

Analysis on Different Market Data for Real Estate Valuation – Investigations on German Real Estate Market

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SUMMARY

In Germany, real estate valuation is used for different purposes like lending on real estates and tax purposes (e.g. inheritance tax). A legally reliable valuation in areas and markets with only few transactions is causing problems due to the limited available market data. Hence, the reliable statistical analysis fails for short evaluation periods. In this work, alternative market data sources are discussed. The focus lies on the knowledge of real estate experts, offer prices, and site characteristics. First analysis on these data are presented to combine these different data. For this propose, first relationships among this data are investigated. Also the accuracy of the different available data is considered to find a way to give proper weights for these data in an aggregation.

ZUSAMMENFASSUNG

Die Immobilienbewertung in Deutschland wird für die verschiedensten Zwecke, wie beispielsweise die Beleihung von Immobilien oder steuerliche Aspekte (Erbschaftssteuer) benötigt.

Die zuverlässige und rechtssichere Bewertung von Immobilien in sogenannten kaufpreisarmen Lagen mit wenigen Markttransaktionen stellt auf Grund der fehlenden Marktdaten ein Problem dar. Bei nur wenigen Marktinformationen können hier insbesondere für kurze Auswerteziträume keine statistisch sicheren Auswertungen durchgeführt werden.

Im Rahmen dieser Arbeit erfolgt die Untersuchung weiterer alternativer Datenquellen wie das Wissen von marktkundigen Experten, Angebotspreisen und Standortfaktoren. Zusammenhänge von Kaufpreisen zu diesen Daten werden untersucht und Möglichkeiten der Ableitung von Genauigkeitsmaßen analysiert. Im Ergebnis lässt sich eine Gewichtung der Datenquellen für eine Aggregation ableiten.

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1. VALUATION APPROACHES IN GERMANY

Real estate valuation has become more and more important in the recent years. This is evidenced by the change of the fiscal valuation to a market value basis (reform of inheritance tax in 2009) or the need for reliable property values for the economy after financial and property crisis. In the German valuation practice, three legally normed valuation methods are established: Sales Comparison Approach, Cost Approach and Income Approach (Kleiber, Fischer, & Werling, 2014). The same methods are used in international valuation practice, also; the differences to the German methods are irrelevant for this paper.

The focus of this paper is on the Sales Comparison Approach: this method is based on evidence of real transactions. It is the approach, which is closest to the market, if sufficient and suitable data is available (Gerardy, Möckel, Troff, & Bischoff, 2015; Kleiber et al., 2014; Mürle, 2007). The Sales Comparison Approach derives a functional relationship between the dependent variable and one or more independent variables – usually using the method of regression analysis. The regression analysis has been established in valuation for decades. Within the Sales Comparison Approach, regression analysis is used to derive conversion coefficients and price indices. Using this data, an appraiser is able to adjust the comparable transactions, so market value could be derived by mean of the adjusted transactions (Pelzer, 1978; Reuter, 1989; Ziegenbein, 1977; and in general: Fahrmeir, Kneib, & Lang, 2009; Urban & Mayerl, 2011). But also the Cost Approach and the Income Approach are relied on the method of regression analyses. Results of these analysis are the property rate and the factor of market adjustment, which adjust the determined value to the according market (Gerardy et al., 2015).

All of the valuation methods are only limited usable, if there are only few or no transactions, e.g. in an inner city area in the functional submarket of unbuilt parcels or in a decreasing periphery rural region in almost all functional submarkets. The valuation gets more challenging, if the information is insufficient. It is also unhelpful that the official statistics and market data for real estate valuation are not contemporary available (e.g. Schulden, 2005, pp. 495). Until now, the data are available after a one-year or two-year period. This is caused by the unreliable statistical analysis of the rare available purchase price data in short evaluation periods. In the case of lack of data, the expert's knowledge and the experience of appraisers are required. Hence, market value has to be derived by professional expertise. If there are some transactions available, these data are taken systematically into account to a greater or less extent. Also, the experts will use all existing data, e.g. from databases with offers (see below). The gathered information is also weighted by their expertise. Reuter (2006) adapted a Delphi method for his intersubjective price comparison by using the knowledge of appraisers to derive the market value.

