Real Estate Reference Values for a Better Market Transparency

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SUMMARY

The improvement of market transparency on the real estate market is one of the most important objectives currently. In Germany market transparency is strongly supported by the advisory committees of land values which release in general key information about the real estate market and its significant parameters and characteristics. Worth mentioning here in particular are the real estate market reports, (standard) land reference values and other for the valuation process required information. A next step of innovation to increase market transparency is the estimation of (standard) real estate reference values. These values are average geo-referenced location values for the whole property what include the land and the building part. The article explains the theoretical background of the estimation of real estate reference values with its important points. For the submarket of condominiums procedures and results for a specific research area in North-Rhine Westphalia, Germany are shown. Special attention is paid to the selection of the significant value influencing object characteristics within the multiple regression analyses. Research has shown that reference land-values can be derived in general, however, various restrictions have to be considered. The number of value influencing object characteristics for built-up properties is much higher than for undeveloped land. Heterogeneity requires a larger number of comparable prices as well as expert knowledge of the operator. Estimation of real estate reference values for the chosen research area has proven that market transparency can be increased. A major condition is that enough comparable prices for the specific submarket are available. Urban areas should fulfil this precondition. Future research should focus on other real estate submarkets, e.g. individual residential houses or mixed properties.

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1. INTRODUCTION

The improvement of market transparency on the real estate market is one of the most important objectives currently. In Germany market transparency is strongly supported by the advisory committees of land values which release in general key information about the real estate market and its significant parameters and characteristics, in particular real estate market reports, (standard) land reference values and other required information and data for the valuation process.

Standard land reference values have to be deduced and published by law at least every second year. They are georeferenced average location values that already exist for the majority of properties in Germany whereas comparable real estate reference values for developed properties are a relatively recent development that exists only for a number of selected cities yet. Estimation of real estate reference values seems in several respects reasonable, first data basis for real estates (with a building on it) is much bigger and second there is a strong demand for such comparable values. Valuation of real estate using real estate reference values complies with the principal of the comparison valuation method. In the ideal case a sufficient number of comparable prices (based on real purchase prices) with the exact same value influencing characteristics as the valuation objects are available. Nonetheless high complexity should not be neglected either. The number of value-relevant object characteristics is much higher compared to land reference values. For this reason data basis have to be of a high level of quality. That includes the number of registered comparable prices (the more, the better) as well as the integrity of the data. The challenge is to represent the conditions on the real estate market comprehensively and in a clear and understandable way at the same time. For example, to reflect all local conditions appropriate local adjustment factors for every single city with its different sub markets would be necessary. However, this increases complexity because the number of coefficients would also increase immensely. On the other hand it is doubtful that for small research areas necessary sufficient number of comparable prices is available to enable reliable analysis.

The method to deduce reference values for real estates presented in this paper is based on an integrative evaluation model, which combines statistical regression analysis and experts knowledge. The following article describes the estimation of real estate reference values for the submarket of condominiums. Section 2 introduces the study area and the data set. Section 3 describes the methodology of analysis. In section 4 the results are presented. The article ends with a discussion and conclusion of the main findings. For further information we recommend the master thesis of Wenzler at the Rheinische Friedrich-Wilhelms-Universität Bonn (2014).

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2. STUDY AREA AND DATA

Real estate reference values were derived for the Rhine-Sieg district located in the state of North Rhine-Westphalia, Germany. The district encloses the city of Bonn and borders to Cologne and is characterized by suburbs of the large cities and several medium-sized cities on the one hand and rural regions on the other hand. Population density varies significantly from about 166 to 1.700 inhabitants per square kilometer (Real estate market report Rhine-Sieg district 2014, p.11). Figure 1 shows the geographical location of the Rhine-Sieg district within Germany.

Figure 1: Geographical location of the Rhine-Sieg district within Germany
(Source: plz-suche.org)

The advisory committees of land values of the Rhine-Sieg district provided 5.884 comparable prices for the submarket of condominiums for the period from January 2009 to December 2013. An analysis over several submarkets at the time should be avoided due to object characteristics are in general to heterogeneous and would lead to unsatisfactory results. Data cleansing was carried out to ensure that only useful and reliable comparable prices entered into analysis. For example incomplete datasets had to be removed due to regression analysis requires complete ones. Finally 2.892 prices remain. Table 1 gives an overview of the variables within the dataset.

