Rethinking the economic valuation of natural land

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CHAPTER 7.

How green do we want to live in 2100? Lessons learned from the homes of the present-day rich

7. How green do we want to live in 2100? Lessons learned from the homes of the present-day rich[45]

Abstract – The present study explores the extent to which rich Dutch households live green, in the form of green surrounding homes directly and nearby public green. The authors interpret this 'greenness' as a sign of how green the wider population wishes to live in the long-term as it grows wealthier over time. Property transaction data comprising about 80% of the 2009-2012 residential market are analyzed. Our focus is on 2,303 properties that sold for at least 1 million Euros, as representative of 'properties of the rich'. Results indicate that the rich live relatively green: on average, and depending on local degrees of urbanization, the parcels of million Euro properties are up to 7.0 times larger than parcels of cheaper properties. We find too that the rich live closer to public green spaces than the more general population, especially if such green is highly appreciated by a wide public. Furthermore, the rich are found to live in either very highly urban locations or in the least urban locations – if these are nearby cities. We apply our results in basic long-term 'forecasts' of demand for residential space across local property markets. Our premise is that, competition for land aside, more people start to live like the present-day rich. The forecasts suggest that preferences for green living, and the extent to which these are accommodated by existing residential structures, may increasingly diverge if we grow richer over time – unless we rethink how green and urbanity can be combined. The results presented here may foster long ongoing research and policy debate on urban planning.

[45] This chapter is based on: Daams, M.N., & Sijtsma, F.J. How green do we want to live in 2100? Lessons learned from the homes of the present-day rich. *Submitted to an ISI rated journal*.

7.1 Introduction

Urbanization is an ongoing long term process across the globe. Empirical evidence suggests that people worldwide, apart from those in very poor regions, "may all live in cities by the end of the century" (Batty 2011, p. 771). Over this same period we may also become considerably wealthier if historical trends continue (see Clark 2007), in part because urbanization fosters processes that lead to wealth creation (Bettencourt and West 2010). For instance, agglomeration economies of cities offer many jobs and allow people to specialize; cities also provide an extensive variety of consumer amenities which people value greatly (Glaeser et al. 2001). Higher wealth, however, appears to correspond with higher appreciation of green in residential areas (see Anderson and West 2006; Brueckner et al. 1999; Zietz et al. 2008) – and such green is essentially the counterpart of urbanity. This poses an important question for urban planning in the aim to strike a balance between the advantages of the supply of green and levels of urban density: as we grow wealthier over time, will we in future long for more green in our increasingly urban living environment? And if so, should cities not be built in a greener way than is currently being done? Indeed, due to the durability of residential real estate, decisions made today on how to balance green and grey as cities develop, will strongly influence how optimally residential preferences can be met in the future. Hence, this paper sets out to discover more about our future preferences for green living.

Predicting future residential preferences is notoriously challenging. Predictive models, however complex and comprehensive, are bound to use data on current preferences, trends therein, or scenarios, and thus the uncertainty of their predictive accuracy remains (Horowitz 2002). Perhaps for this reason, the literature on the measurement of future residential preferences (e.g. Myers and Gearin 2001; Chen et al. 2009) to the authors' knowledge, does not include studies that focus on green. This gap in the literature is emphasized in the research agenda outlined in James et al. (2009, p. 71), who comment on the insufficient knowledge on how "the resilience and adaptability of urban areas to future economic, housing and environmental demands [can] be enhanced through appropriate design and management of urban green spaces".

In this study we take on the challenge of 'forecasting' how green the Dutch population wants to live in the future, and by doing so take an approach that is powerful in its simplicity. Our research here rests on the premise that the general population's *future* green preferences can be broadly understood from the characteristics and locations of residential properties bought by the *present-day* rich – if the general population grows richer over time – as suggested by trends in the Netherlands over past decades and centuries (Statistics Netherlands 2012; Luiten van Zanden and Van Leeuwen 2012). As Clark (2007, p. 4) puts it, "we already see how the rich live, and their current lifestyle

predicts powerfully how we all eventually live if economic growth continues" as "over the long run income is more powerful than any ideology or religion in shaping lives." Clark's statement resonates in this paper. We presume here that as we grow richer over time, the residential standards of 'the masses' may converge towards those of the present-day rich, but not so close as to mirror them precisely. The underlying rationale is that since demand for residential space both inside and outside of the home is elastic with income, as Cheshire and Sheppard (2004) show, increases in general wealth add pressure to the competition for land. An increase in competition drives up land prices since countrywide only limited adjustment may be possible on the supply-side of the land market. This is due to a Ricardian-like limitation of the supply of land for development. This situation is expected to continue over the long-run due to the Dutch government's history of restrictive use of planning controls (see Rietveld and Wagtendonk 2004), which are likely to be implemented since the already limited growth of the population is expected to slow over time. Thus, given the abovementioned market circumstances, even in the long-run it is not people's absolute wealth that matters when they seek to buy large properties with large parcels, but rather their relative wealth (Hirsch 1976). We also adhere to the notion that general wealth is likely to rise over the long-term (c.f. Clark 2007), and this would enlarge the material (residential) aspirations of the wider population (Easterlin 2001; Hirsch 1976). How a widespread change in aspirations unfolds, with respect to how green people wish to live, is what this paper 'forecasts'.

In examining the extent to which the present-day rich live green as a sign of future preferences of the wider population, we compare the characteristics of very expensive properties with other – less expensive – properties. To do so, we use property transaction data comprising about 80% of the Dutch residential market over 2009-2012 – allowing for the observation of 2,303 properties that sold for at least 1 million Euros. We analyze the size of these property parcels and measure the proximity of these properties to generic public green space and to public green space deemed *particularly attractive*. We investigate the consideration that 'greenness' of properties may vary in accordance with local degree of urbanization. The abovementioned analysis is also performed on a sample of properties that sold for less than 1 million Euros, containing 99% of all observed properties, to assess how green the relatively general population lives. We compare the findings of the 'very expensive property' and the 'cheaper property' samples so that we may understand the relative magnitude of how green the rich live.