First approaches, which combine this experts' knowledge and transactions with a method of regression, is derived by Weitkamp & Alkhatib (2012) and Alkhatib & Weitkamp (2012). They

used Bayesian interference to combine different information in the form of prior knowledge. The last mentioned Bayesian approaches are developed to deal with outliers in areas with a small number of purchases (Alkhatib & Weitkamp, 2013; Weitkamp & Alkhatib, 2014). In addition, a combined Fuzzy-Bayesian analysis of uncertainty of market value is introduced in Alkhatib et al. (2015).

Beside to robust market analysis with purchase prices and experts' knowledge other market information sources could be used like offer prices and site characteristics. The official directive for the Sales Comparison Approach (BMUNBR, 2014, No. 2(2)) allows us to use other data (market indicators) in absence of the purchase prices. An investigation on these information sources is necessary to combine different information from various sources in one evaluation. The following paper includes a first analysis of the relationships between purchase prices and the different data. After a brief description of the mentioned data in Section 2, first investigations and results on these are presented in Section 3. In Section 0 the results are summarized and future work is presented.

2. MARKET DATA FOR VALUATION PRACTICE

There are many sources for real estate valuation data. In an investigation by Gudat (2010) different data sources for the Sales Comparison Approach were presented. In this approach the raw data are analyzed to combine different data from different sources to get a more reliable result for valuation. In the following section, the different usable raw market data and market indicators are described. This raw data can be used to determine information on the real estate market and derive or improve valuation data for the valuation practice. Beside the purchase price database (see Section 2.1), which is used for all official investigations on real estate markets, other data like the mentioned experts' knowledge (Section 2.2), offer prices (Section 2.3) and site characteristics (Section 2.4) can give additional market information (see Figure 1).



Figure 1 Investigated sources for market data

2.1 Purchase prices and derived data

In Germany, public authorities, namely the committees of valuation experts' record all real estate transactions (Kertscher, 2007). In addition to the price of the transaction, the attributes, such as the coordinates, the area of land, quality description of the buildings, rights and other characteristics, which are relevant for valuation, are stored in these databases. The committees of valuation experts are legally obliged to publicize different market data like standard land values or comparison factors (Kleiber et al., 2014, p. 405). The federal investigations on the real estate market and the derivation of the necessary data is done with the data from their purchase price databases in Germany. Even

the Federal Statistical Office uses the data from these price collections to derive data, for example, on the change on land prices (DESTATIS, 2014). The derived data has to be published in market reports and standard land value maps. The published information is freely available for everyone. Published material is used from different real estate related institutions such as appraisers or banks. The access for third parties to the official purchasing price database depends on the legal situation in the different federal states. Weglage (2012) summarizes the legal situation in the different federal states. In some federal states the access to the information in these databases are free for research purposes. Basically persons with a legitimate interest are entitled to receive anonymized information from the database for a fee.

2.2 Experts' Knowledge

The Encyclopedia Britannica defines an expert:

„EXPERT (See also: Lat. expertus, from experiri, to try), strictly, skilled, or one who has special knowledge; as used in law, an expert is a person selected by a court, or adduced by a party to a cause, to give his opinion on some point in issue with which he is peculiarly conversant.[...]“

Experts' knowledge is used in many applications with different backgrounds (see Stehr & Grundmann, 2011). In this work, the experts' knowledge for the market of real estates and the value relevant influences is examined. As mentioned in Section 1, experts' knowledge is especially important in markets with few or no available purchase price data. Here, the determination of the market value based mainly on such expertise. A first analysis of experts' knowledge on real estate markets has demonstrated that the experts have a good 'feeling' for the market (e.g. Weitkamp & Alkhatib, 2012). The way experts act depends on many factors. Different studies in social sciences dealing with experts' knowledge discovered that different environmental influences have an effect on the experts' choice (Kahnemann, 2012; Laux, 2007). Another knowledge from the social science is that the respondents use an anchor when they are not sure about their estimates (Tversky & Kahnemann, 1974). Examples for these anchors may be a just created appraisal or an article they have read. They also give different answers to same question when the question is reworded (Kahnemann & Tversky, 1984). A first analysis of experts' knowledge and habits in real estate settings tried to handle these issues (Jeschke et al. 2014; Steinbrecher, 2015).

