Technical Appendix to "The Housing Stock, Housing Prices, and User Costs: The Roles of Location, Structure and Unobserved Quality"

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Abstract

This appendix presents summary statistics as well as detailed tables of results for Models 1-9 in the main paper. These results show that the results found in Model 1, the baseline model in the main paper, are robust to the addition of a large range of additional variables.

1 Introduction

We use data from the "secure access" version of waves 2011-2014 of the English Housing Survey (EHS). The data is described in detail in Section 3 of the main paper. Summary statistics for the data are presented in Table A.1.

As detailed in the main body of the paper, the model estimated is a Type 5 Tobit model. The estimating equations are

$$\ln R = \alpha z + \varepsilon_r \tag{1}$$

$$\ln \pi_o = \beta z + \varepsilon_o \tag{2}$$

$$\ln \pi_o - \ln \pi_r = \gamma \mathbf{z} + \varepsilon_\mathbf{s}. \tag{3}$$

Due to computational constraints in the secure data laboratory, we chose to estimate the two pairs of equations, (1) and (3) and (2) and (3) separately using maximum likelihood estimation.

In this appendix, we describe the nine specifications estimated and provide detailed tables of results for each.

1.1 Model 1: baseline specification

The baseline specification, Model 1 in the tables below, includes nonparametric functions of dwelling location and size, indicator variables for dwelling type, dwelling age, parking availability, litter on the property and various measures of energy efficiency. It also includes a continuous measure of rear plot depth. For owner-occupied properties, we also include an indicator for whether the property price is self-reported or not. For rentals, we include measures of whether the rental was furnished by the landlord and an

indicator for whether the rental was self-reported to be at market rent.

Dwelling size is measured in square meters. As discussed in Section 4 in the main paper, location coordinates are measured in polar coordinates, distance d from Trafalgar square and angular distance θ from due East. The model includes third-order Chebyshev polynomials in size, seventh-order Chebyshev polynomials in distance, and third-order Fourier series in the angular distance. It also includes interactions between the distance terms and the angular distance terms.

1.2   Models 2-5: alternate specifications

We considered several alternate specifications to gauge the robustness of our results to model specification. Model 2 adds bedrooms, bathrooms, living rooms, number of big kitchens, fireplaces, attic, balcony and basement. Model 3 adds measures of housing quality defined as the first five principal components of a set of more than 60 measures of property quality. Model 4 adds the first three principal components from a set of more than 40 measures of neighborhood quality. Finally, Model 5 adds the first four principal components from a set of six additional neighbourhood variables.

1.3   Models 6-9: specifications with exclusion restrictions

Because geographic indicators might serve as useful proxies for local government policies that affect sector allocations, we considered four additional specifications that use geographic indicators as proxies for unobserved local policies. We label these models Model 6 - Model 9. Model 6 includes county fixed effects in the selection equation. It would have been better to use local authority or postcode district fixed effects, but this was not possible given our sample size. If local policies on sector choice vary across

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counties but market conditions do not (conditional on distance direction and location quality), then it would be valid to exclude county fixed effects from the pricing equations. Model 7 includes a variable that measures the fraction of dwellings in the local authority area that are "right-to-buy" dwellings. Right-to-buy dwellings are dwellings that were formally social housing but that have been sold. The fraction that are right-to-buy may reflect historical local political decisions that are independent from a dwelling's characteristics. Model 8 includes the predicted share of social housing in the local authority. This may be a valid instrument for reasons similar to those above. Finally Model 9 includes a measure of the predominant "tenure" of properties in the local authority area (i.e. privately built, local authority built, etc.). As above, this variable may be correlated with historical local policies that are independent of dwelling characteristics.

2 Results

Table A.1 displays summary statistics by sector for the other main variables that are used in our empirical analysis. Tables A.2-A.4 display results for Models 1-5. Each table refers to estimates from one of the equations (1)–(3) above. One can see in the tables that most of the results are not changed by adding additional variables to Model 1. In each case, the added variables (or subsets of them) have coefficients that are statistically different from zero. However, the main results are largely unchanged. For most parameters, there are no statistically different differences across columns in the tables. Here we comment on the most important differences.

The most important differences across Models 1-5 are differences in the impact of size when bedrooms and other variables are added in Model 2. We discuss these differences in detail in Section 5.2.2. in the main paper. In addition, for the log-value

equation (2), there are some small differences across the models in the dwelling type results. The coefficient on detached decreases from 0.198 in Model 1 to 0.096 in Model 5. The coefficient on converted flat increases from -0.288 to -0.200 (the difference is on the border of being significant at the 5% level) in moving from Model 1 to Model 5. Also, the coefficient on low rise flat declines from -0.179 to -0.101. Moving from Models 1-3 to Models 4-5 does lead to some small changes in the parking coefficients and the litter coefficients. Parking and litter are correlated with the neighborhood quality and urban character variables that are added in Models 4-5. The impact of bedrooms in Models 3-5 is slightly stronger than in Model 2. However, the difference is not statistically significant. The small difference could arise because the property quality measures in Models 3-5 are correlated with the bedroom variables in Model 2.

Finally, we would like to highlight that our estimates of ρ_{os} are stable across Models 1-5. The smallest estimate is Model 1, $\rho_{os} = 0.667$ (0.83) and the largest estimate is Model 5, $\rho_{os} = 0.71$ (0.072). None of the estimates are statistically distinct from the baseline Model 1 estimate of 0.667.

Table 2 displays results from Models 1-5 for the log-rent equation (1). As with log-values there are differences in the results with respect to size. These are discussed in Section 5.2.2. in the main paper. There are also some differences in the impact of dwelling type on log rent. In Models 2-5, the coefficient on detached properties is lower and the coefficient on bungalows is higher but the differences are not statistically significant. Converted flats, low rise and high rise have smaller discounts in rents in Models 2-5 (converted flats: -0.362 in Model 1 vs -0.129 in Model 5; low rise: -0.287 in Model 1 versus -0.125 in Model 5; and high rise: -.26 vs -.146). Bedrooms have a stronger impact in Models 3-5 but the difference from Model 2 is not significant.

