated with the application and development of real estate appraisal methods. Part I focuses on the emerging problems associated with property valuation. d’Amato and Kauko examine the theoretical background and application of property valuation and find that academic research still appears to focus on the integration of financial and property markets. The continued use of models based on the concept of a perpetually increasing income could, they argue, lead to a repeat of the errors which caused the 2008 global property crash. The role of automated valuation methods (AVM) in the 2008 financial crisis is discussed by Mooya who concludes that the use of AVMs are highly dependent on the both the assessor’s understanding of a specific market and the inclusion of additional data to capture the market context.

In Part II, case studies from Italy, Germany and Turkey provide examples of AVM in practice and the impact of banking reform measures in emerging markets. Eilers and Kunert carry out an analysis of REITs in Turkey following the introduction Basel III. Analysing the performance of Turkish direct real estate investment compared with that of real estate investment companies (REICs) based on three assess classes (residential, office and retail), they found that REICs did not perform as well as direct real estate investments and had become a ‘developer’s vehicle’ for construction companies and contractors.

The problems associated with calculating value when data is sparse is addressed by d’Amato, Cvorovich and Amoruso who explore the potential use of the Short Tab Market Comparison Approach as a method to statistically define the
relationship between property prices and their characteristics where there is little
data available. Moving away from the standard approach to AVM, Ciuna and Salvo
propose an automatic procedure based on the Market Comparison Approach to
define equations related to a specific market place rather than treating all markets as
homogenous. Ciuna, De Ruggiero and Salvo address the use of the Income
Approach, as recommended by the International Valuation Standards, in situations
where there is a lack of comparable data. They propose calculating the capitalisation
rate with an automated valuation model which is based on a real estate database
built through a computerised geocoding automatic procedure rather than a capitalisation rate which is generally extracted from a different segment of the market.

Part III looks at the methodological challenges of using AVM. Del Giudice and
De Paola undertake a spatial analysis of the residential rental market in central
Naples with geadditive models based on a penalised spline function in order to
improve upon the usual Kriging techniques. They find that this approach is reliable,
efficient and flexible and as such useful in modelling realistically complex
situations.

Locational attributes are also the focus for the study by Curto, Fregonara and
Semeraro who introduce a new approach to measure the relative improvement in
price and asset liquidity prediction when the location is known. The use of different
AVMs is examined by d’Amato and Amoruso in two case studies to explore first,
the relationship between DCF inputs and outputs and second, the use of Locational
Value Response Surface Modelling. More complex specifications of locational
characteristics are investigated by Bidanset, Lombard, Davies, McCord and
McCluskey who examine the impact of Kernel and Bandwidth specification of
gerographically weighted regression on the equity and uniformity of mass appraisal
models.

The ability of AVM models to cope with diverse market conditions is explored
by Kesken and Dunning who found that multilevel AVM is an ideal tool to cal-
culate the effect of earthquakes on the housing market in Istanbul; a location with
frequent seismic activity. Kesken and Dunning suggest that, appraisers working in
segmented markets with natural disasters should consider the methodological
advantages of using multilevel models to estimate value impacts in these locations.
The appropriateness of using multilevel mass appraisal models approaches was also
examined by Ciuna, Salvo and Simonotti in their appraisal of residential apartments
in Palermo, Italy.

Part IV considers two different AVM approaches. First, the use of fuzzy logic is
proposed by González to overcome the problems associated with defining market
segments, where boundary lines for each location or sub-market are often blurred.
Second, the main issue for many researchers and assessors is the lack or unavail-
ability of data. D’Amato and Renigier-Bilozor found that where data is scarce the
issue of calculating a single point estimate can be overcome using rough set theory.

In Part V, consideration is given to reducing inaccuracies in valuations.
Although property valuation has been often been called an ‘art’ and not a ‘science’,
this sentiment, arguably, reflects the assessors application of the available tech-
niques rather than the valuation methods and underlying concepts themselves.
McCluskey and Borst focus on the way in which comparables are selected and weighted to reflect the subject property. They state that, with advances in research the subjectivity associated with comparable selection and the determination of variable weightings can be minimised and therefore the sales comparison approach can now be viewed as a more scientific approach, rather than one based on the knowledge and expertise of the assessor. Appraiser bias is also addressed by Lausberg and Dust who discuss the problems associated with anchoring heuristics, where appraisers anchor to reference points; such as a previous valuation and make adjustments to it to reach their estimate. They state that, while many studies have acknowledged the importance of the anchoring effect in appraisals, the accuracy of the valuation can be increased through the use of improved valuation software which includes a decision support tool.

