THE IMPACT OF NATURAL AMENITIES ON PEOPLE'S WELL-BEING: EVIDENCE FROM HOUSE PRICES IN DUTCH URBAN AREAS

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Extended abstract

In the context of ongoing urbanization worldwide, both policy makers and academics show an increasing attention for the role of natural amenities as a driver of urban well-being (Partridge 2010; OECD 2014; MacKerron and Mourato 2013). Understanding how natural amenities relate to well-being is relevant to spatial policy and urban investment decisions for two main reasons. One is that this helps to substantiate the appropriate allocation of public resources to maintain natural amenities in urban areas. The second reason is that balancing urbanization and natural amenities supply is not straightforward: natural amenities may add to urban well-being, but they are also the counterpart of urban land use, and may as such constrain local agglomeration and the well-being generating processes that it fosters (Bettencourt and West 2010). Within this context, it is timely that empirical studies provide further insights into the impact of natural amenities on the well-being of people who live in urban areas.

Since the impact of natural amenities on well-being is not directly observable, a wide range of empirical studies has sought to approximate it from the effect of natural amenities on the prices of nearby houses (Waltert and Schläpfer 2010). Indeed, house prices internalize how buyers value living nearby natural amenities, given their expectations of how this will impact on their well-being. The premium that people pay for houses located nearby natural amenities can be disentangled from house prices using the hedonic price model (Palmquist 2005). However,

recent hedonic studies show that results on the value of natural amenities depends on whether the amenity itself is measured following an objective approach or a perception-based one.

Objective measures capture spatial relations - through proximity or view - between houses and natural land use features that are observed in land use data (e.g. parks or urban forests; see the literature review by Waltert and Schläpfer 2010). In contrast, recent studies have used information from map-based surveys, in which people designate locations of natural features that they appreciate in general, in order to make objective land use measures more subjective (Czembrowski et al. 2016; Daams et al. 2016). Results from those studies show that the well-being from living nearby natural amenities can be gravely misestimated when using objective land use measures alone. However, additional investigation of the current topic is warranted for urban areas in specific: the Daams et al. (2016) study estimates the effects on house prices from natural places that people perceive as attractive, but which are mostly large and exurban. The Czembrowski et al. (2016) study, in turn, studies natural amenities in an urban context, but shows mixed results (i.e. positive as well as negative coefficients) for the observed amenity measures.

This paper contributes to the literature through refining the measurement of how natural amenities in urban areas impact on the prices of nearby houses. In so doing, we first measure the intra-urban locations of natural amenities that are likely to be strongly valued by house buyers. This is done by combining objective land use data with map-based (GIS) survey data on perceptions of attractive natural places, following Daams et al. (2016). This yields a measure that serves as a proxy for the perceived amenity value of natural places within urban areas. These measures provide *per se* a spatial assessment of which natural amenities add to people's well-being. Quantifying their impact on house prices, however, may yield information that is additionally relevant to policy decision making.

Our study area is the highly urbanized country of the Netherlands, within which we observe property prices in multiple urban areas. This allows us to exploit the variation in both natural amenities and urban structure that characterizes the Netherlands, and also to deal with effects from unobserved characteristics of houses and their locations. This can then be done without specifying spatial controls that are too tight, thus preventing that they absorb proximity effects of natural amenities (Abbott and Klaiber 2011). Importantly, the observed urban areas are

delineated by the OECD functional urban area (FUA) definition (OECD 2012; Brezzi and Veneri 2015). The FUA definition is specified to ensure, based on population density and commuting patterns, that cities are identified in functional and economics terms, instead of on their administrative boundaries and that they can be compared within and across countries. The consistency of this measure of 'urban' allows us to generate consistent measures of how amenity-levels of the natural amenities within FUAs are distributed across space.

Overall, this study is motivated by the re-occurring interest in combining objective and subjective measurement in the hedonic analysis of natural amenities (since i.a. Earnhart 2001), and is aimed to advance recent spatially explicit methodologies (c.f. Czembrowski et al. 2016; Daams et al. 2016).

Study area: urban areas and natural amenities data

Natural amenities are measured using survey data from the Hotspotmonitor (HSM) database, as per February 2017. The HSM survey asks respondents to designate attractive natural places on a Google Maps-based map. These attractive natural places may be on land or water, located within or outside of urban areas, and should feature natural amenity – in a broad sense. Taken together, HSM designations of attractive natural places allow us to measure locations of natural amenities that are perceived as attractive by multiple HSM respondents.

The Dutch cities that are observed in this study are operationalized using the OECDs functional urban areas (FUA) definition. This functional and economic definition of urban areas is consistent with the hedonic assumption of freely mobile buyers, within the observed study area, who pay for the benefits that they may derive from living nearby natural amenities. An advantage of the FUAs definition is that it generally measures boundaries of cities that extend beyond the cities' administrative boundaries. This allows sufficient within-city variation in houses' distances to natural amenities, which is necessary for appropriate estimation of price-effects from this proximity (Graves 2013). However, we do not restrict our analysis to within-city natural amenities. Indeed, natural amenities that are relevant to the purchase decisions of house buyers may not necessarily be located within the daily urban system that FUAs reflect. Instead they may be located outside of a FUA, in an area that reflects a 'monthly' urban system of sorts, which includes space for occasional recreational activities. Therefore we allow our