The magnitude of how green the rich live is – in this study – assumed to demonstrate a relative preference for green living. However, it is possible that some rich prefer to live in properties with large parcels, not plainly because of direct enjoyment of green associated with the property, but because the green allows them to remain unobserved while outdoors, or otherwise mitigates negative externalities from neighbors.

If so, the rich are not motivated only by the ability to enjoy the typical aesthetic or recreational amenities that green brings about. Perhaps the rich seek anonymity in the rural (Somerville et al. 2015) by acquiring large estates, even though anonymity may be achieved in cities, as these host higher densities of population including other rich people. The precise motivations driving rich households to seek green are nevertheless beyond the scope of this paper. In the wider literature, land consumption by the rich is often related to the exhibition of wealth, prestige and status (Green and Owens 2013; Hirsch 1976; Pow 2011; Woods 2011). For example, Woods (2011) suggests that some of the present-day rich emulate the rural lifestyles of the old aristocracy. Similarly, Brueckner et al. (1999) show that urban location patterns of rich households can be endogenous. Such behaviors seem to justify the general assumption of the current paper that, if wealth increases over time, more people may seek to live as green as the present-day rich.

Our analysis on how green the present-day rich are living, builds on a theoretical rationale that underpins a wide literature on hedonic property price modeling (e.g. Anderson and West 2006; Daams et al. in press; Palmquist 2005). Hedonic models estimate the change in property price, given a marginal change in a particular attribute, such as square meters or distance to green, to reveal present-day residential preferences from sampled property transactions. A key assumption then is that buyers acquire properties with the mix of attributes most preferable to them, and importantly, those that they can afford, given their budget for housing. Along the same line of thought we argue that when people are subject to a budget constraint so negligible that they are able to consider buying nearly any property listed for sale, they have relative freedom to buy property which reflects their 'ultimate' preferences most closely. Hence, one can explore if people ultimately prefer to live more green, or less green, without estimating how households' willingness to pay for a *marginal* change in the 'greenness' of their living environment is influenced by income level, as economic valuation studies tend to do (e.g. Anderson and West 2006; Ferreira and Moro 2013; Zietz et al. 2008). The *absolute physical dimensions* of the parcels of present-day rich properties, and how close these properties are to public green, are also insightful by themselves. They offer an important window onto whether the wider population prefers to live more green or less green, in the future as it grows wealthier over time.

This paper explores how green the present-day rich are living and discusses the implications for urban planning if general wealth continues to rise over time. In doing so, it contributes to the literature on green urban planning (c.f. James et al. 2009), and also adds to the ongoing debate on how green, or how centralized, or decentralized we should build our cities (Breheny 1996; Kühn 2003; Matsuoka and Kaplan 2008). In addition, as explicitly encouraged by Hay and Muller (2012), this research adds to the geographical field that examines lifestyles of the rich (Beaverstock et al. 2004).

We structure the remainder of the paper as follows. The next section describes the study area, data and methodology applied. The main results are then discussed in section 7.3, which also analyzes demand for space if in the future more people start to live like the present-day rich. Section 7.4 discusses implications of this paper's results for urban planning.

7.2 Data and methodology

Our study area, the country of the Netherlands, is suitable for our 'natural field experiment' for three reasons. First, the country's gross domestic product per capita grew considerably, by a factor of 7.0, from 1921 to 2011 in real terms – as data from Statistics Netherlands indicates. Of course, rises in real prices of property and land have restricted households from increasing the quality of their residential situations. Nevertheless, it is clear that over the past century the residential standard of the Dutch has risen considerably, and we expect it to do so in the future. Second, in European countries, the location choices of the rich are driven by the presence of (natural) amenities rather than by the location of new construction, as is the case in the United States (Brueckner and Rosenthal 2009). Thus, it is reasonable to assume that in the Netherlands, the locations of properties of the rich give a fair representation of how near to public green the rich prefer to live. Third, the country is highly urbanized but also contains rural areas and the supply of green varies across space. For these reasons, the Netherlands offers an appropriate case for inquiring into the question of building greener cities – since more people may wish to live like the present-day rich in the future.

One may wonder why this study does not directly survey the general population on its expected preferences for green living in the future. We do not because predicted utility is shown to have poor accuracy. If people are unable to predict a change in their taste for ice cream flavors over a week's time (Kahneman and Snell 1992), they are unlikely to be able to predict accurately how green they want to live years in the future as their wealth increases. Hence, we study how wealth and green living relate by analyzing rich households' actual market behavior.

Properties of the wealthy are sampled from 2009-2012 data on property transactions registered in the Dutch Association of Real Estate Brokers and Real Estate Experts (NVM) database. The NVMs data comprise about 80% of all transactions on the Dutch market in the observed years. Prices are adjusted for inflation to reflect the value of the Euro in 2012. The transaction data also describe several characteristics of the observed properties, including parcel size and location but the data give no information about buyers. This study defines properties of the wealthy as properties that sold for 1 million Euros or more, because buying such property requires a very large budget for housing. Of course, alternative definitions of 'wealthy' can be proffered, and several are indeed

considered later in the paper. After basic cleaning of the data,[46] the sample of 1 million Euros properties includes 2,303 single family properties and 201 apartments. As a 'general population' benchmark, we use a sample drawn from the NVMs database which includes all other properties sold at prices below 1 million Euros.[47] These observations include 254,871 single family properties and 113,498 apartments. Single family properties and apartments are considered separately, as their price-formation and their distributions by urban density are structurally different. The distributions of million Euros single family properties and apartments across NVM broker local property markets (N=76) are shown in Figure 7.1. All observations are geocoded at address level.

To delineate public green we use 2010 land use data from Statistics Netherlands. These data describe green of at least one hectare in size across the Netherlands. Green is defined by any non-developed land, including agricultural, in addition to typical green features such as parks, lakes and forests. With respect to green, we also consider that "as household incomes change over time, amenities are like hamburger or caviar in that some are inferior and some superior" (Graves 1983, p. 542). To distinguish among the 'caviar' in the green within our study area, we also use data that delineate green land uses that are highly appreciated by a wide Dutch public (at national scale). These data were generated in a study by Daams et al. (in press) by combining 2010 land use data with Hotspotmonitor data. The Hotspotmonitor is a Google Maps-based survey that asks respondents to designate green that in their perception is attractive– see De Vries et al. (2013). Distances to (attractive) green are Euclidean in order to ensure a straightforward interpretation.