The breadth of research presented here provides a sound basis for the next step in the evolution of AVM with exciting examples of new techniques to improve on the current valuation methods adopted by assessors.

Dr. Sally Sims
Oxford Brookes University
To extract key dimensions from a complex set of micro-level market data requires the use of high-quality data cross-sections and a robust modelling tool. Such tools have been developed within a realm known as mass appraisal: systematic economic valuation of groups of properties using standardised procedures largely based on the multiple regression analysis (MRA). Hitherto mass appraisal has been mostly restricted to taxation, although mortgage lending is fast becoming another widespread application area. In a more generic sense, mass appraisal offers an untapped possibility to link the property value with various characteristics of the building, plot and its vicinity, as well as social and functional features of the neighbourhood and local area. Ideally the data should cover differences in socio-economic aspect and differences in environmental aspects such as pollution. At present, valid property value data is easy to find in some countries and difficult (or even impossible) to find in others.

Following the experience of our edited book Mass appraisal methods—an international perspective for property valuers RICS Series, Blackwells, Oxford, 2008, a number of our colleagues who read it proposed a sequel focusing our attention on a concept known as automated valuation method/model (AVM, Automated Valuation Methodology). The present book picks on this request and poses some questions about AVM methodology. For this reason we have raised a number of issues: in particular, on the current methodological framework of AVM, about the main problems encountering AVM applications, and what we realistically could do to improve AVMs so as to make our financial—and by implication, social—world safer. This line of research seeks to contribute to the current debate on AVMs especially after the crisis of 2007–2008. After this extensive and tragic economic crisis we are entitled to have our doubts and we are also increasingly concerned about the social responsibility of AVM for the stability of our economies. As a consequence our field of research now has an opportunity to contribute, in an effective way, to improve the stability of our financial system. AVMs may be helpful in several fields. They can, for example, be used in the collateral estimation, in the valuation of real estate portfolios. According to Basel II agreement and EU Directive 2006/48/CE, banks should provide periodic automatic valuation to appraise properties for which acquisition has
been financed in the mortgage lending process. In this valuation activity for mortgage lending purposes statistical and mathematical modelling may be used in combination with valuation.

When we examine strategic issues within mass appraisal AVMs are relevant due to their huge financial—and as a consequence also socio-economic—significance. How to avoid—or at least mitigate—a new financial crisis stemming from real estate market bubbles? So this is about socio-economic sustainability. The crisis showed that AVM can work in a normal situation with rising and stable prices, but not in a more abnormal one with falling prices. Since then a debate is emerging, but it is still not sufficiently developed in terms of conclusions between any connection between data, methods and the financial consequences.

To remind the initiated readers—and to demonstrate the point for the uninitiated ones—in our prior book on mass appraisal we followed a line of argumentation based in what we discovered was a contemporary problem—the difficulty of promoting development in the valuation paradigm. Since then, however times have changed, towards more favourable attitudes among the real estate research community, more people being involved, higher level of technical and methodological expertise, more and better datasets, greater R&D activity and data management responsibility of the private sector, the development of ICT and hardware, and not least, the new reality imposed on us by the massive global market meltdown (with consequences thereof) from 2007–2008 onwards. Because of these changes, the focus of our present book is rather different than what was the case documented in the prior book, almost a decade ago. In the present book each chapter makes a cut into the problem area we begun theorising in the previous book, rather than following a suggested line of argumentation—or vision—that would be common for all contributions. In the present compilation of papers the approach remains the same as in the prior one: we need to explore the unknown. This time we have not focussed on a competition amongst the results obtained applying different AVM methods as in the prior work. It is instead about an assemblance of different issues at stake, including best practices, real-life constrains, administrative procedures, software capabilities, expert competences, modelling frameworks, background theories and more.

When reading these books a detail in terminology is worth noting. Namely, in some instances the term computer-assisted mass appraisal (CAMA) is used instead of the term AVM. It is to observe that these two terms are not synonyms: AVM is about financial aims and mathematical procedures whereas CAMA pertains to any administrative end applications; however, plenty of overlap between these two realms exist as many methods can be used for both. At a technical level, the main difference between a CAMA estimate of value and the one produced by the AVM is the effective date of the appraised value estimate. CAMA systems value all properties in a jurisdiction as of a statutory valuation date such as January 1st of each year. On the other hand, AVMs usually are designed to produce a value estimate that coincides with the sale date of the property.