proximity measures to extend beyond FUA boundaries – but under the condition that the involved natural amenities are designated by HSM respondents who live within the observed FUA. Figure 1 illustrates the distribution of perceived natural amenities in two (random) FUAs in the Netherlands. Given that the distribution of proximity to natural amenities may vary across FUAs, see also Daams and Veneri (2016), which may influence our capitalization estimates, we include multiple FUAs in our study area.
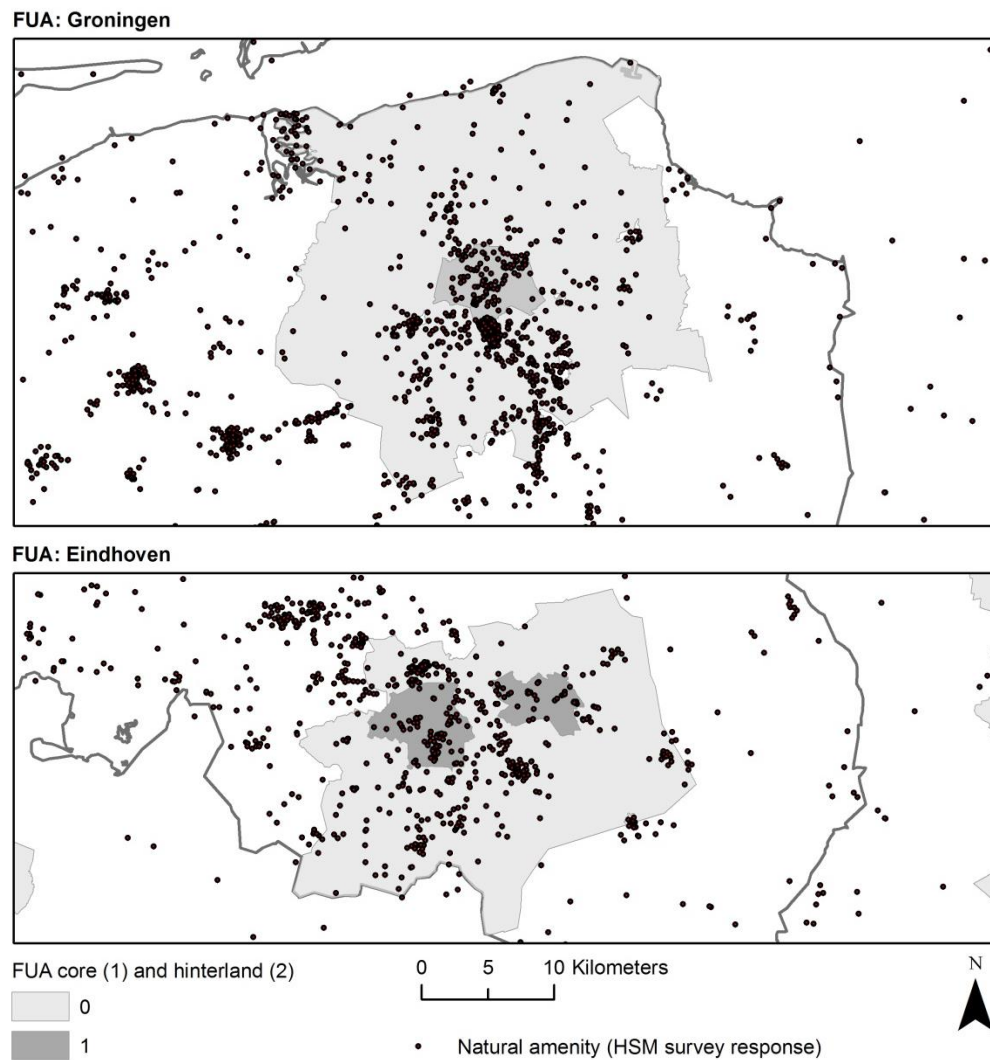
Figure 1. Spatial distribution of natural amenities within two Dutch FUAs.

Methods and data

This study applies a standard log-linear hedonic price model using conventional hedonic control variables, as well as models that include spatial fixed effects. The spatial fixed effects control for unobserved locational characteristics that are capitalized in house prices and correlated with proximity to natural amenities. Furthermore, to account for possible local similarities of houses, for example in terms of structural style, standard errors are clustered zip code level.

The house price data observed in this study amounts to 402,598 observations of single family property and apartment transactions over 2009-2012. The data are obtained from the Dutch Association of Real Estate Brokers and Real Estate Experts (NVM). The NVM's database has recorded about 80% of all transactions in the Netherlands during the observed period. It measures a wide selection of the control variables typically included in hedonic analysis, including addresses. Using this address data we geocode house transactions at building level. We keep only those observations that are located within FUAs that are covered by the HSM data, and which have complete address information. Using the geocoded data we measure this study's variable of interest, the proximity of houses to natural amenities.

More specifically, our natural amenity variables capture the Euclidean distance between the observed houses and the nearest natural amenities, as well as the latter's perceived amenity-level. The observed measure of natural amenity serve as a proxy for the average perception of such amenity by potential house buyers. Including this subjective measure in a hedonic model addresses anecdotal interpretations in various existing hedonic studies which found that some natural places, of the same land use type, have a relative high or low impact on house prices.

A strength of the observed natural amenity measure is that the underlying survey data on perceptions are sampled independently from the house price data. This mitigates the possible influence that spatial selection effects in house location choices may have on the estimated amenity-effects (as house buyers may select into locations near natural amenities that they have a taste for). Furthermore, our measurement approach is in line with the approach taken in Daams et al. (2016), who observe mostly exurban natural amenities, and show a connection with house prices that is uniquely strong within the hedonic literature. Hence, we expect our measure, within its explicitly urban context, to show a positive effect on house prices as well.

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