Table 1: Key explanatory variables of the regression model and their coding

Variables	Description	Coding
Regional Location	The Rhine-Sieg district consists of 19 municipalities. To verify the influence of the specific municipality each of them will be represented by a variable.	Dummy-variables for each municipal
Small-scale Location	To distinguish different qualities of location between the municipalities.	Dummy-coding in 4 groups: - excellent - good - normal - moderate
Date of sale	To consider the economic development during the investigation period.	Dummy-variables for each Year (2009 – 2013)
Living Space	Number of m² of the condominiums.	Dummy-coding in 3 groups: - 0 – 40 m² - 41 – 90 m² - > 90 m²
Age/Modernization	To describe the influence of the age and condition.	2 third-degree polynomials: - age < 15 or modernized within the last 15 years - age > 15 and <u>no</u> modernizations within the last 15 years
Floor	To describe the influence of the floor the condominiums are located.	Dummy-coding in 4 groups: - basement/ground floor - 1st - 4th floor - > 4th floor - attic floor
Number of floors	Describes the number of floors of the building the condominium belongs to.	Dummy-coding in 2 groups: - 1 – 7 floors - > 7 floors

3. METHOD

As mentioned before an integrative evaluation model is used to deduce real estate reference values. The aim of the model is to combine statistical methods with (valuation) expert's knowledge. Results of the multiple linear regressions will be resolved so that every influencing factor can be expressed through surcharges or discounts in percent. Comparable prices from the purchase price collection can be standardized by the deduced adjustment factors. The integrative evaluation model can be subdivided into the following steps:

- Multiple linear regression
- Partial model solving and result monitoring
- Expert valuation
- Generation of real estate reference values

Figure 2 shows the single work steps to generate real estate reference values. As in figure 2 also can be seen, that it might be essential to perform modifications during the process sequence (red darts) before generate final real estate reference values. In general all changes at the sample or regression model parameters require a repeat of every single step. This iterative approach is even recommended. Only in very few cases the first effort will lead to the ideal regression model. Below the different single steps are described.

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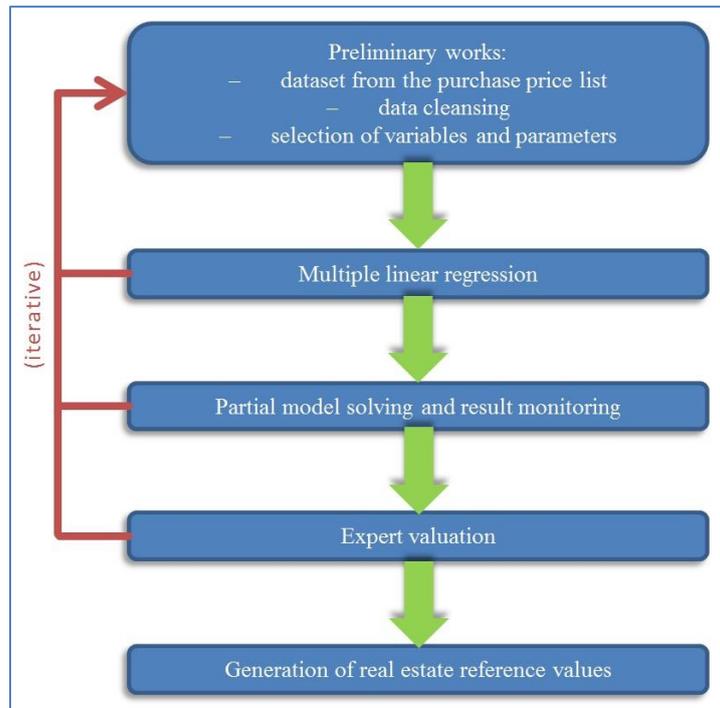
Figure 2: Process sequence to generate real estate reference values

Multiple linear regression

After data cleansing and selection of the model parameters (strongly influenced by the available data) multiple linear regression can be performed. Specific variables have to be coded as dummy variables in advance if necessary, e.g. location characteristics. For some variables it might be necessary to estimate the influence as a polynomial, e.g. the building's age. It is important to point out, that expert knowledge of the local real estate market is already needed at this point in the process since estimation what parameter influences or does not influence the value of the real estate is essential. Results of the regression are the coefficients with its statistics. The statistics are useful for a first assessment of the estimated coefficients and to identify outliers. If outliers are found, they have to be removed from the dataset and the multiple linear regression has to be performed again.