Our estimates of the correlation between log rent unobservables and the selection

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unobservable is 0.95 in all models. The estimate is stable across all models.

Table A.4 reports detailed results for the selection equation (3) across Models 1–5. The main implications for selection have been discussed in the main text in Section 5. There are slight variations across models in Table A.4, however, the implied probabilities of selection into either sector remain largely unchanged, can be seen in table 8 in the main text. The estimates for detachedness decrease when adding variables to Model 1, however, they were never statistically different from zero. The effect of being a bungalow property increases across columns, as does the impact of being a converted flat. Similarly to both tables A.2 and A.3 above, the impact of bedrooms is larger in Models 3–5 than it is in Model 2, with the differences not statistically different from zero.

Tables A.5–A.7 display results for Models 6-9. These models test whether adding variables to the selection equation change any of our results. In Model 6 we add county fixed effects. In Model 7 we add measures of the fraction of properties in the local authority estate that are right-to-buy. In Model 8, we add the predicted postcode level market share of social housing. In Model 9, we add indicators for the predominant tenure of properties in the local area. All of these variable are potentially correlated with local policies that affect selection but not rents or values. Of these variables, only the county fixed effects are significant in the first stage selection equation. Across all models, all parameters are virtually unchanged. In particular, our estimates of ρ_{os} range from 0.71 to 0.74 and our estimate of ρ_{rs} is 0.95. The former is slightly higher than the range estimated from Models 1-5, 0.667 to 0.71. However, it is not statistically distinct. We conclude that our estimates of ρ_{os} and ρ_{rs} are robust.

3 Tables

Table A.1: Summary statistics by sector

	Rental	Owner-occupied	All
no parking access	0.3115	0.1174	0.1544
street parking	0.2202	0.1130	0.1335
off-street parking	0.4683	0.7696	0.7121
no litter	0.6906	0.8212	0.7963
minor litter	0.2957	0.1704	0.1943
major litter	0.0137	0.0084	0.0094
rear plot depth (sq. meters)	8.1709	15.4083	14.0287
SAP05/09[1]	54.8144	51.8487	52.4140
cavity, insulation	0.1547	0.3136	0.2833
cavity, no insulation	0.3786	0.3512	0.3564
other insulation	0.4667	0.3352	0.3603
heating age 0-3 years	0.2283	0.2451	0.2419
heating age 3-12 years	0.4207	0.4036	0.4069
heating age 12+ years	0.3510	0.3513	0.3512
double glazed (80%+)	0.6708	0.7958	0.7720
0-1 bedrooms	0.2099	0.0410	0.0731
2 bedrooms	0.4011	0.2238	0.2576
3 bedrooms	0.2862	0.4730	0.4374
4 bedrooms	0.0821	0.2057	0.1822
5+ bedrooms	0.0207	0.0565	0.0497
1 bathroom	0.8573	0.7048	0.7339
2 bathrooms	0.1287	0.2458	0.2235
3+ bathrooms	0.0140	0.0494	0.0426
0 living rooms	0.0137	0.0007	0.0032
1 living room	0.8107	0.5277	0.5816
2+ living rooms	0.1756	0.4716	0.4152
big kitchen	0.8406	0.9560	0.9340
fireplaces	0.2817	0.4823	0.4440
attic	0.0444	0.1170	0.1031
balcony	0.0303	0.0270	0.0295
Observations	1,016	3,043	4,059

[1]Each property has an energy efficiency rating calculated by the surveyor using the Standard Assessment Procedure (SAP05 or SAP09). This rating is based on an estimate of each dwelling's energy cost per square meter. It takes account of the cost of space and water heating, ventilation, and lighting. Higher ratings are for more energy efficient properties.

Table A.1: Summary statistics by sector

	Rental	Owner-occupied	All
basement	0.0230	0.0199	0.0205
self-reported value		0.8266	
freehold	.	0.8823	
market rent[2]	0.9290		
furnished	0.2335		
partly furnished	0.2169		
unfurnished	0.5496		
log value	.	12.4151	.
log rent	7.8565		.
log value (std. dev.)		0.5009	.
log rent (std. dev.)	0.5419		.
Observations	1,016	3,043	4,059

Table A.2: Log-value equation(2): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
detached	0.198	0.170	0.168	0.134	0.096
	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)
bungalow	0.138	0.170	0.154	0.128	0.102
	(0.021)	(0.022)	(0.037)	(0.036)	(0.035)
converted flat	-0.288	-0.191	-0.206	-0.206	-0.197
	(0.052)	(0.049)	(0.052)	(0.050)	(0.047)
low rise	-0.179	-0.101	-0.106	-0.114	-0.087
	(0.031)	(0.032)	(0.039)	(0.039)	(0.038)
high rise	-0.077	-0.010	-0.010	-0.022	0.018
	(0.076)	(0.074)	(0.080)	(0.074)	(0.073)
street parking	-0.018	-0.017	-0.018	-0.042	-0.044
	(0.026)	(0.025)	(0.024)	(0.024)	(0.024)
off-street parking	0.120	0.116	0.114	0.091	0.067
	(0.024)	(0.022)	(0.022)	(0.022)	(0.022)
minor litter	-0.092	-0.096	-0.083	-0.055	-0.055
	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)
major litter	-0.138	-0.129	-0.100	-0.031	-0.034
	(0.054)	(0.052)	(0.052)	(0.044)	(0.044)
rear plot depth	0.004	0.003	0.003	0.003	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

[2]Self-reported to be let at market rate.

