Property Value Uplift Tool: Final Report

Jonathan Halket
Mateusz Mysliwski
Lars Nesheim
Polly Simpson

Centre for Microdata Methods and Practice
IFS

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Abstract

We were commissioned by the National Infrastructure Commission to create a software tool to estimate the property value uplift resulting from various infrastructure investments including building new settlements and making investments in road or rail transportation. This report describes the outputs of the project and some preliminary analysis conducted with the software tool. The three main outputs of the project are: 1) a comprehensive database on property values, property characteristics, infrastructure, and features of the geographic and economic environment that affect property values in England; 2) results from a range of econometric models relating property values to property size and type, property location and to features of the local geographic environment; 3) a "property value uplift" (PVU) tool in the form of a web application that enables users to evaluate how property values in a stable economic environment might change in response to small scale investments in roads, public transport or houses.

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1 Introduction

Governments can generate big impacts on citizens' well-being and business productivity through investment in public goods (like transport networks) and through planning decisions that determine which land can be used and what it can be used for. When making these decisions policy makers face trade-offs. Transport investments are expensive but reduce time wasted in commuting or shipping goods. This enables people to access a wider range of jobs, shops, and cultural destinations and enables firms to reduce costs and increase productive efficiency. Planning restrictions can protect areas of cultural and environmental importance but also limit the construction and supply of new housing and commercial property in desirable locations.

When deciding which projects to fund, policy makers need to understand how big these impacts are. One way to measure these impacts is through their impacts on property prices. A new road or rail line makes some locations more valuable. As a result some of the benefits become "capitalised" into property values. Similarly, changes in planning restrictions, change the value of affected properties. These price changes, with careful interpretation, can inform governments about the benefits of policies for local residents. They also can be directly relevant to local authorities when making project funding decisions or when negotiating developer contributions to the local community.

With these issues in mind, we were commissioned by the National Infrastructure Commission (NIC) to create a software tool to estimate the property value uplift resulting from infrastructure investment and relaxing planning constraints. Specifically, the commission was interested in:

- How the price of existing properties would respond to investment in new or improved road and rail infrastructure
- What the price of properties would be in a new hypothetical settlement constructed where one does not currently exist

In order to address these questions, the project has three main outputs.

First, we have put together two comprehensive property-level databases. The first contains information about residential property values, residential property structural characteristics (including size) and characteristics of locations that affect value (e.g. travel time to jobs, noise exposure, floodrisk). The second contains similar information for commercial properties and commercial property rateable values from the Valuation Office Agency.

The two databases combine a wide variety of publicly available data sources, and some restricted licence data. The residential property database, contains information on the price and type of (almost) every property sold in England[1] between 2008 and 2017, linked to property size from MHCLG's Energy Performance Certificate database, precise coordinates from the Ordnance Survey, local land use from the Generalised Land Use Database, planning policies from MHCLG, exposure to flood risk and noise from the Environment Agency, and travel times by car or public transportation estimated from Google Maps Distance Matrix API). The commercial property database contains the same information but measures rateable value and only at a single point in time, April 2015.

The two datasets have taken considerable time and effort to construct and will be of use to future researchers interested in analysing property values and other questions related to infrastructure and economic geography. A subset of the residential property database (containing only publicly available data) with accompanying documentation will soon

[1] Due to data availability, the analysis focuses solely on England.

be available on the CeMMAP website (CeMMAP). The commercial property database and some of the data in the full residential property database is only available under restricted terms. For this reason, for the restricted access data sources, we will provide documentation on how to obtain access as well as computer code that can be used to clean and use these data sources.

Second, we have used this data to study how house prices and commercial property rents vary with the characteristics of a property and it's location. We have estimated a range of econometric models that allow us to measure the contribution of each characteristic to property value or to property rent. Several features of our approach are notable. We split our analysis into two steps, which allows us to study what makes *places* desirable separately from what makes properties desirable. We use 'semiparametric' specifications, enabled by the volume of data available to us, meaning that our approach captures the complicated ways in which the value of a property can vary with its size or travel time to nearby cities. We also have chosen to conduct our analysis at a regional level so that our models can be tailored to local conditions (for example, varying the key commuting destinations). This report provides further details of these results.

Third and finally, by combining the databases and results from our econometric analysis, we have created a "property value uplift" (PVU) tool in the form of a web application (**CeMMAP PVU tool**) that can be used to evaluate how the prices and rents of existing properties might change in response to small scale investments in roads or public transport. Users can also input details of prospective settlements and predict the value of and rent for properties at new sites. The tool is very flexible, allowing the user to be very specific about the type and location of investment they'd like to evaluate. It is also very detailed, predicting the impact on the full distribution of house prices in the area (not just what happens to average house prices) and the full distribution of commercial rents. The results highlight how localised the benefits of transport infrastructure can be.

However, the results of the tool are subject to a health warning. The questions posed by NIC are difficult to answer, largely because people and firms move in response to new or improved infrastructure. In this project - given time and other practical considerations - we have sought to predict the short-run effect of new construction or infrastructure investment as robustly as possible using a rich dataset and sophisticated econometric methods. Our findings do not take into account large scale changes in the macroeconomic environment, or long run effects resulting from changes in job locations, commuting or residential patterns. For example, the tool will not accurately predict the impact of new, very large rail schemes since these tend to prompt medium to long term shifts in commercial location decisions, residents' location decisions and travel behaviour. Throughout this report we explain the strengths and limitations of our model. Nonetheless, the results of the tool can be considered the best short run estimates available given existing data and the timescale of the project, and an excellent starting point for future analysis of public investment and planning decisions.

1.1 Summary findings for residential property

- The database we have created are large and detailed, and can be used to evaluate the relationship between property prices and important elements of local geography.
- The model with time fixed effects, property type, property size and detailed location (in latitude and longitude) explains 62% (Northeast and Northwest 63%) to 79% (Southeast and East of England) of the variation in property prices.

- Property prices grew in all regions from 2008-2017 but in the South started at a much higher level and grew at a faster rate.

- Prices increase with size in all regions, but at a faster rate in the South and in London. In the North, the price of a 200 square meter property is about £200,000 more expensive than a 50 square meter property. In the South, a 200 square meter property is about £400,000 more expensive. In London, a 200 square meter property is about £1,000,000 more expensive than a 50 square meter property.

- In all regions, price per square meter is sharply higher for small properties (less than 50 square meters) and is mostly flat for larger properties. For small properties (less than 50 sq. m.), price per square meter ranges from £12,000 in London, £5,000 - £6,000 in the East of England and the Southeast, to £1,400 in the Northeast. Other regions have prices per square meter for small properties ranging from £2,000 - £3,500. For larger properties, price per square meter ranges from £8,500 in London to £800 in the Northeast. Price per square meter in the other regions ranges from about £1,100 to £3,100.

- Prices vary in complex ways with geography. In each region there are several peaks in the price distribution around property value "hot spots". Sometimes hotspots are big cities like London or Cambridge. Sometimes they are expensive suburbs like Wirral near Liverpool or Wilmslow near Manchester. Sometimes they are National Parks like Windermere. Other cases are more complex like transport junctions near Daventry.

- Variation in location values is explained by land use and planning conditions, measures of income (index of multiple deprivation in the area) and travel times by road and public transport to important hot spots. These include the coast, nearby rail stations, motorways and towns, and the large employment centres in the region.

1.2 Summary findings for commercial property

- VOA data on rateable values are available only for April 2015 and so no evaluation of changes over time is possible.

- The model with fixed effects for commercial use type (usecode) and nonparametric functions of size and location (latitude and longitude) explains 79% (Cornwall-Devon) to 85% (Cambridge-Milton Keynes-Oxford corridor) of the variation in log rateable values of commercial properties.

- Rateable values increase faster with size in London and the Southeast than in other regions. In London, a 2,500 square meter property has a rateable value that is nearly £700,000 per year higher than a one square meter property. In contrast, in Cornwall-Devon, a 2,500 square meter property is worth only about £120,00 per year more than a one square meter property. Both commercial use type and size are much more important in terms of explaining variation in commercial property values than property type and size are for explaining variation in residential values. There is much more variation in size of commercial properties (ranging from one square meter to more than 6,000 square meters. There is also much more variation in types of commercial property with 49 distinct categories important for explaining property values.

- In all regions, the price per square meter is sharply higher for small commercial properties (less than 50 square meters) and is largely flat (as a function of property size) for larger properties. For small properties, the price per square meter (rent per year) ranges from £1,000 in London to £400 in Yorkshire, the East and West Midlands, and the Northwest. Other regions have values in between these extremes. For large properties (more than 100 square meters), price per square meter ranges from £400 in London to £50 in Yorkshire and Cornwall-Devon. Other regions have values in between these extremes. To convert these rateable values into property values, one should multiply by a factor of 21.9 (assuming average commercial yield of 0.0456, see Savills (2018).)
- The number of property hot spots that determine commercial property values is much smaller than the number that affect residential property values. In each region, there are only a few key destinations. These hot spots frequently are the centres of the biggest cities in the region.

1.3 Summary finding for all property

- The PVU tool provides the ability to predict (changes in) travel times and property prices for new settlements, road projects and public transport projects.
- We present results from the evaluation of three examples of new settlements, one in the Cambridge-Milton Keynes-Oxford Arc (CAMKOX), one near Nottingham in the East Midlands, and one near Leeds in Yorkshire. Each of the example settlements consists of a mix of 9,500 residential properties and 500 commercial properties. We estimate that new residential properties in the three settlements would be worth £450,930, £199,909, and £220,506 on average per property respectively. Each of the proposed settlements would consist of a mix of properties of different sizes and type chosen to be similar to existing settlements in the region. The values of individual properties in each of the settlements vary depending on size, precise location and property type.
- We estimate that the new commercial properties in the three settlements would be worth £9,387,224, £4,355,616, and £4,927,093 respectively. These values are obtained under the assumption that the mix of new commercial properties in these new settlements is the same as the mix of existing commercial properties (in terms of property size and type of commercial use) in the national economy. In other words, the fraction of big and small, offices, restaurants, etc, is assumed to be the same as that national economy. The predicted values would be higher if more high value business properties were built or if larger business properties were built. The tools' predictions for commercial property values depend heavily on what is assumed about the mix of commercial properties in the new settlement. This result stems from the large variation in values of commercial property that exists in the raw VOA data.
- Combining these estimates with estimates of the cost of agricultural land, we estimate that average gain per property for all property (adding together both residential and commercial) net of the cost of land for these new settlements is £897,745 in CAMKOX, £321,248 in the East Midlands, and £341,496 in Yorkshire. These values minus construction costs and minus the social value of preserving land as agricultural land represent the economic value available to the government, to landowners, and to developers from converting land from agricultural land to housing in these

locations. They also represent the land value uplift that developers, landowners, and the government can negotiate over when making planning decisions. The model's house price predictions for new settlements are stable across model specifications. However, precise predictions depend on the location and characteristics of the new properties.

- For roads, the predictions of the model are more sensitive to model specification. The impact of roads on property values depends on the precise way roads affect travel times to the travel "hotspots" in our model and on how people value those "hotspots". Our preferred specification includes a set of destinations based on population size, price hot spots and model fit. While the impact of road investments on property prices depends on detailed location and nature of the project, several illustrative projects show that regional level road investments that reduce travel times by 10% can increase average residential property values by about £3,186 per property in the Cambridge-Milton Keynes-Oxford region, £2,138 per property in the East Midlands, and £874 per property in Yorkshire and increase commercial property values by £14,078 per property in CAMKOX, £5,766 per property in the East Midlands, and £8,996 per property in Yorkshire. City level projects, as one would expect, have more local impacts and increase values by smaller amounts.

- For public transport investment projects, the conclusions are similar but the impacts on property values are smaller. This arises naturally because roughly 90% of journeys are by car. As a result, the short run impact of public transport projects on property values is small.

- We stress that for both road and public transport investment projects, these results do not capture any long term effects of large scale investments. In the long run, investment projects that lead to large scale relocation of residential and commercial activity will almost certainly have impacts that are quite different from those predicted by our tool. In addition, the tool only captures the effects on residential property values. Not all project impacts will be capitalised into property values so these estimates provide only a partial measure of the economic impacts of these projects. Other impacts such as value of time and the economic impacts of pollution must also be estimated to obtain a complete picture of the economic impacts.

1.4 Outline of remaining sections of report

The remainder of this document is structured as follows. Section 2 provides a brief summary of the theoretical background to our analytical approach. Section 3 provides details of the database. Section 4 explains the econometric models underlying our analysis. Section 6 contains some descriptive analysis of the data. Section 7 presents our econometric results. Section 8 discusses limitations of the analysis. Section 9 gives some example results obtained from the PVU tool. Appendices B and C contain supporting tables and figures.

2 Theoretical background

Anyone who has spent time searching for a house to rent or buy soon realises that houses cost more when they are bigger and when they are in more desirable locations. This simple idea is the basis of an enormous academic literature that seeks to understand the determinants of property and land prices. A few key lessons from this literature are useful for understanding the analysis undertaken for this project.

The first lesson is that houses, which can differ widely in size, style and location, can be thought of not as many different products, but as a single ‘differentiated’ product, bought and sold in one market for housing. Following this logic, the price of a house can be split up into the *implicit* price of its components: a price for it’s proximity to the train station, a price for each bedroom, a price for being in the catchment area of an outstanding school and so on. If we only observe a single house, it’s impossible to work out the implicit price of each individual component, but if we observe lots of houses, which vary in their price and characteristics, then we can infer the contribution of each feature to the total price. In essence, this is the approach taken by the “hedonic” pricing literature that seeks to determine the contribution to house prices of structural characteristics (for example size, type of property, number of bedrooms, energy performance, age of structure, etc) and locational characteristics (proximity to jobs, public services, and parks, air quality and pollution in the surrounding area etc). The economic theory underlying these relationships is discussed in a wide set of textbooks and academic papers including (Hidano, 2002; Sheppard, 1999; Gibbons and Machin, 2005, 2008; Nesheim, 2008).

The second lesson is that people choose where to live (in part) based on travel time to places they care about, so will move if the transport network changes. This means if we build a faster train line from a suburb of Manchester to the centre, prices could go up by more than expected if the new line results in more people wanting to move into the area. Or, they could go up less than expected if builders respond to the investment by increasing the supply of new homes in the area, which keeps up with the increased demand. It is challenging to model behavioural responses to transport investment (though not impossible, see for example Ahlfeldt et al. (2015), and slow (both in terms of doing the analysis, and in terms of how quick a PVU tool would run if it were based on a structural model) - making it beyond the scope and timeline of this project. Nonetheless, it’s important to bear in mind that this is the theoretical reason why our results only predict the ‘short-run’ effect of investment.

A third lesson is that price does not equal willingness to pay of all households but only of the “marginal” household, who is at the margin of being willing to pay for a property. Someone who is willing to pay the current property price in a location and move in is evidently willing to pay the price. However, people already living in the location may have willingness to pay that is much higher (and those living elsewhere may have willingness to pay that is much lower). So it’s worth exercising caution when interpreting price changes as the ‘benefits’ of an investment more broadly defined (i.e. changes in ‘welfare’ as economists call it).

The final lesson is that willingness to pay for a property is not an intrinsic fixed quantity. It depends on the set of alternatives available. If there is only one good option in terms of location, then people may be willing to pay a great deal to live in that location. However, if alternative locations become more attractive, then willingness to pay for the original good option, will decline as some people will choose to move to the alternatives. In the long run, this means that investments can increase prices in some locations while reducing prices in others.

Some of the lessons above are not new in academic terms, dating back to the 1960s and before, but there are many examples of recent research in this area.

There is a very large literature that analyses the relationship between house prices and locational characteristics (roads, pollution, airports, schools, etc.) and housing characteristics (e.g. dwelling size and type). Three recent examples are Gibbons et al. (2014), Hilber and Vermeulen (2016), Halket et al. (2015). There is also a large literature looking at planning constraints, infrastructure and various methods of raising tax revenue. Some examples include Cheshire and Sheppard (2002), Burge and Ihlanfeldt (2006), and Barker (2006).

Hilber and Vermeulen (2016) provides a survey of the large literature studying the impact of planning constraints on house prices. The literature focuses on the UK and the US. In addition, Hilber and Vermeulen (2016) use Local Planning Authority (LPA) level data on house prices, planning applications, supply constraints, and income to estimate how each of these factors affected house price growth from 1974 to 2008. For house prices they use the Survey of Mortgage Lenders and the Land Registry. To measure planning constraints they use data from MHCLG on the refusal rate of planning applications for major residential projects. To measure supply constraints they use data on the share of developable land from the 1990 Land Cover Map of Great Britain and Ordinance Survey Panorama Digital Elevation data. We use data similar to theirs in our analysis. They find that: i) regulatory constraints have a substantive positive impact on the house price-earnings elasticity; ii) the effect of constraints due to scarcity of developable land is largely confined to highly urbanised areas; iii) Uneven topography has a quantitatively less meaningful impact; iv) The effects of supply constraints are greater during boom than bust periods.

Halket et al. (2015) uses data from the English Housing Survey waves 2008 - 2014. They focus on data from Greater London and develop a nonparametric model relating house prices to detailed measures of geographic location and property size and type. They find that a 7th order polynomial in distance from London along with directional coordinates captures the geographic variation in house prices. They find that location, property size, and building type are the most important determinants of house prices. We use methods similar to Halket et al. (2015) to develop the models underlying the Land Value Uplift tool.

Gibbons et al. (2014) uses Nationwide house price data and data from a number of sources to estimate the relationship between house prices and a variety of amenities including natural habitats, greenbelts, parks, coastlines, rivers, National Parks, travel to work centres, local topography, schools and transport links. They find that all of these variables are important for explaining house prices. We use data sources similar to theirs and explore related model specifications.

3 The Database

Measuring the relationship between locational amenities and property values requires access to extensive and high quality data. Fortunately, a great deal of such data is available. We have collated a large set of (mostly) publicly available data sources to produce our database. The residential property database consists of nearly all residential property transactions in England from 2008 to 2017. For each property, the database records the transaction price, the property size and type, and a large set of characteristics of the properties location. The commercial property database contains similar information for commercial properties. It contains information on type of commercial establishment and on rateable values in April 2015. The commercial property database does not contain information on how rateable values or commercial use may have changed over time. For both databases, more details about what is measured can be seen in Table 3.0.1.

The main sources of data for the databases are

- HM Land Registry prices paid data from 2008 to 2017

- MHCLG Energy Performance Certificate database (for residential property)
- Property co-ordinates, water network, coastline and transport network from the Ordnance Survey
- Travel times from Google Maps Distance Matrix API
- Details of local plans for housing construction, land subject to planning restrictions (e.g. Greenbelt) and Index Multiple Deprivation from MHCLG
- Floodrisk and noise exposure from the Environment Agency
- Population density from 2011 Census
- Land Use from Generalised Land Use Database 2005
- Registered Institute of Chartered Surveyors (RICS) Farmland Market Directory
- Valuation Office Agency 2017 Compiled Rating List database (containing information on April 2015 values).

The databases contain information on a large set of variables. Complete details can be found in the Data Documentation Appendix and the computer code that describes the data. In Table 3.0.1 we highlight the most important variables and the raw data source of each.

Nearly all data in the database are publicly available, with the exception of MHCLG's EPC data, geographic coordinates from Ordnance Survey AddressBase Premium, and the VOA data. The MHCLG EPC data can be used for research, but only after the user registers and confirms that they understand and agree to a set of licence conditions. AddressBase Premium is available as a commercial product from OS or, for public sector use, through the public sector mapping agreement. The VOA data requires a licence from the VOA.

The PVU Database Documentation Appendix and the accompanying computer code provide further details about obtaining and cleaning the data as well as further details on the content of the complete database.

Section 6 below provides some descriptive analysis of the information in the databases.

4 Property Value Models

Following the hedonic approach described in Section 2, the property value models developed in this section will look at how within-region differences in house prices and commercial rents can be explained by differences in property characteristics and location, using the rich set of characteristics included in our databases. Because the model structure is essentially the same for both commercial and residential sectors, we focus our discussion on the residential property market and simply highlight the differences between the models in the two sectors.

In both cases, we split the analysis into two steps - first we look at how property prices vary with their structural characteristics and location (defined simply as co-ordinates). In the second stage, having stripped out the contribution of the property itself to price, we focus just on the determinants of location value. This approach allows us to study how people value different types of structures (e.g. the price premium of detached houses compared to flats) separately from how they value different locations (e.g. urban vs. rural locations).

Table 3.0.1: PVU Databases: main variables

Type	Variable	Description	Source
Outcome	pricepaid	Transaction price of property	
Building	propertytype	Detached/flat etc.	
Building	newbuild	Is it a new build	Land Registry
Building	tenure	Freehold/leasehold	
Building	transferdate	Date of transaction	
Location	postcode	Postcode	
Commercial	rateablevalue	Rateable value	
Commercial	usecode	Commercial property type	Valuation Office Agency
Location	postcode	Postcode	
Location	longitude	Longitudinal coordinate	OS AddressBase
Location	latitude	Latitudinal coordinate	Premium
Building	total_floor_area	Floorspace in m^2	MHCLG EPC data
Building	number_rooms	Number of rooms	
Planning	greenbelt	1 if situated in Greenbelt	MHCLG green belt statistics
Planning	localplanrate	Planned housing increase (LA %)	MHCLG collated local plans
Planning	builtuparea_pct	Built-up land (LA%)	MHCLG land
Planning	restrictedland_pct	Protected land (LA%)	constraints
Amenity	prob_4band	Risk of flooding	EA planning flood zone data
Amenity	noiseclass	Daytime traffic volume	EA road noise
Amenity	roadnoise	1 = traffic louder than 55dB	
Amenity	distance_coast	Distance to coast	Computed using GIS software
Travel	drivetime_XXX	Drive time to XXX	Google maps/estimates
Travel	transtime_XXX	Public transport time to XXX	Google maps/estimates
Travel	avgtime_XXX	Average travel time to XXX	Computed average of drive and public transport time
Travel	distance_station	Distance to rail station	Computed using GIS software
Landuse	lu_domestic_shr	Domestic property landuse share in OA	
Landuse	lu_gardens_shr	Garden landuse share in OA	
Landuse	lu_nondom_shr	Non-domestic landuse share in OA	
Landuse	lu_road_shr	Road landuse share in OA	Generalized Landuse Database 2005
Landuse	lu_rail_shr	Rail landuse share in OA	
Landuse	lu_greenspace_shr	Greenspace landuse share in OA	
Landuse	lu_water_shr	Water landuse share in OA	
Population	imddecile	IMD decile (OA)	English Indices of Deprivation 2015
Population	popdensityOA	Population density (OA)	2011 Census

Note: Variables indicated OA are variables that are measured at the Census Output Area (OA) level. Variables indicated LA are measured at the Local Authority (LA) level. IMD decile measures the ranking of the Output Area in terms of the MHCLG English Indices of Deprivation (IMD). More details of variable definitions can be found in Table B.0.2.

The two steps of the analysis correspond to two equations. The first equation captures how property values vary with time, property characteristics and geographic coordinates. For the residential property model, included property characteristics are total floor area measured in square meters, property type (detached house, semi-detached house, or flat), and tenure type (freehold or leasehold). For the commercial property model, included property characteristics are total floor area, again measured in square meters and type of establishment.[2]. For commercial properties time effects are not included because commercial rents are observed only at a single point in time. For both residential and commercial properties, geographic coordinates are measured in latitude and longitude. We call the component of property value that varies with geographic coordinates the estimated "location value" of a property.

Specifically, for the residential property market, we estimated a model of the form

$$\log v_{it} = \alpha_t + \beta h_i + f(a_i) + g(x_i, y_i) + \varepsilon_{it} \quad (1)$$

where $\log v_{it}$ is the logarithm of property value for property i sold at time t, α_t captures time effects, h_i is a set of property characteristics including building and tenure type, a_i is the total floor area of the property measured in square metres, and (x_i, y_i) are the longitude and latitude of the property. The variable ε_{it} captures unmeasured or unobserved factors that affect property values but that we do not observe in our data.

The two terms $\beta h_i + f(a_i)$ measure the contribution to property value of structural characteristics. They measure how property values change with building type and size, holding location fixed. The last term, $g(x_i, y_i)$, captures the contribution of location to property value. We label this term the **location value** or **locational value**. The location value measures how property values change with location, holding property size and type fixed.

For the commercial property market, we estimated a model of the form

$$\log r_{ic} = \gamma_c + f(a_i) + g(x_i, y_i) + \varepsilon_{ic} \quad (2)$$

where $\log r_{ic}$ is the logarithm of rateable value for property i of establishment type c measured in April 2015, γ_c captures the average effect of establishment type c on rents, a_i is the total floor area of the property measured in square metres, and (x_i, y_i) are the longitude and latitude of the property. The variable ε_{ic} captures unmeasured or unobserved factors that affect property rents but that we do not observe in our data.

For commercial property, $\gamma_c + f(a_i)$ measures the contribution to rent of structural characteristics. These terms measure how commercial rents change with property size and establishment type, holding location fixed. As for residential property, the last term $g(x_i, y_i)$, captures the contribution of location to property rents. Again, we label this term the **location value** of a property.

For both residential and commercial properties, the functions $f(a_i)$ and $g(x_i, y_i)$ are functions whose shapes are estimated **nonparametrically**. This means that we do not make an assumption in advance about the way that property values vary with location

[2]The properties in the VOA data are grouped into establishment types based on a "usecode". In the raw data, there are more than 50 establishment types. We aggregated these and created a list of 49 establishment types. Examples establishment types include shops, office and premises, parking spaces, workshop, warehouse, restaurant, etc. Details of the establishment types in the raw data can be found in the "2017 Compiled List and SMV Data Specification." Currently, this can be found at https://voaratinglists.blob.core.windows.net/html/documents/2017%20Compiled%20List%20and%20SMV%20Data%20Specification.pdf

or size. For example, property values may fall rapidly as one moves away from a big city centre, then increase near a rail station, then fall again before rising as one moves closer to a neighbouring city centre.

If one were to use **parametric** estimation methods, one would assume that f and g were parametric functions. For example, one could assume that each was a **linear** function. This would imply that prices fall (or increase) at a constant rate the further south one travels and that the proportional impact on price of going from a 50m2 flat to a 100m2 flat would be the same as going from a 100m2 flat to a 150m2 flat.

Parametric methods have the benefit of simplicity. Parametric models are easy to compute and the results are easy to interpret. Moreover, if the true relationship between log property values, property characteristics and location coordinates is close to linear, then a linear parametric model provides a good approximation. With small datasets, parametric methods are often the only reasonable alternatives.

However, when true relationship between log property values and property size or location is nonlinear, linear parametric models are likely to provide very poor approximations and lead to erroneous conclusions. In this case, especially when there is no prior knowledge about the shapes of f and g, nonparametric methods are robust and can reveal the true relationship. **Nonparametric** estimation seeks the functional forms for f and g that best fit the data. For example, nonparametric analysis may reveal that the true functional forms of f or g are quadratic, or cubic, or perhaps are better approximated by higher order polynomials. In some cases, indeed in our analysis of English property data, these methods lead to dramatic improvement in model fit over parametric methods.

The main drawbacks of nonparametric methods are that they require large datasets to be effective, increase computational costs, and require more care and effort in terms of summarising and interpreting the results. For this project, we had access to very large datasets and were able to keep computational costs to a reasonable level. Also, it was clear from prior work (Halket et al., 2015), that a simple linear model would fail to provide robust predictions of how property values vary with geography.

For these reasons we chose to use **semiparametric** methods, which allow us to capture the highly complex ways that property values vary with property size and location, whilst putting some structure on the relationship between price and other characteristics. After considering a large range of specifications, we selected a log-linear semiparametric model that best fit the data based on statistical and economic criteria. It was also the best approach available given resource constraints and our interest in model interpretability. We tested this model against a linear semiparametric model and also against a more general Box-Cox transformed model. In all cases, the log linear model outperformed the linear model. The Box-Cox model performed slightly better than the log linear for some regions and equally well for some regions. Overall it gave similar results in terms of economic magnitudes. For simplicity and interpretability, we chose to use the log linear model for all regions. We expect that future work could improve the model using alternatives based either on a fully nonparametric approach (Li and Racine, 2007) or based on a machine learning approach (Friedman et al., 2001).

For both the residential property and commercial property models, the second equation captures how location value depends on the location characteristics in our database. In our model this equation has the form:

$$g(x_i, y_i) = \gamma z_{1i} + f(z_{2i}) + \eta_i \tag{3}$$

where z_{1i} is a set of location characteristics (including local land use, planning restrictions etc, but excluding travel time) and z_{2i} is a set of measures of travel times to various towns, cities, and employment locations. A more detailed description of the variables in this model (and the theoretical motivation for their inclusion) is given below. As with the first equation we considered a large range of specifications and made our selection based on model fit. Both equations were then estimated using the statistical software R (see https://www.r-project.org).

4.1 Land use and planning

Land use and planning policies in each location are important determinants of property values. They can be intrinsically desirable (e.g. living in an area with a lot of green space) and also capture the extent to which the supply of housing in the local area is constrained (by planning decisions, or by a lack of developable land).

Land use measures were obtained from the Generalised Land Use Database and are measured at the 2003 census area statistics (CAS) ward level, which we convert to Output Area (OA). The measures record the share of land in the CAS ward/OA used for domestic structures, gardens, non-domestic structures, roads, rail, greenspace, and water.

The restrictiveness of planning policy in a particular area is more difficult to measure. We choose not to include the acceptance rate of planning applications due to the endogeneity of this measure (developers apply where or when they believe they have a better probability of being granted permission). We do include an indicator for whether the property is in an area designated as greenbelt, a measure of the share of land in the local authority that is designated as greenbelt, an area of outstanding natural beauty, a national park or an area of special scentific interest (all designations that preclude development), and a Local Authority level measure of the planned rate of housing construction in the local authority (according to the local plans that councils are obliged to put together).

4.2 Coast, National Parks and Areas of Outstanding Natural Beauty

For most regions of the country, property values are heavily affected by being near the coast, near a national park, or near an Area of Outstanding Natural Beauty. For coastal properties, we assume that properties with 30 kilometres of the coast are potentially affected by distance to the coast. For properties near National Parks and Areas of Outstanding Natural Beauty, we assume that properties within 30 minute drive time of these amenities are affected by drive time. We explored other thresholds and specifications and found that this provided the best fit. In addition, for some regions specific coastal or park locations are important destinations and so travel times to those destination are included in the model (e.g. Salcombe in Devon and Windermere in the Northwest).