Green can be considered as a counterpart to developed land, and for this reason the interplay between green and urban density is an important focal point in our study. Spatial variation in urban density is measured from 2012 grid data acquired from Statistics Netherlands; in these data, urban density is measured as the per square kilometer

[46] From the full transaction dataset we use only observations of secondary market transactions of properties with a permanent residential function.

[47] This 'cheaper' sample includes properties with sale prices of 800,000 Euros or 900,000 Euros, which can be considered expensive. Therefore, we checked if the use of a sample of more 'averagely' priced properties led to results different from our main analysis selling for less than 1 million Euros. Such was not the case, since the distribution of property prices below 1 million Euros is skewed toward the lower price range. Thus, in the current reference sample the characteristics of the relatively expensive properties have limited weight.

density of addresses within a one kilometer radius from a reference address. Urban densities are averaged at the level of grid cells with a resolution of 500x500 meters. With these data we are able to construct two measures of urban density: urban density at property location in the 500x500m grid cell and the average urban density in the NVMs local property market (see Figure 7.1a), where the observed property is located. Following definitions by Statistics Netherlands, our analysis mostly refers to urban densities as: 'non-urban' (density < 500), 'little urban' (500 =< density < 1,000), 'moderately urban' (1,000 =< density < 1,500), 'highly urban' (1,500 =< density < 2,500), or 'very highly urban' (density => 2,500). Furthermore, since apartments are mostly located in 'very highly urban' areas (Figure 7.1c), we consider apartments separately from single family properties. This allows us to necessarily pay close attention to results for single family properties, since these are likely to be more heterogeneous due to variation in urban density – as comparison of Figure 7.1a and Figure 7.1b suggests.

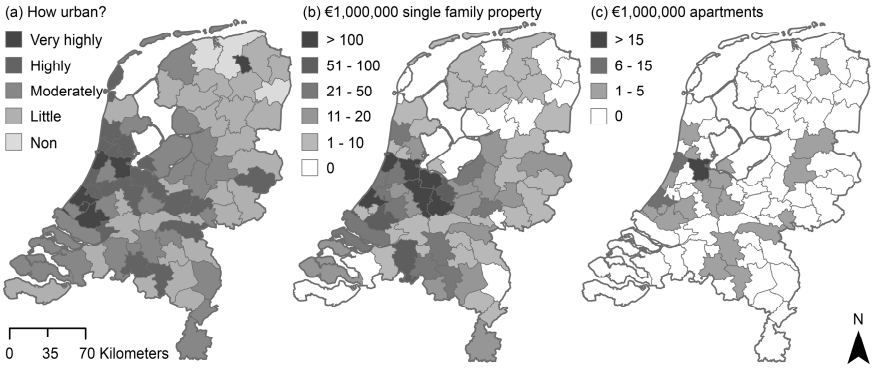

Figure 7.1 – Urban density and million Euro transactions of single family properties (N=2,303) and apartments (N=201), per local property market.

7.3 Results

7.3.1 Main results

Our aim is to determine how green the present-day the rich live and to compare this finding with how green the more general population lives. We first examine some of the basic characteristics of *single family* properties that have sold for 1 million Euros or higher, and compare these with the characteristics of single family properties that sold for lower prices (Table 7.1). A similar analysis is performed for a sample of apartments at the end of this section.

The first main finding is that the mean selling price of '1 million Euro properties' (€1,425,815) is about five times higher than the price for properties at lower selling prices (€269,341); therefore, the difference in mean parcel size is approximately a factor of 8, suggesting that parcel size is elastic with (extreme) wealth. To put this finding in perspective, the consumption of living area responds considerably less to wealth: 1 million Euro properties are, on average, about two times larger than properties with lower selling prices. These findings indicate that higher wealth corresponds with a corresponding higher need for more green surrounding the home rather than additional living space within the home. Kolmogorov-Smirnov tests comparing the distributions of both observed samples for each variable in Table 7.1 reject the hypothesis that the distributions of these samples are equal ($p < 0.01$).

Table 7.1 – Property characteristics.

	Million Euros properties		Lower-priced properties	
	mean	*stdev*	*mean*	*stdev*
Price (€)	1,425,815	803,741	269,341	137,644
Living area (m²)	287	83	130	41
Parcel (m²)	3,944	14,293	487	2,156

Note: The current sample is national in scope, thus no price-based regional stratification is shown.

However, it is likely that living area and parcel sizes are sensitive to local variation in urban density. We therefore turn to the relation between urban density and how green the rich live. We first examine how million Euro properties are distributed across different degrees of urban density. Table 7.2 shows how 'urban' are the (500X500m) locations of million Euro properties *within* local property markets of distinct degrees of urbanization. This finding yields important insights. With regard to urban density it is clear that the rich avoid the 'non-urban' and 'little urban' markets; only 5% of the million Euro homes are located in one of the aforementioned local property markets. Depending on level of urbanization at local property market level, the rich are 2.09 to 5.14 times more concentrated in 'non-urban' locations, with such differences being large, especially in 'highly urban' and 'very highly urban' local property markets. In addition to the figures provided in Table 7.2, the data show that of all million Euro properties at 'non-urban' locations, 57% are located in a 'very highly urban' local property market. Furthermore, this share is 88% when 'non-urban' locations in at least moderately urban markets are considered. So, although the rich prefer to live at 'non-urban' locations, they mostly situate themselves close to the cities.

When we consider the above observations of the rich, one might surmise that they prefer extremes of urban density. We report in Table 7.2 that, compared to properties with lower property prices, million Euro properties are most concentrated in 'very highly urban' locations (1.44 times more) and 'non-urban' locations (1.92 times more). We

Table 7.2 – Distribution of properties across degrees of urbanization.