2.3 Offer Prices

The way of marketing, especially residential real estates, has significantly changed during the last decades. In the past, most of the real estates were offered by advertisements in regional newspapers. Today, a much easier way to present real estates on supra-regional platforms exists. In Germany, most real estates are marketed and searched via the Internet on the two large platforms: Immobilienscout24 and ImmoWelt (including ImmoNet) (Görs, 2009). There you can find nearly all marketed properties even those which were marketed by estate agents or banks. Only real estates, which were exclusively marketed by word of mouth or newspapers, are not listed on these platforms. The largest real estate marketing platform Immobilienscout24 is clicked 12-million times per month (comScore, 2015).

There have been investigations on the potential of offer prices for real estate valuation in the past (Dinkel & Kurzrock, 2012). Critical arguments against the use of offering prices with respect to the German law for real estate valuation are discussed in Sprengnetter (2010). The mentioned investigations determine a reduction between offer and purchase price of about 10 to 15%. This information can be used to reduce the offer prices for a joint evaluation.

The number of available offer prices has raised due to the increase in the use of Internet platforms recently. Also, the accuracy of the description for the offered real estates has greatly improved a lot caused by the bigger space for information on an Internet platform than in a newspaper advertisement or an exposé in the window of a real estate office. Another fact that improves the accuracy is, that the real estate agents can be rated on those platforms. In addition, there are new mandatory legal statements for all real estate advertisements, e.g. the new energy certificate which has to be indicated in all advertisements for real estates since May 2014 (BMW_i, 2014, § 16a).

2.4 Site characteristics

Site characteristics can be divided in three economic framework conditions which influence the real estate market (see Schulten, 2005, p. 490):

- Quality of location and traffic and transport links,
- Socio-demographic data (e.g. population trends, vacancy rates and development of household structures) and
- Regional economy (labour market, economic power and purchasing power).

The mentioned conditions are indicators, which influence the real estate market and are publicly available. Market data can be divided in interior and exterior indicators. Interior indicators are directly linked to real estate like household structures and vacancy rates. Exterior market indicators are affecting the market mostly from demand side without a direct link to the real estate market.

3. INVESTIGATION ON THE DATA

After this brief overview of the various data, the first analysis deals with the relationship among the different data to be modelled.

Therefore, a spatial and functional submarket are analyzed, in this paper, the submarket is the real estate market of the district Nienburg (Weser). The district Nienburg is situated in the south of Lower Saxony and has 120 000 inhabitants in 54 000 households. More than 90% of the buildings in this area are one and two family houses (LK Nienburg, 2015). As a functional submarket the investigation focus on these one and two family houses. The investigation on experts' knowledge is only done in the local real estate market of the city Nienburg with 30 000 inhabitants – a medium sized town located around 50 km from Hanover as state capital of Lower Saxony (Zensusdatenbank, 2015). The investigation on offer prices are done with data from the whole district.

3.1 Investigation on Purchase prices

In our first investigation, we use approximately 300 purchase prices from the city of Nienburg (Weser) from transactions, within a period of four years. A multiple linear regression with five parameters is carried out. The expected parameters that influence the market value are the age, the quality of the real estate, the size of the land, the living space and the quality of the location. The descriptive statistic for the dataset is shown in Table 1.

Table 1: Descriptive statistics for the used dataset.

	<i>Target values</i>	<i>Influencing factors</i>				
Parameter	Price per sqm living space [€/sqm]	Area of living space [sqm]	Construction year	Standard land value [€/sqm]	Area of lot [sqm]	Equipping standard
Min.	279	63	1900	33	118	1
Max.	1 706	248	2006	200	2 035	5
Mean	949	134	1963	79	662	3
Median	909	130	1965	70	622	3

We use the surrounding land price of the different objects to compare the locational quality in real estate valuation models. In our analysis, we take the standard land value on a specific date (31.12.2014) to compare all the objects which were sold on different times over a period of 4 years. This is done because of the fast rising prices on real estate market in this region. The locational quality is changing much slower over time.

All estimated parameters are significant (error probability = 5%) and the adjusted R-squared is about 0.4. The relationship between price per square meter living space and the locational quality is shown in Figure 2.