4.3 Pollution and flood risk

To capture potential impacts of air and noise pollution on property values we include measures of road noise from the Environment Agency, (straight-line) distance to the nearest airport, distance to the nearest motorway, and distance to the nearest A-road. Because air and noise pollution are highly local we assume that these effects only affect properties that are less than 10 kilometres away.[3] To capture the impact of flood risk, we included a measure of flood risk (also from the Environment Agency via Open Floodrisk) categorised as high, medium, low, very low, or none.

[3] We explored other thresholds including 5, 20 and 30 kilometres.

4.4 Travel times

Both theory and intuition tell us that proximity to nearby places of work or leisure affects property prices. However, we faced several challenges incorporating this into the model.

First, it's not obvious in advance where people care about travel time *to*. This is a theoretical concern as our model will be misspecified if we don't include travel time to destinations that people care about. It's also a practical concern - we could try to construct an index that contains information on travel time to all cities and towns in England (weighted by how far away they are, and some indicator of how important they are as a destination, like employment figures) but computing how this measure changes as a result of a new road being evaluated by a user of the PVU tool would be very slow.

Second, there are multiple ways to make a journey - including walking, by car or by public transport - and the travel time by these different modes can differ widely.

Third, the impact of reducing travel time on price can be non-linear, and not always positive in a specific location. When comparing two cities or travel to work areas, a reduction in travel costs in one city makes that city more attractive and so will tend to increase property values. However, a reduction in travel costs within a city has more complicated effects. It tends to increase property values for locations that are far from the centre because it increases their access to central locations while lowering property values for locations close to the centre. Part of the reason many people are willing to pay high prices to live close to the centre is that they save on travel costs. If travel costs are lower, then the benefit is smaller. Hence, reductions in travel times tend to provide an overall benefit to the city as a whole while redistributing property values from locations with good access to amenities to locations with less access. Our specification needed to be sufficiently flexible to capture these complicated effects.

Taking these considerations into account (and after evaluating a large set of possible specifications) we drew several conclusions that informed our specification for model 2.

On the first question ('travel time to *where*?'), we found that property values are predominantly affected by travel times to nearby destinations. This means that the most important travel time variables to include in the model are travel time to the nearest "postal town", the nearest rail station, the 3 closest "major destinations".

To put mathematically the idea that property values depend on travel times to the 3 nearest destinations, let the set of destinations in a region be J and let $r_{ij} = 1$ if destination j is the closest destination (in terms of travel time) to a property at location i. Let $r_{ij} = 2$ if destination j is the second closest destination and let $r_{ij} = 3$ if destination j is the 3rd closest destination. Let $z_{2i} = (t_{i1}, ..., t_{iJ}, r_{i1}, ..., r_{iJ})$ be the set of travel times and travel time rankings from location i to all possible destinations. We assume that

$$f(z_{2i}) = \sum_{j=1}^{J} \sum_{k=1}^{3} \gamma_{jk} \mathbf{1}(r_{ij} = k)\, t_{ij}. \tag{4}$$

For each region, major destinations are defined empirically to be locations in the region that either are employment or population centres or locations that are property value "hot spots". Reflecting the fact that residential and commercial valuations of locations are not identical, the residential and commercial property value hot spots are not identical. Residential hot spots include suburban residential areas, areas of outstanding natural beauty, transport hubs, and commercial centres. In contrast, commercial hot spots are more centered on transport hubs and commercial centres. Tables B.0.20 and B.0.21 provide lists of residential property value "hot spots" by region. Some hot spots are large city centres like London or Cambridge. Others are expensive suburbs like Wirral near Liverpool or Wilmslow near Manchester. Others are important tourist destinations like Windermere or transport junctions like Daventry. Commercial property value hot spots are detailed in Tables B.0.26 and B.0.26.

On the second question ('travel time by what mode?') - property values depend more heavily on travel times by modes that make up a larger share of trips, so we decided to use the **weighted average** of travel time by car and travel time by public transport. Section 5.1 details how we computed this weighted average.

On the final issue of non-linearities in the relationship between travel time and location value, as discussed in Section 4 our semiparametric approach (that is nonparametric in travel time) enables us to take these complexities into account.

5 Travel time model

Our property value models require us to estimate travel times by road and public transport from every property to a large set of locations. Downloading travel time data for such a large set of origin destination pairs was not feasible. Moreover, to make predictions for the impact of transport investments, we require a travel time model to predict travel times for arbitrary origin and destination pairs.

To solve this problem, for each region, we downloaded driving and public transport travel times for 10,000 randomly selected origin-destination pairs and then estimated two nonparametric travel time models:

$$t_{ij}^{car} = \phi^{c}\left(x_i, y_i, d_{ij}, \theta_{ij}\right) + u_{ij}^{c} \qquad (5)$$

$$t_{ij}^{public} = \phi^{p}\left(x_i, y_i, d_{ij}, \theta_{ij}\right) + u_{ij}^{p} \qquad (6)$$

where (x_i, y_i) are the origin coordinates (measured in Eastings and Northings), d_{ij} is the distance in kilometres from origin (x_i, y_i) to destination (x_j, y_j) and θ_{ij} is the direction of travel from i to j. For example, due North is the direction $\frac{\pi}{2}$, West is π, etc. We modelled both ϕ^c and ϕ^p nonparametrically as high order polynomial functions of their arguments. The results give us predictions for travel times by car and by public transport for every origin-destination pair in our sample.

5.1 Weighted average travel times

In general, the location value of a property at location i depends on travel times by car and public transport to the set of destinations that are of most value to the households living in location i. For each origin-destination pair, the importance of car and public transport travel time depends on the probabilities of travelling by car or by public transport. In fact, for each destination j, if households choose mode of travel using a logit discrete choice model, then the benefit of living in location i and travelling to destination j depends approximately on the **weighted average travel time** for the journey from i to j. See Appendix A for details of this approximation. For each location i, we therefore pick destinations as described in section 4.4, and assume that property values at location i depend on the weighted average of travel times from i to each relevant destination j. Mathematically, this is expressed as follows:

Let π_{ij} be the fraction of commuting and other trips from i to j made by car and let $1 - \pi_{ij}$ be the fraction made by public transport. For each property i and for each destination j we computed the weighted average travel time t_{ij} as

$$t_{ij} = \pi_{ij} t_{ij}^{car} + \left(1 - \pi_{ij}\right) t_{ij}^{public} \qquad (7)$$

where t_{ij}^{car} is travel time by car and t_{ij}^{public} is travel time by public transport.

As described in Appendix A, we estimated the probabilities π_{ij} using a logit model and data from the 2008 UK National Transport Survey.

6 Descriptive statistics

Because the impact of amenities on property prices varies significantly across the country, we analysed the data separately and estimated a separate model for each of 11 regions. We also estimated separate models for residential properties and for commercial properties. The regions analysed are chosen to conform to NUTS 1 statistical regions with two exceptions. Firstly, we split the South West into 2 regions: Devon and Cornwall forming one region and Gloucestershire, Bristol, Wiltshire, Somerset, and Dorset forming a second. Secondly, we formed a CAMKOX region for the corridor including Cambridge, Milton Keynes, and Oxford. The regions are listed in Table 6.0.1.

Table 6.0.1: Regions

1. Devon and Cornwall	2. East of England
3. East Midlands	4. London
5. North East	6. North West
7. South East	8. South West (excluding Devon and Cornwall)
9. West Midlands	10. Yorkshire and the Humber
11. Cambridge-Milton Keynes-Oxford	

Note: The statistical region of the South West was split into two regions because Devon and Cornwall are both geographically and economically separate from the rest of the region. The composite region of CAMKOX (Cambridge-Milton Keynes-Oxford) was created because investment projects in this regional corridor are being considered by the NIC.

6.1 Residential property database

Tables B.0.3-B.0.4 provide summary statistics for the residential property database for each of the 11 regions. The average price paid varies dramatically across regions with a low of £137,460 in the Northeast to a high of £461,260 in London. The main variables for which the average price varies across regions are the local authority level fraction of land that is developed ('builtup'), population density, Index of Multiple Deprivation (IMD) decile, distance to an AONB, distance to a motorway and drive time to a motorway. The other variables do not vary greatly (on average) across regions. However, they do vary within regions.

Figure 1 shows how average prices vary across regions and also how they have varied over time from 2008 to 2017. Four main facts are apparent in the figure:

- There is a large difference in prices between London, the South East and the rest of the country. The average price in London in 2008 was higher than the average 2017 price in all regions except the South East.
- Prices were flat for about a year after the financial crisis.
- Prices increased dramatically from 2009 to 2017 in all regions.
- Prices increased much more in London than in the rest of England.

6.2 Commercial properties

Tables B.0.5 - B.0.6 provide summary statistics for the commercial property database for each of the 11 regions. The distribution of geographic variables across regions are largely the same as for the residential property database. Average commercial property values are higher than residential property values.[4] London has the highest average values of £1,035,000 per commercial property. Four regions have average values of more than £400,000 (East England, £421,000, Southeast, £479,000, Southwest, £403,000, and the West Midlands £411,000), four regions have average values between £300,000 - £400,000 (East Midlands, Northeast, Northwest, and Yorkshire), and Cornwall and Devon has the lowest average value of £255,000. CAMKOX has an average higher of £592,000.

The table also shows that average floor areas of commercial properties are larger than for residential properties ranging from 185 square meters in London to 301 square meters in the West Midlands. These average figures mask the additional fact that floor areas of commercial properties are much more variable than floor areas of residential properties. The smallest commercial properties are small offices or small parking areas, similar in size to small flats. The largest are large industrial, logistics, or manufacturing spaces, some more than 6,000 square meters.

Because the VOA data is only available at a single point in time, April 2015, we are not able to examine how commercial property values have changed over time.

7 Econometric results

We estimated equations (1), (3) and (5) separately for residential and commercial properties and separately for each region detailed in Table 6.0.1. For each property type, region and estimated equation, the tables and figures detailed below provide detailed results on parameter estimates and model fit. Here we provide some summary discussion.

7.1 Residential properties: Model 1 results

7.1.1 Parametric results

Model 1 included indicator variables for each year from 2009-2017, indicator variables for property type (detached house, flat, semi-detached house, terraced house and other), new builds and leasehold properties. Tables B.0.7-B.0.8 report parameter estimates for each of these variables. The Tables show that there are significant differences across regions. The year fixed effects clearly show the steady property price growth over time for all regions and the large property price increases in the South East, London and the East of England. The tables show that flats, semi-detached properties, other building types and terraced properties have lower prices than detached houses. The exact parameter values show a large range across regions. Part of this has to do with unmeasured property characteristics such as lot size, building age, and quality that are correlated with building types. These correlations are likely to vary across regions as the stock of housing varies across regions.

The tables show that leasehold properties sell at a discount and that new builds sell at a premium. The new build premium is higher in the Northern regions. It is around 10% in the South and 20% in the Northern regions.

[4]The VOA data provides information as to the rateable values. This is an estimate of the annual rent for each property. We converted these into estimates of property values by dividing by an estimate of the average commercial yield. We assume that average commercial yield is 0.0456. This was the average yield for prime commercial property in the UK for 2017 and 2018 as reported by Savills (2018).

The tables also show that the models explain between 61% and 79% of the variation in property prices. Since we have control nonparametrically for location, most of the residual variation is likely due to unmeasured property characteristics like lot size, building age and quality. The unexplained variation is larger in the North East and the North West. Partly, this can be explained by the fact that the South experienced larger price increases and the model captures this through time fixed effects.

7.1.2 Nonparametric results

For the functions, f and g, we used the Categorical Regression Spline (crs) package in R with an additive basis (Nie and Racine, 2012). This package models f as

$$f(a) = \sum_{k=1}^{K} \beta_i B_i(a) \tag{8}$$

where for $k = 1$ to K, $B_k(a)$ is a polynomial spline function. Each polynomial spline function is a polynomial on an interval $[a_L(k), a_H(k)]$ and is zero outside the interval. The crs package chooses the endpoints of the intervals based on quantiles of the distribution of a. The package chooses the number of segments and the order of the polynomials to minimise a least square cross-validation criterion function.

Similarly, we model $g(x, y)$ as

$$g(x, y) = \sum_{k_1=1}^{K_1} \beta_{1k} B_{k1}(x) + \sum_{k_2=1}^{K_2} \beta_{2k_2} B_{k_2}(y) + \sum_{k_3=1}^{K_3} \beta_{3k_3} B_{k_3}(x * y) \tag{9}$$

The nonparametric components of the model contain many parameters. For each region, Table B.0.9 reports the number of segments for each spline function. For most regions, the best fitting nonparametric model consisted of fewer than 6 segments. However, for CAMKOX, the East of England, and the North West, the best fitting model included more than 60 segments. No model is exactly linear and some are far from linear. Table B.0.10 shows what degree spline polynomial was chosen. The spline polynomials of size ranged from quadratic to degree 12 in the East of England. The spline polynomials in the latitude and longitude dimension all have many segments and relatively low degree.

Figures 2 - 4 show the predicted function $\widehat{f}(a)$ for each region. The figures show that in the northern regions the average price of a 200 square meter property was about £200,000 more than a 50 square meter property. In the South, the average price of a 200 square meter property was about £400,000 more than a 50 square meter property. In London, a 200 square meter property cost over £1,000,000 more than a 50 square meter property.

Figures 5 - 7 show the predicted price per square meter versus total floor area of the property. For residential properties, in all regions, the price per square meter is high for small properties (less than 50 square meters), declines, and then, as a function of property size, is nearly flat for all sizes larger than 100 -150 square meters. The patterns across regions are what one would expect. In London, shown in Figure 6 panel (a), the price per square meter is nearly £12,000 for very small properties. It declines to about £8,500 per square meter for properties between 100 and 200 square meters and then increase to about £9,500 for larger properties. The Southeast and East of England have prices per square meter of between £5,000 - 6,000 per square meters for small properties (less than 50 square meters) and about £3,000 per square meter for large properties (more than 100 square meters). The lowest prices per square meter are in the Northwest (£1,400 per square meter for small properties (less then 50 square meters) and around £800 per square meter for larger properties.

Figures 15 - 17 are heat maps that show how location values vary across locations. These maps are highly specific to each region. Each has peaks near big cities, transport junctions, or other "destinations". For example, panel (a) of Figure 15 shows that there are pronounced peaks in prices near Oxford, to the East and West of Oxford, near Cambridge and to the South of Cambridge, and at the edge of the region near London. There are smaller peaks near Bedford, Northampton, and Milton Keynes. The figure also shows that prices fall as one moves North and East away from London. The heat map for the East Midlands shows pronounced peaks in the Peak District and in the main transportation corridors along the M1 and the A1.

7.2 Residential properties: Model 2 results

7.2.1 Parametric results

Tables B.0.15-B.0.19 show estimates of the parametric components of model 2.

The first set of variables are specific to local authorities. They measure the percentage of land in each local authority that is builtup or restricted and the rate of building in the local plan. These variables are statistically significant predictors of property values. However, the signs and magnitude vary widely across the regions. It is likely that these local authority level variables are functioning to some degree like local authority fixed effects and are not picking up any structural relationships but rather are picking up factors that are specific to local authorities. For example, a positive relationship between builtup area and property values could arise in some regions because, on average, people value more diverse commercial and cultural offerings. On the other hand, a negative relationship could arise in other regions because the positive impact of access to builtup areas is outweighed by negative impacts due to congestion, noise, or pollution.

For example, the coefficient on local authority level builtup area percentage is statistically significant in 8 of 11 regions but is economically small in magnitude. In the CAMKOX region, the average built-up area percentage is 14.28%. The coefficient estimate for CAMKOX is 0.003. This implies that a 10 percentage point increase in the fraction of builtup land (increasing to 24%), would only increase prices by about 3%. The coefficients for other regions are similar in magnitude or insignificant. The coefficients for 5 regions are negative but equally small (East of England, London, Northwest, Southeast, and Yorkshire and the Humber). These results need to be interpreted with caution. These results measure the impact of changing LA level builtup percentage while holding output area land use fixed. Because output area land use is held fixed, one would expect small effects.

The restricted land percentage coefficients are bigger in magnitude. However, the baseline levels of restricted land are all less than 0.51%. For several regions, these results are reasonably large. A one percentage point increase in restricted land percentage in CAMKOX, Cornwall-Devon, or the East of England would increase prices by 21.8%, 22.3% and 14.3% respectively. For other regions, the impacts are smaller, 1.5% in the East Midlands, 6.3% in the Northeast, 4.1% in the Northwest, 6.2% in the Southeast, and 8.3% in the Southwest. For the remaining regions, the coefficients are negative. These results suggest that, everything else equal, local authorities with more restricted land have lower property values.

The coefficients for local authority level planned building rate are not significant in the East and West Midlands. They are negative in all other regions excluding CAMKOX and the Northwest. For all regions excluding these four, local authorities with planned building rates that are 0.01 higher than the baseline average have property values that are 5.7% (Cornwall-Devon) to 12.2% (Southwest) lower than average.

The next set of variables are Census Output Area (OA) level measures of land use from the 2005 General Land Use Database. Parameter estimates for four of these land use variables, gardens, non-domestic, greenspace and water, are largely consistent across regions. All have positive impacts on property values. For example, in CAMKOX, output areas with 10 percentage point higher than average share of land used for gardens (i.e. 24% garden use) have property values that are 3.02% higher. All regions other than London and the Northeast have similar effects ranging from 1.00% higher in the Northwest to 7.99% higher in Yorkshire.

Land used for greenspace shows similar correlations with property values. Defining higher than average output areas to be output areas with 10 percentage point higher than average share of greenspace, higher than average output areas have property values that are 1.2% higher (London) to 7.99% higher (Yorkshire). The exceptions are the Northeast and the Northwest which have negative correlations between greenspace and property values.

In all cases the magnitude of the non-domestic share coefficient is roughly twice as large as the other coefficients. The results indicate that output areas with 10 percentage point higher than average nondomestic share are 3.39% more valuable in London, 7.5% more valuable in the East Midlands, 11.7% more valuable in Cornwall and Devon, and 17.7% more valuable in Yorkshire and the Humber. The other regions excluding the Northeast all lie within this range.

The correlations with road and rail share are quite variable. No obvious pattern holds for these variables. On the one hand higher than average road or rail land use might increase property values because it provides better access to jobs or amenities. On the other hand, higher than average road or rail land use might lower property values due to pollution, congestion, and noise. No clear interpretation of the coefficients on these variables is available.

Population density at the output area level, after controlling for other variables, is not a very important predictor of property values. In some regions, it is is statistically significantly positive, in others negative, and in others not statistically significant. In all cases, the magnitude of the correlation is small. For example, the baseline population density in CAMKOX is 35.40, or 3540 people per square kilometer. Output areas with population density of 45 (roughly 30% more dense) have property values that are 0.1% lower. After controlling for landuse, income class, and transport access, population density has little predictive power.

The IMD decile results are strongly positive and consistent across regions. Locations in the higher decile IMD rankings are higher income locations. The highest ranked locations have property prices that are 3.6% (West Midlands) - 20 % (London) higher than the lowest income locations.

The flood risk variable and the road noise variables are uncorrelated with property values after controlling for other variables in the model.

Parameter estimates for the second set of variables are detailed in Tables B.0.17 - B.0.19. These tables show how property values are related to distance to airports, motorways and A-roads, travel times to AONB or national parks, distance to the coast, and drive time to the nearest rail station and the nearest postal town.

The distance to airports, motorways and A-roads are assumed to impact property values only if the distance is less than 10 kilometers. These variables do not capture travel time effects because we are holding travel times fixed. Rather these variables capture potential noise and air pollution externalities and access to locations other than city centres. These effects are assumed to be very local and have nonzero impact on property values only for nearby properties, less than 10 kilometers in distance. We explored other distances (5, 20 and 30 kilometers), and found that our main results were not sensitive to these alternatives. Note that the net effects of each of these variables could vary across regions and could be positive or negative depending on whether negative pollution externalities or positive access dominate at the local level.

The model includes indicators for whether each property is in an AONB or in a national park. These variables could have negative or positive impacts on property values. For properties not in an AONB or national park, we included drive time to the park for properties that are less than 30 minute drive time from the park. In most cases, being located in an AONB raises property values from 2.2% in Cornwall and Devon to 15.8% in the Southeast. Results for the East Midlands and Yorkshire are insignificant. CAMKOX and the Northwest have negative coefficients. Similarly, being located in a national park is associated with 3.9% (Southeast), 6.9% (Southwest), 11.1% (Yorkshire), and more than 20% in the Northeast, Cornwall and Devon, and the Northwest. The national park is either not relevant in the other regions and is negatively associated with values in the East Midlands.

Finally, the model includes drive time to the nearest rail station and to the nearest postal town.

7.3 Commercial properties: Model 1 results

For the commercial property sector, Model 1 included indicator variables detailing the "usecode" for each property, a nonparametric function of floor area, and a nonparametric function of latitude and longitude. As discussed in footnote 2 on page 8, the VOA properties are grouped into 49 categories defined by establishment type. These establishment types include shops, office and premises, parking spaces, workshop, warehouse, restaurant, etc. The estimated coefficients for the usecode indicator variables capture how much the average log rateable value varies across business establishments. The nonparametric function of size captures how much log rateable values vary across properties of different sizes, and the nonparametric function of latitude and longitude captures how much values vary across locations.

7.3.1 Parametric results

Tables B.0.11 -B.0.12 report statistics on the overall fit of Model 1 for commercial properties. We do not report the values of the usecode coefficients because there are too many to report. The tables show that the model fit is good for all regions. The adjusted R^2 statistic ranges from 0.79 to 0.864 indicating that the variables included in the model explain about 79% to 86.4% of the variation in values. For most regions we selected a random sample of 100,000 properties to estimate the models. For the remaining regions we used all available observations. The regions with fewer than 100,000 observations were CAMKOX (55,683 observations), Cornwall-Devon (65,659 observations) and the Northeast (67,546 observations).

7.3.2 Nonparametric results

For commercial properties, the estimated number of spline segments and degree of the spline polynomials are reported in Tables B.0.13 and B.0.14. The optimal number of spline segments varies from 1 - 50 and is larger than 10 in most cases. The degrees of the spline polynomials range from 2 to 13 in the size dimension, from 1 to 15 in latitude, 1 to 11 in longitude and 1 - 8 in the interaction term between latitude and longitude.

For commercial properties, the relationship between property size and rateable value is shown in Figures 8 - 10. The model allows for the possibility that the relationship between property size and rateable value is nonlinear. A statistical test of the hypothesis the curves are globally linear rejects the hypothesis. However, from the figures one can see that the estimated relationships, while not linear, are nearly linear in all regions. The right tails of the displayed curves do appear to be a bit nonlinear. However, there are very few properties of this size and as a result the confidence bands for the curves (not shown) are wider for the far right tails. For this reason, statistically, one cannot reject the hypothesis that the curves are linear in the far right tails.

The estimates do vary across regions. Panel (a) in Figure 9 shows that rateable values increase by nearly £700,000 when moving from a 0 square meter property to a 3,000 square meter property. At the opposite extreme, Figure 8, panel (b) shows that in Cornwall and Devon, rateable values increase by only about £120,000 when moving from a 0 square meter to a 2,500 square meter property. Rates of increase in the other regions lie in between these two extremes.

Figures 11 - 14 show how price per square meter varies across regions and across property size. In all regions, price per square meter is steeply higher for small properties (less than 50 square meters) and, as a function of property size, is flat for larger properties. The levels vary across regions. For example, in London, shown in Figure 12 panels (c) and (d), price per square meter is about £1,000 for small properties and is about £300-400 for larger properties. The results are shown in two panels because the steep increase for smaller properties is difficult to see when results are shown in one panel. The results for other regions are similar to London but with prices at lower levels. Large properties in the The Southeast have prices per square meter of about £200, the East of England and the East Midlands, £100, the Southwest £150, and the remaining regions between £60 and £100.

The figures show how rateable values and rateable value per square meter increase with property size. Rateable value is an estimate of the annual rent for the property. To convert these rateable values into property values, one should multiply by a factor of 21.9 (average commercial yield of 0.0456).

Figures 18 - 20 display heatmaps that show how commercial property values vary across locations. The commercial property value "hotspots" are estimated to be different from the hotspots for residential properties. The hotspots for commercial properties are indicated in the figures and are listed in Tables B.0.26 and B.0.27. In contrast to the residential property hotspots, each region has fewer commercial property value hotspots. In addition, the commercial value hotspots tend to be more centred on transport hubs. For example, Figure 18, panel (a) shows that for CAMKOX, the three most important locations for commercial property values are the centres of Oxford, Cambridge and London. Similarly, panel (b) in the same figure shows that the most important locations in Cornwall and Devon are Barnstaple, Exeter, Falmouth and Plymouth. In all regions, the commercial property value hotspots are highly correlated with the centres of the biggest cities in the regions.

7.4 Commercial properties: Model 2 results

7.4.1 Parametric results

Tables B.0.22 - B.0.25 contain results from the parametric component of Model 2 for commercial properties.

For commercial properties, results for the local authority level variables are similar to the results for residential properties. Both the share of land that is built up and the share that is restricted are statistically significant predictors of values. However, the magnitudes of the coefficients are small in economic terms. The coefficients on local planning rate are similar in magnitude and sign to the results for residential properties in all cases except for the East of England and the Northeast. For these two regions, the local plan rate coefficients are positive for commercial properties and negative for residential properties. No clear interpretation of these coefficients is available.

In terms of results for local land use, the commercial property results are much more heterogeneous than the residential property results. In seven regions (CAMKOX, East Midlands, East of England, Northeast, Northwest, Southwest and Yorkshire), the domestic share coefficient is negative, in two regions it is insignificant (Cornwall and the Southeast), and in two it is positive (London and the West Midlands). So, in most cases, commercial properties in locations with a larger share of domestic properties have lower values. Consistent with this, locations with a larger share of nondomestic properties have higher values in all regions except CAMKOX and the East Midlands. This is consistent with agglomeration economies increasing values when commercial establishments locate together.

The results also show that the road share of land use is positively associated with property values in all regions except Cornwall and the East Midlands and that rail share is positively associated with value in 6 regions. These results are consistent with road and rail access increasing the value of commercial establishments.

The results for share of land used for gardens, greenspace and water are more mixed. For each of these variables some regions have positive coefficients, some have negative coefficients and some have statistically insignificant coefficients. The relationship between commercial property values and these variables is unclear.

For commercial properties, the results for population density and for IMD decile, again, are similar to the results for residential properties. Having controlled for land use, transport and many other variables, population density is not an important predictor of property values. This does not mean that population density is unimportant. Rather it means that the other variables in the model are more important. For IMD decile, as for residential properties, we find that properties in locations with higher IMD decile populations have values that are 1.1% - 14.8 % higher. The strongest effects are found in London and CAMKOX. Unlike for residential properties, the relationship is not strictly monotonic. In some regions, the highest value commercial properties are not found in the locations with the highest values of IMD decile, but rather are found in the middle deciles.

Finally, in contrast to the finding for residential properties, we do find that flood risk is correlated with commercial property values in some regions. In 5 regions (Cornwall, London, Northeast, Southwest, West Midlands), properties in the highest flood risk band (this is the category excluded from the regression) have 1% - 7% higher property values (as much as 18% higher in the Northeast). In 3 regions (CAMKOX, Southeast and Yorkshire), locations with higher flood risk have lower property values. In the remaining regions there is no statistically significant correlation between flood risk and property values.

8 Limitations

For this analysis we have investigated a wide range of specifications and chosen our preferred specification based on goodness of fit, consistency of results with economic theory, and stability of results. Nonetheless there are limitations to the analysis that are important to keep in mind.

First, our model makes no predictions about medium to long run macroeconomic factors such as economic growth, house price growth or decline, interest rates, etc. Our model simply predicts what prices would have been in 2017, under various alternative conditions. The model relies on variation across locations to identify the impacts of travel times and other variables. It provides a useful geographic comparison but does not attempt to forecast future house price growth or decline.

Second, the model cannot predict the impacts of medium to long term changes in employment location, commuting patterns or residential locations. The model is best suited for providing an approximation to how property prices might change in the short run in response to small-to-medium scale investments in infrastructure.

Third, there are some potentially important variables that we do not observe and are consequently excluded from the analysis. We do not observe lot size, structure quality and age, any planning permissions that have been granted to a property, the location and quality of local schools, or the location of all relevant destinations. To the extent that these omitted variables are important determinants of property values and are correlated with the variables we do include in our analysis, they may cause some omitted variable bias in our results. We have controlled for as much detail of the local geography as feasible and believe that the richness of our model limits any bias that may result from these factors.

Finally, despite our investigation of a wide range of specifications, it is possible that our preferred specification is not completely correct. This could lead to specification bias in our analysis.

9 Property value uplift tool

We embedded the model results in a web application at CeMMAP PVU (demo). This application is based on the R programming language. A user interacts with the webpage, inputs information about the location and size of a potential investment, and the server then computes the impact on travel times and property values. The server produces a report in the form of a pdf file which the user can download.

To use the web application, a user proceeds as follows. First, the user chooses a region. Then they choose an investment type (a settlement, road investment, or public transport investment). Next they input details of the investment including a map of its location and other details. The web application provides instructions on how to use Google Maps to create the map by pointing, clicking and saving. When ready, the user clicks and the server predicts travel times, property values and creates a pdf report of the predictions.

Here we provide some examples of output from the tool for 5 possible investments in 3 regions, CAMKOX, the East Midlands, and Yorkshire and the Humber. In each case, we evaluate:

1. a new settlement consisting of 10,000 properties, 9,500 residential properties and 500 commercial establishments;

2. a road investment project that lowers driving times throughout the region by 10%,

3. a public transport investment project that lowers public transport travel times throughout the region by 10%,

4. a road investment project that lowers driving times by 10% in a single urban area in the region (Oxford for CAMKOX, Nottingham, Derby, Leicester for the East Midlands, and Leeds for Yorkshire);

5. a public transport project that lowers public transport travel times by 10% in a single urban area in the region (the same 3 areas as in item 4.)

In each case, we calculate the impact of the project on travel times and on property values. Table 9.0.1 summarises the property value results. More detailed results on impacts on travel times and on property values for each project are available in Appendix C.

9.1 Predictions for housing projects

The table reports the average property value impact of the proposed new settlements. Each new settlement consists of 10,000 properties with 9,500 residential properties and 500 commercial properties. The table reports the average residential property value in the new settlement, the average commercial property value in the new settlement and the average gain net of the cost of land. The average gain is defined to be the average value per property minus the cost of land required for the project. The cost of land is assumed to be £9,888 per acre which is the median price per acre for agricultural land prices in the 2017 RICS Agricultural Land Market Survey.