Table A.2: Log-value equation(2): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
SAP05[3]	-0.002	-0.002	-0.004	-0.003	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
cavity, insulation	0.053	0.060	0.063	0.059	0.054
	(0.023)	(0.022)	(0.022)	(0.022)	(0.021)
cavity, no insulation	0.040	0.044	0.045	0.040	0.036
	(0.027)	(0.026)	(0.026)	(0.026)	(0.025)
heating age: 3-12[4]	-0.031	-0.033	-0.038	-0.035	-0.034
	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)
heating age: 12+	-0.064	-0.056	-0.058	-0.053	-0.051
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
double glazed[5]	-0.039	-0.032	-0.042	-0.036	-0.033
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
self-reported value	-0.094	-0.094	-0.092	-0.091	-0.087
	(0.015)	(0.014)	(0.014)	(0.014)	(0.013)
2 bedrooms		0.099	0.134	0.142	0.153
		(0.044)	(0.071)	(0.071)	(0.070)
3 bedrooms		0.187	0.220	0.231	0.243
		(0.052)	(0.077)	(0.077)	(0.076)
4 bedrooms		0.255	0.285	0.293	0.313
		(0.054)	(0.079)	(0.078)	(0.077)
5+ bedrooms		0.311	0.334	0.348	0.373
		(0.061)	(0.083)	(0.083)	(0.082)
2 bathrooms		0.107	0.102	0.098	0.087
		(0.015)	(0.014)	(0.014)	(0.014)
3+ bathrooms		0.172	0.171	0.169	0.160
		(0.033)	(0.033)	(0.032)	(0.032)
2+ living rooms[6]		0.064	0.062	0.057	0.061
		(0.012)	(0.012)	(0.012)	(0.012)
1+ big kitchen		0.038	0.042	0.042	0.043
		(0.031)	(0.031)	(0.030)	(0.030)

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[3]Each property has an energy efficiency rating calculated by the surveyor using the Standard Assessment Procedure (SAP05 or SAP09). This rating is based on an estimate of each dwelling's energy cost per square meter. It takes account of the cost of space and water heating, ventilation, and lighting. Higher ratings are for more energy efficient properties.

[4]Heating age is measured in years.

[5]Indicator for at least 80% double glazed.

[6]For the log-value equation, the excluded category is 0-1 living rooms.

Table A.2: Log-value equation(2): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
fireplaces		0.061	0.061	0.058	0.051
		(0.010)	(0.010)	(0.010)	(0.010)
attic		-0.064	-0.066	-0.062	-0.053
		(0.018)	(0.017)	(0.017)	(0.016)
balcony		-0.093	-0.101	-0.110	-0.102
		(0.054)	(0.053)	(0.050)	(0.050)
basement		-0.209	-0.206	-0.197	-0.207
		(0.047)	(0.049)	(0.046)	(0.045)
ρ_{os}	0.667	0.691	0.703	0.697	0.710
	(0.083)	(0.075)	(0.073)	(0.074)	(0.072)
σ_{oo}	0.0902	0.0831	0.0826	0.0975	0.0764
	(0.009)	(0.008)	(0.008)	(0.010)	(0.008)
PCA quality[7]			Y	Y	Y
PCA local[8]				Y	Y
PCA urban[9]					Y
Observations	4059	4059	4059	4059	4059
Log likelihood	-3.522e+06	-3.186e+06	-3.136e+06	-3.036e+06	-2.886e+06
AIC	7.045e+06	6.373e+06	6.272e+06	6.073e+06	5.772e+06
CHI2	5658.25	6701.10	6788.06	7122.41	7603.52

Note: The table displays weighted (using EHS sampling weights) maximum likelihood estimates of Type II Tobit model parameter values estimated using data from the 2011 wave of the EHS. The models includes the variables listed in the table, dummy variables for quarter and dwelling age, and nonparametric functions of size, distance from London, and angular direction. For the nonparametric functions we use Chebyshev polynomials in distance and in size and Fourier series in angular direction. The number of terms in the series were chosen to minimise the Bayes Information Criteria (BIC). The selected model includes third order polynomials in size (square meters), seventh order polynomials in distance (kilometers), and Fourier series up to order three. Polynomials and Fourier series coefficients and selected other variables are omitted from the table for concision.

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[7]Model includes first 5 principal components of more than 60 measures of quality.

[8]Model includes first 3 principal components of more than 40 neighborhood quality measures.

[9]Model includes first 4 principal components of 6 measures of urban character.

Table A.3: Log-rent equation (1): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
detached	0.195	0.132	0.127	0.115	0.116
	(0.086)	(0.081)	(0.082)	(0.083)	(0.087)
bungalow	0.110	0.172	0.191	0.172	0.176
	(0.097)	(0.091)	(0.103)	(0.102)	(0.102)
converted flat	-0.362	-0.129	-0.137	-0.159	-0.168
	(0.076)	(0.067)	(0.075)	(0.075)	(0.075)
low rise	-0.287	-0.125	-0.104	-0.101	-0.092
	(0.056)	(0.055)	(0.068)	(0.069)	(0.070)
high rise	-0.260	-0.146	-0.120	-0.147	-0.137
	(0.114)	(0.113)	(0.121)	(0.122)	(0.122)
1919 to 1944	0.079	0.071	0.043	0.032	0.022
	(0.054)	(0.052)	(0.051)	(0.052)	(0.053)
1945 to 1964	-0.003	-0.002	-0.051	-0.065	-0.069
	(0.066)	(0.065)	(0.064)	(0.063)	(0.065)
1965 to 1980	0.179	0.202	0.144	0.132	0.124
	(0.072)	(0.070)	(0.069)	(0.069)	(0.071)
post 1980	0.073	0.096	0.038	0.013	-0.002
	(0.073)	(0.071)	(0.073)	(0.073)	(0.076)
street parking	-0.058	-0.072	-0.082	-0.094	-0.096
	(0.049)	(0.047)	(0.046)	(0.046)	(0.046)
off-street parking	0.112	0.091	0.071	0.056	0.053
	(0.046)	(0.043)	(0.042)	(0.042)	(0.042)
minor litter	-0.149	-0.156	-0.120	-0.092	-0.095
	(0.037)	(0.036)	(0.037)	(0.038)	(0.038)
major litter	-0.128	-0.089	0.002	0.072	0.062
	(0.129)	(0.119)	(0.114)	(0.113)	(0.113)
rear plot depth	0.008	0.007	0.006	0.006	0.006
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
SAP05[10]	-0.001	-0.001	-0.002	-0.002	-0.002
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
cavity, insulation	0.110	0.096	0.100	0.095	0.095
	(0.060)	(0.058)	(0.057)	(0.057)	(0.057)
cavity, no insulation	-0.037	-0.048	-0.034	-0.044	-0.043
	(0.077)	(0.074)	(0.073)	(0.073)	(0.073)