Partial model resolution and result monitoring

Regression coefficients are hard to interpret in general. For this reason coefficients are converted into adjustment factors for the several valuation object features which allow an easier interpretation in form of increase and reduction factors in percent depending on the value influencing object features. Estimated coefficients and converted adjustment factors have to be validated regarding their size, logical inconsistencies (within the model) and also if they are plus/minus signed correct. For example, the coefficient for the location next to a bustling street should have a negative sign due to this characteristic leads to discount for real estates on the market. By using the adjustment factors all comparable prices can be normalized. Data cleansing already caused a preselection of the prices. Depending on the described steps before further restrictions of the sample or even an adjustment of the regression model might be necessary.

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Expert valuation

Afterwards the adjustment factors should be reviewed by experts for real estate-evaluation (for example members of the local advisory committees of land values) with knowledge about the local real estate market. Review can be done for example through an online-survey or regular interviews. Experts are asked to estimate adjustment factors by themselves without knowing the outcome of the regression. Thereafter results can be compared. In case of justified and strong discrepancies one has to check if modifications on the selection of variables and parameters are necessary. If so, analysis (that includes the three steps mentioned before) has to be repeated iterative.

Generation of real estate reference values

To generate real estate reference values it is necessary to create reference zones that are represented by one specific fictional reference object for each zone. If reference zones for reference land values already exist they can also be used for the definition of the real estate reference value zones. However, it has to be ensured, that already existing zones are comparable in regard to value influencing characteristics. Creation of new zones has the advantage that they can be fitted individual to the available comparable prices. After expert valuation and required iterative reprocessing all used (georeferenced) comparable prices are grouped depending on its belonging to one reference zone. Based on the grouped samples the fictional reference object has to be defined. Afterwards all grouped prices have to be adjusted to the reference object by using deduced adjustment factors. The (final) real estate reference value for the reference zone is a result of the arithmetic mean of all adjusted comparable prices belonging to this zone. In order to deduce reliable real estate reference values attention should be paid to a minimum number of comparable prices within the reference zone.

4. RESULTS

Real estate reference values were generated for selected communities with varying settlement structures in the Rhine-Sieg district. Density of reference values in rural areas is much lower due to the limited number of comparable prices as well as the submarket of condominiums is less represented in rural areas compared to for example the submarket of single-family houses. Table 2 shows the coefficients of the regression analysis.

Within the multiple regressions only statistical significant variables, that have a verifiable influence to the regression model, should be used. Effectiveness of single parameters can be verified by using the t-test. Regression coefficients were converted into adjustment factors for a better interpretation. Table 4 exemplary shows adjustment factors for different location classes (for small-scale location variations).

Finally real estate reference values were generated by using adjustment factors. Reference values can be presented in reference maps as seen in figure 3 (real estate reference values are marked in blue). In the present case new reference zones were not generated. Real estate reference values were in plotted with reference to existing reference land value zones. The minimum number of comparable prices per reference value was set to four. In case of strong structural variation within one reference zone several separate reference values were generated.

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Table 2: Estimated coefficients of the regression analysis

Variables	Characteristic	Regression Coefficients
Addition constant		**2,816.350****
Regional Location	Königswinter (norm)	0
	Siegburg	-84.755**
	Bad Honnef	-193.426**
	Bornheim	-282.790**
	Sankt Augustin	-280.595**
	Niederkassel	-299.756**
	Troisdorf	-366.888**
	Wachtberg	-398.221**
	Rheinbach	-391.499**
	Neunkirchen-Seelscheid	-422.443**
	Meckenheim	-440.801**
	Alfter	-459.693**
	Hennef	-457.857**
	Lohmar	-459.790**
	Much	-662.698**
	Eitorf	-764.660**
	Windeck	-934.875**
	Ruppichteroth	-1,072.264**
	Swisttal	-1,114.737**
Small-scale Location	excellent	357.835**
	good	157.946**
	normal (norm)	0
	moderate	-154.315**
Date of Purchase	2009	-315.128**
	2010	-206.284**
	2011	-121.164**
	2012	-116.705**
	2013 (norm)	0
Living Space	0 – 40 m²	-9.,021*
	41 – 90 m² (norm)	0
	> 90 m²	58.782**
Age/Modernization (Polynomials)	age < 15/modernized; 3rd degree	-0.011**
	age < 15/modernized; 2nd degree	1.780**
	age < 15/modernized; 1st degree	-81.593**
	no modernizations 3rd degree	-0.008**
	no modernizations 2nd degree	1.397**
	no modernizations 1st degree	-74.643**
Floor	basement/ground floor	-51.492**
	$1^{st} – 4^{th}$ floor (norm)	0
	> 4th floor	-13.656*
	attic floor	86.560**
Number of floors	1 – 7 floors (norm)	0
	> 7 floors	-459.584**