The new residential properties are most valuable in CAMKOX with an average value of £450,930. The new residential properties in the East Midlands and Yorkshire-Humber are worth less than half this value. Similarly, the new commercial properties in CAMKOX, with an average value of £9,387,224, are nearly twice as valuable as those in the East Midlands (£4,355,616 per property) and Yorkshire-Humber (£4,927,093 per property). To derive these figures, we assume that the new commercial properties in each settlement have the same distribution of size and commercial use type as the national economy. In other words, the fraction of properties of a particular size and use type is the same as the fraction in the national economy. The value of commercial properties is high because the fraction of large and high value commercial properties in the national economy is high. For the residential results, the proportions of property sizes and property types are representative of the local economy. The proportions in the CAMKOX settlement are similar to properties in Oxford, the proportions in the East Midlands settlement are similar to Derby, and the proportions in the Yorkshire settlement are similar to Leeds. The web application allows users to choose a local authority in the region as a model for the new settlement so that proportions in the new settlement can be chosen to be similar to an existing local authority. Changing the proportions of property sizes, residential property type, and commercial types, in general, does change the predictions from the model. For example, if the new settlements had fewer commercial properties, smaller commercial properties, or less valuables types of businesses, then the predicted property value increases would be smaller.

Nevertheless, under the assumptions used to produced these new settlements, the CAMKOX settlement would generate £897,745 per property, the East Midlands settlement £321,248 per property, and the Yorkshire settlement £341,496 per property.

These average results are easy to understand simply by looking at the baseline average residential property values for each region listed in Tables B.0.3-B.0.4. The baseline average property value in CAMKOX, the East Midlands, and Yorkshire are £277,480,

Table 9.0.1: Summary results of investment projects

Region	Project Type	Detailed location	Average value (per property)	Details
CAMKOX	Settlement	Oxford	£450,930	9,500 new residential properties
			£9,387,224	500 new commercial properties
			£897,745	Average gain net of cost of land
East Midlands	Settlement	Nottingham	£199,909	9,500 new residential properties
			£4,355,616	500 new commercial properties
			£321,248	Average gain net of cost of land
Yorkshire-Humber	Settlement	Leeds	£220,506	9,500 new residential properties
			£4,927,093	500 new commercial properties
			£341,496	Average gain net of cost of land
CAMKOX	Road (10% improvement)	Whole region	£3,186	Gain in residential value
			£14,078	Gain in commercial value
			£3,731	Average gain in value
East Midlands	Road (10% improvement)	Whole region	£2,138	Gain in residential value
			£5,766	Gain in commercial value
			£2,319	Average gain in value
Yorkshire-Humber	Road (10% improvement)	Whole region	£875	Gain in residential value
			£8,996	Gain in commercial value
			£1,281	Average gain in value
CAMKOX	Public transport (10% improvement)	Whole region	£948	Gain in residential value
			£4,335	Gain in commercial value
			£1,117	Average gain in value
East Midlands	Public transport (10% improvement)	Whole region	£553	Gain in residential value
			£1,182	Gain in commercial value
			£584	Average gain in value
Yorkshire-Humber	Public transport (10% improvement)	Whole region	£225	Gain in residential value
			£2,282	Gain in commercial value
			£328	Average gain in value
CAMKOX	Road (10% improvement)	Oxford	£303	Gain in residential value
			£400	Gain in commercial value
			£308	Average gain in value
East Midlands	Road (10% improvement)	Nottingham/Leicester	£478	Gain in residential value
			£1,636	Gain in commercial value
			£536	Average gain in value
Yorkshire-Humber	Road (10% improvement)	Leeds	£75	Gain in residential value
			£4,261	Gain in commercial value
			£284	Average gain in value
CAMKOX	Public transport (10% improvement)	Oxford	£104	Gain in residential value
			£156	Gain in commercial value
			£107	Average gain in value
East Midlands	Public transport (10% improvement)	Nottinghame/Leicester	£87	Gain in residential value
			£387	Gain in commercial value
			£102	Average gain in value
Yorkshire-Humber	Public transport (10% improvement)	Leeds	−£6	Gain in residential value
			£1, 130	Gain in commercial value
			£51	Average gain in value

Note: The table shows estimates of the the average values of residential and commercial property that might be expected after the investment. For the new settlements, the table shows an estimate of the average gain per property net of the cost of land assuming a cost per acre of land of £9,888. This is the median price per acre of land in the 2017 RICS Agricultural Land Market Survey. For the transport investments, a 10% improvement is defined to be a 10% reduction in travel time to all destinations for all properties in the affected geographic area. The average gain in value are calculated assuming that 95% of properties affected are residential and 5% are commercial. The numbers presented are the average values per property. Especially for the transport projects, one must use caution when comparing results since the number of properties affected is not the same for all projects.

£165,060, and £157,780 respectively. These average results mask some of the more detailed predictions from the model. In the background, the tool also defines the other characteristics of the properties (size, type, other location characteristics). The tool chooses the other property characteristics to be representative of a nearby local authority chosen by the users. For example, for the illustrative projects detailed above, the CAMKOX housing settlement was set to have characteristics similar to Oxford, the East Midlands project to have characteristics similar to Derby, and the Yorkshire project to have characteristics similar to Leeds.

The specific results for commercial properties do depend on the size of the new commercial properties and on the commercial use types. In the data, commercial properties range from zero square meters to more than 6,000 square meters. And commercial uses vary from restaurants and pubs to manufacturing facilities. The precise usecode and size of commercial properties has an important impact on property values. A large fraction of the variation in commercial property values depends on the size and the usecode.

For the CAMKOX project, Table C.1.2 shows that the average price of the newly built property is £450,930. The least expensive property is £190,960 and the most expensive is £1.376 million. For commercial properties, the least expensive property is £4.079 million and the most expensive is £31.684 million. For residential properties, this dispersion in values reflects the fact that some of the houses are small and some are large and that not all are precisely in the same location. For commercial properties, one can see that the range of values is much broader than for residential properties. Finally, the table also shows a range of values for net gain depending on the base price of agricultural land.

Similarly, Tables C.6.2 and show the distribution of impacts on property values for the East Midlands and Yorkshire-Humber respectively. For the East Midlands, Table C.6.2 shows that residential property values in the new settlement will range from £103,769 to £627,013 and that commercial values will range from £2.295 million to £14.982 million. Similarly Table C.11.2 shows that residential values in the new settlement will range from £116,838 to £707,393 and that commercial values will range from £2.377 million to £15.399 million. The numbers illustrate the great range of values of commercial property values that are predicted. The precise values for a project depend on heavily on how many new commercial properties are built and what type of commercial usecodes are built.

The predictions from the settlement models are highly stable across different specifications. When building new settlements the primary drivers of residential values are location and the mix of house sizes proposed.. Similarly, for commercial properties, the primary drivers of value are location, the mix of property sizes, and the types of commercial establishments.

9.2 Predictions for road projects

Predictions for road projects are more complicated than for new settlements. The impact of road projects depend on location, on the details of the road network, and on where households and business users desire to travel. For example, near Oxford, travel time to Oxford and travel time to London are both important for commuters and for businesses. For the East Midlands, travel time to employment destinations like Nottingham, Leicester, or Derby are important as well as travel time to the M1 or the A1. In Yorkshire, travel time to the Leeds area is important as is travel time to Sheffield, Middlesbrough, Hull and York. In most cases, travel times to destinations less than one hour away influence property values. Travel times to more distant locations do not affect property values.

A road improvement project that reduced driving travel times throughout the CAMKOX region would raise average residential property values by £3,186 per property and average commercial property values by £14,178. These values represent about 1.2% and 2.4% of baseline values. More detailed results are detailed in Appendix C.2 in Tables C.2.1 - C.2.5. The tables summarise how the project would affect travel times from every property in the region to the geographic hot spots that determine property values in the region. In the CAMKOX region, for residential properties, 21 destinations were found to be important determinants of property values. For commercial properties, only 3 destinations were found to be important. The road project, by assumption reduces travel times to all of them. Details for the changes in travel times are in Tables C.2.1 - C.2.4. The average travel time savings range from 1 minute for travel to the nearest town to 7.7 minutes for travel to Cambridge to 7.0 minutes for travel to London. The travel time savings range from close to zero to as much as 14 or 15 minutes. These numbers sound relatively small, 5-15 minutes. But 5-15 minutes for every trip on every day adds up very quickly.

Tables C.2.5 and C.2.6 show the predicted distribution of impacts on residential and commercial property prices respectively. For residential properties, the impact ranges from - £26,443 to £57,894 and the average gain is £3,186. For commercial properties, the impact ranges from - £137,001 to £845,021 and the average gain is £14,078. The total gain from the project would be these average amounts multiplied by the total number of properties of each type in the region. These results highlight that travel times have a wide range of impacts on property prices depending on where the properties are located and how much travel times to various destinations are affected.

Tables C.4.1 - C.4.6 show similar results for a a transport project that only affects travel times near Oxford. This project only affects properties near Oxford. For those properties, travel times decrease by 10%. Other properties experience no change in travel times. The table show that most properties in the region are unaffected. Nevertheless, Tables C.4.5 and C.4.6 show that the average impact of the project remains non-trivial at £303 per residential property and £400 per commercial property. A small fraction of properties are affected, yet the average effect remains important.

Tables C.7.1 - C.7.4 and C.9.1 - C.9.34 show similar analysis for the East Midlands. A road project improving driving times throughout the East Midlands would increase residential values by £2,138 or 1.3% and commercial values by £5,766 or 1.6%. The tables show that this project would lead to reductions in average travel times to the major destinations (Northampton, Stamford, Eyam, West Bridgford, Oadby, and Daventry) ranging from 4.9 minutes to 7.2 minutes. The largest travel time reductions would be 14.8 minutes. These travel time reductions would increase most property prices. The average increases are noted above and the maximal increases are £35,018 for residential property and £179,365 for commercial property.

As in the CAMKOX region, a smaller local project focused on a small area near Nottingham would reduce travel times only for a subset of affected properties but would still lead to an increase of £478 in average residential property prices and £1,636 for commercial properties.

Finally, for the Yorkshire and the Humber region, Tables C.12.1 - C.12.5 and C.14.1 - C.14.5 detail results of similar road investment projects. The regional road investment project would lead to reductions in average driving time ranging from 4.8 to 7.2 minutes. These travel time reductions would lead to residential property price increases ranging from -£6,906 to £27,918 with an average of £875 per residential property. For commercial properties, the change in property values would range from -£66,220 to £654,438 with an average impact of £8,996. A local road project near Leeds would affect a smaller set of properties but still would have an average impact of £75 per residential property and £4,261 per commercial property. Maximal impacts are £18,042 for residential properties and £654,438 for commercial properties.

For each project, the detailed location matters for project value. This is especially true for commercial properties because the impact on commercial properties is much more sensitive to the size and type of nearby commercial properties. Finally, one also needs to take into account the total number of properties affected by the projects.

The impact of road projects on prices depends on how the project affects travel times, on how those travel times affect prices.

The predictions for road projects are somewhat unstable with respect to model specification.

It is also important to note that road projects may have impacts that are not captured in property values. Not all of the benefit of transport is capitalised into property values. There is also benefit in terms of travel time savings and changes in air and noise pollution. These benefits depend on the cost of travel time and the costs of pollution.

9.3 Predictions for public transport projects

Predictions for public transport projects are similar to predictions for road projects but smaller in value. They are smaller in value because roughly 90% of journeys are car journeys whereas only about 10% are public transport journeys. The fraction of public transport journeys increases for locations with good access to rail and bus networks. The model does account for the fact that improved public transport times do increase the share of consumers who use public transport . However, in the short run, the increase is not large and so, the short run impact of public transport projects is smaller than the short run impact of road projects.

Tables C.3.1 - C.3.6 show predictions for the impact of a public transport project that reduces transit times by 10% in the CAMKOX region. The project reduces average journey times to top destinations by 11.2 to 16.5 minutes. Travel times to London are reduced by 16.5 minutes and the largest reductions are close to 30 minutes. This travel project raises average residential property values by £948 per property and commercial property values of £4,335 per property. The maximal increases are £51,912 for residential properties and £242,420 for commercial properties.

Tables C.8.1 - C.8.4 show results from a similar project in the East Midlands. The project reduces travel times to major destinations by 9.9 to 15.3 minutes and increase average residential property prices by £553 and commercial property values by £1,182. A small number of property values decrease, most increase and the maximal increases are £4,886 for residential properties and £44,125 for commercial properties.

A smaller project, illustrated in Tables C.10.1 - C.10.4, an improvement in public transit near Nottingham, affects fewer properties and increases average residential prices by only £87 and commercial values by only £387. The maximal price increase induced by this project is £2,446 for residential properties and £28,006 for commercial properties.

Tables C.13.1 - C.13.5 show the impact of a reduction in public transport travel times in Yorkshire and the Humber. The project reduces average transit times to major destinations by 8.9 to 20.9 minutes. Some travel times are reduced by 40 to 50 minutes. The project increases average residential property values by £225 and commercial property values by £2,282. A small number of property values fall and the maximum property value increases are £18,146 for residential properties and £185,845 for commercial properties.

Finally, Tables C.15.1 - C.15.5 show the impact of a smaller project that reduces travel times by 10% near Leeds. This project doesn't affect many properties, saving only a few minutes travel time and has an average residential property price impact near zero (-£6) and an average commercial property impact of £1,130. The maximal impacts of this project are £5,049 for residential properties and £185,845 for commercial properties.

The short run impact on property values of public transport projects is higher where property values are higher and is higher when it reduces travel times to valuable destinations. This is an empirical fact. However, it does not quantify impacts of public transport investments on commuting times, reduced congestion, or pollution. Nor does it quantify long run impacts. Quantifying such impacts requires additional work.

A Discrete choice model

The UK National Travel Survey asks a large sample of individuals in UK households to keep a one week diary of all trips made out of the home. The data records information about mode of travel and travel time. Using a sample of trips from the UK National Travel Survey 2008 made by one of seven modes of travel (walking, cycling, taxi, car driver, car passenger, bus, rail), we estimated a logit travel choice model of the form

$$\pi_j = \frac{e^{\alpha_{0j}+\alpha_1 t_j}}{\sum_{k=1}^{7} e^{\alpha_{0k}+\alpha_1 t_k}} \tag{10}$$

where π_j is the probability of travelling by mode j, t_j is the travel time for mode j, and $(\alpha_{01}, ..., \alpha_{07}, \alpha_1)$ are parameters. The model predicts the probability of travel by each mode and how that probability varies with travel time.

It also predicts the utility value from travel to be

$$U = \log \sum_{j=1}^{J} e^{\alpha_{0j}+\alpha_1 t_j}. \tag{11}$$

A linear approximation to this utility value is

$$\widehat{U} = U_0 + \sum_{j=1}^{J} \pi_j t_j \tag{12}$$

For a property at location i, let U_{ij} be the utility from all journeys from i to destination j. We assume that the value of a property at location i depends on the utility from travel to all locations $j = 1, ..., J$. That is it depends on $(U_{i1}, ..., U_{iJ})$. Now U_{ij} can be approximated by $\widehat{U}_i = \widehat{U}_0 + \sum_j \widehat{\pi}_{ij} t_{ij}$ where the terms in the expression are derived from the logit model parameter estimates and t_{ij} is the travel time from i to j.

B Tables and Figures

Table B.0.1: List of variables

Variable	Description
logvalue	Logarithm of property value.
pricepaid	Price paid in 1,000 GBP
detached house	Detached house
flat	Flat
semi-detached house	Semi-detached house
terraced house	Terraced house
newbuild	New build property
freehold	Freehold
leasehold	Leasehold
total_floor_area	Total floor area in square meters
builtuparea_pct (LA)	Percentage of land in LA that is built-up
restrictedland_pct (LA)	Percentage of land in LA that is restricted
localplanrate (LA)	Planned rate of house building in local authority
popdensity (OA)	Population density in output area (hundreds of people per km^2
imddecile:1 (OA)	Ranking of output area by IMD: 1st decile.
imddecile:2 (OA)	Ranking of output area by IMD: 2nd decile.
imddecile:3 (OA)	Ranking of output area by IMD: 3rd decile.
imddecile:4 (OA)	Ranking of output area by IMD: 4th decile.
imddecile:5 (OA)	Ranking of output area by IMD: 5th decile.
imddecile:6 (OA)	Ranking of output area by IMD: 6th decile.
imddecile:7 (OA)	Ranking of output area by IMD: 7th decile.
imddecile:8 (OA)	Ranking of output area by IMD: 8th decile.
imddecile:9 (OA)	Ranking of output area by IMD: 9th decile.
imddecile:10 (OA)	Ranking of output area by IMD: top decile.
floodrisk:High	High risk of flooding
floodrisk:Low	Low risk of flooding
floodrisk:Medium	Medium risk of flooding
floodrisk:None	Zero risk of flooding
floodrisk:Very Low	Very low risk of flooding
roadnoise	Roadnoise exceed 75 DbH

Table B.0.2: List of variables (continued)

Variable	Description
lu_domestic_shr (OA)	Domestic properties share of land use in OA
lu_gardens_shr (OA)	Gardens share of land use in OA
lu_nondom_shr (OA)	Non-domestic structures share of land use in OA
lu_road_shr (OA)	Road share of land use in OA
lu_rail_shr (OA)	Rail share of land use in OA
lu_path_shr (OA)	Public paths share of land use in OA
lu_greenspace_shr (OA)	Greenspace share of land use in OA
lu_water_shr (OA)	Water share of land use in OA
lu_other_shr (OA)	Other share of land use in OA
drive_town	Travel time by car to postal town (minutes)
trans_town	Travel time by public transport to postal town (minutes)
distance_airport	Distance to airport in kilometers
distance_AONB	Distance to nearest AONB in kilometers
AONB	1 if property is in an AONB
distance_motorway	Distance to nearest motorway in kilometers
distance_aroad	Distance to nearest A-road in kilometers
drive_motorway	Travel time to nearest motorway by car (minutes)
drive_aroad	Travel time by car to nearest A-road (minutes)
distance_station	Distance to nearest rail station (kilometers)
drive_station	Travel time by car to nearest rail station (minutes)
trans_station	Travel time by public transport to nearest rail station (Minutes)

Table B.0.3:
Residential property database
Summary statistics (1)

	CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
logvalue	-1.03	1.99	-0.10	1.72	0.01	-0.32
pricepaid (1,000 GBP)	277.48	217.63	165.06	248.34	461.26	137.46
detached	0.29	0.31	0.34	0.29	0.05	0.19
flat	0.13	0.13	0.05	0.14	0.43	0.10
semi-detached	0.29	0.22	0.33	0.28	0.17	0.34
terraced	0.29	0.34	0.28	0.28	0.35	0.37
newbuild	0.13	0.09	0.09	0.08	0.05	0.10
freehold	0.86	0.87	0.93	0.84	0.56	0.83
leasehold	0.14	0.13	0.07	0.16	0.44	0.17
total_floor_area	95.81	95.07	94.47	93.13	88.18	91.47
builtuparea_pct (LA)	14.28	22.77	28.89	25.23	85.82	30.19
restrictedland_pct (LA)	0.24	0.25	0.15	0.29	0.11	0.30
localplanrate (LA)	0.01	0.01	0.01	0.01	0.01	0.01
popdensity (OA)	35.40	36.04	39.41	40.93	108.17	45.73
imddecile:1 (OA)	0.01	0.04	0.05	0.03	0.03	0.12
imddecile:2 (OA)	0.02	0.06	0.08	0.05	0.11	0.11
imddecile:3 (OA)	0.03	0.10	0.10	0.07	0.15	0.12
imddecile:4 (OA)	0.04	0.17	0.10	0.11	0.14	0.12
imddecile:5 (OA)	0.07	0.15	0.08	0.12	0.12	0.10
imddecile:6 (OA)	0.08	0.15	0.11	0.13	0.12	0.07
imddecile:7 (OA)	0.15	0.11	0.12	0.12	0.11	0.08
imddecile:8 (OA)	0.15	0.11	0.14	0.12	0.09	0.09
imddecile:9 (OA)	0.21	0.08	0.13	0.11	0.10	0.11
imddecile:10 (OA)	0.24	0.03	0.10	0.13	0.04	0.08
floodrisk:High	0.01	0.01	0.01	0.01	0.005	0.001
floodrisk:Low	0.04	0.02	0.06	0.03	0.11	0.01
floodrisk:Medium	0.01	0.02	0.03	0.01	0.01	0.003
floodrisk:None	0.93	0.95	0.89	0.94	0.87	0.99
floodrisk:Very Low	0.0001	0.003	0.01	0.01	0.001	0.0004
roadnoise	0.07	0.06	0.07	0.07	0.12	0.07
lu_domestic_shr (OA)	0.04	0.05	0.05	0.05	0.12	0.07
lu_gardens_shr (OA)	0.14	0.14	0.18	0.18	0.27	0.16
lu_nondom_shr (OA)	0.02	0.02	0.03	0.03	0.06	0.03
lu_road_shr (OA)	0.06	0.07	0.08	0.07	0.16	0.10
lu_rail_shr (OA)	0.004	0.003	0.004	0.004	0.01	0.01
lu_path_shr (OA)	0.01	0.01	0.005	0.01	0.01	0.01
lu_greenspace_shr (OA)	0.66	0.63	0.60	0.58	0.27	0.56
lu_water_shr (OA)	0.02	0.04	0.02	0.03	0.02	0.02
lu_other_shr (OA)	0.04	0.04	0.05	0.05	0.08	0.05
drive_town	11.39	12.29	13.19	11.71	22.82	11.36
trans_town	35.11	36.84	40.41	40.91	33.29	32.27
distance_airport	45.82	35.49	42.40	29.24	12.74	30.39
distance_AONB	16.51	5.15	79.35	23.19		26.40
AONB	0.03	0.08	0.001	0.01	0	0.01
distance_motorway	8.91	52.68	15.69	35.20	9.13	11.88
distance_aroad	0.95	0.90	0.70	1.00	0.31	0.61
drive_motorway	15.87	55.38	24.52	41.91	27.88	19.00
drive_aroad	7.79	9.13	8.74	9.46	6.64	9.49
distance_station	4.23	4.87	4.12	3.44	1.04	4.46
drive_station	10.81	13.27	11.36	11.07	7.74	13.56
trans_station	34.38	38.70	38.36	39.07	17.99	37.11

Note: See Table B.0.2 for more information about variable definitions.

Table B.0.4:
Residential property database
Summary statistics (2)

	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
logvalue	-3.71	-0.13	-0.02	0.004	-0.91
pricepaid (1,000 GBP)	159.58	298.63	235.18	176.40	157.78
detached	0.19	0.27	0.30	0.24	0.22
flat	0.08	0.17	0.13	0.08	0.07
semi-detached	0.36	0.27	0.26	0.36	0.36
terraced	0.36	0.29	0.31	0.32	0.34
newbuild	0.07	0.07	0.09	0.08	0.07
freehold	0.64	0.82	0.85	0.88	0.86
leasehold	0.36	0.18	0.15	0.12	0.14
total_floor_area	92.69	95.92	95.75	92.19	91.70
builtuparea_pct (LA)	38.60	29.89	28.31	46.06	25.62
restrictedland_pct (LA)	0.40	0.42	0.37	0.29	0.51
localplanrate (LA)	0.01	0.01	0.01	0.01	0.01
popdensity (OA)	49.93	46.56	40.85	43.94	43.19
imddecile:1 (OA)	0.13	0.02	0.02	0.09	0.11
imddecile:2 (OA)	0.11	0.04	0.04	0.11	0.09
imddecile:3 (OA)	0.09	0.06	0.06	0.09	0.09
imddecile:4 (OA)	0.10	0.08	0.09	0.10	0.08
imddecile:5 (OA)	0.09	0.09	0.11	0.12	0.09
imddecile:6 (OA)	0.09	0.11	0.14	0.10	0.10
imddecile:7 (OA)	0.09	0.11	0.13	0.10	0.12
imddecile:8 (OA)	0.11	0.12	0.15	0.10	0.11
imddecile:9 (OA)	0.11	0.14	0.14	0.10	0.10
imddecile:10 (OA)	0.09	0.21	0.13	0.09	0.09
floodrisk:High	0.004	0.01	0.01	0.003	0.01
floodrisk:Low	0.04	0.05	0.06	0.02	0.07
floodrisk:Medium	0.01	0.02	0.01	0.01	0.03
floodrisk:None	0.95	0.92	0.92	0.97	0.88
floodrisk:Very Low	0.001	0.001	0.002	0.01	0.01
roadnoise	0.10	0.11	0.07	0.09	0.08
lu_domestic_shr (OA)	0.06	0.06	0.06	0.07	0.05
lu_gardens_shr (OA)	0.18	0.21	0.20	0.23	0.15
lu_nondom_shr (OA)	0.03	0.03	0.03	0.04	0.03
lu_road_shr (OA)	0.10	0.09	0.08	0.10	0.08
lu_rail_shr (OA)	0.01	0.005	0.004	0.005	0.01
lu_path_shr (OA)	0.01	0.01	0.01	0.01	0.01
lu_greenspace_shr (OA)	0.51	0.52	0.54	0.49	0.62
lu_water_shr (OA)	0.04	0.04	0.02	0.01	0.02
lu_other_shr (OA)	0.06	0.05	0.05	0.06	0.05
drive_town	18.29	14.15	14.04	12.28	14.56
trans_town	47.86	43.42	36.75	34.34	40.25
distance_airport	33.91	28.67	35.15	33.12	42.70
distance_AONB	36.82	7.87	5.38	19.37	28.18
AONB	0.004	0.05	0.06	0.01	0.003
distance_motorway	4.93	10.77	22.97	6.33	9.92
distance_aroad	0.54	0.67	0.80	0.62	0.68
drive_motorway	24.60	22.01	34.86	13.80	19.04
drive_aroad	12.95	11.32	9.90	8.22	9.72
distance_station	2.02	2.08	4.40	2.74	3.15
drive_station	15.12	12.95	13.25	10.81	11.85
trans_station	42.61	40.93	35.37	30.16	36.08

Note: See Table B.0.2 for more information about variable definitions.

Table B.0.5:
Commercial property database
Summary statistics (1)

	CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
logvalue	1.26	-0.59	0.01	0.05	-0.19	0.33
price (1,000 GBP)	592	255.33	358.67	421.33	1,035.33	356.22
total_floor_area	304.60	159.56	299.46	260.51	184.74	272.74
builtuparea_pct	15.85	16.74	32.52	25.83	90.53	30.21
restrictedland_pct	0.24	0.27	0.15	0.28	0.07	0.30
localplanrate	0.01	0.01	0.01	0.01	0.01	0.01
popdensityOA	21.40	24.32	29.29	24.78	83.11	27.45
imddecile:1	0.02	0.09	0.12	0.07	0.05	0.28
imddecile:2	0.04	0.09	0.16	0.10	0.16	0.14
imddecile:3	0.04	0.12	0.16	0.10	0.18	0.13
imddecile:4	0.09	0.22	0.12	0.12	0.17	0.11
imddecile:5	0.08	0.17	0.09	0.13	0.11	0.11
imddecile:6	0.10	0.13	0.08	0.13	0.11	0.05
imddecile:7	0.18	0.07	0.09	0.11	0.11	0.06
imddecile:8	0.15	0.06	0.09	0.10	0.05	0.05
imddecile:9	0.15	0.04	0.07	0.08	0.04	0.04
imddecile:10	0.16	0.01	0.03	0.06	0.01	0.02
floodrisk:High	0.01	0.03	0.02	0.02	0.01	0.01
floodrisk:Low	0.06	0.06	0.10	0.07	0.15	0.02
floodrisk:Medium	0.02	0.04	0.06	0.02	0.01	0.01
floodrisk:None	0.90	0.86	0.82	0.88	0.83	0.96
floodrisk:Very Low	0.0003	0.01	0.01	0.01	0.001	0.002
lu_domestic_shr	0.04	0.04	0.06	0.05	0.12	0.06
lu_gardens_shr	0.12	0.10	0.15	0.15	0.19	0.11
lu_nondom_shr	0.04	0.03	0.05	0.04	0.14	0.05
lu_road_shr	0.07	0.06	0.09	0.07	0.19	0.11
lu_rail_shr	0.01	0.003	0.01	0.01	0.02	0.01
lu_path_shr	0.01	0.005	0.01	0.01	0.01	0.01
lu_greenspace_shr	0.65	0.67	0.55	0.58	0.20	0.52
lu_water_shr	0.02	0.04	0.02	0.04	0.03	0.04
lu_other_shr	0.06	0.05	0.07	0.07	0.11	0.08
drive_town	11.40	13.06	12.82	12.31	20.42	14.34
trans_town	36.26	39.09	41.25	40.71	30.06	38.13
distance_airport	47.77	36.34	43.63	29.03	12.13	31.96
distance_AONB	16.94	4.74	76.76	21.80		25.83
AONB	0.06	0.13	0.004	0.03	0	0.02
distance_motorway	8.97	63.61	15.82	39.51	8.17	13.52
distance_aroad	0.87	0.99	0.57	0.96	0.16	0.56
drive_motorway	16.02	64.44	24.96	45.86	28.25	20.12
drive_aroad	8.02	10.22	8.78	9.79	6.02	13.52
distance_station	4.31	6.11	3.85	3.51	0.84	3.87
drive_station	11.17	14.84	11.35	11.57	7.32	15.41
trans_station	35.85	42.54	40.05	39.67	16.91	38.27

Note: See Table B.0.2 for more information about variable definitions.

Table B.0.6:
Commercial property database
Summary statistics (2)

	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
logvalue	1.40	0.08	0.34	-0.22	-0.06
price	353.56	479.11	403.33	410.67	347.33
total_floor_area	249.71	228.07	236.94	300.87	274.78
builtuparea_pct	40.96	30.05	28.10	49.27	26.04
restrictedland_pct	0.38	0.43	0.38	0.26	0.53
localplanrate	0.01	0.01	0.01	0.01	0.01
popdensityOA	33.82	34.26	29.48	28.16	30.84
imddecile:1	0.27	0.05	0.06	0.19	0.25
imddecile:2	0.13	0.07	0.06	0.18	0.11
imddecile:3	0.11	0.09	0.11	0.12	0.14
imddecile:4	0.11	0.11	0.10	0.10	0.08
imddecile:5	0.08	0.09	0.13	0.12	0.10
imddecile:6	0.08	0.13	0.15	0.09	0.08
imddecile:7	0.07	0.11	0.12	0.07	0.08
imddecile:8	0.06	0.11	0.11	0.06	0.06
imddecile:9	0.05	0.12	0.09	0.05	0.06
imddecile:10	0.03	0.12	0.06	0.03	0.03
floodrisk:High	0.01	0.03	0.02	0.01	0.02
floodrisk:Low	0.06	0.08	0.09	0.05	0.11
floodrisk:Medium	0.01	0.03	0.03	0.02	0.07
floodrisk:None	0.91	0.87	0.85	0.91	0.79
floodrisk:Very Low	0.0005	0.003	0.01	0.01	0.02
lu_domestic_shr	0.07	0.06	0.06	0.06	0.05
lu_gardens_shr	0.14	0.18	0.16	0.18	0.13
lu_nondom_shr	0.06	0.04	0.05	0.06	0.05
lu_road_shr	0.13	0.09	0.09	0.10	0.10
lu_rail_shr	0.01	0.01	0.01	0.01	0.01
lu_path_shr	0.01	0.01	0.01	0.01	0.01
lu_greenspace_shr	0.46	0.51	0.54	0.47	0.55
lu_water_shr	0.04	0.04	0.03	0.01	0.02
lu_other_shr	0.09	0.07	0.07	0.09	0.08
drive_town	18.24	13.86	15.84	13.30	13.01
trans_town	47.80	41.31	37.49	33.20	40.08
distance_airport	36.20	28.56	35.72	32.58	42.10
distance_AONB	35.07	7.87	5.16	19.00	27.85
AONB	0.004	0.07	0.09	0.01	0.005
distance_motorway	5.01	11.36	23.03	6.46	10.14
distance_aroad	0.38	0.58	0.73	0.50	0.52
drive_motorway	26.94	23.56	35.83	14.02	19.49
drive_aroad	15.07	11.74	11.69	8.80	10.20
distance_station	1.98	1.99	4.49	2.50	2.62
drive_station	15.31	13.34	13.42	11.29	11.38
trans_station	43.76	39.47	36.57	28.15	36.10

Note: See Table B.0.2 for more information about variable definitions.

