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COMPARING DIFFERENT MASS APPRAISAL MODELS

Introduction. Mass appraisal is a valuation technique to appraise large quantities of properties with statistical and mathematical formal relationship between the price and the characteristics. Mass appraisal is an important research field both for academician and professional in Italy (Simonotti, 2006). Mass appraisal modelling in the last decade discovered the role of spatial correlation as an important aspect of mass appraisal modelling (Des Rosiers et al., 1999; Des Rosiers et al., 2003; Des Rosiers et al., 2005).

Mass appraisal techniques are a field of research that applies different methodologies to define a single point estimate (The Appraisal of Real Estate, 13th edition). Several contributions highlighted the possibility to classify mass appraisal method the above all is the distinction between Orthodox modeling and heretic modeling (Kauko and d'Amato, 2008) can be useful to distinguish well known and applied models from emerging approach to mass appraisal. The work is focused on a comparison among different mass appraisal modeling applied to a sample of observations from Minsk. After running a linear regression location blind the application of Location Value Response Surface (O'Connor, 1982) are compare to the application of Spatial Autoregressive Models and Multilevel Modelling.

Mass appraisal is the systematic appraisal of groups of properties as of a given date using standardized procedures and statistical testing (Gloudemans, 1999). This valuation method is applied to property objects with many similarities. Mass appraisal of real estate is commonly applied to compute real estate tax.

The purpose of mass valuation is to estimate the market value. It must be distinguished from the market price and other, non-market values (IVS, 17th edition, 2005). In the international valuation standards 2005 (IVS), issued by the International Valuation Standards Committee (IVSC), the market value is defined as the estimated amount of money for which a property should exchange on the date of valuation between a willing buyer and a willing seller in arm's-length transaction after proper marketing where in the parties acted knowledgeably, prudently and without compulsion (Gloudemans, 1999). The market price is formed when curves of supply and demand intersect, it is influenced by many objective and subjective factors. The market price equals to the market value very rarely,

because the market of real estate is not an ideal market. The market price of real estate reflects many subjective factors, so a real estate assessor mustfind the most objective, suitable for all value.

The universal model of mass appraisal of real estate value in a particular country must in essence be functional, practically applicable, consistent and adaptable to the real conditions and trends in the real estate market. It must also recognize all relevant factors which influence the price of real estate in each spatial unit, and at the same time preserve all of the essential features of that area and use them in the process of determining the average price of real estate within it.

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Mass appraisal models are commonly based on the sales comparison approach. Various methods have been used for real estate mass appraisal, among which parametric regression analysis is the traditional choice (Theriault, Des Rosers, Menetrier&Joerin, 2005). In some studies nonparametric regressions have been applied successfully (e. g., Filho&Bin, 2005). Among machine learning methods the most commonly used are neural networks (Curry, Morgan, Silver, 2002; Ge, Runeson, Lam, 2003; Kauko, 2003; Kauko, Hooimeijer, Hakfoort, 2002; Liu, Zhang, Wu, 2006; Selim, 2009; Verikas, Lipnickas, Malmqvist, 2002).

Comparing Different Mass Appraisal Models. In order to find the most efficient Automated Valuation Model, J. Wayne Moorein (2005) in his experiment tested four automated valuation model types most commonly used in mass appraisal. A one-way analysis of variance (ANOVA) was conducted to evaluate the hypothesis that differences in market value estimating accuracy exist between these major AVM methods and to analyze the relationship between AVM type chosen and the resulting coefficient of dispersion (COD). A lower COD is an important indicator of better quality assessments.

The independent variable, AVM type, included four types: adaptive estimation procedure (AEP), multiple regression analysis including non-linear regression (MRA), the traditional cost approach (COST), and a hybrid transportable cost-specified market (TCM) method. The dependent variable was the COD that resulted from applying each AVM to predict the selling prices of the same set of 1.299 properties in the control test group.

This experiment has shown that a statistically significant difference in results as measured by COD does exist between the major property valuation methodologies. It has provided clear statistical evidence to support what most CAMA practitioners believe to be true: a market-calibrated AVM will predict selling prices more accurately than a purely cost-based AVM. What may be surprising is that the hybrid transportable cost-specified market (TCM) approach, using only two market variables, appears to have performed as well as the other market AVMs as indicated by the Tukey test evaluating pair-wise differences between the means. This finding indicates a need for more research into TCM, which has evolved over the years without clear definition or documentation, but is nonetheless widely used in various forms.

Vilius Kontrimasa and Antanas Verikas in 2007 compared ordinary least squares (OLS) linear regression method with computational intelligence approaches – support vector machine (SVM) regression, multilayer perceptron (MLP), and a committee of predictors.

Results of research indicated the superiority of OLS regression over the MLP. However, the SVM clearly outperformed both the OLS regression and MLP based models. The results indicate that non-linear modeling is required. SVM as being capable of non-linear modeling and finding the global minimum of the cost function suits very well for the task.

The proposed committee of models has shown an excellent performance and clearly outperformed the separate predictors. The number of unacceptable valuations, which is the main parameter in the mass appraisal tasks, was only 1. It means that only 1% of valuations do not satisfy the accuracy limits for the mass appraisal.

Also, Evgeny A. Antipov and Elena B. Pokryshevskaya in 2011 have conducted comparative analysis of performance achieved by their own methodology called Random Forest with 9 other algorithms (Multiple regression, CHAID, Exhaustive CHAID, CART, k-Nearest Neighbors (2 modifications), Multilayer Perceptron neural network (MLP) and Radial Basis Function neural network (RBF), Boosted Trees).

They conclusions after test being held were as follows:

1. For all algorithms and for any of the procedures (either one step or two-step) sales ratio is in the acceptable range of 0.9–1.1.

2. For the majority of the algorithms MAPE and COD decreased on both training and test samples after the two step procedure hadbeen used. This leads to a conclusion that it is reasonable to use this procedure instead of assessing the overall price of a real estate object. In their study they will use the two-step procedure as the main one.

3. Despite the presence of a validation sample to avoid overfitting, neural networks (MLP and RBF), often considered as the best class of

methods for real estate appraisal, are not among the best performing techniques in our study. Neural networks could probably deliver better results after some fine-tuning, but they think mass appraisal algorithms should be as independent ofan analyst and as universal as possible. The main reason of neural networks poor performance is the small number of observations.

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