* t-test: $p < 0.05$
** t-test: $p < 0.01$

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Table 4: Adjustment factors for small-scale location variations

Location class	Number of comparable prices	Adjustment factors for real estate reference values
1 – excellent	57	1,20
2 – good	1.113	1,09
3 – normal	1.481	1,00
4 – moderate	241	0,91
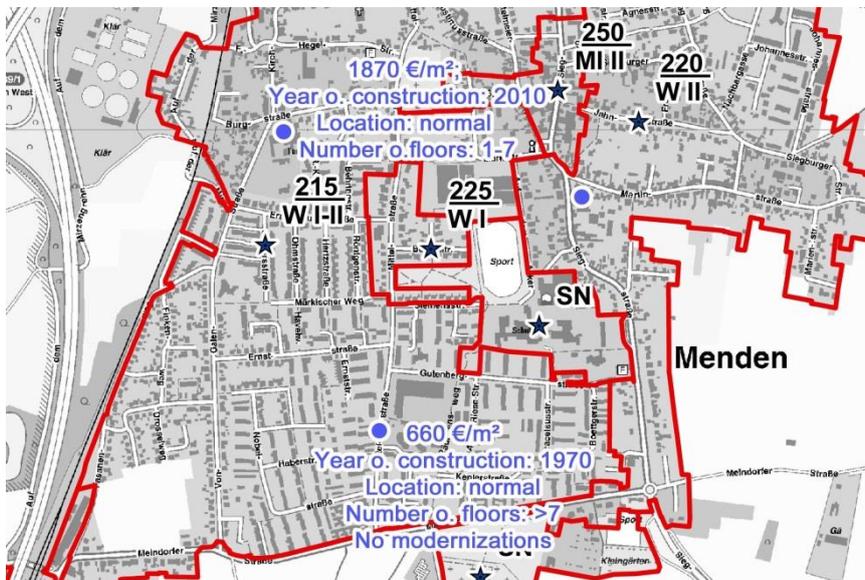
Figure 3: Real estate reference values in Sankt Augustin (Rhine-Sieg district)

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5. DISCUSSION AND CONCLUSION

Within the study real estate reference values could be generated for the Rhine-Sieg district for the submarket of condominiums. However, there are several limitations. Due to too few comparable prices in several municipalities (especially in rural areas) estimation of adjustment factors had to be performed for the whole district in one turn. Special features on a smaller scale might possibly get lost. Due to higher complexity a basis of expert's knowledge (in real estate valuation as well as the local real estate market) is required for evaluation and interpretation. Furthermore it has to be discussed if an estimation of real estate reference values should be carried out only for selected areas again due to too few comparable prices. Even in urban areas comparatively few comparable prices are often available. For different submarkets (e.g. single-family houses) and other study areas situation might be totally different. Further research is recommended. Adjustment factors were converted out of regression coefficients. Factors strongly depend on data basis and model variables. Both can change within the iterative process. Some variables are better to deduce than other. For example, location factors could be deduced better compared to factors for the number of floors within a building. As can be seen in figure 3 real estate reference values spread in a wider range compared to land reference values which is caused by the high influence of building characteristics on the sales price. Therefore, depending on the local structure, it might be necessary to generate a higher density of reference zones. The precondition for this is again the availability of a sufficient number of comparable prices. Complexity and effort (temporal and costs) of the estimation of real estate reference values are especially high when running the process for the first time. Less effort can be expected for future estimations, e.g. annual ones. The study has shown that real estate reference values increase real estate market transparency. Especially in urban areas with a sufficient number of comparable prices the introduced method can be used to generate reference values for real estates. In rural areas a balance between effort and benefits need to be found.

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BIOGRAPHICAL NOTES

M. Sc. Patrick Wenzler graduated in Geodesy and Geoinformation at the University of Bonn (Germany) in 2014 with a focus in land and real estate valuation.

Verm.-Ass. Dipl.-Ing. Sebastian Kropp graduated in Geodesy at the Dresden University of Technology (Germany) in 2006 with a focus in land and real estate management. After two years in the state of Baden-Württemberg where he achieved the title of assessor he worked for almost two years in a bank dealing mostly with real estate valuation. Since July 2010 he has been working as a research assistant and PhD student at the Department for Urban Planning and Real Estate Management at University of Bonn. His main research interest focuses on real estate management and valuation.

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