Table B.0.7:
Residential property
Model 1 results (1)

	Dependent variable:					
	logprice					
	CAMKOX	Cornwall-Devon	East Midlands	East of England	London	Northeast
year2009	−0.066***	−0.066***	−0.084***	−0.074***	−0.065***	−0.080***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
year2010	0.013***	−0.003	−0.042***	−0.012***	0.033***	−0.068***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
year2011	0.015***	−0.022***	−0.052***	−0.008*	0.054***	−0.102***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
year2012	0.042***	−0.016***	−0.034***	0.008*	0.095***	−0.111***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
year2013	0.065***	−0.011**	−0.015***	0.036***	0.159***	−0.122***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
year2014	0.151***	0.029***	0.038***	0.112***	0.308***	−0.101***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
year2015	0.237***	0.068***	0.089***	0.200***	0.397***	−0.083***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
year2016	0.331***	0.103***	0.150***	0.301***	0.493***	−0.067***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
year2017	0.378***	0.129***	0.199***	0.359***	0.534***	−0.051***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.006)	(0.006)
flat	−0.027***	−0.269***	−0.413***	−0.314***	−0.263***	−0.640***
	(0.006)	(0.007)	(0.007)	(0.006)	(0.009)	(0.006)
other type	−0.142***	−0.026*	−0.067***	−0.097***	−0.292***	−0.486***
	(0.017)	(0.014)	(0.019)	(0.018)	(0.021)	(0.020)
semi-detached	−0.166***	−0.212***	−0.260***	−0.179***	−0.154***	−0.278***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.004)
terraced	−0.234***	−0.314***	−0.428***	−0.306***	−0.222***	−0.549***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.004)
newbuild	0.077***	0.091***	0.151***	0.116***	0.084***	0.242***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)
leasehold	−0.425***	−0.146***	−0.109***	−0.198***	−0.102***	0.076***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.004)
Observations	100,000	100,000	100,000	100,000	100,000	100,000
R^2	0.774	0.682	0.700	0.790	0.738	0.621
Adjusted R^2	0.774	0.681	0.699	0.790	0.737	0.620
Residual Std. Error	0.232	0.256	0.257	0.236	0.312	0.347
F Statistic	1,353.979***	1,528.639***	1,427.308***	1,627.948***	2,650.011***	752.351***
Note:						*p<0.1; **p<0.05; ***p<0.01

Table B.0.8:
Residential property
Model 1 results (2)

	Dependent variable:				
	logprice				
	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
year2009	−0.069***	−0.072***	−0.074***	−0.062***	−0.075***
	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)
year2010	−0.032***	0.011***	0.006	−0.018***	−0.042***
	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)
year2011	−0.066***	0.007*	−0.005	−0.035***	−0.064***
	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)
year2012	−0.063***	0.029***	0.012***	−0.028***	−0.069***
	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)
year2013	−0.063***	0.058***	0.025***	−0.005	−0.068***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
year2014	−0.029***	0.142***	0.092***	0.033***	−0.023***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)
year2015	0.012**	0.226***	0.157***	0.075***	0.006
	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)
year2016	0.055***	0.313***	0.229***	0.138***	0.053***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)
year2017	0.095***	0.361***	0.279***	0.177***	0.078***
	(0.006)	(0.004)	(0.005)	(0.005)	(0.005)
flat	−0.415***	−0.276***	−0.330***	−0.483***	−0.483***
	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)
other type	−0.348***	−0.103***	−0.059***	−0.145***	−0.291***
	(0.020)	(0.017)	(0.018)	(0.019)	(0.022)
semi-detached	−0.249***	−0.186***	−0.203***	−0.263***	−0.269***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
terraced	−0.561***	−0.293***	−0.289***	−0.429***	−0.502***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
newbuild	0.210***	0.095***	0.093***	0.166***	0.184***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
leasehold	−0.026***	−0.196***	−0.099***	−0.048***	−0.0004
	(0.003)	(0.006)	(0.005)	(0.005)	(0.004)
Observations	100,000	100,000	100,000	100,000	100,000
R^2	0.630	0.789	0.705	0.686	0.672
Adjusted R^2	0.630	0.788	0.705	0.686	0.671
Residual Std. Error	0.339	0.241	0.248	0.279	0.302
F Statistic	795.635***	1,773.400***	1,116.688***	1,382.995***	1,020.288***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table B.0.9:
Residential property
Model 1: number of spline segments

Region	Size	Latitude	Longitude	Lat_Long
CAMKOX	68	65	39	52
Cornwall-Devon	3	98	1	2
East Midlands	2	54	31	36
East of England	62	50	32	50
London	2	47	16	15
Northeast	5	99	41	1
Northwest	74	86	13	4
Southeast	6	29	54	86
Southwest	4	54	1	55
West Midlands	5	56	39	1
Yorkshire-Humber	3	76	37	54

Note: For the estimated model, this table shows the optimal number of spline segments for each region and for each variable. For example, row 1 shows that the nonparametric model for region 1 has 68 segments in the "size" dimension, 65 segments in the "latitude" dimension, 39 segments in the "longitude" dimension and 52 segments in the "latitude*longitude" dimension.

Table B.0.10:
Residential property
Model 1: degree of spline polynomials

Region	Size	Latitude	Longitude	Lat_Long
CAMKOX	2	2	5	5
Cornwall-Devon	2	4	2	13
East Midlands	5	8	4	8
East of England	12	5	3	2
London	2	1	4	4
Northeast	2	1	1	0
Northwest	4	3	14	1
Southeast	4	9	4	3
Southwest	4	2	0	1
West Midlands	9	3	5	0
Yorkshire-Humber	10	2	2	1

Note: For the estimated model, this table shows the optimal degree of each spline polynomial for each region and for each variable. For example, row 1 shows that the nonparametric model for region 1 has quadratic polynomials in the "size" dimension and in the "latitude'" dimension, 5th order polynomials in the "longitude" dimension and 5th order polynomials in the "latitude*longitude" dimension.

Table B.0.11:
Commercial property
Model 1 results (1)

	Dependent variable:					
	logprice					
	CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
Observations	55,683	65,659	100,000	100,000	100,000	67,546
R^2	0.849	0.791	0.828	0.827	0.864	0.807
Adjusted R^2	0.848	0.790	0.828	0.827	0.864	0.807
Residual Std. Error	0.498	0.467	0.506	0.518	0.499	0.541
F Statistic	1,390.232***	1,233.142***	2,395.000***	2,606.817***	3,206.167***	1,601.770***
Note:						*p<0.1; **p<0.05; ***p<0.01

Table B.0.12:
Commercial property
Model 1 results (2)

	Dependent variable:				
	logprice				
	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
Observations	100,000	100,000	100,000	100,000	100,000
R^2	0.806	0.831	0.821	0.823	0.805
Adjusted R^2	0.806	0.830	0.821	0.823	0.804
Residual Std. Error	0.528	0.515	0.504	0.498	0.526
F Statistic	2,150.727***	2,445.259***	2,924.421***	2,580.199***	1,729.944***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table B.0.13:
Commercial property
Model 1: number of spline segments

Region	Size	Latitude	Longitude	Lat_Long
CAMKOX	7	50	50	47
Cornwall-Devon	46	41	7	50
East Midlands	7	12	44	42
East England	21	26	16	42
London	6	46	13	49
Northeast	20	48	17	42
Northwest	11	45	8	48
Southeast	13	48	20	31
Southwest	11	31	50	1
West Midlands	16	44	18	32
Yorkshire-Humber	25	50	49	49

Note: For the estimated model, this table shows the optimal number of spline segments for each region and for each variable. For example, row 1 shows that the nonparametric model for region 1 has 7 segments in the "size" dimension, 50 segments in the "latitude" dimension, 50 segments in the "longitude" dimension and 47 segments in the "latitude*longitude" dimension.

Table B.0.14:
Commercial property
Model 1: degree of spline polynomials

Region	Size	Latitude	Longitude	Lat_Long
CAMKOX	12	4	5	1
Cornwall-Devon	8	1	1	2
East Midlands	13	15	11	3
East England	6	7	2	3
London	9	4	10	2
Northeast	3	1	1	1
Northwest	6	1	1	8
Southeast	10	3	3	4
Southwest	8	5	2	0
West Midlands	6	1	3	1
Yorkshire-Humber	2	2	4	1

Note: For the estimated model, this table shows the optimal degree of each spline polynomial for each region and for each variable. For example, row 1 shows that the nonparametric model for region 1 has 12th order polynomials in the "size" dimension, 4th order polynomials in the "latitude" dimension, 5th order polynomials in the "longitude" dimension and linear functions in the "latitude*longitude" dimension.

Table B.0.15:
Residential property
Model 2 results (1)

	Dependent variable:					
	location_value					
	CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
builtuparea_pct (LA)	0.003***	0.001***	0.001***	−0.0003***	−0.003***	0.001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0001)
restrictedland_pct (LA)	0.218***	0.223***	0.015**	0.143***	−0.658***	0.063***
	(0.012)	(0.012)	(0.007)	(0.009)	(0.033)	(0.020)
localplanrate (LA)	6.761***	−5.712***	0.162	−7.976***	−7.366***	−5.796***
	(0.369)	(0.998)	(0.281)	(0.518)	(0.394)	(1.435)
lu_domestic_shr (OA)	0.784***	0.150*	−0.127	−0.488***	0.389***	0.025
	(0.102)	(0.089)	(0.090)	(0.105)	(0.083)	(0.114)
lu_gardens_shr (OA)	0.302***	0.445***	0.331***	0.269***	−0.043	−0.488***
	(0.036)	(0.050)	(0.049)	(0.043)	(0.053)	(0.069)
lu_nondom_shr (OA)	0.865***	1.168***	0.750***	0.550***	0.339***	−1.134***
	(0.073)	(0.125)	(0.106)	(0.096)	(0.100)	(0.144)
lu_road_shr (OA)	−0.297***	−0.499***	0.310***	0.719***	−0.166	−0.531***
	(0.088)	(0.097)	(0.088)	(0.099)	(0.107)	(0.120)
lu_rail_shr (OA)	1.250***	−0.239*	0.145	0.477***	0.464***	−0.283**
	(0.115)	(0.127)	(0.100)	(0.135)	(0.084)	(0.112)
lu_greenspace_shr (OA)	0.328***	0.224***	0.246***	0.216***	0.120**	−0.428***
	(0.036)	(0.044)	(0.043)	(0.038)	(0.049)	(0.061)
lu_water_shr (OA)	0.337***	0.298***	0.339***	0.260***	0.052	−0.322***
	(0.047)	(0.046)	(0.055)	(0.041)	(0.057)	(0.076)
popdensity (OA)	−0.0001***	−0.0002***	0.00001	0.00005	0.0001***	−0.0001
	(0.00002)	(0.00003)	(0.00003)	(0.00004)	(0.00002)	(0.00004)
imddecile2(OA)	0.007	0.014***	0.012***	0.027***	0.012	0.015***
	(0.011)	(0.005)	(0.005)	(0.008)	(0.010)	(0.005)
imddecile3(OA)	0.010	0.019***	0.037***	0.046***	0.034***	0.039***
	(0.010)	(0.004)	(0.005)	(0.007)	(0.010)	(0.005)
imddecile4 (OA)	0.019*	0.021***	0.033***	0.042***	0.083***	0.061***
	(0.010)	(0.004)	(0.005)	(0.007)	(0.010)	(0.005)
imddecile5 (OA)	0.022**	0.033***	0.050***	0.063***	0.115***	0.074***
	(0.010)	(0.004)	(0.005)	(0.007)	(0.010)	(0.006)
imddecile6 (OA)	0.033***	0.050***	0.057***	0.075***	0.157***	0.067***
	(0.010)	(0.004)	(0.005)	(0.007)	(0.010)	(0.006)
imddecile7 (OA)	0.043***	0.045***	0.060***	0.091***	0.193***	0.087***
	(0.009)	(0.005)	(0.005)	(0.007)	(0.010)	(0.006)
imddecile8 (OA)	0.054***	0.050***	0.072***	0.098***	0.199***	0.097***
	(0.009)	(0.005)	(0.005)	(0.007)	(0.011)	(0.006)
imddecile9 (OA)	0.059***	0.060***	0.081***	0.111***	0.196***	0.113***
	(0.009)	(0.005)	(0.005)	(0.007)	(0.011)	(0.006)
imddecile10 (OA)	0.052***	0.082***	0.112***	0.144***	0.199***	0.194***
	(0.009)	(0.006)	(0.005)	(0.007)	(0.012)	(0.007)
floodrisk:Low	0.008	0.002	0.016	−0.015	0.033	−0.019
	(0.008)	(0.008)	(0.010)	(0.014)	(0.021)	(0.043)
floodrisk:Medium	0.032***	0.008	−0.018	−0.007	−0.020	0.015
	(0.010)	(0.009)	(0.011)	(0.016)	(0.027)	(0.046)
floodrisk:None	0.007	−0.006	0.009	−0.013	−0.003	−0.019
	(0.008)	(0.007)	(0.010)	(0.013)	(0.021)	(0.041)
floodrisk:Very Low	−0.049	0.012	0.121***	−0.030*	−0.074	−0.017
	(0.068)	(0.015)	(0.014)	(0.017)	(0.063)	(0.074)
noiseclass>=75.0		−0.029			0.227***	
		(0.071)			(0.083)	
noiseclass55.0-59.9	−0.010**	−0.010**	0.008*	−0.011**	0.017**	−0.014**
	(0.004)	(0.004)	(0.005)	(0.006)	(0.007)	(0.007)
noiseclass60.0-64.9	−0.008	0.002	0.018***	−0.005	0.004	0.003
	(0.005)	(0.006)	(0.006)	(0.007)	(0.007)	(0.009)
noiseclass65.0-69.9	−0.008	0.005	0.012	−0.014	0.002	−0.006
	(0.008)	(0.009)	(0.010)	(0.013)	(0.011)	(0.017)
noiseclass70.0-74.9	0.014	−0.038**	0.037	−0.016	0.046**	−0.017
	(0.017)	(0.019)	(0.036)	(0.040)	(0.021)	(0.061)
Observations	9,563	9,682	9,703	9,700	9,746	9,722
R^2	0.877	0.722	0.693	0.878	0.802	0.616
Adjusted R^2	0.875	0.720	0.691	0.877	0.800	0.614
Residual Std. Error	0.068	0.071	0.079	0.098	0.144	0.122
F Statistic	585.514***	307.737***	315.638***	1,067.801***	630.770***	238.537***
Note:						*p<0.1; **p<0.05; ***p<0.01

Table B.0.16:
Residential property
Model 2 results (2)

	Dependent variable:				
	location_value				
	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
builtuparea_pct (LA)	−0.0001*	−0.00002	0.00003	0.0001	−0.001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
restrictedland_pct (LA)	0.041***	0.062***	0.083***	−0.037***	−0.279***
	(0.010)	(0.007)	(0.009)	(0.008)	(0.016)
localplanrate (LA)	6.536***	−2.544***	−12.179***	−1.006	−6.510***
	(0.415)	(0.375)	(0.746)	(0.650)	(1.152)
lu_domestic_shr (OA)	−0.676***	−0.065	0.102	0.549***	1.020***
	(0.098)	(0.074)	(0.075)	(0.084)	(0.136)
lu_gardens_shr (OA)	0.099**	0.268***	0.162***	0.477***	0.799***
	(0.041)	(0.041)	(0.040)	(0.049)	(0.090)
lu_nondom_shr (OA)	0.151*	0.665***	0.616***	0.999***	1.765***
	(0.091)	(0.094)	(0.089)	(0.102)	(0.181)
lu_road_shr (OA)	−0.100	0.400***	0.046	−0.028	0.808***
	(0.080)	(0.080)	(0.080)	(0.077)	(0.133)
lu_rail_shr (OA)	−0.146*	0.827***	−0.436***	0.171*	0.714***
	(0.081)	(0.093)	(0.097)	(0.102)	(0.122)
lu_greenspace_shr (OA)	−0.069*	0.242***	0.167***	0.414***	0.799***
	(0.036)	(0.038)	(0.035)	(0.044)	(0.078)
lu_water_shr (OA)	−0.062*	0.251***	0.234***	0.491***	0.779***
	(0.038)	(0.039)	(0.038)	(0.078)	(0.084)
popdensity (OA)	−0.00003	0.0001***	0.00003	0.00004	0.0001***
	(0.00003)	(0.00003)	(0.00003)	(0.00002)	(0.00003)
imddecile2 (OA)	0.011***	0.010	0.011	0.007**	0.026***
	(0.004)	(0.008)	(0.007)	(0.003)	(0.005)
imddecile3 (OA)	0.028***	0.023***	0.018**	0.016***	0.032***
	(0.004)	(0.008)	(0.007)	(0.003)	(0.005)
imddecile4 (OA)	0.043***	0.032***	0.019***	0.031***	0.047***
	(0.004)	(0.007)	(0.007)	(0.003)	(0.005)
imddecile5 (OA)	0.046***	0.046***	0.044***	0.034***	0.075***
	(0.005)	(0.007)	(0.007)	(0.003)	(0.005)
imddecile6 (OA)	0.058***	0.068***	0.037***	0.028***	0.080***
	(0.005)	(0.007)	(0.006)	(0.003)	(0.005)
imddecile7 (OA)	0.062***	0.058***	0.046***	0.038***	0.094***
	(0.005)	(0.007)	(0.007)	(0.003)	(0.005)
imddecile8 (OA)	0.080***	0.059***	0.047***	0.045***	0.109***
	(0.005)	(0.008)	(0.006)	(0.004)	(0.005)
imddecile9 (OA)	0.078***	0.074***	0.051***	0.033***	0.117***
	(0.005)	(0.008)	(0.007)	(0.004)	(0.005)
imddecile10 (OA)	0.090***	0.087***	0.067***	0.036***	0.176***
	(0.005)	(0.008)	(0.007)	(0.004)	(0.006)
floodrisk:Low	0.041**	−0.039***	−0.041***	−0.009	−0.065***
	(0.018)	(0.009)	(0.011)	(0.014)	(0.016)
floodrisk:Medium	0.014	−0.016	−0.025*	0.021	−0.061***
	(0.022)	(0.011)	(0.014)	(0.015)	(0.016)
floodrisk:None	−0.003	−0.034***	−0.026**	0.003	−0.040***
	(0.017)	(0.008)	(0.011)	(0.013)	(0.015)
floodrisk:Very Low	0.085**	−0.066***	−0.052**	0.009	−0.047**
	(0.039)	(0.024)	(0.021)	(0.016)	(0.022)
noiseclass>=75.0		0.042		−0.130*	
		(0.086)		(0.067)	
noiseclass55.0-59.9	0.003	0.021***	0.009*	0.001	0.018***
	(0.005)	(0.004)	(0.005)	(0.003)	(0.006)
noiseclass60.0-64.9	0.007	0.021***	−0.006	0.002	−0.007
	(0.006)	(0.005)	(0.006)	(0.004)	(0.007)
noiseclass65.0-69.9	0.006	0.007	−0.013	−0.001	0.028**
	(0.010)	(0.009)	(0.011)	(0.007)	(0.012)
noiseclass70.0-74.9	−0.015	0.044	0.005	0.063***	0.006
	(0.020)	(0.029)	(0.024)	(0.023)	(0.031)
Observations	9,640	9,711	9,701	9,645	9,677
R^2	0.655	0.832	0.603	0.846	0.764
Adjusted R^2	0.653	0.831	0.600	0.844	0.762
Residual Std. Error	0.099	0.086	0.084	0.067	0.106
F Statistic	236.214***	605.255***	166.036***	458.839***	374.492***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table B.0.17:
Residential property
Model 2 results (3)

	Dependent variable:				
	location_value				
	CAMKOX	Cornwall-Devon	East Midlands	East England	Northeast
I(distance_airport >= 10)	−0.740***	0.105***	−0.231***	−0.014	−0.044**
	(0.065)	(0.012)	(0.019)	(0.011)	(0.020)
I((distance_airport <10) *log(distance_airport))	−0.325***	0.073***	−0.102***	−0.009	0.003
	(0.030)	(0.006)	(0.009)	(0.005)	(0.010)
I(distance_motorway >= 10)	−0.001	0.007	0.149***	−0.058***	0.0003
	(0.004)	(0.006)	(0.004)	(0.006)	(0.007)
I((distance_motorway <10) *log(distance_motorway))	0.012***	−0.009***	0.025***	0.014***	0.008***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
I(distance_aroad >= 10)			0.001	0.128***	0.402***
			(0.079)	(0.014)	(0.063)
I((distance_aroad <10) *log(distance_aroad))	−0.00004	−0.001*	0.003***	−0.003***	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
AONB	−0.196***	0.022**	−0.032	0.096***	0.069**
	(0.016)	(0.011)	(0.032)	(0.026)	(0.030)
I((drive_AONB >= 30))	−0.233***	−0.026**	−0.162***	−0.144***	−0.008
	(0.016)	(0.011)	(0.018)	(0.024)	(0.032)
I((drive_AONB <30) *log(1 + drive_AONB))	−0.076***	0.011***	−0.044***	−0.032***	−0.005
	(0.005)	(0.004)	(0.007)	(0.008)	(0.010)
natpark		0.269***	−0.118***	−0.027	0.235***
		(0.027)	(0.032)	(0.028)	(0.050)
I((drive_natpark >= 30))		0.258***	−0.221***	−0.037*	−0.080***
		(0.027)	(0.017)	(0.021)	(0.026)
I((drive_natpark <30) *log(1 + drive_natpark))		0.072***	−0.052***	−0.002	−0.001
		(0.009)	(0.005)	(0.007)	(0.008)
I(distance_coast >= 30)		−0.103***	0.209***	0.014*	0.091***
		(0.010)	(0.018)	(0.008)	(0.012)
I((distance_coast <30) *log(distance_coast))		−0.015***	0.040***	0.018***	0.003
		(0.001)	(0.005)	(0.002)	(0.002)
I(avgtime_station >= 30)	−0.046***	0.184***	−0.011	0.125***	−0.007
	(0.012)	(0.009)	(0.009)	(0.011)	(0.016)
I((avgtime_station <30) *log(1 + avgtime_station))	0.003	0.045***	−0.001	0.016***	0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
I((avgtime_town >= 30))	0.040***	0.063***	0.008	0.066***	0.109***
	(0.009)	(0.008)	(0.007)	(0.011)	(0.015)
I((avgtime_town <30) *log(1 + avgtime_town))	0.014***	0.002	−0.0005	0.016***	0.010***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.004)
Observations	9,563	9,682	9,703	9,700	9,722
R^2	0.877	0.722	0.693	0.878	0.616
Adjusted R^2	0.875	0.720	0.691	0.877	0.614
Residual Std. Error	0.068	0.071	0.079	0.098	0.122
F Statistic	585.514***	307.737***	315.638***	1,067.801***	238.537***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table B.0.18:
Residential property
Model 2 results (4)

	Dependent variable:
	location_value
	London
I((distance_airport <5) ∗log(distance_airport))	−0.064***
	(0.016)
I(distance_motorway >= 5)	−0.033***
	(0.006)
I((distance_motorway <5) ∗log(distance_motorway))	0.007*
	(0.004)
I(distance_station)	0.013***
	(0.003)
distance_tubestation	−0.036***
	(0.005)
I((avgtime_town >= 21))	−0.486***
	(0.114)
I((avgtime_town <21) ∗log(1 + avgtime_town))	−0.159***
	(0.037)
spline_avgtime_town1	0.149***
	(0.048)
spline_avgtime_town2	0.237***
	(0.074)
spline_avgtime_town3	0.370***
	(0.084)
spline_avgtime_town4	0.399***
	(0.083)
spline_avgtime_town5	0.443***
	(0.087)
spline_avgtime_station1	−0.071***
	(0.028)
spline_avgtime_station2	−0.042*
	(0.025)
spline_avgtime_station3	−0.044*
	(0.026)
spline_avgtime_station4	−0.043
	(0.026)
spline_avgtime_station5	−0.204***
	(0.046)
spline_avgtime_tubestation1	0.069**
	(0.027)
spline_avgtime_tubestation2	0.070***
	(0.025)
spline_avgtime_tubestation3	0.037
	(0.025)
spline_avgtime_tubestation4	0.053**
	(0.026)
spline_avgtime_tubestation5	0.060
	(0.046)
Observations	9,746
R^2	0.802
Adjusted R^2	0.800
Residual Std. Error	0.144
F Statistic	238.537***
Note:	*p<0.1; **p<0.05; ***p<0.01

Table B.0.19:
Residential property
Model 2 results (5)

	Dependent variable:				
	location_value				
	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
I(distance_airport >= 10)	−0.213***	0.089***	0.153***	−0.275***	−0.348***
	(0.016)	(0.012)	(0.018)	(0.012)	(0.018)
I((distance_airport <10) ∗log(distance_airport))	−0.072***	0.039***	0.098***	−0.110***	−0.124***
	(0.008)	(0.006)	(0.008)	(0.006)	(0.009)
I(distance_motorway >= 10)	0.072***	0.065***	0.044***	0.012***	0.123***
	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)
I((distance_motorway <10) ∗log(distance_motorway))	0.013***	0.007***	0.019***	−0.003**	0.030***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
I(distance_aroad >= 10)	0.014				−0.197***
	(0.054)				(0.046)
I((distance_aroad <10) ∗log(distance_aroad))	0.001	0.005***	−0.005***	−0.0002	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
AONB	−0.080*	0.158***	0.055*	0.039*	−0.036
	(0.045)	(0.025)	(0.030)	(0.020)	(0.059)
I((drive_AONB >= 30))	−0.114***	0.123***	0.028	0.049***	0.0004
	(0.042)	(0.025)	(0.030)	(0.018)	(0.059)
I((drive_AONB <30) ∗log(1 + drive_AONB))	−0.019	0.031***	0.003	0.014***	−0.002
	(0.016)	(0.008)	(0.010)	(0.005)	(0.019)
natpark	0.211***	0.039***	0.069		0.111**
	(0.038)	(0.013)	(0.056)		(0.047)
I((drive_natpark >= 30))	0.121***	0.056***	−0.002	−0.072	0.034
	(0.032)	(0.013)	(0.037)	(0.054)	(0.044)
I((drive_natpark <30) ∗log(1 + drive_natpark))	0.065***	0.013***	0.017	−0.019	0.015
	(0.010)	(0.004)	(0.012)	(0.017)	(0.014)
I(distance_coast >= 30)	−0.040***	−0.026***	−0.039***	−0.295	0.105***
	(0.007)	(0.006)	(0.007)	(0.218)	(0.014)
I((distance_coast <30) ∗log(distance_coast))	−0.009***	0.001	−0.002	−0.088	0.016***
	(0.002)	(0.001)	(0.001)	(0.067)	(0.003)
I(avgtime_station >= 30)	0.054***	−0.014	0.013	−0.050***	0.007
	(0.009)	(0.011)	(0.011)	(0.009)	(0.012)
I((avgtime_station <30) ∗log(1 + avgtime_station))	0.019***	−0.014***	−0.004	−0.020***	0.015***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
I((avgtime_town >= 30))	−0.066***	0.058***	0.052***	0.022***	−0.019*
	(0.008)	(0.010)	(0.010)	(0.008)	(0.011)
I((avgtime_town <30) ∗log(1 + avgtime_town))	−0.018***	0.014***	0.018***	0.004*	−0.008**
	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)
Observations	9,640	9,711	9,701	9,645	9,677
R^2	0.655	0.832	0.603	0.846	0.764
Adjusted R^2	0.653	0.831	0.600	0.844	0.762
Residual Std. Error	0.099	0.086	0.084	0.067	0.106
F Statistic	236.214***	605.255***	166.036***	458.839***	374.492***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table B.0.20:
Residential property
Destinations (1)

CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
Badby	Bude	Northampton	Cambridge	Trafalgar Square	Annitsford
Bletsoe Bedford	Challacombe	Stamford	Southend-on-Sea	Charing Cross Station	Corbridge
Botley	Crockernwell	Eyam	Norwich	Euston Station	Craster
Cambridge	Croyde	West Bridgford	Colchester	King's Cross Station	Darlington
Colmworth	Helford	Oadby	Liverpool Street Station	Liverpool Street Station	Nunthorpe
Ducklington	Kingsand	Daventry	St Pancras Station	London Bridge Station	
Fringford	Otterton		Marylebone Station	Marylebone Station	
Fritwell	Padstow		Euston Station	Paddington Station	
Great Chishill	Salcombe		London King's Cross	St Pancras Station	
Great Houghton Northampton	St Agnes			Waterloo Station	
Hadenham	St Austell				
Heythrop	St Ives				
Oxford					
Stoke Mandeville					
Upper Basildon					
Wheatley					
Woburn					
Worlds End Newbury					
Liverpool Street Station					
St Pancras Station					
Marylebone Station					
Euston Station					
Paddington Station					
London King's Cross					

Table B.0.21:
Residential property
Destinations (2)

Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
Bury	Brighton	Alton Pancras	Abberley	Doncaster
Seatoller	Canterbury	Bath	Belfry Hotel	Harrogate
Tebay	Chalfont St Giles	Chipping Campden	Buxton	Kingston upon Hull
Warrington	Dorking	Christchurch	Chilcote	Leeds
Widnes	Hampton Court Palace	Clifton	Kenilworth	Osmotherley
Wilmslow	Guildford	Dundry	Kilpeck	Sheffield
Windermere	Oxford	Hungerford	Lapworth	York
Wirral	Euston Station	Minehead	Lichfield Trent Valley	Middlesbrough
	London Bridge Station	Portishead	Moreton-in-March	Scunthorpe
	Marylebone Station	West Littleton	Pipe Aston	Skipton
	Paddington Station	West Stafford	Princethorpe	Driffield
	Victoria Station		Shrewsbury	
	Waterloo Station		Sutton Coldfield	
			Weethley	
			Wellesbourne	
			Weston Heath	
			Wetwood Stafford	
			Wilmcote	

Table B.0.22:
Commercial property
Model 2 results (1)

	Dependent variable:					
	location_value					
	CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
builtuparea_pct	0.004***	0.001***	0.001***	0.001***	0.003***	0.001***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0004)	(0.0002)
restrictedland_pct	0.165***	0.155***	0.021***	0.110***	0.103**	−0.109***
	(0.018)	(0.018)	(0.008)	(0.011)	(0.048)	(0.026)
localplanrate	6.603***	−10.203***	0.687**	3.011***	−5.111***	10.020***
	(0.475)	(1.133)	(0.312)	(0.584)	(0.421)	(1.874)
lu_domestic_shr	−2.417***	0.044	−1.727***	−0.625***	0.889***	−1.147***
	(0.173)	(0.150)	(0.095)	(0.118)	(0.082)	(0.135)
lu_gardens_shr	−0.792***	0.263***	−0.472***	0.077*	−0.211***	−0.005
	(0.082)	(0.089)	(0.050)	(0.044)	(0.051)	(0.077)
lu_nondom_shr	−0.894***	2.068***	−0.823***	0.182*	0.653***	0.014
	(0.133)	(0.212)	(0.106)	(0.093)	(0.063)	(0.145)
lu_road_shr	0.971***	−0.639***	−0.200**	0.416***	0.479***	0.280**
	(0.160)	(0.172)	(0.088)	(0.104)	(0.100)	(0.140)
lu_rail_shr	−1.455***	1.285***	−0.612***	0.519***	0.859***	−0.227*
	(0.199)	(0.172)	(0.085)	(0.096)	(0.084)	(0.123)
lu_greenspace_shr	−0.707***	0.047	−0.632***	−0.048	0.263***	−0.213***
	(0.070)	(0.074)	(0.042)	(0.036)	(0.046)	(0.064)
lu_water_shr	−1.269***	0.139*	−0.686***	−0.014	0.539***	0.049
	(0.102)	(0.080)	(0.052)	(0.038)	(0.050)	(0.072)
popdensityOA	0.0001	−0.0001***	−0.00002	−0.0002***	−0.0001***	−0.0004***
	(0.0001)	(0.00005)	(0.00003)	(0.00005)	(0.00003)	(0.0001)
imddecile2	0.103***	0.019***	0.005	0.045***	0.010	−0.013**
	(0.014)	(0.006)	(0.004)	(0.006)	(0.009)	(0.005)
imddecile3	0.040***	0.100***	0.013***	0.038***	0.027***	0.017***
	(0.014)	(0.006)	(0.004)	(0.006)	(0.009)	(0.006)
imddecile4	0.049***	0.075***	0.008*	0.028***	0.096***	0.065***
	(0.012)	(0.006)	(0.004)	(0.006)	(0.009)	(0.006)
imddecile5	0.172***	0.062***	0.016***	0.029***	0.107***	0.036***
	(0.013)	(0.006)	(0.005)	(0.006)	(0.010)	(0.006)
imddecile6	0.078***	0.103***	0.040***	0.021***	0.099***	0.031***
	(0.013)	(0.006)	(0.005)	(0.006)	(0.010)	(0.008)
imddecile7	0.180***	0.101***	0.041***	0.027***	0.139***	0.041***
	(0.013)	(0.007)	(0.005)	(0.006)	(0.010)	(0.007)
imddecile8	0.136***	0.096***	0.056***	0.042***	0.129***	0.103***
	(0.013)	(0.007)	(0.005)	(0.006)	(0.012)	(0.008)
imddecile9	0.161***	0.132***	0.074***	0.020***	0.122***	0.072***
	(0.013)	(0.008)	(0.005)	(0.007)	(0.012)	(0.009)
imddecile10	0.148***	0.081***	0.086***	0.055***	0.067***	0.068***
	(0.013)	(0.014)	(0.007)	(0.007)	(0.021)	(0.011)
prob_4bandLow	−0.018	0.017**	0.007	−0.020**	0.044**	0.007
	(0.013)	(0.008)	(0.008)	(0.009)	(0.021)	(0.021)
prob_4bandMedium	0.007	0.017**	−0.010	−0.055***	0.034	0.143***
	(0.016)	(0.008)	(0.008)	(0.011)	(0.027)	(0.023)
prob_4bandNone	−0.018	0.011*	0.009	−0.010	0.073***	0.054***
	(0.012)	(0.006)	(0.008)	(0.009)	(0.021)	(0.019)
prob_4bandVery Low	−0.086	0.073***	0.045***	−0.043***	0.059	0.180***
	(0.081)	(0.015)	(0.015)	(0.013)	(0.053)	(0.040)
Observations	9,652	9,687	9,704	9,651	9,748	9,703
R^2	0.620	0.550	0.508	0.844	0.833	0.573
Adjusted R^2	0.618	0.548	0.506	0.842	0.832	0.570
Residual Std. Error	0.139	0.109	0.092	0.099	0.169	0.140
F Statistic	306.924***	190.085***	191.987***	580.891***	847.523***	198.732***
Note:						*p<0.1; **p<0.05; ***p<0.01

Table B.0.23:
Commercial property
Model 2 results (2)

	Dependent variable:				
	location_value				
	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
builtuparea_pct	−0.001***	0.0003***	0.001***	−0.001***	−0.001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
restrictedland_pct	−0.039***	0.069***	0.066***	−0.050***	−0.036*
	(0.011)	(0.007)	(0.009)	(0.011)	(0.019)
localplanrate	10.362***	1.919***	2.684***	−8.018***	12.156***
	(0.485)	(0.375)	(0.738)	(0.879)	(1.363)
lu_domestic_shr	−2.166***	−0.028	−0.365***	0.258***	−0.583***
	(0.102)	(0.074)	(0.074)	(0.097)	(0.142)
lu_gardens_shr	0.229***	−0.106***	0.219***	0.228***	0.513***
	(0.052)	(0.036)	(0.043)	(0.062)	(0.081)
lu_nondom_shr	0.601***	0.015	0.919***	0.437***	1.787***
	(0.094)	(0.082)	(0.084)	(0.123)	(0.153)
lu_road_shr	0.853***	0.372***	1.752***	0.786***	0.108
	(0.087)	(0.080)	(0.081)	(0.091)	(0.125)
lu_rail_shr	0.179*	−0.009	−0.101	0.965***	0.289***
	(0.092)	(0.102)	(0.096)	(0.118)	(0.108)
lu_greenspace_shr	−0.022	−0.043	0.411***	0.288***	0.180***
	(0.042)	(0.032)	(0.032)	(0.051)	(0.067)
lu_water_shr	−0.030	−0.004	0.437***	1.225***	0.291***
	(0.045)	(0.033)	(0.034)	(0.095)	(0.074)
popdensityOA	−0.0001***	0.00004*	−0.0001	−0.0001***	0.00000
	(0.00004)	(0.00002)	(0.00003)	(0.00003)	(0.00004)
imddecile2	0.027***	0.028***	0.039***	0.029***	0.011**
	(0.004)	(0.005)	(0.005)	(0.003)	(0.004)
imddecile3	0.054***	0.025***	0.046***	0.064***	0.028***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
imddecile4	0.053***	0.025***	0.039***	0.045***	0.030***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)
imddecile5	0.062***	0.025***	0.065***	0.053***	0.054***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)
imddecile6	0.062***	0.043***	0.069***	0.051***	0.042***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
imddecile7	0.057***	0.046***	0.058***	0.065***	0.049***
	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
imddecile8	0.078***	0.045***	0.056***	0.068***	0.073***
	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)
imddecile9	0.075***	0.054***	0.071***	0.046***	0.030***
	(0.007)	(0.006)	(0.006)	(0.005)	(0.006)
imddecile10	0.089***	0.069***	0.054***	0.062***	0.074***
	(0.008)	(0.006)	(0.006)	(0.007)	(0.008)
prob_4bandLow	−0.025*	−0.024***	0.021***	0.050***	−0.009
	(0.014)	(0.006)	(0.007)	(0.010)	(0.010)
prob_4bandMedium	−0.028*	−0.012	0.014*	0.052***	−0.031***
	(0.017)	(0.007)	(0.008)	(0.011)	(0.010)
prob_4bandNone	−0.025*	−0.025***	0.009	0.053***	0.004
	(0.013)	(0.005)	(0.006)	(0.009)	(0.009)
prob_4bandVery Low	0.014	−0.047***	0.029**	0.006	−0.068***
	(0.055)	(0.017)	(0.013)	(0.013)	(0.016)
Observations	9,689	9,679	9,679	9,708	9,695
R^2	0.627	0.807	0.643	0.661	0.693
Adjusted R^2	0.624	0.805	0.640	0.657	0.690
Residual Std. Error	0.118	0.085	0.089	0.089	0.115
F Statistic	248.746***	436.443***	196.625***	203.418***	214.276***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table B.0.24: Commercial property Model 2 results (3)

	Dependent variable:					
	location_value					
	CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
I(distance_airport >= 10)	0.649***	−0.046***	−0.053***	−0.105***		−0.445***
	(0.129)	(0.016)	(0.016)	(0.011)		(0.036)
I((distance_airport <10) *log(distance_airport))	0.305***	−0.002	−0.023***	−0.024***		−0.162***
	(0.059)	(0.008)	(0.008)	(0.005)		(0.016)
I(distance_motorway >= 10)	−0.060***	0.050***	0.017***	−0.007		0.026***
	(0.006)	(0.010)	(0.005)	(0.007)		(0.008)
I((distance_motorway <10) *log(distance_motorway))	−0.016***	0.008**	−0.004**	0.005**		−0.008***
	(0.003)	(0.004)	(0.002)	(0.002)		(0.003)
I(distance_aroad >= 10)		0.236***		0.045***		0.162***
		(0.056)		(0.014)		(0.043)
I((distance_aroad <10) *log(distance_aroad))	−0.008***	−0.002***	−0.003***	−0.007***		0.006***
	(0.001)	(0.001)	(0.001)	(0.001)		(0.001)
AONB	0.041*	0.210***	−0.024	0.628***		0.284***
	(0.024)	(0.021)	(0.023)	(0.032)		(0.021)
I((drive_AONB >= 30))	0.033	0.226***	0.057***	0.425***		0.208***
	(0.024)	(0.021)	(0.021)	(0.032)		(0.025)
I((drive_AONB <30) *log(1 + drive_AONB))	−0.001	0.089***	0.009	0.167***		0.093***
	(0.008)	(0.007)	(0.007)	(0.009)		(0.008)
natpark		0.159***	0.070***	0.099***		−0.320***
		(0.025)	(0.013)	(0.020)		(0.055)
I((drive_natpark >= 30))		0.154***	−0.220***	0.378***		−0.350***
		(0.024)	(0.012)	(0.021)		(0.038)
I((drive_natpark <30) *log(1 + drive_natpark))		0.056***	−0.057***	0.108***		−0.094***
		(0.009)	(0.004)	(0.006)		(0.011)
I(distance_coast >= 30)		−0.142***	0.006	0.066***		−0.058***
		(0.014)	(0.014)	(0.009)		(0.012)
I((distance_coast <30) *log(distance_coast))		−0.015***	−0.037***	0.015***		0.016***
		(0.001)	(0.004)	(0.002)		(0.003)
I(avgtime_station >= 30)	−0.164***	0.005	−0.007	0.043***		−0.138***
	(0.018)	(0.012)	(0.009)	(0.011)		(0.017)
I((avgtime_station <30) *log(1 + avgtime_station))	−0.056***	0.012***	0.009***	−0.002		−0.064***
	(0.005)	(0.004)	(0.003)	(0.003)		(0.005)
I((avgtime_town >= 30))	−0.001	0.057***	−0.036***	0.004		0.099***
	(0.015)	(0.011)	(0.008)	(0.010)		(0.014)
I((avgtime_town <30) *log(1 + avgtime_town))	0.004	0.015***	−0.021***	−0.001		0.011***
	(0.004)	(0.003)	(0.003)	(0.003)		(0.004)
I(distance_airport >= 5)					−0.164***	
					(0.027)	
I((distance_airport <5) *log(distance_airport))					−0.047**	
					(0.020)	
I(distance_motorway >= 5)					−0.019***	
					(0.007)	
I((distance_motorway <5) *log(distance_motorway))					0.019***	
					(0.005)	
I(distance_station)					0.021***	
					(0.004)	
distance_tubestation					−0.015**	
					(0.006)	
I((avgtime_town >= 21))					−0.791***	
					(0.174)	
I((avgtime_town <21) *log(1 + avgtime_town))					−0.239***	
					(0.054)	
spline_avgtime_town1					0.198***	
					(0.066)	
spline_avgtime_town2					0.329***	
					(0.093)	
spline_avgtime_town3					0.522***	
					(0.124)	
spline_avgtime_town4					0.495***	
					(0.120)	
spline_avgtime_town5					0.630***	
					(0.123)	
spline_avgtime_station1					−0.076**	
					(0.037)	
spline_avgtime_station2					−0.051	
					(0.034)	
spline_avgtime_station3					−0.070**	
					(0.035)	
spline_avgtime_station4					−0.004	
					(0.036)	
spline_avgtime_station5					−0.163***	
					(0.051)	
spline_avgtime_tubestation1					0.069**	
					(0.035)	
spline_avgtime_tubestation2					0.030	
					(0.033)	
spline_avgtime_tubestation3					0.012	
					(0.034)	
spline_avgtime_tubestation4					−0.016	
					(0.034)	
spline_avgtime_tubestation5					0.031	
					(0.055)	
Observations	9,652	9,687	9,704	9,651	9,748	9,703
R^2	0.620	0.550	0.508	0.844	0.833	0.573
Adjusted R^2	0.618	0.548	0.506	0.842	0.832	0.570
Residual Std. Error	0.139	0.109	0.092	0.099	0.169	0.140
F Statistic	306.924***	190.085***	191.987***	580.891***	847.523***	198.732***

Note: *p<0.1; **p<0.05; ***p<0.01

Table B.0.25:
Commercial property
Model 2 results (4)

	Dependent variable:				
	location_value				
	Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
I(distance_airport >= 10)	−0.168***	0.047***	0.067***	0.079***	0.243***
	(0.015)	(0.011)	(0.018)	(0.018)	(0.021)
I((distance_airport <10) ∗log(distance_airport))	−0.057***	0.020***	0.013	0.001	0.104***
	(0.007)	(0.006)	(0.009)	(0.008)	(0.010)
I(distance_motorway >= 10)	0.032***	−0.030***	−0.017***	−0.012**	0.105***
	(0.006)	(0.004)	(0.006)	(0.005)	(0.008)
I((distance_motorway <10) ∗log(distance_motorway))	−0.002	−0.008***	−0.0001	−0.006***	−0.016***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
I(distance_aroad >= 10)	−0.145**				−0.141***
	(0.070)				(0.042)
I((distance_aroad <10) ∗log(distance_aroad))	−0.003***	−0.002***	−0.004***	0.0002	−0.0005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
AONB	0.015	0.096***	−0.087***	0.030	0.008
	(0.039)	(0.031)	(0.028)	(0.026)	(0.050)
I((drive_AONB >= 30))	0.012	0.066**	−0.113***	0.062**	0.118**
	(0.032)	(0.031)	(0.027)	(0.024)	(0.049)
I((drive_AONB <30) ∗log(1 + drive_AONB))	0.002	0.045***	−0.049***	0.011	0.040**
	(0.013)	(0.010)	(0.009)	(0.007)	(0.016)
natpark	−0.082**	0.010	−0.086*	0.030	0.014
	(0.041)	(0.013)	(0.046)	(0.106)	(0.035)
I((drive_natpark >= 30))	−0.092**	0.065***	−0.068	−0.317***	0.019
	(0.041)	(0.014)	(0.044)	(0.056)	(0.035)
I((drive_natpark <30) ∗log(1 + drive_natpark))	−0.029**	0.022***	−0.022	−0.086***	0.003
	(0.013)	(0.004)	(0.014)	(0.017)	(0.011)
I(distance_coast >= 30)	0.049***	0.056***	0.041***	−0.057	0.070***
	(0.006)	(0.008)	(0.006)	(0.181)	(0.013)
I((distance_coast <30) ∗log(distance_coast))	0.002	0.011***	0.004***	0.003	−0.001
	(0.002)	(0.001)	(0.001)	(0.056)	(0.003)
I(avgtime_station >= 30)	−0.048***	0.064***	−0.061***	−0.028**	0.025**
	(0.009)	(0.010)	(0.010)	(0.012)	(0.012)
I((avgtime_station <30) ∗log(1 + avgtime_station))	−0.026***	0.014***	−0.023***	−0.012***	−0.002
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
I((avgtime_town >= 30))	−0.116***	−0.064***	0.002	−0.012	0.042***
	(0.009)	(0.009)	(0.007)	(0.010)	(0.013)
I((avgtime_town <30) ∗log(1 + avgtime_town))	−0.033***	−0.031***	0.002	−0.004	0.016***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)
Observations	9,689	9,679	9,679	9,708	9,695
R^2	0.627	0.807	0.643	0.661	0.693
Adjusted R^2	0.624	0.805	0.640	0.657	0.690
Residual Std. Error	0.118	0.085	0.089	0.089	0.115
F Statistic	248.746***	436.443***	196.625***	203.418***	214.276***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table B.0.26:
Commercial property
Destinations (1)

CAMKOX	Cornwall-Devon	East Midlands	East England	London	Northeast
Cambridge	Barnstaple	Leicester	Cambridge	Trafalgar Square	Middlesbrough
Oxford	Exeter	Nottingham	Norwich	Heathrow Airport	Newcastle upon Tyne
	Falmouth	Peak District National Park	Liverpool Street Station	Stansted Airport	Manchester
	Plymouth	Grantham	London King's Cross	Gatwick Airport	Leeds
		Banbury			

Table B.0.27:
Commercial property
Destinations (2)

Northwest	Southeast	Southwest	West Midlands	Yorkshire-Humber
Manchester	Brighton	Bristol	Birmingham	Bradford
Liverpool	Southampton	Bournemouth	Wolverhampton	Harrogate
Windermere	Euston Station	Victoria Station	Coventry	Leeds
	Victoria Station	Reading	Stoke on Trent	Ripon
	Guildford			Sheffield
				York
				Middlesbrough

C Predicted impact of sample investment projects

C.1 CAMKOX Region
Housing project: construction of 100 houses
Location: near Oxford

Table C.1.1: Settlement details

Variable	Value
Location	Near Oxford
Centroid (longitude,latitude)	(-1.29824, 51.7259798)
Area (square km.)	11.29
Number of dwellings	100
Population density	35

Other characteristics of the new town are chosen to be similar to Oxford local authority.

Table C.1.2: Property prices (units = year 2017 GBP)

Statistic	Mean	Min	Pctl(25)	Median	Pctl(75)	Max
New residential price	450,930	190,960	359,745	403,564	481,893	1,376,164
New commercial price	9,387,224	4,079,200	7,727,693	8,792,259	10,147,490	31,684,483
Average new price	897,745	214,372	728,142	822,999	965,173	2,891,580
Average increase (low cost)	682,226	−1,151	512,618	607,476	749,650	2,676,057
Average increase (medium cost)	621,951	−61,427	452,343	547,201	689,374	2,615,782
Average increase (high cost)	394,629	−288,748	225,021	319,879	462,052	2,388,782
Percent increase (low cost)	417%					
Percent increase (medium cost)	326%					
Percent increase (high cost)	178%					

Rows 1 and 2 present statistics on the distribution of new prices for residential and commercial property. Row 3 presents statistics on the average increase across all properties. These results assume 95% of properties are residential and 5% commercial. The average increase figures (low, medium, and high) measure the average gain in property value assuming all land in the settlement previously was farmland and was purchased at prices per acre of £7,727, £9,888, and £18,038 respectively. The final rows present the percentage increase in property values over the assumed baseline agricultural land values in the three scenarios with low medium, and high agricultural land values.

C.2 CAMKOX Region
Road improvement project: 10% reduction in driving times
Location: entire region

Table C.2.1: Change in Avg. time (minutes): (new minus old)

Statistic	BAD	BLT	BOT	CAM	CLM	DUC
Mean	−6.5	−5.7	−6.4	−7.7	−5.8	−7.3
Min	−10.6	−11.6	−12.6	−14.6	−12.2	−13.8
Pctl(25)	−7.7	−8.2	−8.9	−11.5	−8.8	−10.0
Median	−6.5	−5.0	−6.1	−7.2	−4.7	−6.9
Pctl(75)	−5.2	−3.5	−3.8	−4.9	−3.5	−4.4
Max	−1.2	−0.04	−0.7	−0.7	−0.003	−0.6
St. Dev.	2.0	2.7	3.4	3.8	3.1	3.5

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Badby, Bletsoe, Botley, Cambridge, Colmworth and Ducklington.

Table C.2.2: Change in Avg. time (minutes): (new minus old)

Statistic	FRG	FRT	GCH	GHN	HAD	HTP
Mean	−5.2	−5.6	−7.6	−5.8	−5.5	−7.1
Min	−10.3	−11.0	−14.1	−10.3	−10.5	−13.7
Pctl(25)	−6.6	−7.1	−10.7	−7.1	−6.9	−9.0
Median	−4.7	−4.9	−7.0	−5.8	−5.1	−6.8
Pctl(75)	−3.6	−3.9	−4.8	−4.2	−4.0	−5.0
Max	−0.2	−0.4	−1.0	−0.9	−0.01	−0.6
St. Dev.	2.2	2.4	3.1	1.9	2.4	2.9

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Fringford, Fritwell, Great Chishill, Great Houghton, Hadenham, and Heythrop.

Table C.2.3: Change in Avg. time (minutes): (new minus old)

Statistic	OXF	STO	UPB	WHE	WOB	WOR
Mean	−6.3	−5.5	−7.5	−5.9	−4.9	−7.9
Min	−12.4	−10.2	−13.7	−11.7	−10.0	−14.5
Pctl(25)	−8.6	−6.8	−9.9	−8.0	−6.7	−10.6
Median	−5.9	−5.6	−7.8	−5.4	−4.9	−8.3
Pctl(75)	−3.8	−4.1	−4.9	−3.6	−2.7	−4.5
Max	−0.7	−0.05	−0.8	−0.04	−0.5	−1.0
St. Dev.	3.3	2.1	3.3	3.0	2.5	3.7

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Oxford, Stoke Mandeville, Upper Basildon, Wheatley, Woburn, and Worlds End.

Table C.2.4: Change in Avg. time (minutes): (new minus old)

Statistic	LON	Town	AONB	Motorway	A-road	Station
Mean	−7.0	−1.1	−3.0	−1.6	−0.8	−1.1
Min	−15.4	−4.5	−6.9	−6.1	−8.0	−5.2
Pctl(25)	−9.2	−1.3	−4.2	−2.1	−0.9	−1.2
Median	−7.1	−1.0	−2.8	−1.4	−0.7	−0.9
Pctl(75)	−5.5	−0.7	−1.8	−1.0	−0.6	−0.7
Max	−0.01	0.0	0.0	−0.01	−0.000	−0.000
St. Dev.	3.1	0.6	1.6	0.8	0.4	0.5

Each column lists statistics of the change in travel times to the destination listed in the column heading. LON is London, Town is the nearest town, AONB is the nearest Area of Outstanding Natural Beauty, and Station is the nearest rail station.

Table C.2.5: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	269, 234	272, 420	3, 186
Min	61, 520	65, 703	−26, 443
Pctl(25)	182, 515	184, 381	870
Median	239, 366	242, 392	2, 983
Pctl(75)	321, 120	324, 883	5, 140
Max	1, 234, 192	1, 249, 422	57, 894
St. Dev.	127, 468	128, 923	4, 690

The project area is approximately 5.4×10^4 square kilometres. It is located near Cambridge, Milton Keynes, and Oxford. The project aims to reduce travel times to all destinations to 90 % of baseline travel times.

Table C.2.6: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	450, 453	464, 531	14, 078
Min	6, 940	7, 280	−137, 001
Pctl(25)	103, 250	106, 466	2, 716
Median	210, 402	217, 263	6, 318
Pctl(75)	446, 215	460, 419	14, 070
Max	25, 231, 580	26, 076, 601	845, 021
St. Dev.	853, 874	881, 161	29, 994

The project area is approximately 5.4×10^4 square kilometres. It is located near Cambridge, Milton Keynes, and Oxford. The project aims to reduce travel times to all destinations to 90 % of baseline travel times.

C.3 CAMKOX Region
Public transport improvement project: 10% reduction in travel times
Location: entire region

Table C.3.1: Change in Avg. time (minutes): (new minus old)

Statistic	BAD	BLT	BOT	CAM	CLM	DUC
Mean	−13.2	−12.4	−12.8	−14.4	−12.5	−15.0
Min	−25.9	−24.1	−25.1	−26.4	−25.3	−26.7
Pctl(25)	−15.5	−16.4	−17.8	−18.0	−17.1	−20.2
Median	−13.4	−11.9	−12.9	−16.2	−11.3	−15.6
Pctl(75)	−10.9	−9.0	−8.0	−11.2	−8.8	−9.7
Max	−3.6	−0.01	−2.0	−1.4	−0.002	−2.2
St. Dev.	3.2	4.7	5.4	5.2	5.2	5.7

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Badby, Bletsoe, Botley, Cambridge, Colmworth and Ducklington.

Table C.3.2: Change in Avg. time (minutes): (new minus old)

Statistic	FRG	FRT	GCH	GHN	HAD	HTP
Mean	−11.6	−12.0	−13.2	−13.0	−11.9	−14.8
Min	−25.6	−25.9	−26.2	−25.3	−23.5	−27.8
Pctl(25)	−14.3	−15.8	−14.6	−16.1	−15.1	−19.7
Median	−10.7	−10.8	−13.4	−13.3	−11.6	−14.5
Pctl(75)	−8.6	−9.0	−11.0	−9.9	−9.0	−10.1
Max	−1.5	−1.4	−0.6	−2.2	−1.0	−1.3
St. Dev.	4.4	4.7	3.6	3.7	4.3	5.4

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Fringford, Fritwell, Great Chishill, Great Houghton, Hadenham, and Heythrop.

Table C.3.3: Change in Avg. time (minutes): (new minus old)

Statistic	OXF	STO	UPB	WHE	WOB	WOR
Mean	−12.5	−11.9	−13.3	−12.1	−11.2	−13.7
Min	−25.1	−21.8	−23.4	−24.8	−20.6	−22.8
Pctl(25)	−17.3	−14.9	−16.6	−16.1	−14.8	−17.3
Median	−12.6	−12.4	−14.5	−11.8	−12.0	−15.5
Pctl(75)	−8.0	−9.1	−9.6	−7.8	−6.9	−9.5
Max	−2.0	−1.3	−1.7	−1.3	−0.5	−2.7
St. Dev.	5.4	4.0	4.2	4.9	4.4	4.5

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Oxford, Stoke Mandeville, Upper Basildon, Wheatley, Woburn, and Worlds End.

Table C.3.4: Change in Avg. time (minutes): (new minus old)

Statistic	LON	Town	Station
Mean	−16.5	−3.4	−3.4
Min	−39.7	−35.1	−33.0
Pctl(25)	−19.9	−3.9	−3.9
Median	−16.8	−2.9	−2.7
Pctl(75)	−13.3	−2.2	−2.1
Max	−1.0	−0.000	−0.03
St. Dev.	7.5	2.2	2.2

Each column lists statistics of the change in travel times to the destination listed in the column heading. LON is London and Town is the nearest town.

Table C.3.5: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	269,234	270,182	948
Min	61,520	63,169	−7,806
Pctl(25)	182,515	183,169	279
Median	239,366	240,350	728
Pctl(75)	321,120	322,246	1,398
Max	1,234,192	1,238,754	51,912
St. Dev.	127,468	127,903	1,860

The project area is approximately 5.4×10^4 square kilometres. It is located near Cambridge, Milton Keynes, and Oxford. The project aims to reduce travel times to all destinations to 90 % of baseline travel times.

Table C.3.6: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	450,453	454,789	4,335
Min	6,940	7,033	−81,599
Pctl(25)	103,250	104,274	944
Median	210,402	212,487	1,973
Pctl(75)	446,215	450,329	4,187
Max	25,231,580	25,428,810	242,420
St. Dev.	853,874	862,031	9,060

The project area is approximately 5.4×10^4 square kilometres. It is located near Cambridge, Milton Keynes, and Oxford. The project aims to reduce travel times to all destinations to 90 % of baseline travel times.

C.4 CAMKOX Region
Road investment project: 10% reduction in driving times
Location: Oxford

Table C.4.1: Change in Avg. time (minutes): (new minus old)

Statistic	BAD	BLT	BOT	CAM	CLM	DUC
Mean	−0.3	−0.4	−0.1	−0.6	−0.4	−0.1
Min	−5.5	−8.6	−1.7	−12.3	−9.3	−3.2
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	1.1	1.8	0.3	2.5	1.9	0.6

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Badby, Bletsoe, Botley, Cambridge, Colmworth and Ducklington.

Table C.4.2: Change in Avg. time (minutes): (new minus old)

Statistic	FRG	FRT	GCH	GHN	HAD	HTP
Mean	−0.2	−0.2	−0.5	−0.3	−0.1	−0.2
Min	−3.8	−3.6	−11.9	−6.9	−3.8	−3.9
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.7	0.7	2.4	1.4	0.6	0.8

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Fringford, Fritwell, Great Chishill, Great Houghton, Hadenham, and Heythrop.

Table C.4.3: Change in Avg. time (minutes): (new minus old)

Statistic	OXF	STO	UPB	WHE	WOB	WOR
Mean	−0.05	−0.2	−0.2	−0.1	−0.3	−0.2
Min	−1.3	−5.1	−4.2	−2.1	−7.2	−4.0
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.2	0.9	0.8	0.3	1.4	0.8

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Oxford, Stoke Mandeville, Upper Basildon, Wheatley, Woburn, and Worlds End.

Table C.4.4: Change in Avg. time (minutes): (new minus old)

Statistic	LON	Town	AONB	Motorway	A-road	Station
Mean	−0.5	−0.05	−0.1	−0.1	−0.04	−0.1
Min	−10.5	−1.3	−3.3	−2.2	−0.9	−1.4
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	2.1	0.2	0.6	0.3	0.2	0.2

Each column lists statistics of the change in travel times to the destination listed in the column heading. LON is London, Town is the nearest town, AONB is the nearest Area of Outstanding Natural Beauty, and Station is the nearest rail station.

