PSSRU

Geographical differences in the provision of care home services in England

Julien Forder and Jose-Luis Fernandez

PSSRU Discussion Paper 2824 (revised)
Feb 2012
www.pssru.ac.uk

Contents

Introduction

This paper assesses the geographical distribution of the location of care homes in England. The *State of health care and adult social care in England* report by the Care Quality Commission (CQC) in 2010/11 showed significant regional variation in the provision of care home beds in England (see Care Quality Commission 2011, figure 5). The report showed that the South East has the greatest supply of beds and the North East has the lowest supply. Headline bed-supply figures on their own, however, are not good indicators of regional differences in access to care home beds. Supply can be measured as the number of care home places available in an area and expressed as rate per capita (of people over 65), but supply is also likely to be correlated with demand in a market. As a result, localities with relatively low levels of supply are not necessarily

poorly served if demand is also low. But if demand is high and supply is low, this might be problematic.

It is also the case that some parts of the country have high input costs – of labour and capital – which mean that the supply of care home places will be more costly in those areas than in other areas. In theory, high unit cost areas are compensated by the relative needs formula (RNF) which is used to allocate central government funding to councils with social care responsibilities. The idea is that high-cost areas receive greater funding per capita than low-cost areas to allow for the higher price of care home supply in those areas (Darton, Forder et al. 2010). But, in practice, there are a number of reasons why extra funding may not translate into higher demand.

The aim of this paper is make these allowances. It seeks to identify areas of England that are poorly served in terms of having a combination of a relatively high demand for care home services but also a relatively poor level of supply. There are alternatives to care home services, such as domiciliary care, that might be suitable for lower need people, but otherwise low net supply (net of demand) might indicate unmet need and/or high prices for care.

To assess how well an area is served, we would ideally aim to produce some metric that combines both demand and unit-cost (supply) information to indicate the comparative situation of an area compared to other areas. One way of doing this is to calculate *net supply price difference* – the difference between the (predicted) market price, given demand and supply, and the potential unit cost of services – and compare this between localities. The unit cost of services depends on a combination of cost-relevant factors, such as capital prices (using house prices as a proxy) and labour costs. We do not have a direct measure of unit cost, but since we are only interested in comparing unit cost between areas we can focus on differences in cost between areas that arise because areas have different capital and labour costs. Assuming that profit rates do not vary directly with these factor costs, we can estimate how care home unit costs vary between areas using a regression of care home price on cost-relevant factors only. The predicted price from this estimation will capture variation in cost factors between areas but not other factors, such as the effect of care home supply on profit rates.

Net supply price difference is then the predicted market price in an area less the predicted price including just cost factors. This difference will be zero at the sample mean, but in any given area it will be non-zero, and the size and sign of the difference are meaningful in a comparative sense. Where we see a positive difference between market price and potential cost in a locality, we can infer that supply is low relative to demand, over and above differences in cost. With a negative difference, the converse applies: supply is high relative to demand, again given local

costs. It is on this basis that we can map the distribution of net supply of care home services across England.

In principle, 'market price' can be determined as the average of the actual prices of care home beds provided in a particular. The problem with this approach is that the supply of care home places is concentrated geographically at the location of the care home and so many areas will have zero beds but offer access to people who live nearby. For example, take two neighbouring localities. One of the areas, call it area A, has a care home located just inside the border with the other, whilst the other (area B) does not. Because people can move to the care home, it is clearly not the case that people in area B have no access to a care home. Strictly, the supply price of area B is undefined since there is no supply, but it is clear that people living in area B could move to the care home just over the administrative boundary and pay the price of places offered by the home in area A. The potential market price in area B is just higher than that in area A (it is slightly higher because people have to travel further on average).

The effective market price can be calculated for all localities in England using the results of a market price regression. In particular, we can estimate the relationship between the prices charged by care homes and a range of demand and supply factors, including the (competitor) supply of care home beds within range of the care home in question. The resultant equation can then be applied at a small area level – specifically, lower super output areas (LSOAs) – using averages for the independent variables across the small area to calculate price. In this way, we predict a market price, conditional on supply and demand, for all small areas/LOSAs in England.

We are implicitly assuming that the size of barriers to entry and other market imperfections (e.g. information imperfections) vary across England (Forder, Knapp et al. 1996). In this way, a high net supply price, i.e. low net supply, can be sustained in some localities without attracting new market entry. Without these barriers/imperfections, we would expect a more uniform supply of care home beds, given demand and local costs (note that variation in the latter demand and unit costs would still imply variation in supply even without market entry limitations). Potentially, this analysis could be used to guide commissioners and providers in making decisions about market entry.