Local property market level		*Property location within 500x500m grid cell* (a) Distribution of 1+ million Euros homes						Ratio of (a) and the distribution of properties with selling prices < 1MM €					
		(1)	(2)	(3)	(4)	(5)	*Total*	(1)	(2)	(3)	(4)	(5)	*Total*
Very highly urban	(1)	0.42	0.21	0.08	0.13	0.16	*0.36*	1.13	0.63	0.46	1.37	5.14	*2.85*
Highly urban	(2)	0.10	0.15	0.13	0.27	0.35	*0.37*	0.51	0.43	0.61	1.64	5.01	*1.13*
Moderately urban	(3)	0.03	0.09	0.10	0.30	0.48	*0.21*	0.39	0.34	0.41	1.26	2.74	*0.73*
Little urban	(4)	-	0.03	0.06	0.18	0.73	*0.05*	-	0.27	0.30	0.56	2.09	*0.23*
Non-urban	(5)	-	-	-	-	-	*0.00*	-	-	-	-	-	*0.02*
Total		*0.19*	*0.15*	*0.10*	*0.22*	*0.33*	*1.00*	*1.44*	*0.58*	*0.47*	*1.02*	*1.92*	*1.00*

Note: Ratios are calculated by dividing the shares of million Euros homes by the shares of non-million Euro homes. The number assigned to each property level density class corresponds to the labels for density classes at local property market level, indicating the same degree of urbanization but at another spatial scale. The 'non-urban' local property markets includes only a single 1 million Euros property; thus, for non-urban markets only 'totals' are shown.

Table 7.3 – Property characteristics by local degree of urbanization.

	Very highly urban		Highly urban		Moderately urban		Little urban		Non-urban	
	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.	Mean	St.dev.
Million Euros homes										
Price (€)	1,478,833	1,027,750	1,357,455	722,239	1,392,331	607,333	1,390,937	589,546	1,459,801	862,762
Living area (m²)	284	74	283	75	285	83	293	86	288	89
Parcel (m²)	349	429	969	828	1,558	2,750	2,465	9,275	9,164	22,740
Distance to nearest public green (m)	111	107	124	110	113	108	103	107	42	66
Non-million Euro homes										
Price (€)	280,998	150,268	256,647	126,333	255,208	122,111	271,537	133,404	294,433	160,915
Living area (m²)	124	45	125	34	128	35	132	39	140	52
Parcel (m²)	170	1,538	216	844	257	837	353	837	1,604	4,560
Distance to nearest public green (m)	197	157	161	128	142	107	120	91	61	64

Note: The overall mean distance to the nearest green is 88 meters for million Euro homes, and 136 meters for lower priced homes.

observe for example, that in 'little urban' local property markets the million Euro properties in most cases (73%) have 'non-urban' locations. According to our results, 'moderately urban' locations seem to have little popularity among the rich.

We can now turn to Table 7.3, which gives sizes of living areas and parcels disaggregated by degree of urbanization at property level.[48] While the average prices and living areas of million Euro properties are similar across degrees of urbanization, the average parcel size of these properties shows considerable variation: they vary from 349m² (SD = 429 m²) in 'very highly urban' locations to 9,164 m² (SD = 22,740 m²) in 'non-urban' locations. Across degrees of urbanization, the average parcel sizes of million Euro properties are 2.1 to 7.0 times larger than the average parcel sizes of properties sold for lower prices, a finding which clearly suggests that the rich prefer considerable amounts of green surrounding their homes in any urban density context.

Table 7.3 also shows the proximity of properties to public green (of any kind, not just so-called *attractive* green, which we analyze later). For each degree of urbanization measured at the property location, the distance to public green is, on average, somewhat lower for million Euro properties, compared to the distances of properties with lower selling prices. Differences seem to become more prominent as population density increases.

The previous finding merits further scrutiny. Since for any property some type of green may be nearby, it may be more informative to examine the percentage of the observed properties that are very close to public green: within 50 meters. In this case we see that 50% of the million Euro properties are within 50 meters of public green, whereas only 26% of the properties below 1 million Euros are as closely situated. This indicates that the rich live relatively close to public green.[49]

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[48] For each of the variables in Table 7.3, Kolmogorov-Smirnov tests reject the hypothesis that the distributions of the two observed property samples (split by urban density) are equal ($p < 0.01$).

[49] In further analysis we considered a measure of public green disaggregated by distinct natural land uses, as categorized in the land use data; these indicated that, across locations of different urban densities, the rich have a taste for living nearby 'forest and open nature'. We observe that the rich live closer to such nature than those who bought properties below 1 million Euros – although in urban locations this only holds in case 'forest and open nature' is particularly attractive. Furthermore, the data consistently indicate that the rich dislike living near agricultural land; however, the data also show a

To better understand the preference to live near public green, we now focus on one of its special characteristics: highly attractive areas. Figure 7.2 shows the distribution of the two samples of properties that are analyzed in this study by distance to green perceived as highly attractive by a wider public (comprising about 7% of total public green area). Nearly 30% of these properties are situated within 500 meters of attractive green. The distribution of the remaining properties also shows a strong tendency towards relatively lower distances. Figure 7.2 shows a much flatter distribution of properties with selling prices below 1 million Euros: of these properties, 75% are located within 6.69 kilometers of attractive green, whereas 75% of the properties of the rich are found within 2.29 kilometers. Our findings suggest that public green spaces, which are attractive to the wider public, indeed seem like caviar to the rich (c.f. Graves 1983).

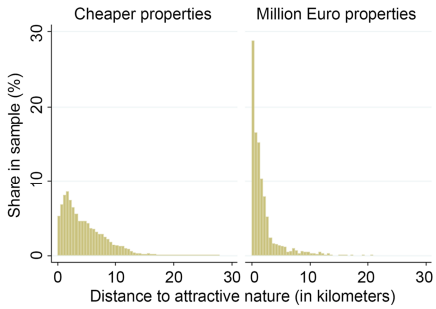

Figure 7.2 – Sample distribution by distance to nearest attractive nature, per 0.5 kilometer (km) interval. The .25, .50, and .75 quartiles are within the sample of million Euro properties, 0.39 km, 1.17 km, and 2.29 km, respectively, and in the same order, 1.79 km, 3.71 km, and 6.69 km in the case of the sample of cheaper properties (transaction prices below 1 million Euros).