Table C.4.5: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	269,234	269,537	303
Min	61,520	61,520	−16,857
Pctl(25)	182,515	182,563	0
Median	239,366	239,472	0
Pctl(75)	321,120	321,352	0
Max	1,234,192	1,234,192	23,333
St. Dev.	127,468	127,863	1,971

This table shows the distribution of property prices across all properties in the region

Table C.4.6: Commercial property prices (units = year 2017 GBP)

Statistic	Base Price	New price	Change in price
Mean	450,453	450,853	400
Min	6,940	6,940	−137,001
Pctl(25)	103,250	103,250	0
Median	210,402	210,571	0
Pctl(75)	446,215	446,849	0
Max	25,231,580	25,231,580	122,666
St. Dev.	853,874	854,384	4,480

This table shows the distribution of property prices across all properties in the region

C.5 CAMKOX Region Public transport investment project: 10% reduction in public transport travel times Location: Oxford

Table C.5.1: Change in Avg. time (minutes): (new minus old)

Statistic	BAD	BLT	BOT	CAM	CLM	DUC
Mean	−0.1	−0.1	−0.02	−0.1	−0.1	−0.04
Min	−1.3	−2.1	−0.7	−2.2	−2.2	−1.1
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.3	0.4	0.1	0.5	0.5	0.2

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Badby, Bletsoe, Botley, Cambridge, Colmworth and Ducklington.

Table C.5.2: Change in Avg. time (minutes): (new minus old)

Statistic	FRG	FRT	GCH	GHN	HAD	HTP
Mean	−0.04	−0.04	−0.1	−0.1	−0.04	−0.04
Min	−1.0	−0.9	−2.0	−1.7	−1.0	−1.0
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.2	0.2	0.4	0.3	0.2	0.2

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Fringford, Fritwell, Great Chishill, Great Houghton, Hadenham, and Heythrop.

Table C.5.3: Change in Avg. time (minutes): (new minus old)

Statistic	OXF	STO	UPB	WHE	WOB	WOR
Mean	−0.02	−0.1	−0.05	−0.02	−0.1	−0.04
Min	−0.7	−1.3	−1.0	−0.6	−1.7	−1.0
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.1	0.2	0.2	0.1	0.4	0.2

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Oxford, Stoke Mandeville, Upper Basildon, Wheatley, Woburn, and Worlds End.

Table C.5.4: Change in Avg. time (minutes): (new minus old)

Statistic	LON	Town	Station
Mean	−0.1	−0.02	−0.02
Min	−2.0	−0.7	−0.7
Pctl(25)	0.0	0.0	0.0
Median	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0
Max	0.0	0.0	0.0
St. Dev.	0.4	0.1	0.1

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.5.5: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	269,234	269,338	104
Min	61,520	61,520	0
Pctl(25)	182,515	182,515	0
Median	239,366	239,409	0
Pctl(75)	321,120	321,176	0
Max	1,234,192	1,234,192	6,743
St. Dev.	127,468	127,597	514

This table shows the distribution of property prices across all properties in the region

Table C.5.6: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	450,453	450,610	156
Min	6,940	6,940	0
Pctl(25)	103,250	103,250	0
Median	210,402	210,500	0
Pctl(75)	446,215	446,676	0
Max	25,231,580	25,231,580	33,878
St. Dev.	853,874	854,102	1,169

This table shows the distribution of property prices across all properties in the region

C.6 East Midlands Region
Housing project: construction of 100 houses
Location: near Nottingham

Table C.6.1: Settlement details

Variable	Value
Location	Near Nottingham
Centroid (longitude,latitude)	(-1.201721, 52.8686989)
Area (square km.)	4.53
Number of dwellings	100
Population density	35

Table C.6.2: Property prices (units = year 2017 GBP)

Statistic	Mean	Min	Pctl(25)	Median	Pctl(75)	Max
New residential price	199,909	103,769	152,930	178,137	216,821	627,013
New commercial price	4,355,616	2,295,271	3,305,831	3,850,122	4,952,441	14,981,996
Average new price	407,694	213,344	310,575	361,736	453,602	1,344,762
Price increase (low cost)	321,248	126,896	224,129	275,289	367,154	1,258,316
Price increase (medium cost)	334,942	110,926	212,017	280,238	384,900	1,272,550
Price increase (high cost)	243,763	19,747	120,838	189,059	293,721	1,181,372
Percent increase (low cost)	472%					
Percent increase (medium cost)	369%					
Percent increase (high cost)	202%					

Rows 1 and 2 present statistics on the distribution of new prices for residential and commercial property. Row 3 presents statistics on the average increase across all properties. These results assume 95% of properties are residential and 5% commercial. The average increase figures (low, medium, and high) measure the average gain in property value assuming all land in the settlement previously was farmland and was purchased at prices per acre of £7,727, £9,888, and £18,038 respectively. The final rows present the percentage increase in property values over the assumed baseline agricultural land values in the three scenarios with low medium, and high agricultural land values.

C.7 East Midlands Region
Road investment project: 10% improvement in travel times
Location: entire region

Table C.7.1: Change in Avg. time (minutes): (new minus old)

Statistic	NHN	SFD	EYM	WBR	OAD	DAV
Mean	−6.7	−6.1	−7.2	−4.5	−4.9	−6.5
Min	−14.1	−13.5	−14.8	−11.0	−12.1	−14.4
Pctl(25)	−8.5	−7.2	−9.6	−6.2	−5.9	−8.1
Median	−7.1	−6.1	−7.0	−4.2	−4.7	−6.4
Pctl(75)	−4.8	−5.1	−5.0	−3.1	−3.9	−4.6
Max	−0.6	−0.1	−0.4	−0.6	−0.5	−0.04
St. Dev.	2.8	1.9	2.7	2.1	2.1	2.5

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Northampton, Stamford, Eyam, West Bridgford, Oadby, and Daventry.

Table C.7.2: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−1.2	−7.7	−1.0
Min	−15.1	−17.9	−9.9
Pctl(25)	−1.4	−8.9	−1.1
Median	−1.0	−7.8	−0.9
Pctl(75)	−0.8	−6.2	−0.7
Max	−0.000	−0.000	−0.000
St. Dev.	0.8	2.9	0.6

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.7.3: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	160, 788.3	162, 926.0	2, 137.7
Min	58, 537.9	59, 621.3	−4, 671.8
Pctl(25)	111, 894.1	113, 876.1	476.4
Median	140, 048.5	142, 050.7	1, 936.8
Pctl(75)	189, 509.0	191, 830.9	3, 179.9
Max	612, 464.1	608, 159.1	35, 018.3
St. Dev.	69, 044.9	69, 596.8	2, 923.1

This table shows the distribution of property prices across all properties in the region

Table C.7.4: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	320, 927.6	326, 693.4	5, 765.8
Min	4, 493.5	4, 637.2	−82, 424.0
Pctl(25)	75, 273.2	77, 001.1	1, 077.6
Median	147, 770.6	150, 354.1	2, 519.2
Pctl(75)	288, 080.5	293, 819.3	5, 283.6
Max	23, 244, 567.0	23, 337, 182.0	179, 365.4
St. Dev.	864, 700.9	873, 332.2	12, 914.0

This table shows the distribution of property prices across all properties in the region

C.8 East Midlands Region
Public transport improvement project: 10% reduction in public transport travel times
Location: entire region

Table C.8.1: Change in Avg. time (minutes): (new minus old)

Statistic	NHN	SFD	EYM	WBR	OAD	DAV
Mean	−14.4	−13.0	−14.6	−9.9	−10.8	−15.3
Min	−33.6	−26.0	−29.6	−22.9	−27.1	−36.5
Pctl(25)	−17.4	−14.7	−17.5	−11.9	−12.4	−18.5
Median	−14.1	−13.1	−14.1	−9.9	−10.5	−14.1
Pctl(75)	−11.2	−11.2	−12.0	−7.5	−8.9	−10.9
Max	−2.0	−0.6	−1.0	−1.8	−1.6	−0.6
St. Dev.	5.5	3.0	3.5	3.9	4.0	5.6

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Northampton, Stamford, Eyam, West Bridgford, Oadby, and Daventry.

Table C.8.2: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−4.1	−14.0	−3.9
Min	−50.9	−51.8	−50.6
Pctl(25)	−4.5	−17.0	−3.9
Median	−3.4	−14.0	−3.1
Pctl(75)	−2.6	−11.8	−2.4
Max	−0.000	−0.000	−0.000
St. Dev.	3.7	7.7	4.3

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.8.3: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	160,788	161,341	553
Min	58,538	58,718	−3,232
Pctl(25)	111,894	112,370	228
Median	140,049	140,514	552
Pctl(75)	189,509	190,287	861
Max	612,464	611,535	4,886
St. Dev.	69,045	69,202	642

This table shows the distribution of property prices across all properties in the region

Table C.8.4: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	320,928	322,110	1,182
Min	4,494	4,528	−161,835
Pctl(25)	75,273	75,645	267
Median	147,771	148,499	598
Pctl(75)	288,081	289,034	1,182
Max	23,244,567	23,272,042	44,125
St. Dev.	864,701	866,199	5,167

This table shows the distribution of property prices across all properties in the region

C.9 East Midlands Region Road investment project: 10% reduction in driving travel times Location: Nottingham-Derby-Leicester area

Table C.9.1: Change in Avg. time (minutes): (new minus old)

Statistic	NHN	SFD	EYM	WBR	OAD	DAV
Mean	−0.9	−0.9	−0.6	−0.2	−0.6	−0.9
Min	−7.8	−8.1	−5.5	−3.5	−5.3	−7.2
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	2.4	2.3	1.7	0.7	1.6	2.2

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Northampton, Stamford, Eyam, West Bridgford, Oadby, and Daventry.

Table C.9.2: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−0.1	−1.2	−0.1
Min	−1.9	−14.8	−1.3
Pctl(25)	0.0	0.0	0.0
Median	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0
Max	0.0	0.0	0.0
St. Dev.	0.4	3.3	0.3

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.9.3: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	160,788	161,266	478
Min	58,538	58,538	0
Pctl(25)	111,894	112,487	0
Median	140,049	140,446	0
Pctl(75)	189,509	189,896	0
Max	612,464	612,464	32,373
St. Dev.	69,045	69,177	1,804

This table shows the distribution of property prices across all properties in the region

Table C.9.4: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	320, 928	322, 564	1, 636
Min	4, 494	4, 494	−1, 805
Pctl(25)	75, 273	75, 966	0
Median	147, 771	148, 131	0
Pctl(75)	288, 081	291, 289	0
Max	23, 244, 567	23, 244, 567	104, 221
St. Dev.	864, 701	866, 480	6, 543

This table shows the distribution of property prices across all properties in the region

C.10 East Midlands Region
Public transport investment project: 10% reduction in public transport travel times
Location: Nottingham-Derby-Leicester area

Table C.10.1: Change in Avg. time (minutes): (new minus old)

Statistic	NHN	SFD	EYM	WBR	OAD	DAV
Mean	−0.2	−0.2	−0.2	−0.1	−0.2	−0.2
Min	−1.8	−1.6	−1.4	−0.9	−1.3	−1.8
Pctl(25)	0.0	0.0	0.0	0.0	0.0	0.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.5	0.5	0.5	0.2	0.4	0.5

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Northampton, Stamford, Eyam, West Bridgford, Oadby, and Daventry.

Table C.10.2: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−0.05	−0.2	−0.04
Min	−0.6	−2.0	−0.7
Pctl(25)	0.0	0.0	0.0
Median	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0
Max	0.0	0.0	0.0
St. Dev.	0.1	0.5	0.1

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.10.3: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	160, 788.3	160, 875.5	87.1
Min	58, 537.9	58, 537.9	0.0
Pctl(25)	111, 894.1	112, 025.1	0.0
Median	140, 048.5	140, 107.1	0.0
Pctl(75)	189, 509.0	189, 521.7	0.0
Max	612, 464.1	612, 464.1	2, 445.6
St. Dev.	69, 044.9	69, 064.9	253.1

This table shows the distribution of property prices across all properties in the region

Table C.10.4: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	320, 927.6	321, 314.3	386.7
Min	4, 493.5	4, 493.5	0.0
Pctl(25)	75, 273.2	75, 517.1	0.0
Median	147, 770.6	147, 875.5	0.0
Pctl(75)	288, 080.5	288, 877.5	14.7
Max	23, 244, 567.0	23, 244, 567.0	28, 005.9
St. Dev.	864, 700.9	865, 110.5	1, 500.1

This table shows the distribution of property prices across all properties in the region

C.11 Yorkshire and the Humber Region
Housing investment project: construction of 100 houses
Location: near Leeds

Table C.11.1: Settlement details

Variable	Value
Location	Near Leeds
Centroid (longitude,latitude)	(-1.6257414, 53.8303571)
Area (square km.)	5.99
Number of dwellings	100
Population density	35

Other characteristics of the new town are chosen to be similar to Oxford local authority.

Table C.11.2: Property prices (units = year 2017 GBP)

Statistic	Mean	Min	Pctl(25)	Median	Pctl(75)	Max
New residential price	220,506	116,838	154,677	197,870	239,870	707,393
New commercial price	4,927,093	2,377,475	3,550,099	4,342,674	5,481,413	15,399,107
Average new price	455,834	221,549	324,448	405,110	501,947	1,441,979
Price increase (low cost)	341,496	107,212	210,110	290,773	387,610	1,327,641
Price increase (medium cost)	309,519	75,235	178,134	258,806	355,633	1,295,665
Price increase (high cost)	188,923	−45,362	57,537	138,199	235,036	1,175,068
Percent increase (low cost)	399%					
Percent increase (medium cost)	312%					
Percent increase (high cost)	171%					

Rows 1 and 2 present statistics on the distribution of new prices for residential and commercial property. Row 3 presents statistics on the average increase across all properties. These results assume 95% of properties are residential and 5% commercial. The average increase figures (low, medium, and high) measure the average gain in property value assuming all land in the settlement previously was farmland and was purchased at prices per acre of £7,727, £9,888, and £18,038 respectively. The final rows present the percentage increase in property values over the assumed baseline agricultural land values in the three scenarios with low medium, and high agricultural land values.

C.12 Yorkshire and the Humber Region Road investment project: 10% reduction in driving times Location: entire region

Table C.12.1: Change in Avg. time (minutes): (new minus old)

Statistic	DON	HRG	KSN	LDS	OSM	SHF
Mean	−4.6	−5.1	−6.2	−4.1	−6.9	−5.2
Min	−11.3	−11.2	−13.5	−10.3	−13.4	−12.2
Pctl(25)	−5.5	−6.3	−7.5	−5.2	−7.9	−6.6
Median	−4.6	−4.9	−6.6	−3.9	−6.9	−5.2
Pctl(75)	−3.5	−3.8	−5.3	−2.6	−5.9	−3.8
Max	−0.5	−0.6	−0.5	−0.5	−0.1	−0.2
St. Dev.	1.7	1.8	2.1	2.0	1.8	2.3

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Doncaster, Harrogate, Kingston-upon-Hull, Leeds, Osmotherley, and Sheffield.

Table C.12.2: Change in Avg. time (minutes): (new minus old)

Statistic	YRK	MBH	SCU	SKP	DRF
Mean	−4.8	−8.6	−5.4	−7.2	−6.7
Min	−9.0	−14.7	−13.6	−13.8	−17.1
Pctl(25)	−5.6	−9.6	−6.5	−9.0	−8.0
Median	−5.0	−8.9	−5.3	−7.1	−7.1
Pctl(75)	−4.0	−8.0	−4.3	−5.0	−5.9
Max	−0.8	−0.2	−0.3	−0.3	−0.4
St. Dev.	1.4	1.7	1.7	2.6	1.9

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to York, Middlesbrough, Scunthorpe, Skipton, and Driffield.

Table C.12.3: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−1.3	−4.0	−1.0
Min	−18.1	−13.5	−14.6
Pctl(25)	−1.4	−5.3	−1.1
Median	−1.1	−4.5	−0.9
Pctl(75)	−0.8	−2.0	−0.7
Max	−0.0	−0.0	−0.0
St. Dev.	1.0	2.3	0.7

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.12.4: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	149,421	150,295	875
Min	54,574	54,852	−6,906
Pctl(25)	101,188	101,691	−98
Median	128,823	129,465	354
Pctl(75)	176,762	177,775	1,025
Max	805,803	833,722	27,918
St. Dev.	70,671	71,386	2,052

This table shows the distribution of property prices across all properties in the region

Table C.12.5: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	287,960	296,956	8,996
Min	8,168	8,391	−66,220
Pctl(25)	75,836	78,386	1,618
Median	143,090	146,905	4,013
Pctl(75)	287,371	298,151	9,114
Max	16,535,965	17,190,402	654,438
St. Dev.	668,120	688,377	23,035

This table shows the distribution of property prices across all properties in the region

C.13 Yorkshire and the Humber Region Public transport investment project: 10% reduction in public transport travel times Location: entire region

Table C.13.1: Change in Avg. time (minutes): (new minus old)

Statistic	DON	HRG	KSN	LDS	OSM	SHF
Mean	−10.1	−10.6	−12.6	−8.9	−15.0	−10.8
Min	−21.0	−29.8	−32.3	−22.2	−44.2	−32.8
Pctl(25)	−11.4	−11.8	−14.1	−10.8	−16.9	−12.9
Median	−10.0	−10.4	−13.0	−8.8	−14.4	−10.7
Pctl(75)	−8.8	−8.5	−12.1	−6.7	−12.2	−9.2
Max	−1.9	−1.0	−0.000	−1.7	−0.01	−2.0
St. Dev.	2.7	3.4	3.3	3.3	4.8	3.9

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Doncaster, Harrogate, Kingston-upon-Hull, Leeds, Osmotherley, and Sheffield.

Table C.13.2: Change in Avg. time (minutes): (new minus old)

Statistic	YRK	MBH	SCU	SKP	DRF
Mean	−10.1	−20.9	−12.3	−12.1	−13.3
Min	−30.1	−51.1	−27.3	−31.2	−40.2
Pctl(25)	−11.3	−24.3	−13.8	−14.2	−15.0
Median	−10.1	−21.2	−12.3	−11.7	−13.5
Pctl(75)	−8.8	−16.9	−11.0	−9.0	−11.9
Max	−1.7	−0.01	−0.002	−0.9	−0.000
St. Dev.	2.7	7.1	2.8	3.7	2.7

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to York, Middlesbrough, Scunthorpe, Skipton, and Driffield.

Table C.13.3: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−4.0	−11.1	−3.6
Min	−51.1	−53.9	−53.8
Pctl(25)	−4.3	−12.0	−3.6
Median	−3.4	−10.9	−2.9
Pctl(75)	−2.7	−8.6	−2.4
Max	−0.0	−0.0	−0.000
St. Dev.	3.5	6.4	3.8

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.13.4: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	149, 421	149, 646	225
Min	54, 574	54, 689	−1, 773
Pctl(25)	101, 188	101, 303	−41
Median	128, 823	129, 069	93
Pctl(75)	176, 762	176, 933	268
Max	805, 803	805, 833	18, 146
St. Dev.	70, 671	70, 841	650

This table shows the distribution of property prices across all properties in the region

Table C.13.5: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	287, 960	290, 243	2, 282
Min	8, 168	8, 230	−29, 907
Pctl(25)	75, 836	76, 425	455
Median	143, 090	143, 750	1, 102
Pctl(75)	287, 371	290, 059	2, 386
Max	16, 535, 965	16, 721, 810	185, 845
St. Dev.	668, 120	673, 874	6, 430

This table shows the distribution of property prices across all properties in the region

C.14 Yorkshire and the Humber Region
Road investment project: 10% reduction in driving travel times
Location: Leeds

Table C.14.1: Change in Avg. time (minutes): (new minus old)

Statistic	DON	HRG	KSN	LDS	OSM	SHF
Mean	−1.2	−1.0	−1.8	−0.5	−1.6	−1.3
Min	−5.8	−5.2	−8.5	−3.5	−7.3	−6.4
Pctl(25)	−3.0	−2.7	−5.4	−1.0	−5.4	−4.0
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	1.9	1.6	3.1	0.9	2.7	2.2

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Doncaster, Harrogate, Kingston-upon-Hull, Leeds, Osmotherley, and Sheffield.

Table C.14.2: Change in Avg. time (minutes): (new minus old)

Statistic	YRK	MBH	SCU	SKP	DRF
Mean	−1.1	−2.3	−1.5	−1.3	−1.9
Min	−5.8	−9.6	−7.3	−6.5	−8.6
Pctl(25)	−3.3	−7.6	−4.6	−4.1	−6.0
Median	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0
St. Dev.	1.9	3.8	2.6	2.2	3.1

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to York, Middlesbrough, Scunthorpe, Skipton, and Driffield.

Table C.14.3: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−0.3	−1.3	−0.2
Min	−3.0	−6.6	−1.8
Pctl(25)	−0.6	−3.9	−0.6
Median	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0
Max	0.0	0.0	0.0
St. Dev.	0.5	2.3	0.4

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.14.4: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	149,421	149,495	75
Min	54,574	54,574	−2,247
Pctl(25)	101,188	101,243	0
Median	128,823	129,010	0
Pctl(75)	176,762	176,762	0
Max	805,803	805,803	18,042
St. Dev.	70,671	70,731	942

This table shows the distribution of property prices across all properties in the region

Table C.14.5: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	287,960	292,221	4,261
Min	8,168	8,168	−24,095
Pctl(25)	75,836	77,476	0
Median	143,090	144,517	0
Pctl(75)	287,371	292,649	3,618
Max	16,535,965	17,190,402	654,438
St. Dev.	668,120	684,889	20,470

This table shows the distribution of property prices across all properties in the region

C.15 Yorkshire and the Humber Region Public transport investment project: 10% reduction in public transport travel times Location: Leeds

Table C.15.1: Change in Avg. time (minutes): (new minus old)

Statistic	DON	HRG	KSN	LDS	OSM	SHF
Mean	−0.3	−0.3	−0.4	−0.2	−0.4	−0.3
Min	−1.3	−1.3	−1.7	−0.9	−1.9	−1.4
Pctl(25)	−0.9	−0.8	−1.4	−0.3	−1.3	−1.1
Median	0.0	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.5	0.4	0.7	0.3	0.7	0.5

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to Doncaster, Harrogate, Kingston-upon-Hull, Leeds, Osmotherley, and Sheffield.

Table C.15.2: Change in Avg. time (minutes): (new minus old)

Statistic	YRK	MBH	SCU	SKP	DRF
Mean	−0.3	−0.7	−0.4	−0.3	−0.4
Min	−1.3	−3.0	−1.6	−1.2	−1.8
Pctl(25)	−0.9	−2.1	−1.2	−1.0	−1.4
Median	0.0	0.0	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0	0.0	0.0
Max	0.0	0.0	0.0	0.0	0.0
St. Dev.	0.5	1.1	0.6	0.5	0.7

Each column lists statistics of the change in travel times to a destination. The column headings are abbreviations of the destination names. The abbreviations correspond to York, Middlesbrough, Scunthorpe, Skipton, and Driffield.

Table C.15.3: Change in Avg. time (minutes): (new minus old)

Statistic	Town	Coast	Station
Mean	−0.1	−0.4	−0.1
Min	−0.9	−2.3	−0.6
Pctl(25)	−0.2	−1.2	−0.2
Median	0.0	0.0	0.0
Pctl(75)	0.0	0.0	0.0
Max	0.0	0.0	0.0
St. Dev.	0.2	0.6	0.1

Each column lists statistics of the change in travel times to the destination listed in the column heading.

Table C.15.4: Residential property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	149,421	149,415	−6
Min	54,574	54,574	−966
Pctl(25)	101,188	101,229	0
Median	128,823	128,859	0
Pctl(75)	176,762	176,765	0
Max	805,803	805,803	5,049
St. Dev.	70,671	70,668	154

This table shows the distribution of property prices across all properties in the region

Table C.15.5: Commercial property prices (units = year 2017 GBP)

Statistic	Base price	New price	Change in price
Mean	287,960.2	289,090.6	1,130.4
Min	8,167.5	8,167.5	−9,245.3
Pctl(25)	75,836.2	76,249.9	0.0
Median	143,090.1	143,506.0	0.0
Pctl(75)	287,370.7	288,871.4	984.2
Max	16,535,965.0	16,721,810.0	185,844.7
St. Dev.	668,119.6	672,942.0	5,699.2

This table shows the distribution of property prices across all properties in the region

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Figure 1:
Residential property
Average regional prices versus time

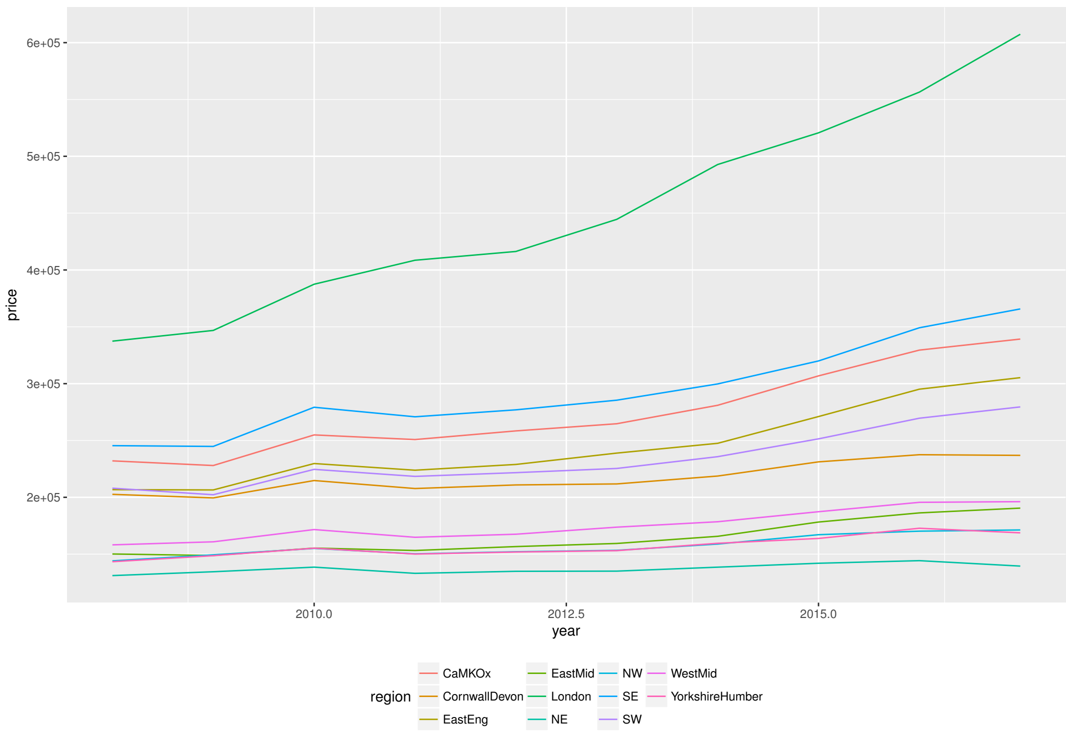


Figure 2:
Residential property prices versus total floor area
(1)

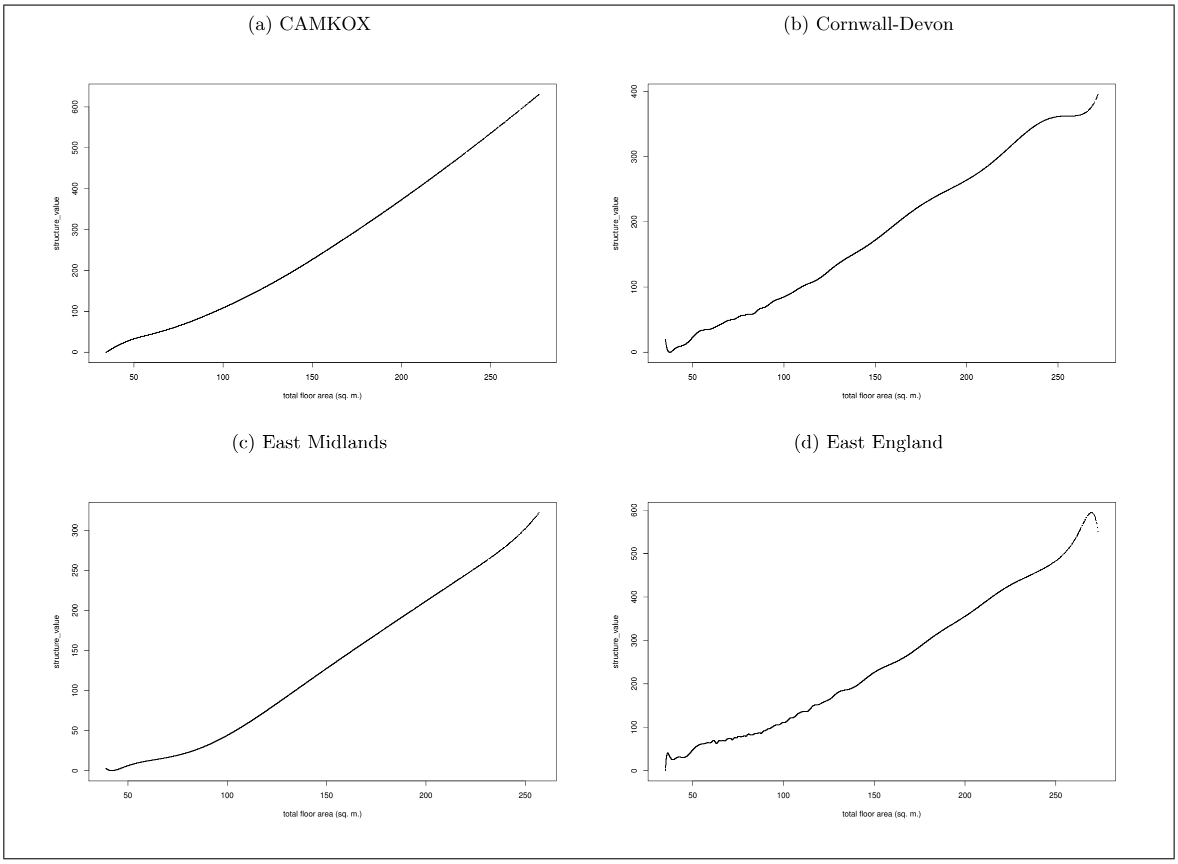


Figure 3:
Residential property
Price vs. total floor area
(2)