Care homes need to be registered by the public regulator, the Care Quality Commission (CQC). Currently, around 10,000 care homes serving older people (over 65s) are registered with CQC in England. With this number of care homes, averaging over 35 places each, total England level supply is high (Laing & Buisson 2010). Whole market concentration ratios – e.g. as indicated by the Hirschman-Herfindhal index – remain very low in spite of a recent increase in market penetration by larger corporate providers. We might hypothesise, however, that the England

level situation can mask pockets of relatively high provider concentration and poor (relative) levels of supply. If this is the case, then we ought to see that the prices that providers can charge do show a significant (negative) correlation with the level of supply locally, particularly if this supply is (inversely) weighted for the geographical distances between the provider and its competitors. This result would indicate that potential new residents do have a preference for care homes that are close to where they were living. If distance or proximity was not important for potential residents then *local* supply would be a far weaker factor in the prices that care homes can charge. Put another way, if geographical proximity is important to people then we would expect a higher probability of local monopolistic pricing in some areas. By the same argument, local levels of demand should also have a significant influence on care home prices.

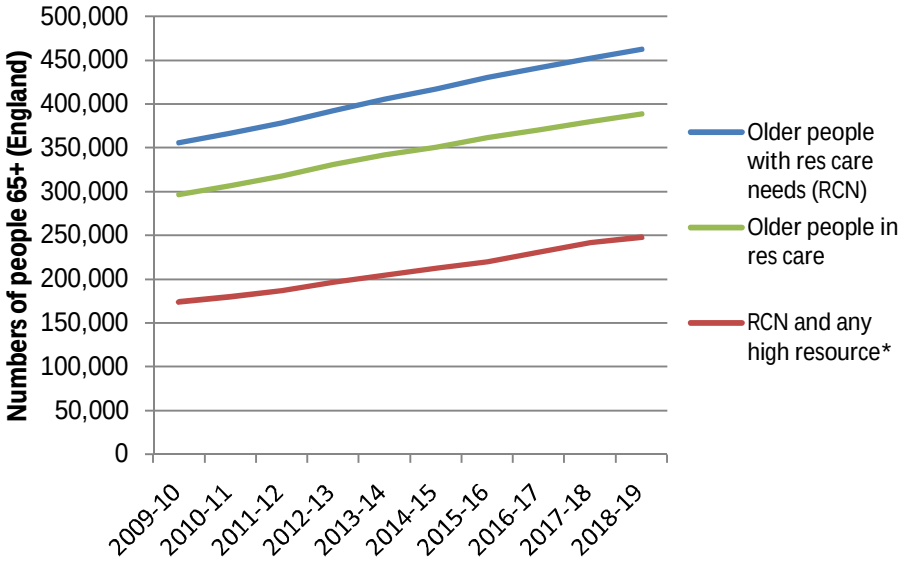
Context

In 2010 there were around 418,000 care home places in the UK and around 381,000 residents, an occupancy rate of just over 90%. Around 40% of places were paid for privately (self-funded) with the bulk of the remaining places funded in part by local authorities (most publicly-funded residents still pay some charge towards the total cost).

The number of places has been reducing over time as more people stay at home and receive high intensity home care packages instead. However, the underlying need for care is increasing as the population grows older. Even with reductions in the incidence rate of long-term conditions, total numbers of older people with care needs can increase. There is much debate about whether healthy life expectancy is keeping track with increases in total life expectancy (Wanless 2006). The Wanless Review of social care assumed as its base care scenario for future projections that age and sex-specific prevalence rates of disability would remain constant (which requires a fall in the incidence rate given the ageing population) (Wanless 2006).

The PSSRU dynamic micro-simulation model also makes this assumption (Fernandez and Forder 2010; Forder and Fernández 2012). This model considers the over 65s population in England and can be used to illustrate underlying demand projected into the future in the absence of supply constraints and changes in policy regarding care home placement criteria. In particular, assuming that needs-eligibility rules and financial means-test rules stay the same as now, the numbers of people with a residential care need (RCN) and the number of residents is projected to increase in the future – see Table 1. For illustration, the figure also reports the numbers of people with 'high' levels of private resources i.e. having income of more than £600 per week or either housing or non-housing assets of more than £60,000. Fuller results of the projections summarised in the figure are available in Appendix 1 and from the authors. Overall demand increases by 30% in the period in the base case and demand by people with a high level of resource increases at a slightly faster rate (43%).