After having discussed our results for single family properties, we now turn to our findings in relation to million Euro *apartments* (N=201). Million Euro apartments are fewer in number than 1 million Euro single family properties (N=2,303) and are very homogenous with respect to urban density: 94% of these apartments are found at 'very

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slight preference for living nearby agricultural land when it is considered to be attractive. A similar pattern was found for water bodies, apart from these being more appreciated in 'very highly urban' locations compared to less urban locations. Million Euro properties are only relatively closer to parks than properties sold at lower prices if parks are both attractive *and* located in a 'very highly urban' setting.

highly urban' locations (in slight contrast with the 84% of apartments sold at lower prices). The high urbanity of apartments is logical; the development of the apartment as a property structure is the solution to intensive demand for urban land. From this it follows that the highest priced apartments are found in the most highly urban locations. Our findings for apartments in relation to green are consistent overall with the findings for single family properties. The average living area of million Euro apartments is 2.0 times larger than the average living area of apartments sold at lower prices (for single family properties this ratio is 2.2). Also, million Euro apartments are on average somewhat closer to public green (115 meters) than apartments sold at lower prices (153 meters). We find that 19% of the former are within 50 meters of green that is highly appreciated by a wider public, in contrast with 2% of the latter. Thus, while the observed apartments of the rich are more urban than the observed single family properties of the rich, they nevertheless both indicate a relative 'greenness'.

7.3.2 Sensitivity analysis

The sensitivity analysis below investigates whether findings are of a similar magnitude as those in the main analysis when 'properties of the rich' are defined in alternative ways. To do so, the key variables of this study on green are examined for three alternative property samples: the most expensive properties stratified by region, new constructions sold for at least 1 million Euros, and properties of millionaires (households with a minimum of capital amounting to 1 million Euros). To understand the level of urbanity for these samples, we assess the mean address density for each sample of the included observations. Given the low number of apartments in the 'new construction' (n=15) and 'millionaire' samples (n=10), the analysis of sensitivity is restricted to single family property samples.

Our first alternative sample includes one percent of the properties in each NUTS II region (Province; N=12)[50] based on the criterion that, within their regions, they sold at the 1% highest price. Considering these data is relevant because the main analysis could overlook properties of rich households located in NUTS II regions where pressure on property price is relatively low, for example, due to the limited presence of cities and agglomerations. Indeed, mean address densities are considerably lower for single family properties and apartments in the 'regional top 1%' sample – as with the million Euro

[50] This spatial scale is the lowest reasonable scale for a regionally-stratified sample, since at the (lower) scale of local property markets it is possible that some markets include only properties that sell at relatively average or even low prices. Thus, sampling properties from those markets could misrepresent the locations where the rich live.

property sample used in the main analysis – see Table 7.4. This may explain why, in the regional top 1% sample, mean parcel size is about 1.5 times larger than that of 1 million Euro properties. Furthermore, both single family properties and apartments in the regional top 1% sample are farther away from attractive nature than similar structures sold for 1 million Euros or more – but are still quite close to these amenities. The extent to which results for the regional top 1% sample and the million Euro properties differ from results for their reference samples is proportionate to the difference between both samples of interest themselves – indeed, results for the reference samples, which include the large mass of properties sold for lower prices are similar.

We now consider whether the preference of the rich in relation to parcel size changes over time. We would assert, however, that preference is not reflected in the characteristics of properties sold on the secondary market (for the existing property stock), since these reflect preferences at the time of their construction. If parcel sizes of expensive properties sold on the secondary market are not satisfactory, by being either too large or too small, the rich may nevertheless still buy these properties. Such may be the case if any dis-utility associated with parcel size is somehow compensated by utility from other characteristics of the property. Most relevant to our analysis therefore is the possibility that the rich buy properties with large parcels not because they prefer large parcels but because they prefer the properties that come with large parcels on the secondary market. To explore this, we analyze a sample of single family properties built recently, as these new constructions are likely to reflect recent preferences for parcel size. Table 7.4 shows that, on average, the parcels (mean = 5,417m²) associated with new construction in our property transaction data are larger than the parcels observed in the main analysis (mean = 3,944m²). This finding seems to suggest that the rich prefer even larger parcels than concluded in the main analysis. What is important here is the robustness of the results in our main analysis: we find a broad similarity among the average parcel sizes in both analyses.

Finally, some of the rich may not live in properties that are ‘expensive’. To check if this influences our main results, we analyze how millionaires live. To do so, we draw from a 2012 national survey, ‘WoON2012’ on housing situations gathered by Statistics Netherlands and the Dutch Ministry of the Interior and Kingdom Relations. This survey (N=69,339) is representative for Dutch households in general. Survey responses are enriched with capital tax data so we can identify the responses of millionaire households (N=287). Following Statistics Netherlands, millionaire households are defined as households with capital of at least €1,000,000. Of the 287 millionaire households observed, 10 live in apartments and 277 live in single family properties. We focus on single family properties in the WoON2012 sample. As with the main sample, we can only analyze green in the form of parcels. The observed parcels cover, on average, a 1,644m²

area (Table 7.4). This average area is considerably less than the 3,944m² area reported in the main analysis for parcels of million Euro properties. But on average the parcels of millionaire properties are still about four times larger than the 426m² parcels of non-millionaire properties. Unfortunately, the property data does not include precise information on their locations. Hence, we do not know whether the results presented here differ from the main results if variation in parcel sizes with urban density is taken into account. Importantly however, by using this alternative definition of 'properties of the rich', and consistent with our main findings, we have determined that parcel sizes are considerably larger than parcels of the general population's properties.[51]

7.3.3 What if we all start living like the rich?

What if, in the long-term, say in 2100, a higher share of the total Dutch population were to demand the same space for green living as the present-day rich do, as general wealth increases over time? This subsection considers how much residential space would be required to satisfy such a 'forecasted' demand, and whether this is possible, given the supply of developable land in the Netherlands. We are referring here to the spatial intensity of possible future demand for land. Such demand may, however, remain latent in the future property market because due to competition for land it is unlikely that a widespread demand for properties as spacious as those bought by the present-day rich would materialize. As a result, wide-spread aspirations for green living and the actual residential structure may diverge over time if general wealth increases. Grasping the magnitude of such a divergent process, should it occur, gives additional meaning to the

