

## RENT ANALYSIS BEYOND CONDITIONAL EXPECTATION – HOW TO ESTIMATE THE SPATIAL DISTRIBUTION OF QUOTED RENTS BY USING GEOGRAPHICALLY WEIGHTED REGRESSION

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### Abstract

Since more and more rental property offers are published on online platforms, it becomes easy to get information on quoted rents immediately. Unlike traditional data collection of rental prices, using these platforms benefits from monitoring developments in the rental market almost in real time. That is especially relevant for tight and dynamically developing markets as changes can be stated earlier and thus, measures of urban planning and social politics can be implemented at an early stage.

Most of the rental offers are connected with web map services which means they are linked to geographic coordinates. That allows the analysis of rental markets by using geostatistical methods.

This research project of rental prices of the city of Magdeburg is based on a geographically weighted quantile regression by using data of quoted rents.

In classic (multiple) regressions the conditional expectation of a dependent variable – in this case: cold rent – is modelled by a linear function between the regression coefficients and a set of explanatory variables – in this case: the single features of the apartment. However, the quantile regression developed by R. Koenker and G. Basset (1978) enables the analysis of the conditional quantile to the quantile value  $\tau \in (0,1)$  of dependent variable in conjunction with a set of explanatory variables.

One of the advantages of this method is that the focus of the analysis can be exceeded from mean tendency to other parts of the conditional distribution in order to have a look at the relationship between lower price segments of the rental market and the flat properties. By focusing on a close-meshed sequence of quantile values it is possible to estimate the whole conditional distribution of the dependent variable.

The distribution of rental price is often described by a positive skew with outliers to the upper side of the distribution. The estimation of the conditional expectation is affected by this, i.e. there is a gap between the conditional median and mean. The key advantage of the quantile regression in contrast to the linear regression is that it is outlier-sensitive.

Another factor that sets the rental prices in the market can be defined by the location of the apartment. The basic assumption applies that the effects of features vary across space. By expanding the quantile regression model by the principle of geographic weighting, spatial effects of the whole city region can be estimated. In addition, geographical weighting handles the problem of spatial auto-correlation.

Combining both methods could be estimated the spatial conditional distribution across the whole urban area. As a consequence, it is possible to answer a multitude of questions in the range of urban planning and social politics.

The objective of this contribution is to present the method of geographical weighted quantile regression by referring to an analysis of quoted rents in the city of Magdeburg. Advantages as well as disadvantages of the method will be made a subject of discussion. In addition to this, further application examples in the context of regional statistics could be the determination of land values or the forecast of crime rates.