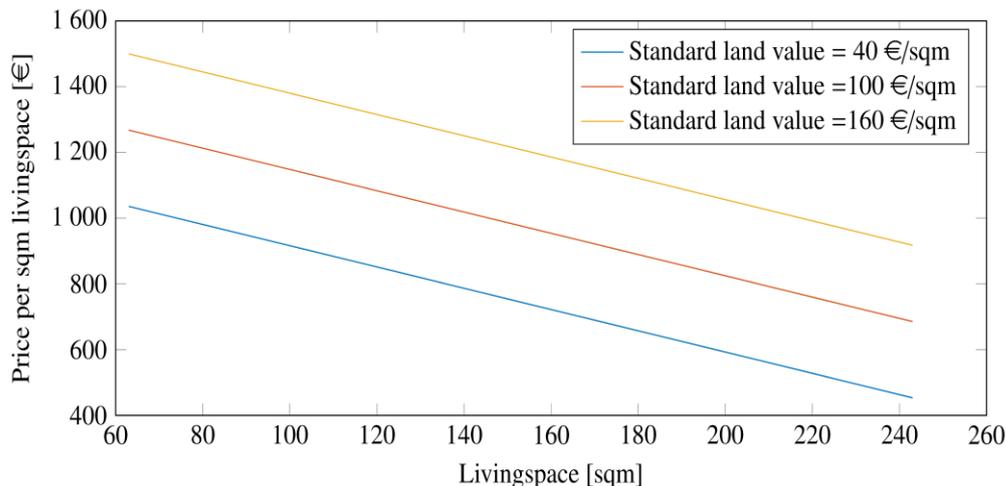


Figure 2: Results of the regression analysis for a standard house. The price per sqm living space depending on the area of living space and the quality of the location.

3.2 Investigation on Experts' knowledge

Beneath market data, we additionally consider experts' knowledge on this submarket. In Weitkamp & Alkhatib (2012), the experts were asked to determine market values in locations where they have their market expertise. In Germany, appraisers from various professions work in the field of real estate valuation like real estate agents, architects, construction engineers, bank employees, geodesists and many other fields. The local experts should use their local expertise to evaluate the market value on the known market. In this actual investigation, 10 experts of the committee of valuation experts for the land and property market in Nienburg participated on the new survey in September 2015. The experts were chosen from local estate agents, construction engineers and official appraisers. Detached one and two family houses as well as semi-detached and row houses in the city of Nienburg (Weser) are selected as a spatial and functional submarket. Each expert obtains all the same necessary information to appraise the market value in form of a report with a quality description and 10 to 15 images. The number of 50 different real estates was described and every object was valued by four different experts. An overall number of nearly 200 estimated expert prices have been derived in this way as so called pseudo purchase prices. The experts estimated the equipping standard of the different houses with the given information. The equipping standard value gives an overall statement of the quality of the house itself. There were five equipping standard classes available (very simple equipped to very well equipped). The estimated dispersion in the estimated equipping standard class between the four values per real estate from the different experts is smaller than 0.3 classes. This leads to the statement that the equipping standard of the houses can be well assessed by the written description without seeing the real estate in reality.

In addition to the survey from 2012, the experts were also asked to add a rating of uncertainties for their estimated market value and the data they used for the calculation, e.g. the uncertainties of remaining useful economic life of a property. All experts tried to answer the requested statement about the uncertainties. Only in 15% the statements are missing (black asterisk in Figure 3). The uncertainties increase where no market data are available. A fictional house with a very superior equipment, which is rarely handled in the investigated area, was described and valued between 250 000 € and 350 000 €. This is much more than the 20% margin allowed by the German jurisdiction. Initially, the derived data were analyzed with a multiple linear regression according to the five coefficients explained in Section 0. All coefficients were estimated with a significance level of 5% and the adjusted R-squared is 0.8. Only the values for the quality of the real estate differ significantly from the values estimated with the purchasing prices. This can be explained with a generalized entry in the purchase price database. If there is no additional information about the quality of the real estate, the equipping standard is set to an average class (category 3) – a case which can be often detected. This is caused by the often missing quality information. The person entering the data into the purchase price collection set the equipping standard to category 3 when statements are missing. This problem will be investigated in future work. For most of the real estates, photos are available from the time of purchase. These photos (in addition to other information) can be used to sort the object in equipping category 3 with hierarchical methods like analytic hierarchy process. This should be done to get a subdivision of this class for the analysis.