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[10]Each property has an energy efficiency rating calculated by the surveyor using the Standard Assessment Procedure (SAP05 or SAP09). This rating is based on an estimate of each dwelling's energy cost per square meter. It takes account of the cost of space and water heating, ventilation, and lighting. Higher ratings are for more energy efficient properties.

Table A.3: Log-rent equation (1): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
heating age: 3-12[11]	-0.087	-0.078	-0.079	-0.073	-0.071
	(0.041)	(0.039)	(0.039)	(0.039)	(0.039)
heating age: 12+	-0.115	-0.098	-0.091	-0.086	-0.089
	(0.046)	(0.045)	(0.044)	(0.044)	(0.044)
double glazed[12]	0.052	0.066	0.041	0.046	0.046
	(0.038)	(0.035)	(0.035)	(0.035)	(0.035)
market rent[13]	0.654	0.626	0.633	0.626	0.624
	(0.081)	(0.074)	(0.074)	(0.074)	(0.073)
partly furnished	0.007	0.025	0.024	0.017	0.015
	(0.032)	(0.031)	(0.030)	(0.030)	(0.030)
unfurnished	-0.037	-0.005	-0.011	-0.015	-0.023
	(0.027)	(0.028)	(0.028)	(0.028)	(0.027)
2 bedrooms		0.247	0.377	0.382	0.389
		(0.055)	(0.090)	(0.091)	(0.091)
3 bedrooms		0.475	0.604	0.620	0.621
		(0.078)	(0.104)	(0.105)	(0.105)
4 bedrooms		0.542	0.674	0.691	0.683
		(0.102)	(0.124)	(0.124)	(0.125)
5+ bedrooms		0.570	0.693	0.706	0.691
		(0.142)	(0.159)	(0.159)	(0.160)
2 bathrooms		0.103	0.096	0.084	0.083
		(0.056)	(0.056)	(0.057)	(0.057)
3+ bathrooms		0.067	0.076	0.074	0.093
		(0.152)	(0.149)	(0.148)	(0.152)
1 living room		0.899	0.822	0.740	0.746
		(0.264)	(0.242)	(0.263)	(0.264)
2+ living rooms		1.082	0.998	0.916	0.920
		(0.268)	(0.246)	(0.267)	(0.268)
1+ big kitchens		0.209	0.191	0.199	0.199
		(0.047)	(0.046)	(0.046)	(0.046)
fireplaces		0.065	0.062	0.060	0.057
		(0.031)	(0.030)	(0.030)	(0.030)
attic		-0.082	-0.076	-0.071	-0.068
		(0.067)	(0.066)	(0.065)	(0.066)

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[11]Heating age is measured in years.
[12]Indicator for at least 80% double glazed.
[13]Self-reported to be at market rate rent.

Table A.3: Log-rent equation (1): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
balcony		-0.222	-0.246	-0.240	-0.241
		(0.109)	(0.113)	(0.114)	(0.112)
basement		-0.189	-0.166	-0.146	-0.135
		(0.107)	(0.107)	(0.105)	(0.107)
ρ_{rs}	0.951	0.951	0.950	0.951	0.950
	(0.012)	(0.012)	(0.013)	(0.013)	(0.012)
σ_{rr}	0.386	0.337	0.324	0.324	0.324
	(0.0525)	(0.042)	(0.040)	(0.040)	(0.040)
PCA quality[14]			Y	Y	Y
PCA local[15]				Y	Y
PCA urban[16]					Y
Observations	4059	4059	4059	4059	4059
Log likelihood	-3.262e+06	-3.109e+06	-3.078e+06	-3.062e+06	-3.047e+06
AIC	6.524e+06	6.217e+06	6.156e+06	6.125e+06	6.095e+06
CHI2	972.04	1126.15	1191.72	1218.75	1249.94

Note: The table displays weighted (using EHS sampling weights) maximum likelihood estimates of Type II Tobit model parameter values estimated using data from the 2011 wave of the EHS. The models includes the variables listed in the table, dummy variables for quarter and dwelling age, and nonparametric functions of size, distance from London, and angular direction. For the nonparametric functions we use Chebyshev polynomials in distance and in size and Fourier series in angular direction. The number of terms in the series were chosen to minimise the Bayes Information Criteria (BIC). The selected model includes third order polynomials in size (square meters), seventh order polynomials in distance (kilometers), and Fourier series up to order three. Polynomials and Fourier series coefficients and selected other variables are omitted from the table for concision.

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[14]Model includes first 5 principal components of more than 60 measures of quality.

[15]Model includes first 3 principal components of more than 40 neighborhood quality measures.

[16]Model includes first 4 principal components of 6 measures of urban character.

