A New Method for Constructing Price Spline Surfaces

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In the context of house-price indices, location-specific neighborhood effects are increasingly modeled by including a geospatial spline surface into the hedonic regression framework. This paper examines how to overcome an essential drawback of polynomial spline behavior: overshooting of estimated spline functions in areas with poor data support. Such data-gap areas are common in real-estate economics as housing transactions are not distributed evenly across space.

We introduce a new method for constructing price spline surfaces that avoids the spline overshooting problem by placing helper points in data-gap areas before estimating the spline surface.

We use the Random Forest method, a simple yet powerful non-parametric method based on decision trees, to estimate the values for these helper points, but other methods (e.g., kernel regression) would also be possible.

The important point is that the helper points stabilize spline behavior where data are missing but do not distort the spline surface in areas where data are plentiful. Our method also has a positive knock-on effect in that it automatically leads to lower overall spline penalization terms and thus improves how the spline surface responds to changes in the actual price data.

Price spline surfaces have multiple application possibilities. They can be used to inform on price gradients and local sub-centers, as an alternative to regional fixed effects in hedonic house price regression models, or as input for quantitative spatial models.

To the best of our knowledge, our method is new - not only to the field of Real Estate Economics - but also to the spline literature. It should, therefore, not only improve the estimation of regional house price gradients, it also has the potential to improve a wide variety of spline applications in other fields.