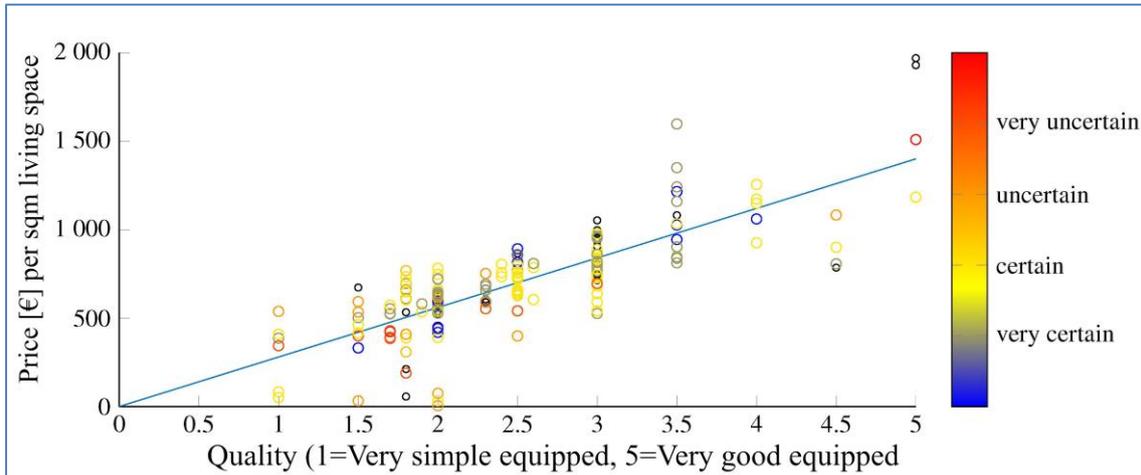


Figure 3: Visualization of the correspondence between the accuracy estimated by the experts and the fit to the regression line of the real estate quality (black = no information about accuracy). It can be shown that the experts with the worst uncertainties (red) are often very close to the regression model. The values with the best estimated accuracy (blue) are scattering much more.

The regression line of the quality of the real estate is presented in Figure 3. It is obvious that the experts with the pessimistic (very uncertain) estimation fit much better to the regression model than the experts with the optimistic estimation (very certain). This confirms the results from social science (Ogburn, 1934). It is expected that the difference of estimation of accuracy and the real accuracy of the estimated market value depends on the profession and personal experiences on real estate market. A real estate agent, who is working with market players, seemed to estimate the market value in different way than a construction engineer. This should be analyzed with a wider dataset in next steps.

3.3 Investigations on offer prices

In the next step, the offer prices are investigated. Here, data from one of the mentioned web platforms (ImmobilienScout24) were analyzed. In a time period of five years a number of 1 400 one and two-family houses were offered on ImmobilienScout24. Only 760 of them have published information about the detailed address (city, street and house number). The coordinates or addresses for the rest is not available yet. In further investigations, more offer prices can be used with the geotag.

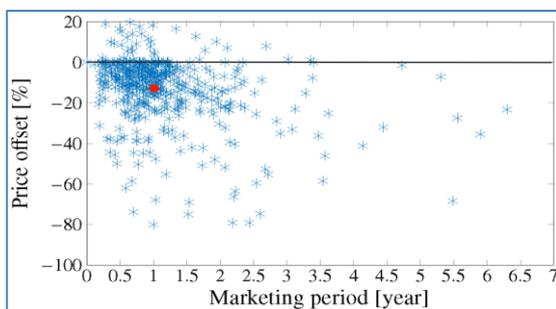


Figure 4: Comparison of marketing period and price offset in %. The red bullet marks the center.

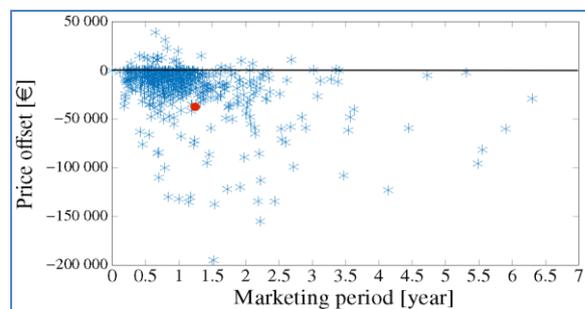


Figure 5: Comparison of marketing period and absolute price offset in €. The red bullet marks the center.

Only 440 purchase prices from the purchase price database in Nienburg could be linked to the mentioned 760 offer prices from Immobilienscout24. This huge offset can partly be explained with the time lag between the time of purchase and the time of entry into the purchase price database. Some purchase prices related to the offer prices are not yet entered in the database. It is also expected that a few properties were not sold after the offer.

