Realistic Uncertainty Estimation of the Market Value Based on a Fuzzy–Bayesian Sales Comparison Approach

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SUMMARY

The real estate and finance crisis has shown the importance of real estate valuation: The market value has to satisfy high objective quality requirements. Besides, the German jurisdiction demands a maximum dispersion of $\pm 20\%$ of the market value. The sales comparison approach as one of the valuation methods is from a mathematical-statistical point of view based on a multiple linear regression analysis. Since decades, it has been considered as a standard procedure for analysing the real estate market and to determine the current market value. The estimated comparative value is in particular depending on the number and the type of value influencing variables which are considered within the regression model. Nevertheless, the uncertainty estimation of this approach has not been extended since its introduction. The uncertainty here results from the inherent inaccuracy of the observations on the one hand, on the other hand from the selected model as imperfect realisation of the reality. The aim of this research is to develop and enhance the uncertainty estimation in the used regression analysis by dividing the uncertainty budget in epistemic and aleatoric parts. While the aleatoric components describe random variability, which can be modelled by means of Bayesian inferences, the epistemic components characterise systematic and/or deterministic influences which result from unsatisfactory knowledge, assumptions, simplifications and linguistic formulations. Epistemic components can be modelled by selected models from fuzzy theory. This paper introduces a Fuzzy-Bayesian approach, which is able to consider the uncertainty of the value affected by the above described characteristics and thus to quantify its impact on the market value. As starting point for this investigation, the data basis is prepared: The market value affecting attributes, which have a significant influence on the valuation approaches, were listed and categorised for exemplary samples of different spatial and objective partial markets. The methodology is tested on a real data set. The establishment of the advanced mathematical approach should allow predicting any real estate values for objects within the selected spatial and objective submarket. It can be concluded, that this approach should provide more precise and appropriate uncertainty estimations of predicted values.

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