Table A.4: Selection equation (3): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
detached	0.101	0.055	0.039	0.036	-0.016
	(0.093)	(0.094)	(0.098)	(0.101)	(0.106)
bungalow	0.583	0.639	0.687	0.689	0.690
	(0.164)	(0.167)	(0.200)	(0.205)	(0.211)
converted flat	-0.678	-0.442	-0.456	-0.480	-0.493
	(0.130)	(0.138)	(0.150)	(0.150)	(0.150)
low rise	-0.452	-0.309	-0.265	-0.257	-0.276
	(0.094)	(0.101)	(0.132)	(0.132)	(0.135)
high rise	-0.450	-0.323	-0.264	-0.287	-0.329
	(0.239)	(0.242)	(0.263)	(0.261)	(0.264)
1919_1944	-0.007	0.034	0.011	0.01	0.091
	-0.09	-0.093	-0.093	-0.093	-0.098
1945_1964	-0.068	0.002	-0.035	-0.058	-0.046
	-0.108	-0.112	-0.111	-0.111	-0.116
1965_1980	0.109	0.209	0.17	0.143	0.079
	-0.115	-0.12	-0.119	-0.119	-0.126
post_1980	-0.017	0.101	0.068	0.028	-0.048
	-0.122	-0.126	-0.126	-0.126	-0.133
street parking	0.018	0.031	0.026	0.011	0.010
	(0.087)	(0.088)	(0.088)	(0.088)	(0.088)
off-street parking	0.344	0.355	0.344	0.328	0.331
	(0.078)	(0.077)	(0.077)	(0.078)	(0.079)
minor litter	-0.258	-0.261	-0.234	-0.200	-0.200
	(0.062)	(0.063)	(0.063)	(0.065)	(0.064)
major litter	-0.146	-0.113	-0.043	0.044	0.053
	(0.218)	(0.217)	(0.206)	(0.209)	(0.211)
rear plot depth	0.013	0.012	0.012	0.011	0.012
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
SAP05[17]	-0.007	-0.007	-0.009	-0.008	-0.008
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
cavity, insulation	0.377	0.364	0.375	0.376	0.372
	(0.093)	(0.094)	(0.095)	(0.069)	(0.069)
cavity, no insulation	0.020	0.000	0.008	0.001	0.009
	(0.115)	(0.117)	(0.117)	(0.117)	(0.117)

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[17]Each property has an energy efficiency rating calculated by the surveyor using the Standard Assessment Procedure (SAP05 or SAP09). This rating is based on an estimate of each dwelling's energy cost per square meter. It takes account of the cost of space and water heating, ventilation, and lighting. Higher ratings are for more energy efficient properties.

Table A.4: Selection equation (3): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
heating age: 3-12[18]	-0.173	-0.176	-0.177	-0.164	-0.158
	(0.069)	(0.069)	(0.068)	(0.068)	(0.068)
heating age: 12+	-0.226	-0.229	-0.223	-0.216	-0.220
	(0.072)	(0.073)	(0.073)	(0.073)	(0.073)
double glazed[19]	0.184	0.211	0.186	0.186	0.172
	(0.068)	(0.068)	(0.069)	(0.070)	(0.071)
2 bedrooms		0.140	0.458	0.464	0.472
		(0.127)	(0.206)	(0.205)	(0.204)
3 bedrooms		0.313	0.626	0.645	0.650
		(0.154)	(0.219)	(0.218)	(0.217)
4 bedrooms		0.283	0.596	0.627	0.614
		(0.171)	(0.231)	(0.230)	(0.229)
5+ bedrooms		0.091	0.399	0.444	0.407
		(0.213)	(0.263)	(0.262)	(0.259)
2 bathrooms		-0.124	-0.124	-0.124	-0.127
		(0.074)	(0.076)	(0.076)	(0.076)
3+ bathrooms		-0.237	-0.186	-0.189	-0.181
		(0.160)	(0.170)	(0.171)	(0.170)
1 living rooms		1.334	1.255	1.104	1.058
		(0.529)	(0.532)	(0.501)	(0.507)
2+ living rooms		1.643	1.572	1.421	1.368
		(0.533)	(0.536)	(0.505)	(0.511)
1+ big kitchens		0.438	0.438	0.454	0.450
		(0.092)	(0.092)	(0.093)	(0.093)

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[18]Heating system age is measured in years.
[19]Indicator for at least 80% double glazed.

Table A.4: Selection equation (3): Models 1-5

	Model 1	Model 2	Model 3	Model 4	Model 5
fireplaces		0.122	0.120	0.117	0.124
		(0.046)	(0.046)	(0.046)	(0.047)
attic		-0.171	-0.171	-0.150	-0.167
		(0.091)	(0.091)	(0.091)	(0.091)
balcony		-0.231	-0.306	-0.295	-0.299
		(0.206)	(0.213)	(0.216)	(0.215)
basement		-0.221	-0.203	-0.177	-0.182
		(0.195)	(0.201)	(0.201)	(0.203)
PCA quality[20]			Y	Y	Y
PCA local[21]				Y	Y
PCA urban[22]					Y

Note: This table displays the parameter estimates for the selection equation from the Type 2 Tobit model for

Models 1-5. Details are the same as in Tables 1 and 2.

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[20]Model includes first 5 principal components of more than 60 measures of quality.

[21]Model includes first 3 principal components of more than 40 neighborhood quality measures.

[22]Model includes first 4 principal components of 6 measures of urban character.

Table A.5: Log-value equation (2): Models 6-9

	Model 6	Model 7	Model 8	Model 9
detached	0.096	0.096	0.096	0.096
	(0.018)	(0.018)	(0.018)	(0.018)
bungalow	0.103	0.101	0.102	0.101
	(0.035)	(0.035)	(0.035)	(0.035)
converted flat	-0.200	-0.199	-0.197	-0.198
	(0.047)	(0.047)	(0.047)	(0.047)
low rise	-0.088	-0.088	-0.087	-0.087
	(0.038)	(0.038)	(0.038)	(0.038)
high rise	0.013	0.016	0.018	0.018
	(0.074)	(0.073)	(0.073)	(0.073)
1919 to 1944	-0.054	-0.052	-0.053	-0.053
	(0.023)	(0.023)	(0.023)	(0.023)
1945 to 1964	-0.055	-0.054	-0.054	-0.054
	(0.026)	(0.025)	(0.026)	(0.026)
1965 to 1980	-0.050	-0.050	-0.050	-0.050
	(0.028)	(0.028)	(0.028)	(0.028)
post 1980	-0.071	-0.072	-0.071	-0.071
	(0.030)	(0.030)	(0.030)	(0.030)
Street parking	-0.044	-0.044	-0.044	-0.044
	(0.024)	(0.024)	(0.024)	(0.024)
off-street parking	0.068	0.067	0.067	0.067
	(0.022)	(0.022)	(0.022)	(0.022)
minor litter	-0.055	-0.055	-0.055	-0.056
	(0.015)	(0.015)	(0.015)	(0.015)
major litter	-0.032	-0.033	-0.034	-0.034
	(0.044)	(0.044)	(0.044)	(0.044)
rear plot depth	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
SAP05[23]	-0.002	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
cavity, insulation	0.055	0.054	0.054	0.054
	(0.021)	(0.021)	(0.021)	(0.021)
cavity, no insulation	0.036	0.036	0.036	0.036
	(0.025)	(0.024)	(0.025)	(0.025)