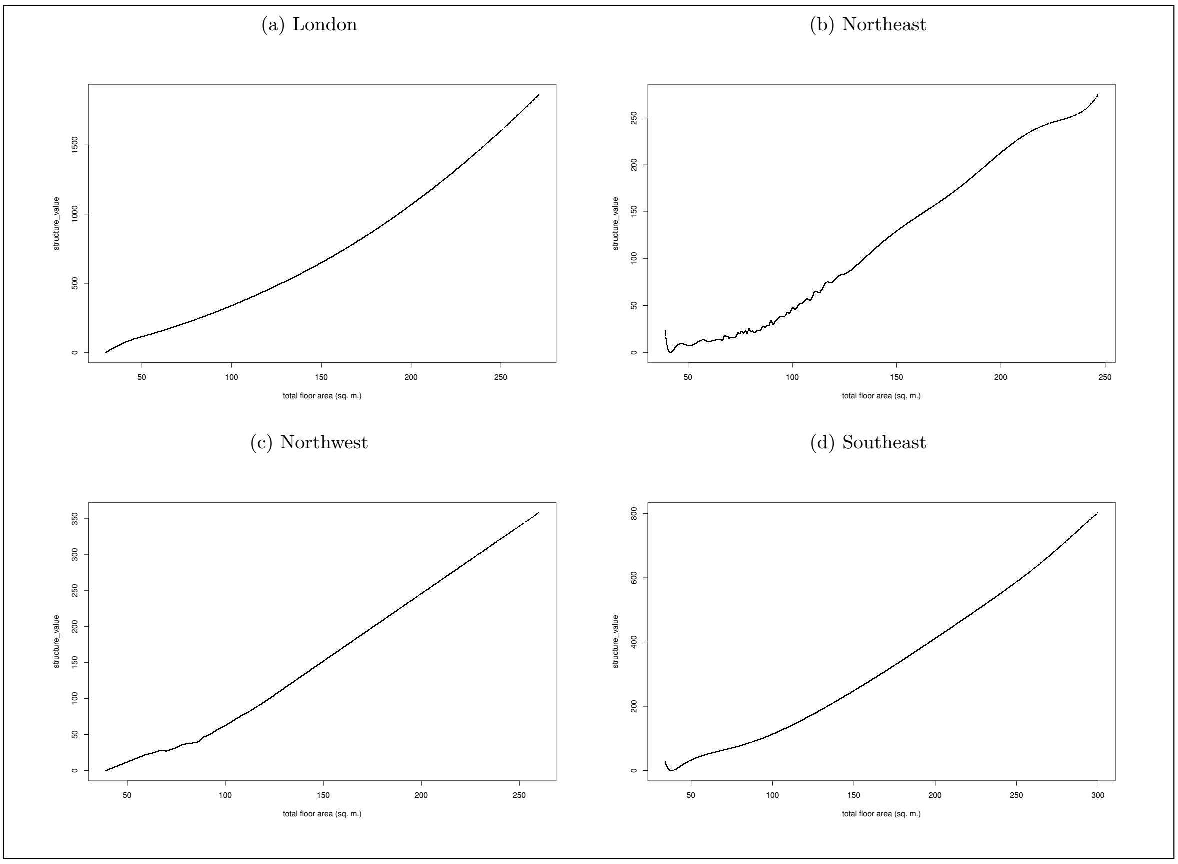


Figure 4:
Residential property
Prices vs. total floor area
(3)

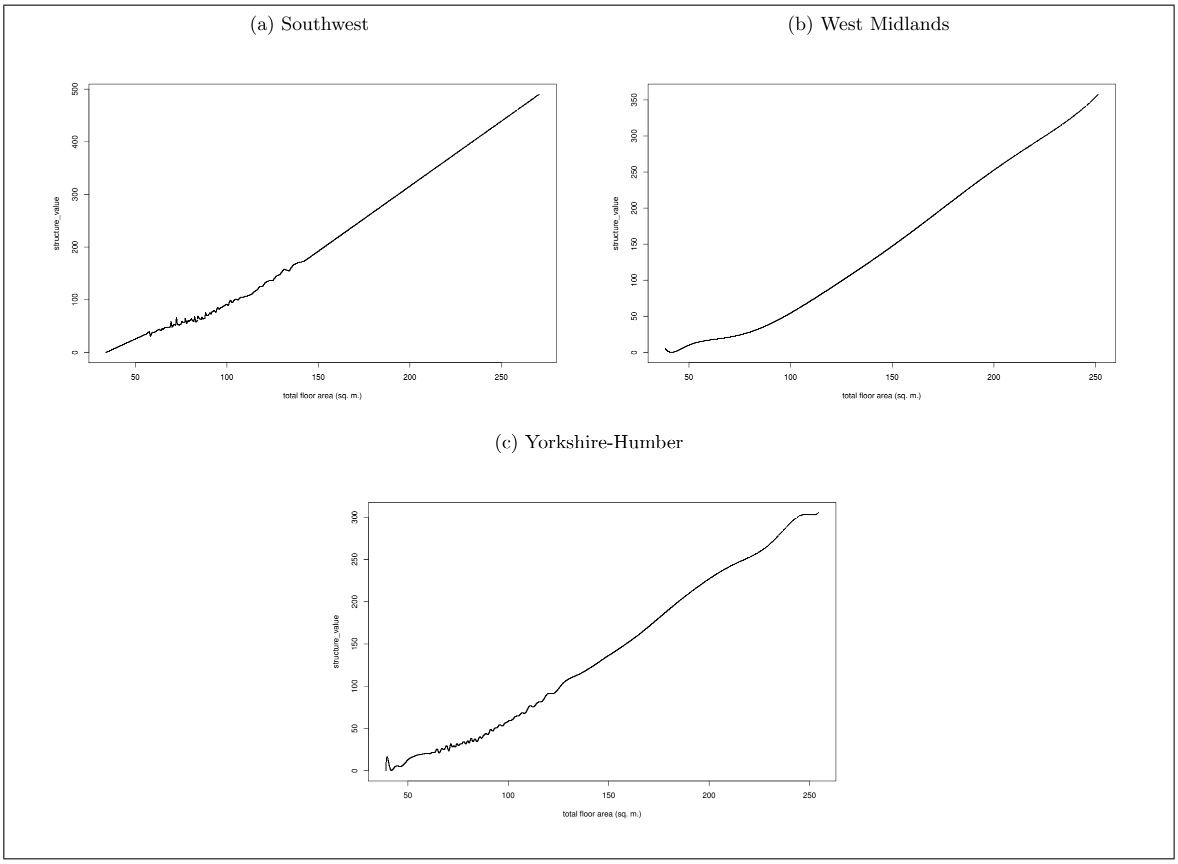


Figure 5:
Residential property
Price per sq. m. vs. total floor area
(2)

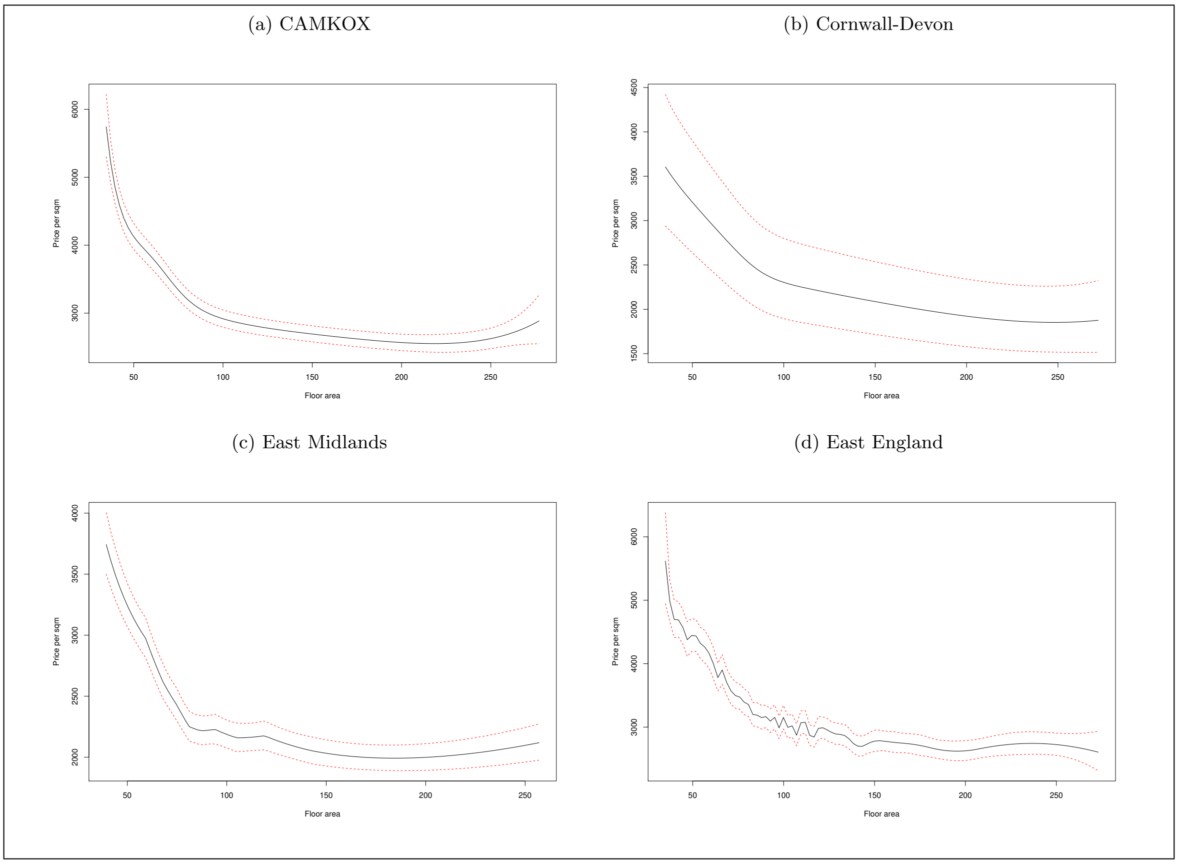
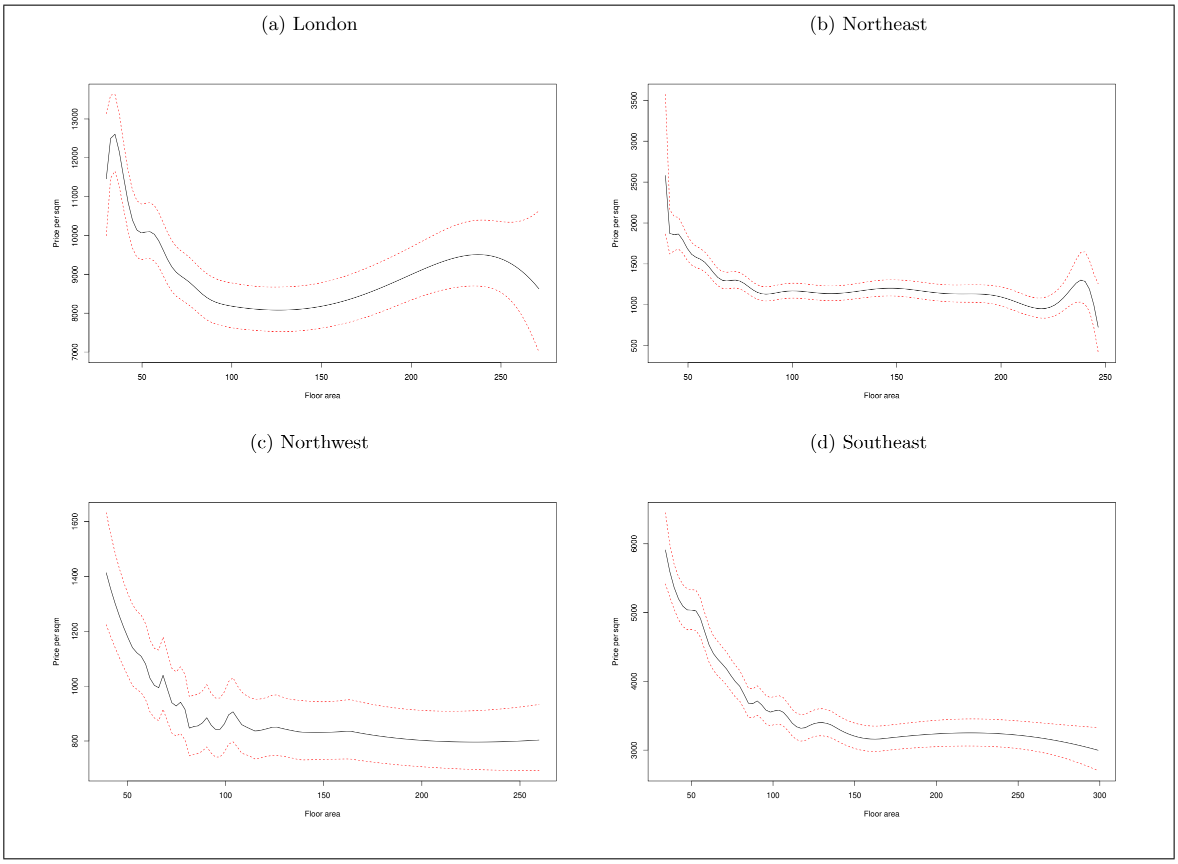


Figure 6:
Residential property
Price per sq. m. vs. total floor area
(2)



(a) London

(b) Northeast

(c) Northwest

(d) Southeast

Figure 7:
Residential property
Price per sq. m. vs. total floor area
(3)

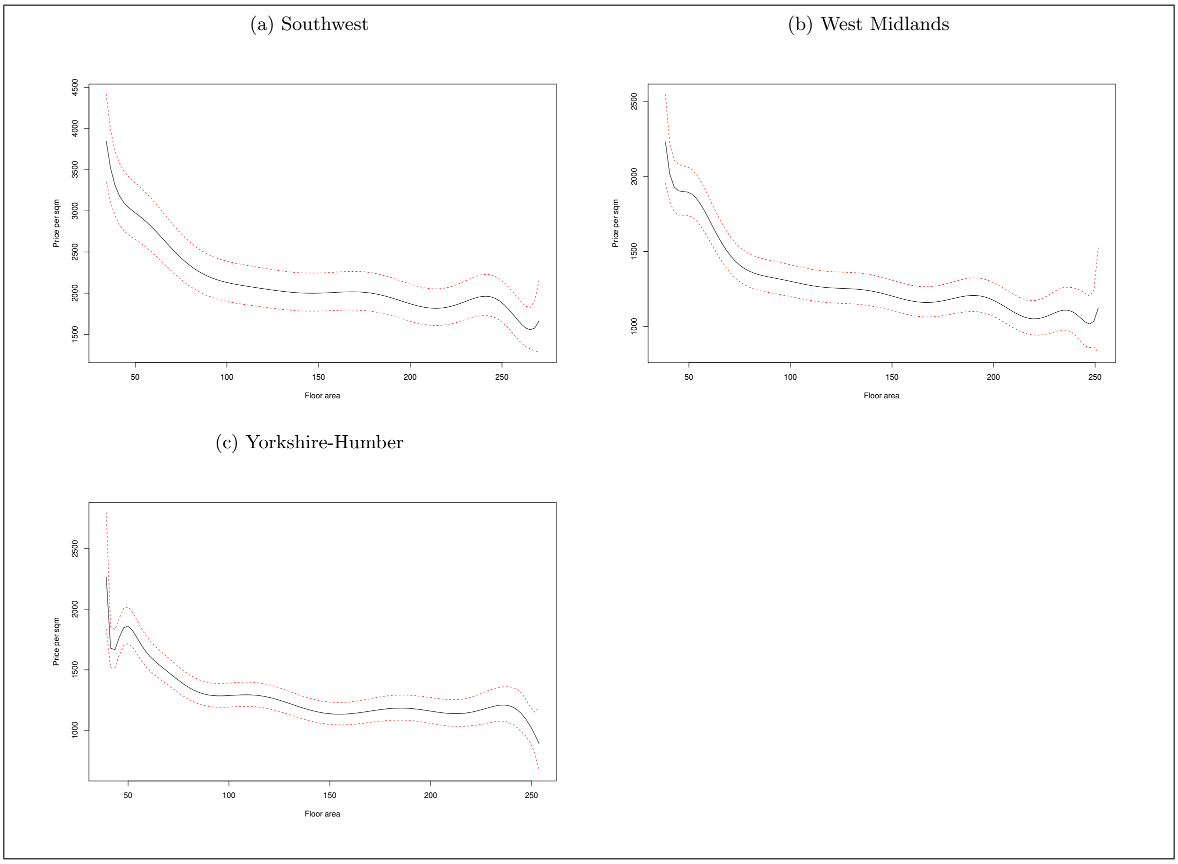


Figure 8:
Commercial property
Rateable value vs. total floor area
(1)

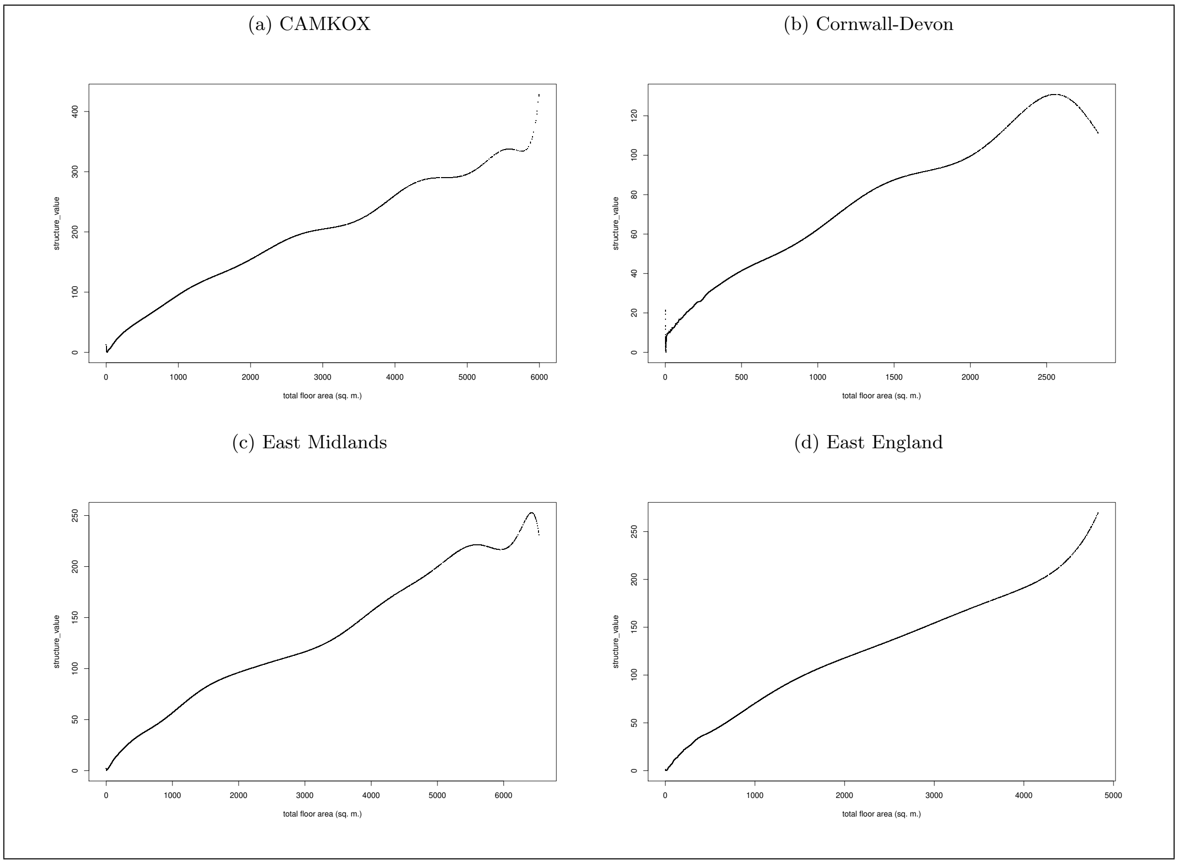


Figure 9:
Commercial property
Rateable value vs. total floor area
(2)

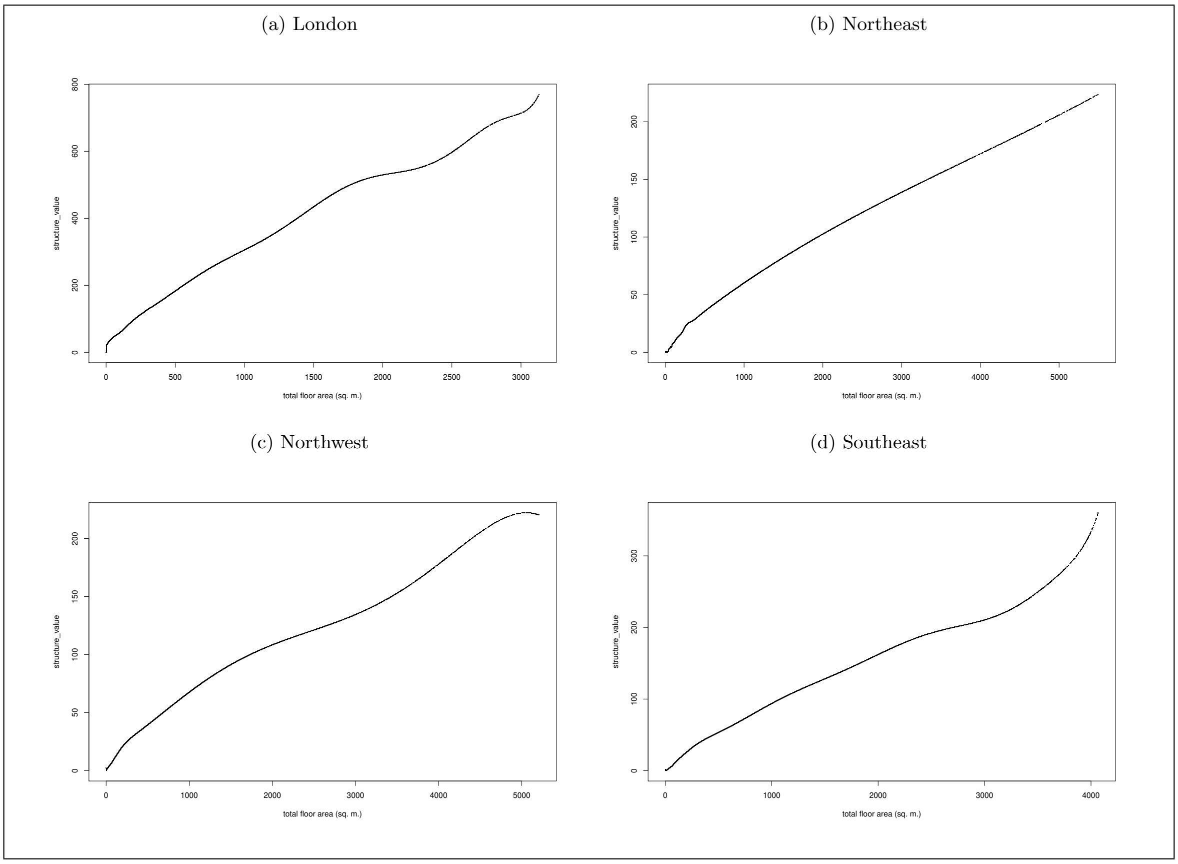


Figure 10:
Commercial property
Rateable value vs. total floor area
(3)

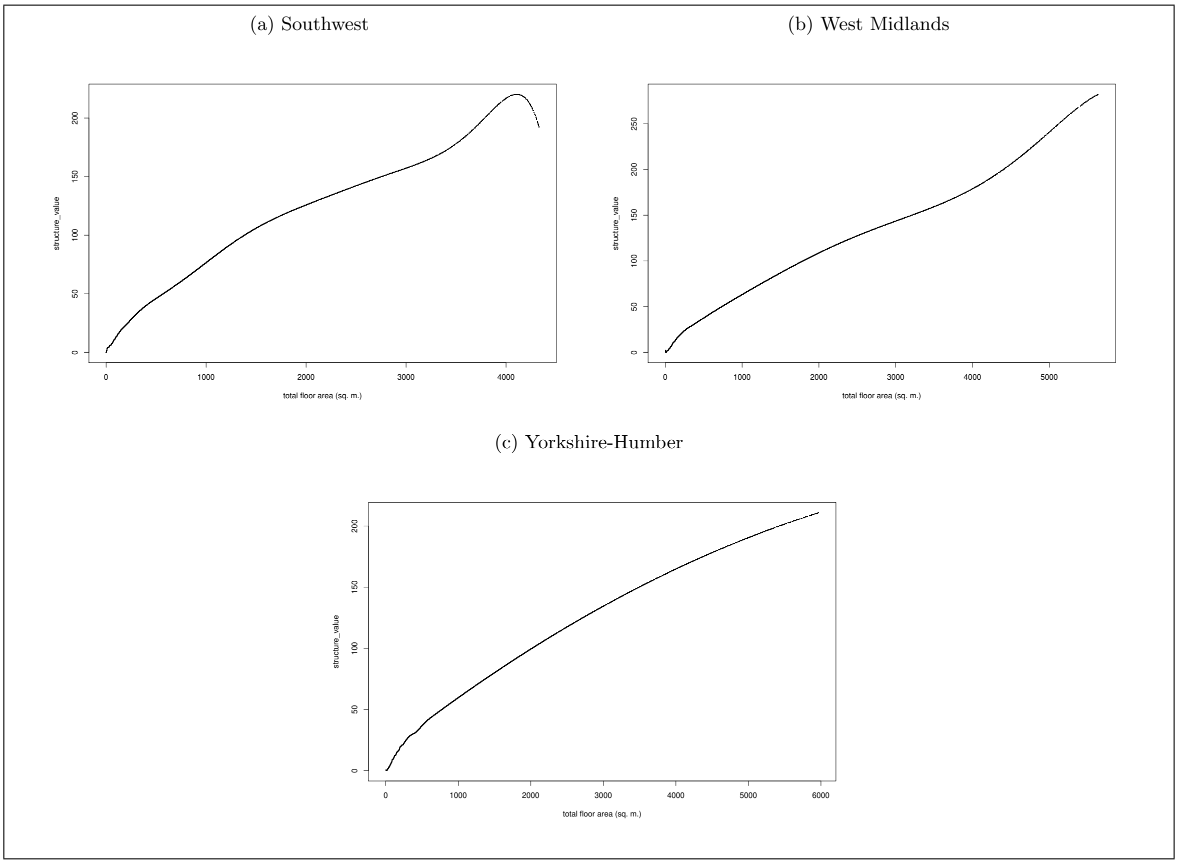
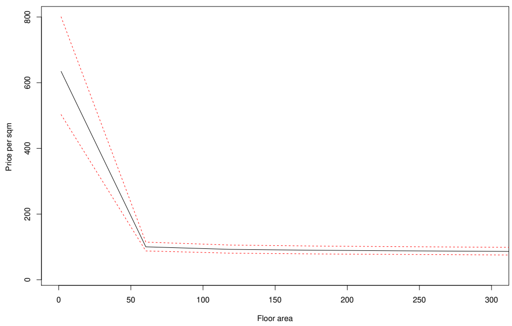
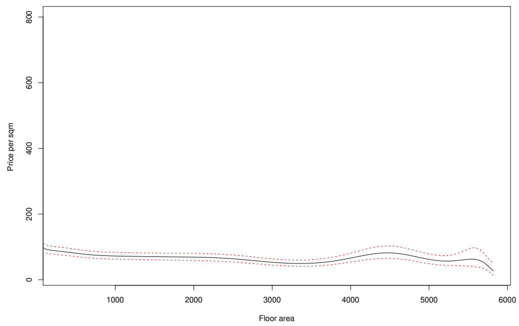


Figure 11:
Commercial property
Price per sq. m. vs. total floor area
(1)

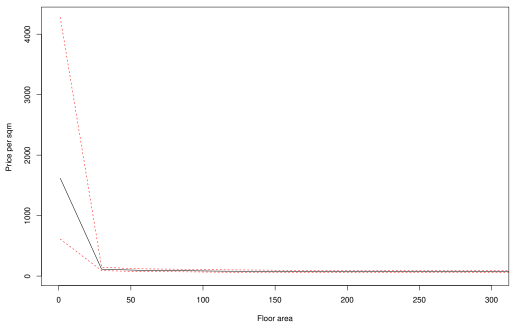
(a) CAMKOX (small)



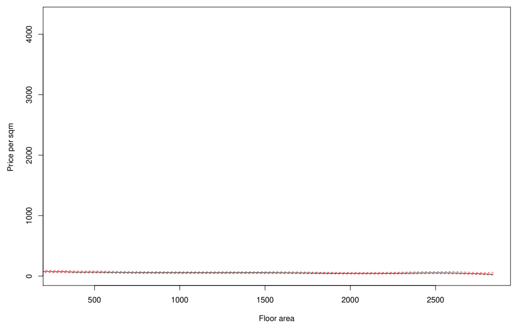
(b) CAMKOX (large)



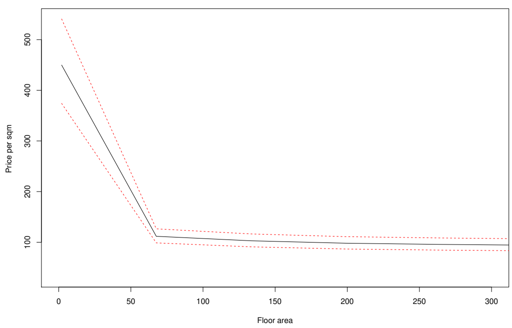
(c) Cornwall-Devon (small)



(d) Cornwall-Devon (large)



(e) East Midlands (small)



(f) East Midlands (large)

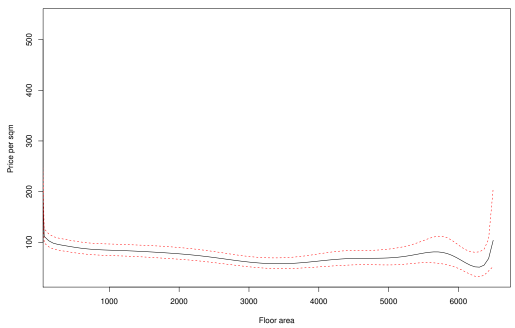


Figure 12:
Commercial property
Price per sq. m. vs. total floor area
(2)