In USA the use of CAMA started in the 1970s and has since then spread around the world. During the last two decades CAMA has developed in an impressive way.
Here it is to note that, in 1999, the Appraisal Standard Board replaced the term ‘estimate of value’ with the ‘opinion of value’ in the USPAP. A clear distinction was made between two important and distinct definitions. The opinion of value regards the final results of an in person valuation and the estimate of value has been indicated as the final results of an AVM. It is worth noting that some institutions consider AVM assisted valuation more reliable than valuation in person.

Lastly, we would like to pay respect to the personal aspirations of all those colleagues, who have helped us develop our research agenda during the past 10–15 years period. To provide a brief summary, a group of academics with broadly similar interests (i.e. appraisal, valuation and market analysis) started working in two meeting organised by the OTB research Institute of Delft University of Technology, the Netherlands—this was in 2006 and 2007. For this reason we usually call this group the Delft group, even if frequent communications among many members of this group already existed a few years before that (the absolute starting point being the ERES meeting in Alicante in 2001). Then we continued with extending this network. Several authors joined our group after a large meeting arranged in Rome in 2010. While the list of authors in this book already gives an idea of this consistence, the whole group of people involved is too large to list here, and to mention only a few names would not be fair to those left out. Here is an exception, however: in this vein we have dedicated this book to the memory of Prof. Koloman Ivanicka Jr. of STU Bratislava, a passionate researcher and a joyful friend of ours.

Bari, Italy
Headington, Oxford, UK
July 2016

Maurizio d’Amato
Tom Kauko
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Acronyms

ANR Annual Net Rent
AVM Automated Valuation Model
BIST Borsa İstanbul Stock Exchange
CAPM Capital Asset Price Model
CBD Central Business District
CBTR Central Bank of Turkish Republic—Türkiye Cumhuriyeti Merkez Bankası
CMBT Capital Markets Board—Sermaye Piyasaları Kurulu (SPK)
COD Coefficient of Deviation
CREAS Computerised Real Estate Appraisal System
DCFA or DCF Discounted Cash Flow Analysis
DSS Decision Support Systems
EPRA European Public Real Estate Association
FTSE Financial Times and Stock Exchange
GRM Gross Rent Multiplier
HPM Hedonic Price Model
IAAO International Association of Assessing Officers
INREV European Association for Investors in Non-Listed Real Estate Vehicles
IPD Investment Property Databank
IPO Initial Public Offering
IQR Interquartile Range
IRR Internal Rate of Return
ISE İstanbul Stock Exchange—İstanbul Menkul Kıymetler Borsası (İMKB)
ITD Investment Transaction Database (DTZ)
IVS International Valuation Standards
LAF Location Adjustment Factor
LVRS Location Value Response Surface
MCA Market Comparison Approach
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<th>Full Form</th>
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<td>MLV</td>
<td>Multilevel Models</td>
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<tr>
<td>MOR</td>
<td>Monthly Net Rent</td>
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<td>MPT</td>
<td>Modern Portfolio Theory</td>
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<td>NAREIT</td>
<td>National Association of Real Estate Investment Trusts</td>
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<td>NCREIF</td>
<td>National Council of Real Estate Index Fiduciaries</td>
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<tr>
<td>NOI</td>
<td>Net Operate Income</td>
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<tr>
<td>OAR</td>
<td>Overall Capitalisation Rate</td>
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<tr>
<td>OMI</td>
<td>Osservatorio del Mercato Immobiliare—Italian Land Registry Observatory</td>
</tr>
<tr>
<td>PMI</td>
<td>Property Market Indicators</td>
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<tr>
<td>REICs</td>
<td>Real Estate Investment Companies—Gayrimenkul Yatırımlar Ortaklıkları (GYO)</td>
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<tr>
<td>REITs</td>
<td>Real Estate Investment Trusts</td>
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<tr>
<td>SAR</td>
<td>Spatial Autoregressive Model</td>
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<td>SEM</td>
<td>Spatial Extension Method</td>
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<td>TNHPI</td>
<td>Turkey New Housing Price Index</td>
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<td>TRBOND</td>
<td>Turkish Government Bonds</td>
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<tr>
<td>VECM</td>
<td>Vector Error Correction Model</td>
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<td>VIC</td>
<td>Value Influence Center</td>
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