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[23]Each property has an energy efficiency rating calculated by the surveyor using the Standard Assessment Procedure (SAP05 or SAP09). This rating is based on an estimate of each dwelling's energy cost per square meter. It takes account of the cost of space and water heating, ventilation, and lighting. Higher ratings are for more energy efficient properties.

Table A.5: Log-value equation (2): Models 6-9

	Model 6	Model 7	Model 8	Model 9
heating age: 3-12[24]	-0.034	-0.034	-0.034	-0.034
	(0.014)	(0.014)	(0.014)	(0.014)
heating age: 12+	-0.051	-0.051	-0.051	-0.052
	(0.016)	(0.016)	(0.016)	(0.016)
double glazed[25]	-0.032	-0.033	-0.033	-0.033
	(0.016)	(0.016)	(0.016)	(0.016)
2 bedrooms	0.155	0.153	0.153	0.154
	(0.070)	(0.070)	(0.070)	(0.071)
3 bedrooms	0.244	0.243	0.242	0.244
	(0.075)	(0.076)	(0.076)	(0.076)
4 bedrooms	0.314	0.314	0.313	0.315
	(0.077)	(0.077)	(0.077)	(0.078)
5+ bedrooms	0.374	0.374	0.373	0.375
	(0.082)	(0.082)	(0.082)	(0.082)
2 bathrooms	0.088	0.087	0.087	0.087
	(0.014)	(0.014)	(0.014)	(0.014)
3+ bathrooms	0.161	0.160	0.160	0.160
	(0.032)	(0.032)	(0.032)	(0.032)
1 living room	0.198	0.196	0.198	0.195
	(0.132)	(0.135)	(0.136)	(0.134)
2+ living rooms	0.260	0.257	0.260	0.256
	(0.133)	(0.135)	(0.137)	(0.135)
1+ big kitchens	0.045	0.043	0.043	0.043
	(0.029)	(0.030)	(0.030)	(0.030)
fireplaces	0.052	0.051	0.051	0.051
	(0.010)	(0.010)	(0.010)	(0.010)
attic	-0.053	-0.053	-0.053	-0.053
	(0.016)	(0.016)	(0.016)	(0.016)
balcony	-0.103	-0.103	-0.102	-0.102
	(0.050)	(0.050)	(0.050)	(0.050)
basement	-0.207	-0.207	-0.207	-0.207
	(0.046)	(0.045)	(0.045)	(0.045)
self-reported value	-0.087	-0.087	-0.087	-0.087
	(0.013)	(0.013)	(0.013)	(0.013)

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[24]Heating age is measured in years.
[25]Inidicator for at least 80% double glazed.

Table A.5: Log-value equation (2): Models 6-9

	Model 6	Model 7	Model 8	Model 9
ρ_{os}	0.7357	0.7104	0.7099	0.7119
	(0.064)	(0.071)	(0.072)	(0.071)
σ_{oo}	0.0772	0.0762	0.0764	0.0764
	(0.0077)	(0.0078)	(0.0078)	(0.0078)
PCA quality[26]	Y	Y	Y	Y
PCA local[27]	Y	Y	Y	Y
PCA urban[28]	Y	Y	Y	Y
county fixed effects	Y			
fraction RTB[29]		Y		
Pr(social)[30]			Y	
predominant tenure[31]				Y
Observations	4059	4059	4059	4059
Log likelihood	-2.864e+06	-2.877e+06	-2.886e+06	-2.884e+06
AIC	5.728e+06	5.753e+06	5.772e+06	5.768e+06
CHI2	7637.5189	7645.2627	7603.2837	7622.4215

Note: The table displays results from Models 6-9. Each model adds a set of additional variables to the selection equation from Model 5 detailed in Tables 1 and 3. The set of variables added are detailed at the bottom of the table.

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[26]Model includes first 5 principal components of more than 60 measures of quality.

[27]Model includes first 3 principal components of more than 40 neighborhood quality measures.

[28]Model includes first 4 principal components of 6 measures of urban character.

[29]Model includes measures of the fraction of properties in the local authority estate that are "right-to-buy" (RTB).

[30]Model includes predicted share of local area that is social housing.

[31]Model includes measures of predominant tenure of properties in local area.