[51] Although the millionaire-based definition has its merits, it overlooks certain 'rich' households, in for example, households whose capital is less than €1,000,000 but whose income is high. In fact, some of the rich may not be defined as 'millionaires' due to having invested their capital in their homes. With this possibility in mind, the definition of 'properties of the rich' as properties that sold for 1 million Euros at minimum seems reasonable. This definition can also be understood from the WoON2012; these data show that among the households that own or rent property with an assessed value of 1 million Euros (N=234), the share of millionaire households is equal to 18.8%. Importantly, the average income of the aforementioned owner or renter households, but excluding millionaires, is €137,692. This income is 3.2 times higher than the median income in the WoON2012 data. Thus, the non-millionaire households living in 1 million Euro properties are nevertheless relatively rich. The abovementioned findings underline the usefulness of observing the 1 million Euro property sample in the main analysis, as it may cover properties of households that are 'rich' in different ways.

Table 7.4 – Sample means for alternative samples.

	Main analysis sample		Alternative specifications of properties of the 'rich'			
	Million Euro properties		Regional top 1%		New construction	Millionaires
	Single family	Apartments	Single family	Apartments	Single family	Single family
Price (€)	1,425,815	1,415,068	1,256,413	771,560	1,750,184	715,622[b]
Living area (m²)	287	171	288	165	263	227
Parcel size (m²)	3,944	-	5,882	-	5,417	1,644
Dist. to green (m)	88	115	74	119	101	-
Dist. to attractive green (m)[a]	1,912	749	2,645	1,646	1,770	-
Address density (within 1km)	1,758	6,898	1,183	4,163	1,383	-
Observations	2,303	201	2,594	1,140	84	277

Notes: [a] mean distance to attractive green is not reported in the main analysis. For samples of single family properties and apartments considered in the main analysis, the data show mean distances of 1,912m and 749m, respectively.
[b]Transaction prices are unknown for this sample as the WoON 2012 survey data include only assessed property values, which we have used to calculate this average.

implications of our main results for spatial planning, which balances levels of urbanity and the supply of green.

We begin with the simplest of all calculations. What if the whole Dutch population turned to present-day rich residential tastes? Would the Netherlands be able to accommodate such a fit? All land in the Netherlands amounts to 33,686 km². Of this area, 5,358 km² is developed, 22,478 km² has an agricultural use, and the remainder is comprised of non-agricultural nature. If the total Dutch population in 2100 were to have residential demands like the present-day rich, the total amount of land needed, parcels only, would be 27,700 km². This area for parcels is similar to the area of *all* present-day developed land and agricultural land combined – no space would remain for the homes themselves, nor for shops, or infrastructure. There is clearly insufficient space in the Netherlands for everyone to live like the present-day rich. Obviously this analysis is extremely simple but it also has a subtle inconsistency related to what seems to be the core of present-day rich residential tastes: they tend to live as green and non-urban as possible *within* urban regions. But if most of the population were to move away from urban centers, these population concentrations would no longer remain.

Let us next take a more modest approach: what if by 2100, not the whole population but a fair share of it, were to adopt the residential standards of the present-day rich? If, say, 25% of the total population had a parcel of land in size that is common to the rich and, importantly lived in the local property markets where present-day rich live, what might we see then?[52]

Our approach to forecasting is as follows. As an experiment, we distribute 25% of all Dutch households (as per 2012) across local property markets in proportion to the distribution of rich households in single family properties. Next we assume that in each local property market the redistributed households demand a parcel of the equivalent size owned by rich households. As a final step, the aggregate demand for parcel space within a local property market is confronted with the supply of developable land at locations likely to be desirable to rich households – based on the criterion that locations must be close to either an urban population core, to attractive nature, or to both (details on cut-off values follow). The resulting ratio is '1' if the forecast indicates that, within the observed local

[52] We could construct forecasts for the demand for space for any share of the population, higher or lower, than 25%. The simple analysis here is linear, so if one wishes to know the outcomes, for example, of a '50% forecast,' that can be achieved by multiplying the results by 2.

property market, the area of developable land equals the demand for parcel space. If demand for parcel space is forecasted to be higher relative to the supply of developable land, the ratio is higher.

Using the abovementioned approach, two slightly different country-wide forecasts can be generated. The first forecast has a more national character (Figure 7.3a) and assumes that, as people become richer over time, they will move to the local property markets where the present-day rich live, and then demand parcels equivalent in size to the average of the rich parcels. Hence, this forecast reflects that the highest priced properties in the Netherlands are found in or near highly urban population cores in the west of the Netherlands (Figure 7.1). The second forecast has a more regional character (Figure 7.3b). It assumes that, as people become richer over time, they are likely to choose more preferable residential locations in local property markets in the region where they live – rather than consider long distance migration, as assumed in the first forecast.

The difference in regional or national orientation is also reflected in the property samples and parameters used to generate both forecasts. The forecast with the national character, in Figure 7.3a, is based on the sample of million Euro properties – the properties sold at the highest prices in the Netherlands as a whole. The distribution of these properties across local property markets is followed if and when all Dutch households are redistributed. These households' demand for parcel space is based on the national average of parcel size that the data for million Euro properties indicate (3,944 m² per household - see Table 7.1). Similarly, the criterion used to define developable land at desirable locations (Figure 7.3c) is set at the national scale.[53] The second forecast, in Figure 7.3b, is based on regional parameters and draws on the sample of properties with the 1% percent highest transaction prices in each NUTS II region (N=12; Province). This regional stratification allows us to distribute Dutch households over local property markets from the NUTS II level down. Similarly, parcel sizes and the criterion on the desirability of the locations of developable lands are differentiated by NUTS II region.