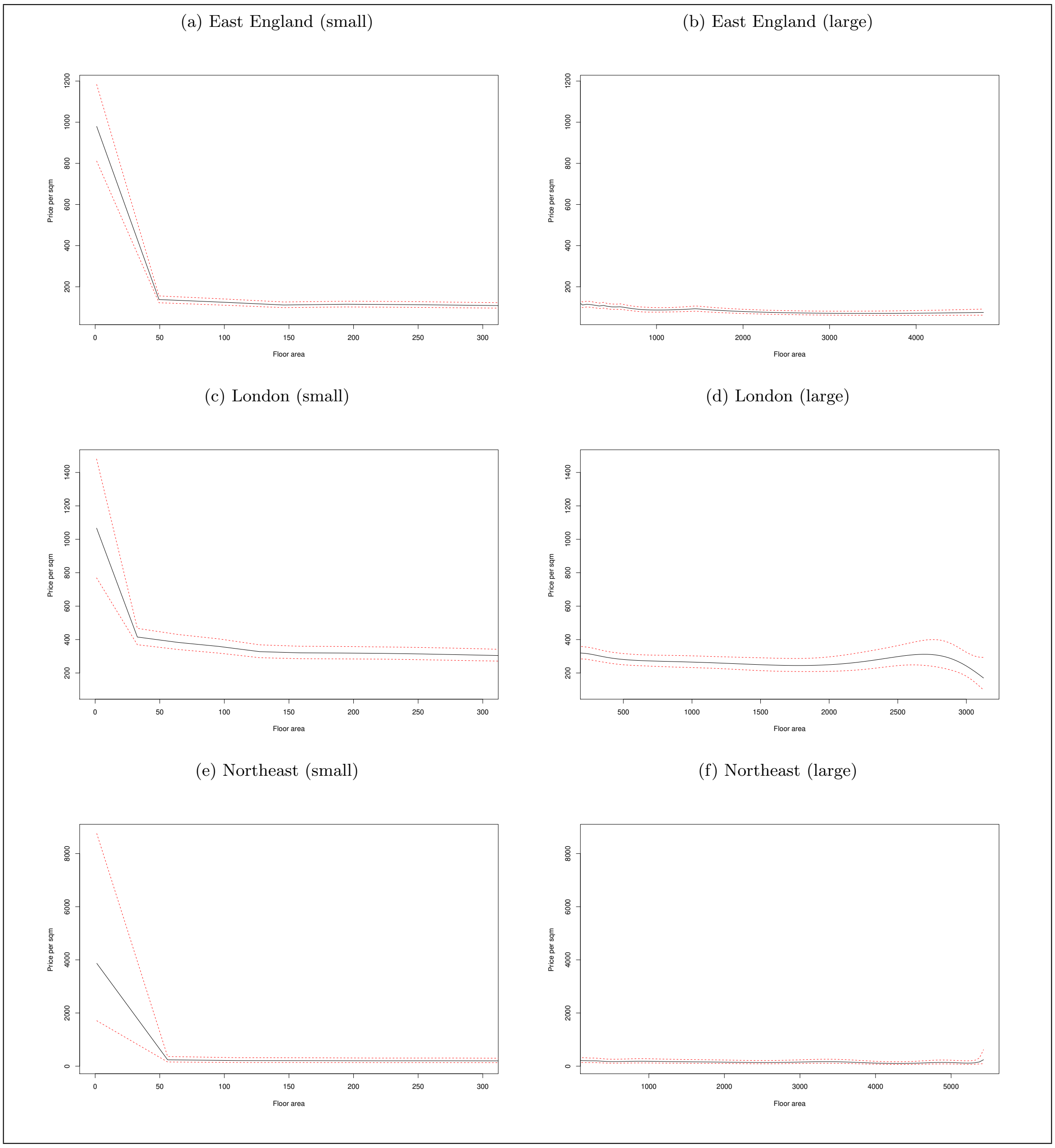


Figure 13:
Commercial property
Price per sq. m. vs. total floor area
(3)

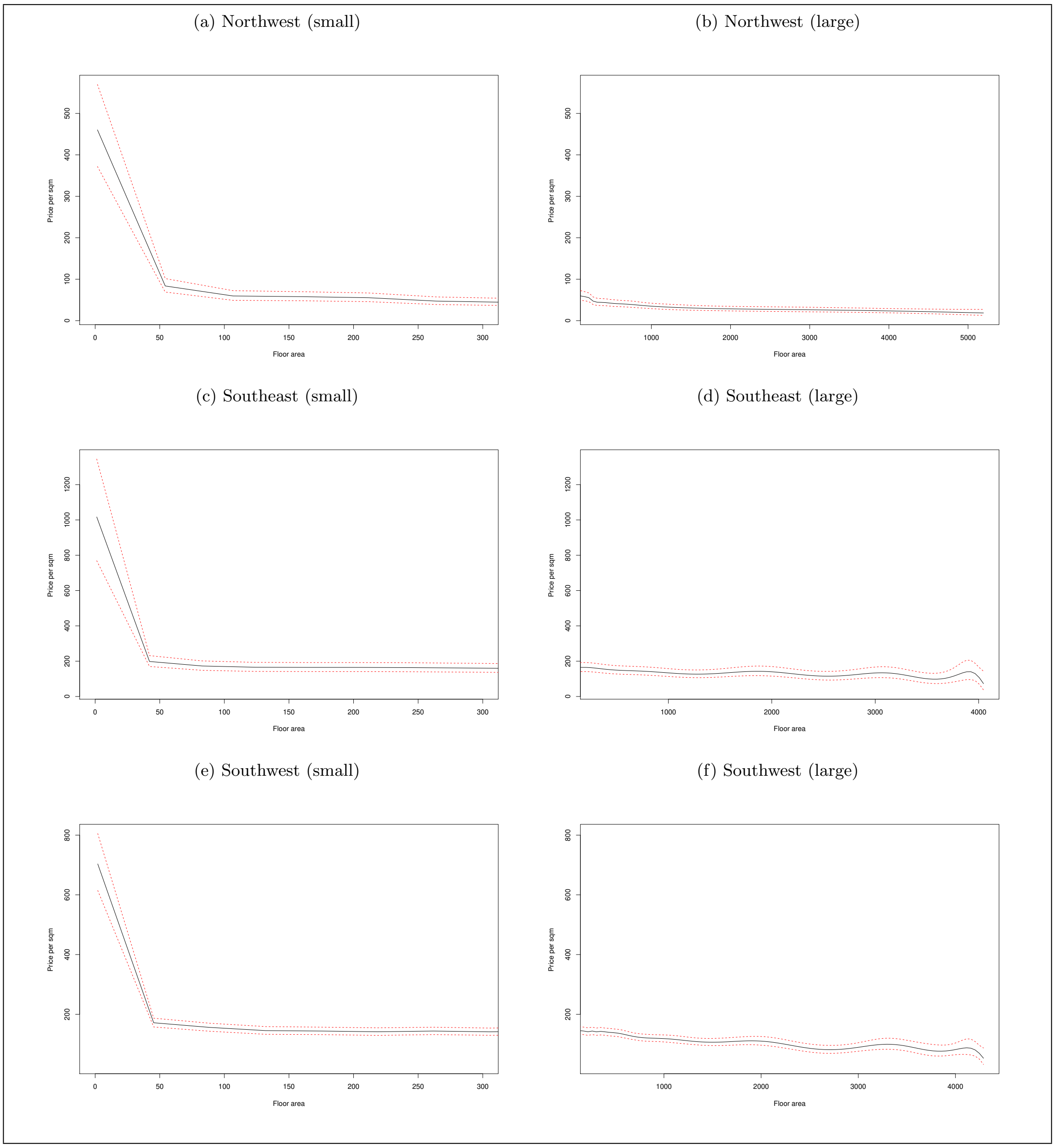
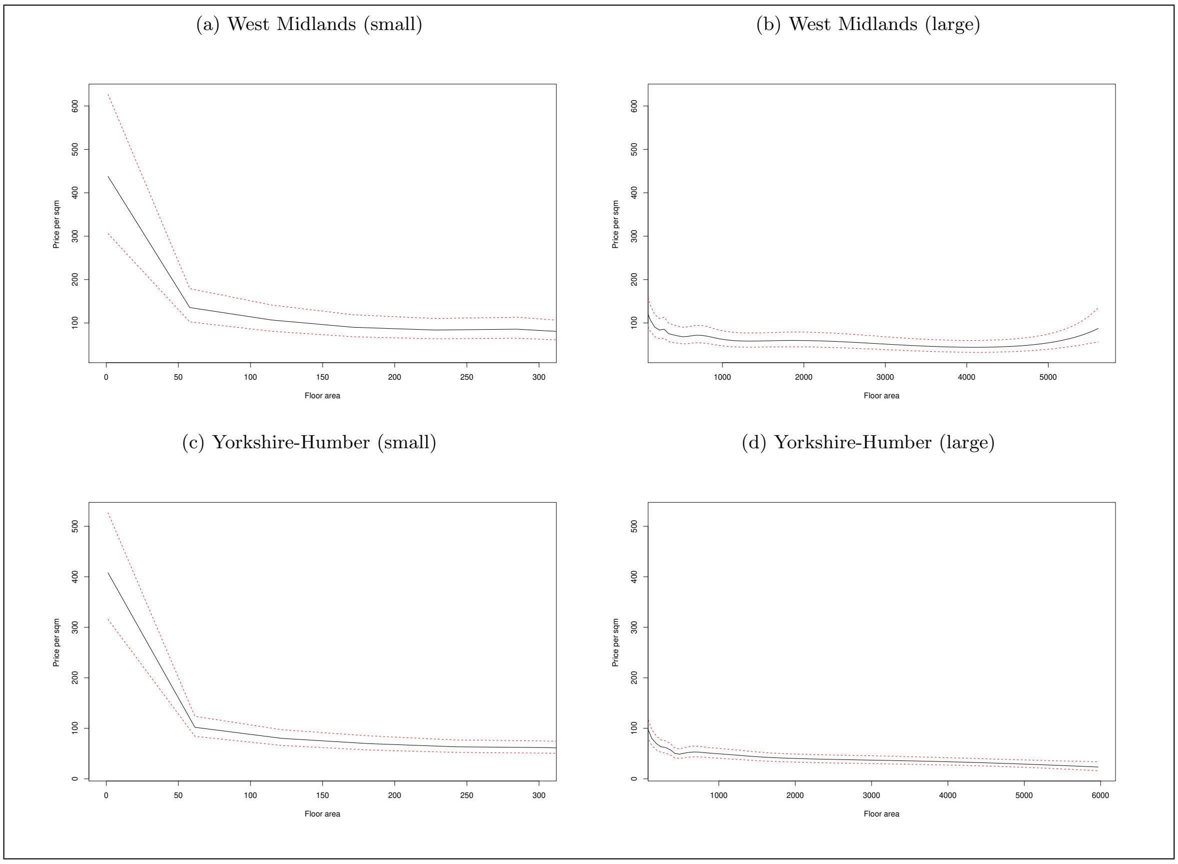


Figure 14:
Commercial property
Price per sq. m. vs. total floor area
(4)



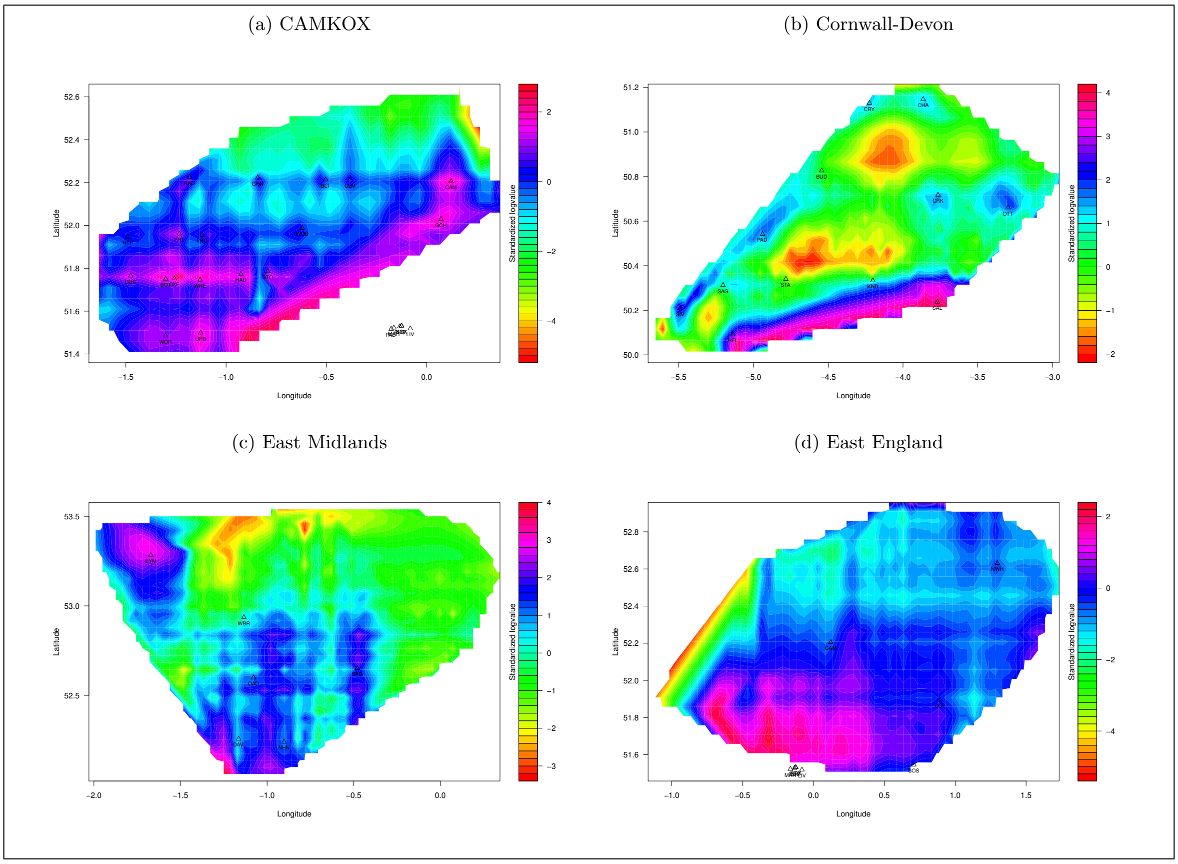
(a) West Midlands (small)

(b) West Midlands (large)

(c) Yorkshire-Humber (small)

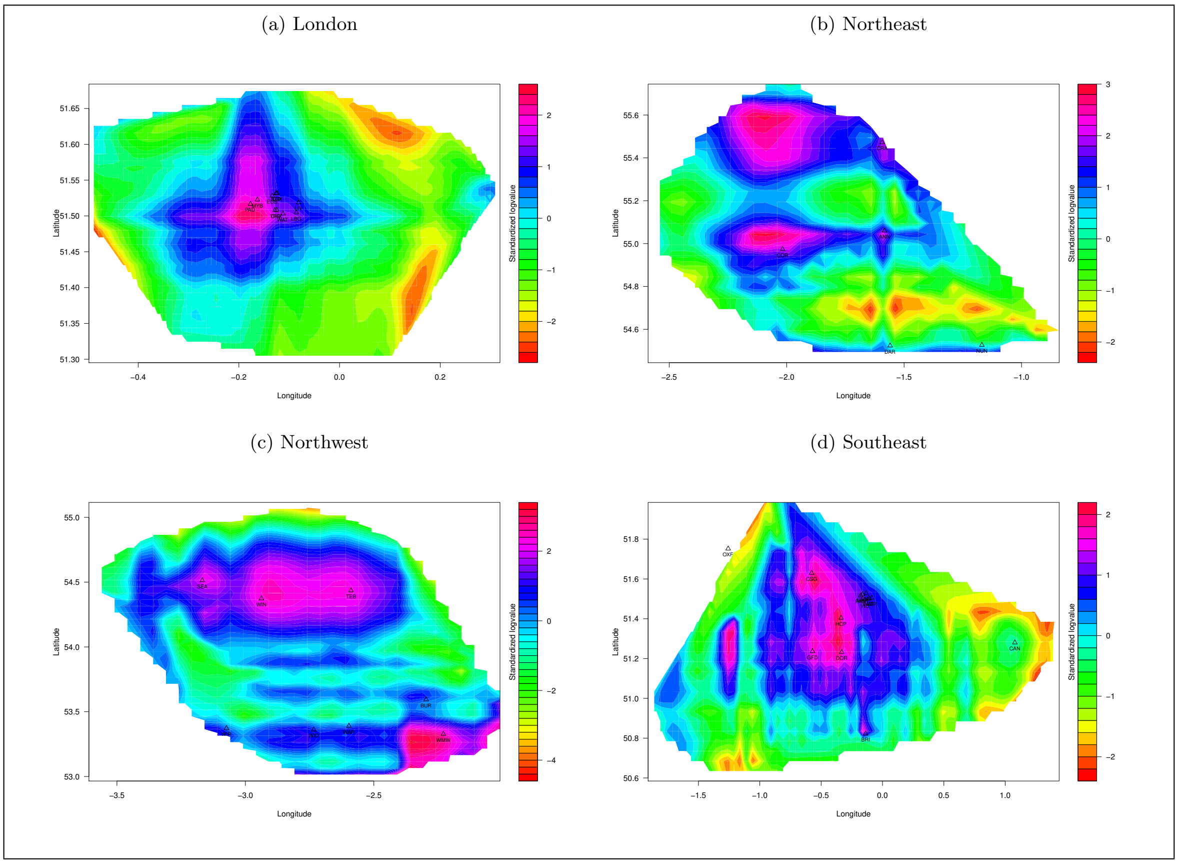
(d) Yorkshire-Humber (large)

Figure 15:
Residential property
Log location value vs location (1)



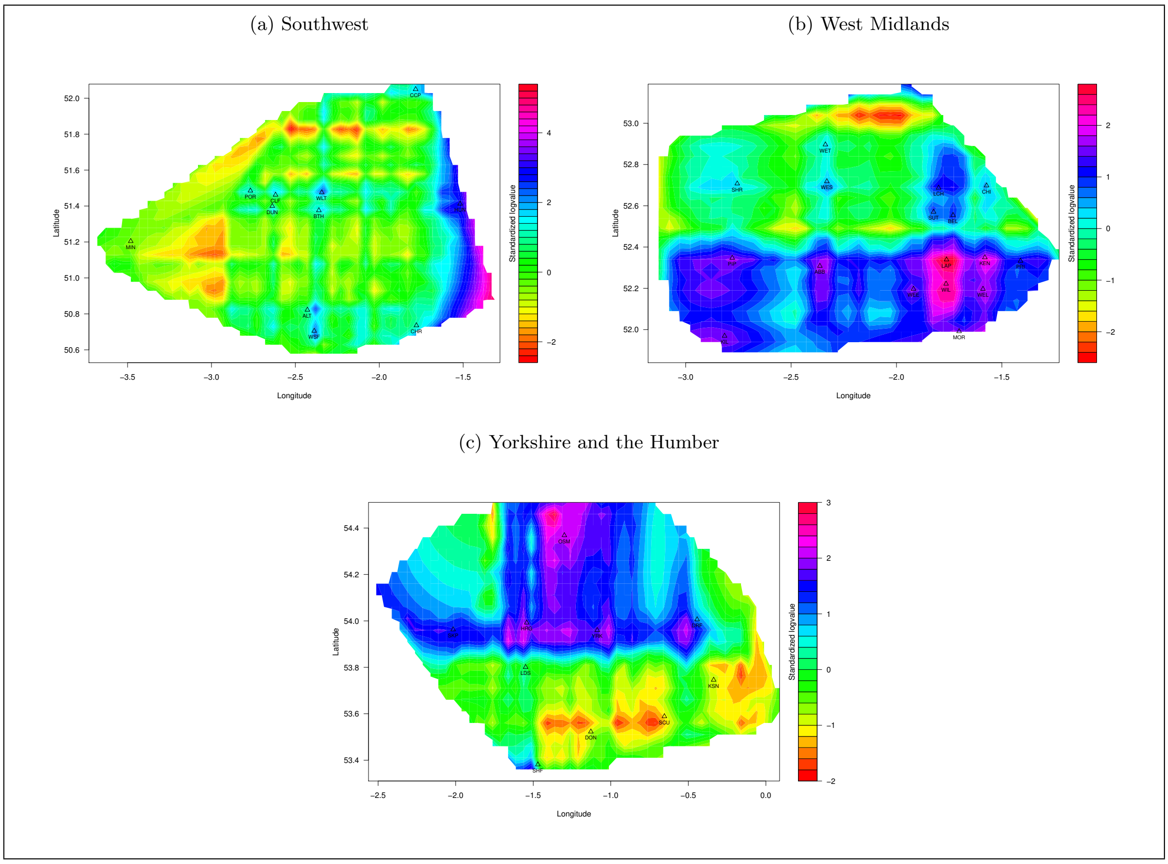
Destinations are indicated with three letter abbreviations. Full names of destinations are listed in Table B.0.20.

Figure 16:
Residential property
Log location value vs. location (2)



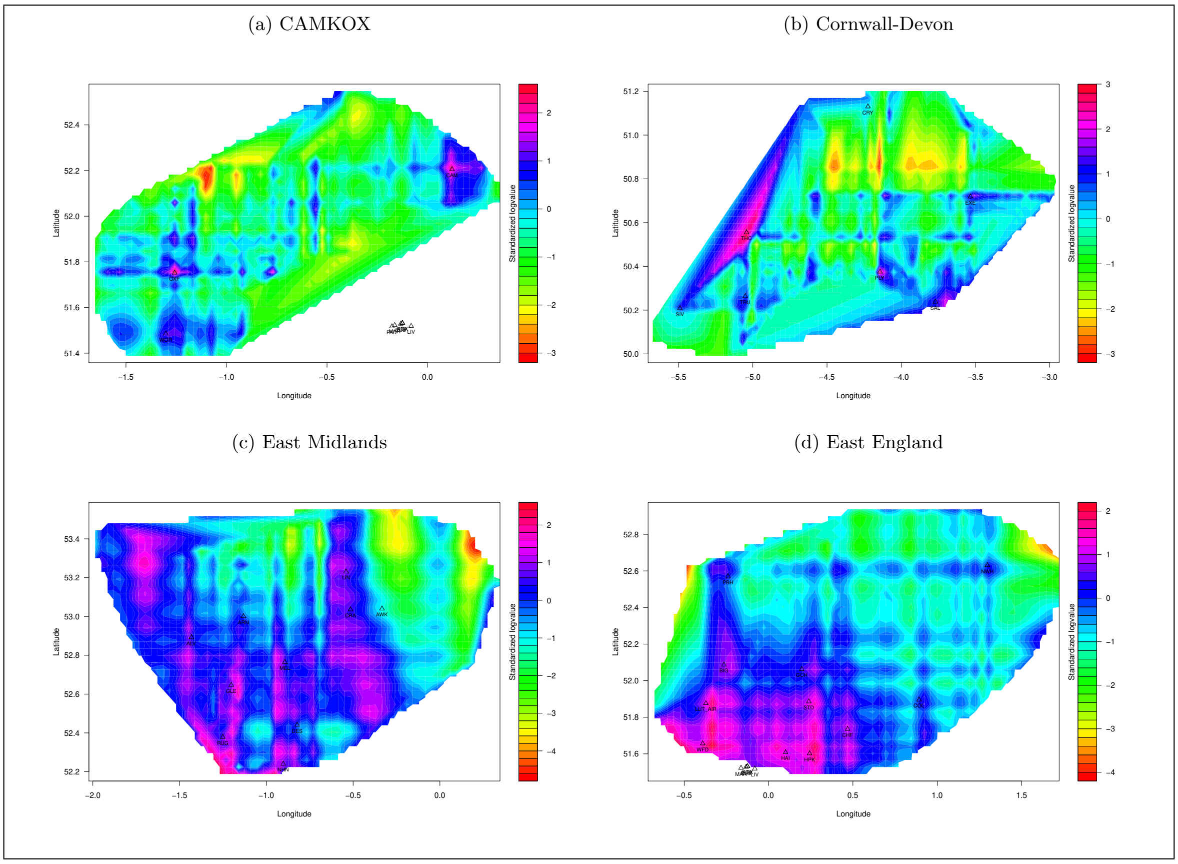
Destinations are indicated with three letter abbreviations. Full names of destinations are listed in Tables B.0.20 and B.0.21.

Figure 17:
Residential property
Log location value vs. location (3)



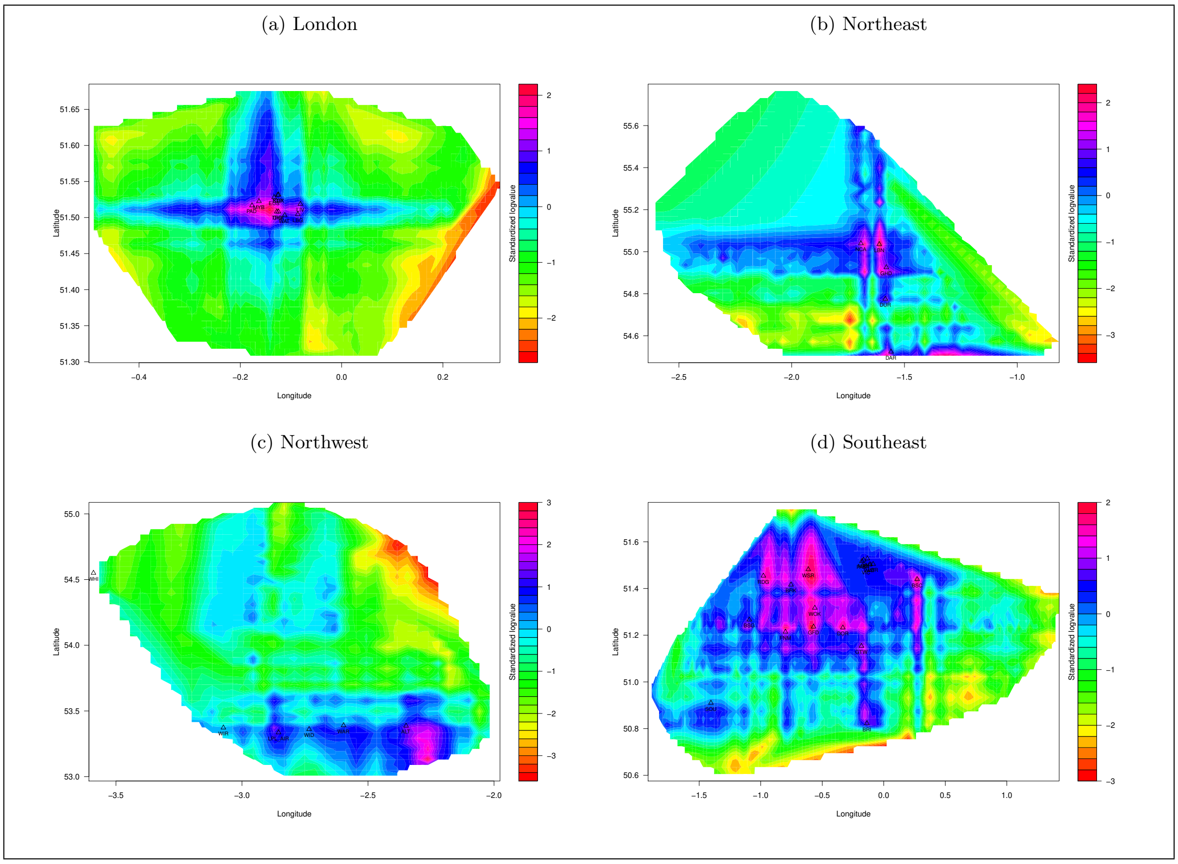
Destinations are indicated with three letter abbreviations. Full names of destinations are listed in Table B.0.21.

Figure 18:
Commercial property
Log location value vs location (1)



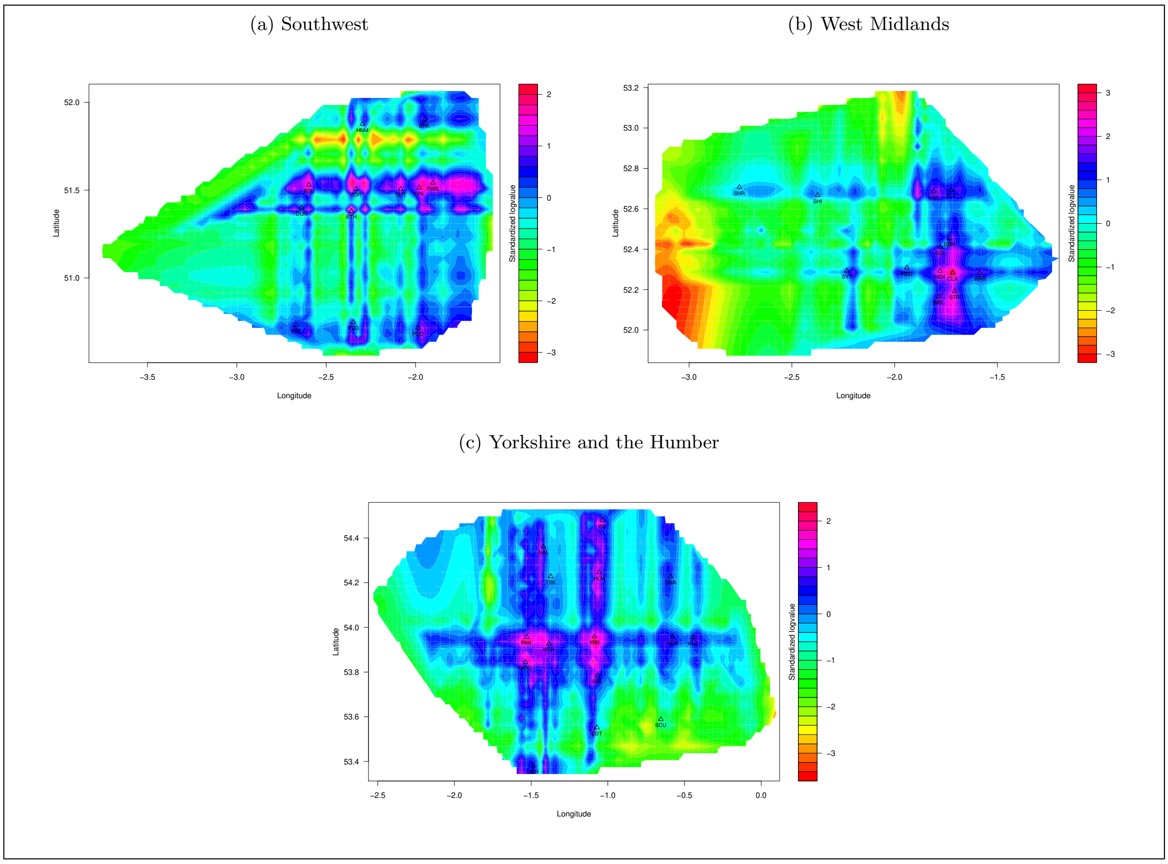
Destinations are indicated with three letter abbreviations. Full names of destinations are listed in Table B.0.26.

Figure 19:
Commercial property
Log location value vs. location (2)



Destinations are indicated with three letter abbreviations. Full names of destinations are listed in Tables B.0.26 and B.0.27.

Figure 20:
Commercial property
Log location value vs. location (3)



Destinations are indicated with three letter abbreviations. Full names of destinations are listed in Table B.0.27.