Table A.6: Log-rent equation (1): Models 6-9

	Model 6	Model 7	Model 8	Model 9
detached	0.116	0.111	0.115	0.111
	(0.087)	(0.086)	(0.086)	(0.087)
bungalow	0.161	0.184	0.176	0.180
	(0.102)	(0.102)	(0.102)	(0.102)
converted flat	-0.163	-0.167	-0.165	-0.167
	(0.076)	(0.076)	(0.076)	(0.075)
low rise	-0.091	-0.090	-0.091	-0.092
	(0.071)	(0.071)	(0.071)	(0.071)
high rise	-0.131	-0.126	-0.131	-0.133
	(0.122)	(0.122)	(0.123)	(0.123)
1919 to 1944	0.019	0.019	0.023	0.022
	(0.053)	(0.053)	(0.053)	(0.053)
1945 to 1964	-0.069	-0.067	-0.067	-0.068
	(0.065)	(0.064)	(0.065)	(0.064)
1965 to 1980	0.129	0.128	0.127	0.127
	(0.071)	(0.071)	(0.071)	(0.071)
post 1980	0.000	0.005	-0.001	0.000
	(0.076)	(0.076)	(0.076)	(0.076)
street parking	-0.092	-0.098	-0.096	-0.096
	(0.046)	(0.046)	(0.046)	(0.046)
off-street parking	0.052	0.054	0.055	0.053
	(0.042)	(0.042)	(0.042)	(0.042)
minor litter	-0.100	-0.097	-0.098	-0.096
	(0.037)	(0.037)	(0.038)	(0.037)
major litter	0.058	0.054	0.057	0.061
	(0.113)	(0.113)	(0.113)	(0.114)
rear plot depth	0.006	0.006	0.006	0.006
	(0.002)	(0.002)	(0.002)	(0.002)
SAP05[32]	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
cavity, insulation	-0.137	-0.136	-0.141	-0.138
	(0.046)	(0.045)	(0.046)	(0.046)
cavity, no insulation	-0.093	-0.090	-0.097	-0.093
	(0.057)	(0.056)	(0.057)	(0.057)

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[32]Each property has an energy efficiency rating calculated by the surveyor using the Standard Assessment Procedure (SAP05 or SAP09). This rating is based on an estimate of each dwelling's energy cost per square meter. It takes account of the cost of space and water heating, ventilation, and lighting. Higher ratings are for more energy efficient properties.

Table A.6: Log-rent equation (1): Models 6-9

	Model 6	Model 7	Model 8	Model 9
heating age: 3-12[33]	-0.075	-0.071	-0.072	-0.071
	(0.039)	(0.039)	(0.039)	(0.039)
heating age: 12+	-0.091	-0.088	-0.089	-0.090
	(0.044)	(0.044)	(0.044)	(0.044)
double glazed[34]	0.044	0.047	0.046	0.045
	(0.035)	(0.035)	(0.035)	(0.035)
2 bedrooms	0.382	0.388	0.387	0.386
	(0.091)	(0.091)	(0.091)	(0.091)
3 bedrooms	0.609	0.618	0.617	0.616
	(0.105)	(0.105)	(0.105)	(0.105)
4 bedrooms	0.704	0.699	0.699	0.701
	(0.118)	(0.117)	(0.118)	(0.118)
5+ bedrooms	0.738	0.753	0.753	0.746
	(0.130)	(0.130)	(0.130)	(0.130)
2 bathrooms	0.077	0.078	0.079	0.077
	(0.056)	(0.055)	(0.056)	(0.056)
3+ bathrooms	0.073	0.078	0.077	0.078
	(0.153)	(0.154)	(0.150)	(0.153)
1 living room	0.742	0.749	0.751	0.749
	(0.266)	(0.267)	(0.265)	(0.266)
2+ living rooms	0.916	0.924	0.926	0.923
	(0.270)	(0.271)	(0.269)	(0.270)
1+ big kitchens	0.198	0.200	0.199	0.198
	(0.046)	(0.046)	(0.046)	(0.046)
fireplaces	0.054	0.057	0.056	0.057
	(0.030)	(0.030)	(0.030)	(0.030)
attic	-0.061	-0.062	-0.065	-0.065
	(0.067)	(0.066)	(0.067)	(0.067)
balcony	-0.235	-0.236	-0.240	-0.242
	(0.110)	(0.111)	(0.112)	(0.112)
basement	-0.138	-0.135	-0.140	-0.134
	(0.107)	(0.107)	(0.107)	(0.106)
market rent	0.617	0.621	0.623	0.626
	(0.071)	(0.073)	(0.072)	(0.072)
partly furnished	0.016	0.015	0.015	0.015
	(0.030)	(0.029)	(0.030)	(0.030)

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[33]Heating age is measured in years.
[34]Indicator for at least 80% double glazed.

Table A.6: Log-rent equation (1): Models 6-9

	Model 6	Model 7	Model 8	Model 9
unfurnished	-0.020	-0.021	-0.023	-0.024
	(0.027)	(0.027)	(0.027)	(0.027)
ρ_{rs}	0.9544	0.9548	0.9534	0.9531
	(0.010)	(0.010)	(0.010)	(0.011)
σ_{rr}	0.3237	0.3250	0.3250	0.3243
	(0.040)	(0.040)	(0.040)	(0.040)
PCA quality[35]	Y	Y	Y	Y
PCA local[36]	Y	Y	Y	Y
PCA urban[37]	Y	Y	Y	Y
county fixed effects	Y			
fraction RTB[38]		Y		
Pr(social)[39]			Y	
predominant tenure[40]				Y
Observations	4059	4059	4059	4059
Log likelihood	-3.035e+06	-3.040e+06	-3.047e+06	-3.047e+06
AIC	6.069e+06	6.080e+06	6.095e+06	6.0923e+06
CHI2	1278.84	1274.64	1264.86	1273.33

Note: The table displays results from Models 6-9. Each model adds a set of additional variables to the selection

equation from Model 5 detailed in Tables 2 and 3. The set of variables added are detailed at the bottom of the table.

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[35]Model includes first 5 principal components of more than 60 measures of quality.

[36]Model includes first 3 principal components of more than 40 neighborhood quality measures.

[37]Model includes first 4 principal components of 6 measures of urban character.

[38]Model includes measures of the fraction of properties in the local authority estate that are "right-to-buy" (RTB).

[39]Model includes predicted share of local area that is social housing.

[40]Model includes measures of predominant tenure of properties in local area.