The results are shown in the four maps across Figure 7.3. Several observations can be made. First, in both forecasts, several local property markets comprise a

[53] Threshold distances are set for the distance to a town or city, as delineated by Statistics Netherlands that is at least moderately urban on average and for distance to attractive green. Threshold distances are 3.0 kilometers for a town or city and 4.4 kilometers for attractive green. Both are based on mean distances plus one standard deviation as observed for the sample of million Euro single family properties – and thus pertain to preferences of a majority of the observed rich.

considerable amount of developable land at locations that are desirable to the rich due to being near an urban population core or to attractive nature (Figure 7.3c and Figure 7.3d). However, many of these local property markets remain green as our 25% forecasts materialize (Figure 7.3a and Figure 7.3b), since relatively few of the present-day rich households live in those markets. Thus, in these markets future demand for parcel space is forecasted to be lower than the supply of developable land – even while this land may be in locations that appear to be desirable. The bottleneck here seems to be that the markets that remain green are too peripheral for the tastes of the rich. This offers little perspective for local property markets in the outer peripheries which in the present-day are already associated with population decline (Haartsen and Venhorst 2010).

Second, clearly in both 25% forecasts in Figure 7.3a and Figure 7.3b, pressure on the land market is indicated to concentrate in central and relatively urban (c.f. Figure 7.1), property markets. Most distinctive about the pattern in the regionally sensitive forecast (Figure 7.3b), compared to the more nationally determined pattern in Figure 7.3a, is that it depicts a higher dispersion of the intensity of demand for space around the most urban cities in the west. Such a pattern may arise in future if conditions develop consistent with the assumptions of the 'regional' forecast; even over the long-term, people may have limited consideration of long distance migration due to an attachment to their home region. This is incorporated in the 'regional' forecast by sorting households into local property markets popular among the rich within households' current (NUTS II) region of residence.

Third, both 25% forecasts (Figure 7.3a and Figure 7.3b) indicate that, in a considerable share of local property markets, the forecast demand for parcel space exceeds the supply of developable land at desirable locations by factors up to 25.7, see Figure 7.3a.[54] The consequence of 25% of the population turning to the housing tastes of the current-day rich means that there is not enough space to accommodate demand. The implication here is that unsatisfied demand would spillover to nearby markets which have surpluses of developable land. Moreover, this analysis considers the forecasted demand for space within local property markets, given their present-day quality, which may deteriorate if more people start to live in these markets.

[54] The intensity of forecasted demand in a specific local property market depends on the number of transactions of expensive properties observed in that market. Since expensive properties are few in number, the amount of sales in a particular market may vary across years. As our transaction data span across four years, it seems reasonable to assume that they give a fair representation of the size of the markets for expensive properties in each market.

Of course, the forecasts presented here do not reflect a likely pattern of parcel space consumption in the future. In local markets, (expectations of) dramatically higher demand for land lead to upward corrections in land prices – which, in turn, decrease the sizes of realized parcels. What is important here is that the forecasts suggest that, in the

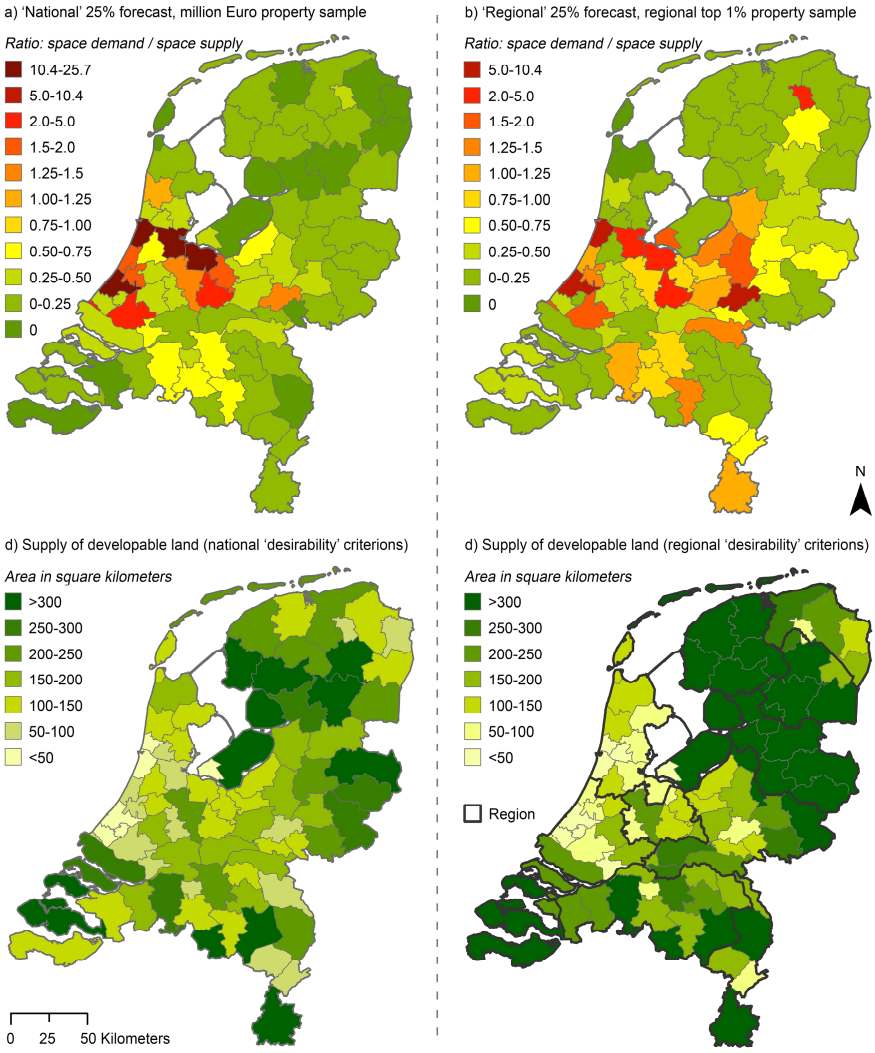

Figure 7.3 – Two forecasts (a and b) on how future demand for parcel space and the supply of agricultural land at desirable locations in (c and d) relate. The premise is that 25% of the total Dutch population would start to live like the present-day rich, and do so while being distributed across local property markets in proportion to the present-day rich.