The offset between offer and sales prices is estimated with approximately 13% and the mean marketing period is approximately one year. These results are similar to the results from other investigations as mentioned in Section 2.3. It is expected that the offset depends strongly on the region. In strained markets like Munich and Hamburg the offset will be much smaller.

The scattering of the offset is very high (see Figure 4 and Figure 5). The offset reaches up to 80% of the offered price and an absolute amount of nearly 200 000 €. But the main amount (approximately 80%) has an offset smaller than 20% and the marketing period is less than 1.5 years. A few purchase prices are up to 20% higher than the offer prices. The reason for this is possibly a bigger demand on these properties than expected by the offer price or additional sold furnishings e.g. a fitted kitchen. These prices will be investigated in detail in future work. In Figure 6 the kernel density for the price offset that is expected for a marketing period longer than one year in Nienburg is shown. The kernel density estimates the probability density function on a given dataset. In contrast to histograms a continuous function is generated. The level of detail of this function depends on the used kernel and bandwidth. In this case a normal kernel function (Gaussian) with a bandwidth of 4.9 is used.

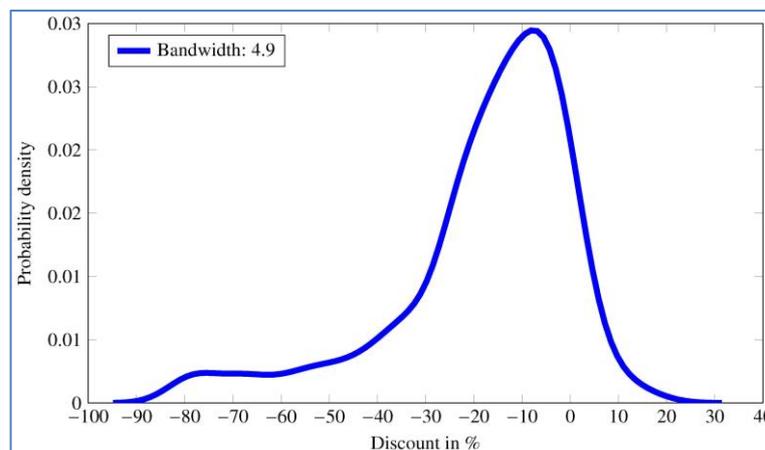


Figure 6: Kernel density for the expected price offset after a marketing period of one year.

Some real estates are sold up to 6.5 years after the beginning of the offer period (Figure 4). It is expected that usual marketing period is much shorter. The vacancy rate in the administrative district of Nienburg Weser is 4.2% (Zensusdatenbank, 2015). This is approximately the German average. Detailed investigations on long time marketed real estates should be done with a view on structural vacancy. Therefore, the end date of the marketing of the real estate should be researched.

4. CONCLUSION AND OUTLOOK

Initial investigations show that there are relationships among different data which can be modelled with a probability density for offer prices. The average price offsets between offer and purchase prices is approximately 13% and is well scattering. Experts' knowledge fits well to purchase prices. The accuracy estimated by the experts coincides with the results in social sciences, but more investigations on this issue are necessary. Nevertheless, the accuracy of the data can be modelled with the information about the measure of dispersion.

With the given information, a Bayesian approach can be considered. The Bayesian approach can handle different data and has the opportunity to include the accuracy of the data. Therefore, a weighting of the different data is necessary. An optimal weighting robust Bayesian approach will be presented in Dorndorf et al. (2016).

In the next step, different analyses will be done to find a relationship between offer prices and purchase prices with the emphasis on different impacts like quality of the houses or data about number of views on the marketing homepage etc. In this investigation, the effect of the mentioned online platforms on the real estate market will be analyzed, too. It is expected that price trends on the offer market can also be seen in the purchase prices with a time offset due to the use of marketing platforms as an information source for potential buyers. An initial investigation on the offer data in Nienburg shows that there is no trend in Nienburg. Probably with other data from more vibrant cities, as Berlin or Munich, such analysis can show the relationship among these data.

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BIOGRAPHICAL NOTES

Matthias **Soot** received his Master of Science (M.Sc.) in Geodesy at the Technical University of Dresden in 2014. For half a year, he worked as a valuation expert in free economy. Since March 2015, he is working at the Geodetic Institute of the Technical University of Dresden at Chair of Land Management. His research focus is on statistical analysis of market information and development of purchasing price databases.

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