Table A.7: Selection equation (3): Models 6-9

	Model 6	Model 7	Model 8	Model 9
detached	-0.036	-0.006	-0.011	-0.013
	(0.106)	(0.105)	(0.106)	(0.105)
bungalow	0.726	0.708	0.692	0.700
	(0.212)	(0.211)	(0.212)	(0.212)
converted flat	-0.506	-0.475	-0.493	-0.490
	(0.150)	(0.150)	(0.150)	(0.150)
low rise	-0.262	-0.267	-0.272	-0.268
	(0.135)	(0.136)	(0.135)	(0.135)
high rise	-0.333	-0.318	-0.323	-0.326
	(0.267)	(0.265)	(0.264)	(0.265)
1919 to 1944	0.095	0.058	0.092	0.078
	(0.099)	(0.100)	(0.099)	(0.099)
1945 to 1964	-0.022	-0.087	-0.045	-0.063
	(0.116)	(0.118)	(0.116)	(0.118)
1965 to 1980	0.085	0.066	0.079	0.074
	(0.125)	(0.127)	(0.126)	(0.127)
post 1980	-0.046	-0.037	-0.049	-0.039
	(0.133)	(0.134)	(0.133)	(0.134)
street parking	0.011	0.013	0.010	0.003
	(0.088)	(0.088)	(0.088)	(0.088)
off-street parking	0.320	0.341	0.332	0.330
	(0.079)	(0.080)	(0.079)	(0.079)
minor litter	-0.208	-0.207	-0.198	-0.203
	(0.064)	(0.064)	(0.064)	(0.064)
major litter	0.064	0.055	0.056	0.054
	(0.210)	(0.209)	(0.211)	(0.212)
rear plot depth	0.012	0.012	0.012	0.012
	(0.003)	(0.003)	(0.003)	(0.003)
SAP05[41]	-0.008	-0.008	-0.008	-0.008
	(0.003)	(0.003)	(0.003)	(0.003)
cavity, insulation	0.371	0.369	0.383	0.376
	(0.095)	(0.095)	(0.095)	(0.094)
cavity, no insulation	0.009	0.011	0.010	0.014
	(0.118)	(0.117)	(0.117)	(0.117)

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[41]Each property has an energy efficiency rating calculated by the surveyor using the Standard Assessment Procedure (SAP05 or SAP09). This rating is based on an estimate of each dwelling's energy cost per square meter. It takes account of the cost of space and water heating, ventilation, and lighting. Higher ratings are for more energy efficient properties.

Table A.7: Selection equation (3): Models 6-9

	Model 6	Model 7	Model 8	Model 9
heating age: 3-12[42]	-0.156	-0.159	-0.158	-0.156
	(0.068)	(0.068)	(0.068)	(0.068)
heating age: 12+	-0.212	-0.222	-0.220	-0.220
	(0.074)	(0.073)	(0.074)	(0.073)
double glazed[43]	0.151	0.179	0.172	0.173
	(0.071)	(0.070)	(0.071)	(0.070)
2 bedrooms	0.482	0.455	0.471	0.467
	(0.205)	(0.204)	(0.203)	(0.205)
3 bedrooms	0.667	0.626	0.649	0.640
	(0.218)	(0.216)	(0.216)	(0.218)
4 bedrooms	0.635	0.593	0.613	0.604
	(0.231)	(0.229)	(0.229)	(0.230)
5+ bedrooms	0.424	0.386	0.406	0.398
	(0.260)	(0.260)	(0.259)	(0.261)
2 bathrooms	-0.118	-0.124	-0.128	-0.125
	(0.076)	(0.077)	(0.076)	(0.076)
3+ bathrooms	-0.198	-0.179	-0.180	-0.181
	(0.164)	(0.172)	(0.170)	(0.170)
1 living room	1.060	1.046	1.061	1.049
	(0.494)	(0.505)	(0.509)	(0.503)
2+ living rooms	1.362	1.372	1.372	1.361
	(0.494)	(0.505)	(0.509)	(0.503)
1+ big kitchens	0.457	0.446	0.450	0.454
	(0.094)	(0.093)	(0.093)	(0.093)
fireplaces	0.116	0.126	0.125	0.123
	(0.047)	(0.047)	(0.047)	(0.047)
attic	-0.159	-0.176	-0.166	-0.169
	(0.091)	(0.091)	(0.091)	(0.090)
balcony	-0.309	-0.288	-0.304	-0.295
	(0.217)	(0.218)	(0.216)	(0.218)
basement	-0.174	-0.187	-0.178	-0.181
	(0.205)	(0.203)	(0.203)	(0.203)
PCA quality[44]	Y	Y	Y	Y
PCA local[45]	Y	Y	Y	Y

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[42] Heating age is measured in years.

[43] Indicator for at least 80% double glazed.

[44] Model includes first 5 principal components of more than 60 measures of quality.

[45] Model includes first 3 principal components of more than 40 neighborhood quality measures.

Table A.7: Selection equation (3): Models 6-9

	Model 6	Model 7	Model 8	Model 9
PCA urban[46]	Y	Y	Y	Y
county fixed effects	Y			
fraction RTB[47]		Y		
11-25%		0.337		
		(0.241)		
26-50%		0.103		
		(0.221)		
51-75%		0.329		
		(0.237)		
76-99%		0.538		
		(0.297)		
not on estate		0.076		
		(0.198)		
Pr(social)[48]			-0.327	
			(0.750)	
predominant tenure[49]				Y
local authority built				0.079
				(0.076)
mixed tenure				-0.110
				(0.110)
Observations	4059	4059	4059	4059
Log likelihood	-2.864e+06	-2.877e+06	-2.886e+06	-2.884e+06
AIC	5.728e+06	5.753e+06	5.772e+06	5.768e+06
CHI2	7637.52	7645.26	7603.28	7622.42

Note: The table displays results for the selection equations for Models 6-9. Each model adds a set of variables to the selection equation from Model 5 detailed in Table 3.

References

DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT (2017): "English Housing Survey, 2008-2014: Secure Access. 6th Edition," Tech. Rep. SN: 6923, UK Data Service, http://doi.org/10.5255/UKDA-SN-6923-6.

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[46]Model includes first 4 principal components of 6 measures of urban character.

[47]Fraction of properties in local authority estate that are "right-to-buy" (RTB).

[48]Predicted share of social housing in postcode.

[49]Predominant tenure of properties in local area