Netherlands, preferences for green living and the extent to which these are accommodated by the actual residential structure, may increasingly diverge over time.

7.3.4 Wrap up of empirical results

The value of this study is in the magnitude of its findings in relation to land use: the very rich live with more green surrounding their homes than the more general population does, and if these rich tastes become more common there is insufficient space for aspirations to materialize. In the main analysis properties of the rich are defined as properties that sold for at least 1 million Euros. Depending on local degree of urbanization, average parcel sizes of the observed million Euro properties are 2.1 to 7.0 times larger than the average parcel sizes of properties transacted for less than 1 million Euros. Results also suggest that higher wealth corresponds with a relatively high need for more green surrounding the home compared to the need for additional living space. In the case of green associated with parcel area, we take note that the underlying motivations for buying specific properties are unobserved in this study. We can conjecture that some rich households prefer properties with relatively large parcels, as these may decrease negative externalities from neighbors or signal prestige to others, in addition to being motivated by direct benefits that green surrounding the home offers. With regard to public green, on average, million Euro properties are closer to such places than lower priced properties are, signaling that the rich appreciate living nearby public green. Public green spaces that are highly appreciated by the wider public seem to be particularly attractive to the rich. Furthermore, with regard to urban density, the data show that the rich prefer extremes: they tend to live in either very highly urban locations or in the least urban locations – if these are nearby cities.

Perhaps the single most important insight in this study stems from a basic forecasting analysis. This analysis has considered what will happen if, in the long-term, say in 2100, 25% of the total Dutch population acquires parcels of a size common to the present-day rich under the assumption that general wealth increases over time. The hypothetical demand for parcel space was confronted with areas of developable land and yielded the conclusion that if 25% of the total population begins to live like the present-day rich, the available space will be insufficient to accommodate future demand for green surrounding homes. The forecasted insufficiency of space varies considerably across local property markets. We expect that preferences for green living and the extent to which these are accommodated by the actual residential structure will increasingly diverge over time. A study of the specific motives of the rich for buying homes surrounded by considerable amounts of green is beyond the scope of this paper. However, the results presented here clearly suggest that, as we grow richer over time, more green should be provided within the mostly urban living environments in the Netherlands.

7.4 Discussion

7.4.1 Should we 'compromise' urbanity and green?

Ever since Howard wrote about the Garden City, the ideal combination of urbanity and green, the 'marriage of town and country' has been a hot topic of research and policy debate. The seminal paper by Breheny (1996) analyses this debate in terms of centralists versus decentralists: is the future of urban form an extremely centralized and agglomerated one or are decentralizing forces predominant? Breheny shows the still vivid potential and need for attaining compromise: an urban form that overall is neither extremely centralized nor extremely dispersed, but rather one that combines both of these forms to harness their merits. We certainly enjoy the many amenities and benefits that urban agglomerations offer (Glaeser et al. 2001), but we also seek to combine an urban lifestyle with our longing for green (e.g. Breheny 1996; Kühn 2003; Matsuoka and Kaplan 2008). The current paper has underlined the relevance of Breheny's compromise position. If we interpret the present-day preferences of the Dutch rich as signposts, as indicators of our actual future residential wishes, then we are on the compromise track: we will long for green living, yes, but we will long for living in or near high-density cities too. This underlines the notion that, after more than 100 years, the *marriage* of town and country that Howard envisaged may still hold important inspirational value as we make decisions about how green we will build our cities.

7.4.2 Greener designs of urban residential areas

The forecasts have illustrated that if economic growth continues not all citizens of the Netherlands will be able to live as spaciously as the present-day rich: the available space is insufficient. Specifically, in several local property markets, especially in the most urban ones, green may in the future be underprovided compared to people's demands for green as they grow richer over time; this poses an open challenge to urban planning: can residential areas be designed that are highly green and at the same time accommodate preferences for high urbanity? We may be required to rethink conventions in urban planning such as, for example, the supply of private gardens in urban areas. To cite Ewing (1997, p. 109): "if you count people's yards, there is abundant open space". This seems inefficient, since "an acre of land used as a pleasure garden for the enjoyment of a single family can never rise above its initial productivity in that use", as Hirsch (1976, p. 20) notes. Perhaps gardens should more often be substituted for public green in order to increase the leisure productivity of involved lands, which appears reasonable if the demand for land is high (Cheshire and Sheppard 2004). Public green may, however, not offer precisely those amenities that private green can offer. Even so, it seems worthwhile to study in an actual market if a 'Park City' design, as a highly urban variation on the Garden City design, appeals to people. And, to arrive at a 'compromise' with high-density

cities, would it be desirable to develop residential property in the middle of nature, in the hinterland of these cities? These questions matter, especially since in urban regions the supply of space may be limited and the demand for green living may increase over time, as this paper strongly suggests. We encourage further debate on this important topic.

7.4.3 Monitoring how and where the rich live

Due to the longevity of residential real estate, the characteristics of the existing supply of homes inherently lags after changes in residential preferences, if any, over time. Given that long-run changes in income is a powerful predictor of how we wish to live (c.f. Clark 2007), why not monitor how and where the rich live, and why? Such monitoring could then also examine the determinants (other than green) that motivate where the rich decide to live, such as costs of commuting and the spatial distribution of historical and consumer amenities (Alonso 1964; Brueckner et al. 1999). A study like this could provide insights to help urban planning to account for residential preferences as the Dutch population grows richer over time that may be more robust than when the relation between wealth and residential preferences are overlooked. Noteworthy is that observable trends in how and where the rich live may differ between countries. Indeed, findings for the Netherlands, for example, may only be transferrable to the United States in a limited way. Between these two countries the preferences of the rich are likely to differ (c.f. Brueckner and Rosenthal 2009); the restrictions imposed by institutional development regimes also differ between the Netherlands and the US. However, we would argue that the method itself, the analysis of the properties of the rich, can be applied more widely internationally. As an extension of the analysis in this paper, future research could evaluate whether the rich buy second homes in rural areas in order to compensate for highly urban primary residential locations, and vice versa.

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