Table 1. Demand for residential care, projections on base care



Source: PSSRU dynamic micro-simulation model projections

* High resource is having either income > £600 per week or either housing or non-housing assets > £60,000

This analysis show future projections of demand. The results are for England as a whole, but there is significant variation between localities in terms of demand and supply. This can be illustrated by assessing how net supply price varies between localities.

Method

Our approach to estimating the relative net supply price for each small area in England involves a number of steps:

- First, estimation of care home price conditional on demand and supply factors at the care home level
- Second, estimation of care home price conditional on unit-cost relevant factors only
- Third, calculation of predicted prices (supply and cost) at the small area level i.e. lower super output areas (LSOAs)
- Fourth, calculation of net supply price difference and ranking of net supply price difference between LSOAs

Care home price estimation

Price data from Laing and Buisson's care home price database were combined with a range of demand and supply factors at care home level. The statistical analysis involves the construction of a local supply/competition variable for each home by finding all other care homes within a certain range of each home and adding up the number of beds they provide (see Forder and

Allan 2011, for details). This bed total is weighted (inversely) for distance so that 'close' beds count for more than 'distant' beds. To identify care homes in range, the addresses of all care homes listed as being registered by the CQC were plotted and distances were measured. The analysis used two care home supply ranges, 10km and 20km.

Our measure of local supply is the number of distance-weighted places from each home divided by the distance-weighted population of over 65s of LSOAs in the same range from each home. We refer to this variable as the *weighted per capita bed supply*. For the denominator, population data were mapped to homes according to the LSOA of the homes and the population in neighbouring LSOAs within range. The same distance weighting rates were applied to the population data as the beds supply data.

Other demand factors were also used in the analysis including: the average level of property prices in each LSOA to affluence and indicators of 'need', such as the proportion of older people living on their own (i.e. without carers) and the numbers of people reported long-term limiting illnesses. House prices are calculated in two ways. The first way is by averaging the price of individual transactions in an area, in this case to LSOA level. There are, however, a relatively small number of transactions in some LSOAs. The second approach is to use council tax bandings, where all properties are banded into 8 price categories. This approach has the advantage of accounting for all properties in an area. Council tax bandings are available in ONS neighbourhood statistics at LSOA level. Also available are house price averages at MSOA level. Using an MOSA level analysis we predicted average prices using the proportion of homes in each band in each area – see Appendix 2. It transpired that the latter imputed house prices were highly correlated with the transaction-averaged prices (just under 90% correlation).

A number of home-level factors were also used in the statistical analysis including: whether the home was registered for nursing care as well as personal care; whether the home catered primarily for people with dementia; whether the home was part of a group; and also the sector (private or voluntary) of the home.

Descriptive statistics are available in Appendix 3.

Potential endogeneity of a care home's price and competitor's supply prompted the use of instrumental variables estimation (2SLS). With the estimation at the home level (with LSOA factors) we used middle-level super-output (MSOA) demand and cost variables as instruments in the regression; namely: house prices and the index of multiple deprivation. The 2SLS estimation gives the relationship between price and all factors – demand, supply and cost. This is the 'price' equation.

In addition, we estimated the relationship between care home prices and local cost factors (house prices and labour supply) only in an OLS regression. As outlined above, this analysis gives predicted price distributions if localities only differed by cost factors, and not supply or demand. We call this the 'cost' equation.

LSOA prices

The results of the statistical analysis give us an equation that we can apply at LSOA level to calculate the potential price for care that could be charged given the characteristics of demand and supply in each LSOA. This equation was applied to the 32,482 LSOAa in England.

A weighted bed-supply variable was also calculated for each LSOA (rather than each care home) by mapping the number of beds within a certain range of the centroid of each LSOA (and weighting inversely for the distance between the LSOA centroid and care homes within range). In this way, LSOA supply may be non-negative, even if the LSOA has zero beds, as long as neighbouring LSOAs within range have care home beds.

Market prices were calculated on this basis applying the 'price' equation to LSOA level bed supply and the other independent variables at their LSOA mean values. Similarly, the 'cost' equation was applied to predict prices on the basis of cost only variables. *Net supply price difference* was calculated by subtracting predicted price in each LSOA as calculated from the 'cost' equation away from predicted price in each LSOA as calculated from the 'price' equation. At the whole sample mean, these two equations predict the same prices and the difference is zero. But in LSOAs with characteristics away from the whole sample mean, the difference can be positive or negative. Where it is positive, price is above implied 'costs' because supply is lower than average relative to demand. Where the calculated difference is negative, the converse is true. This variable should therefore be seen as indicating comparative levels of net supply, given costs, between localities; it cannot be interpreted in an absolute sense.

Self-pay market

The lack of individual-level data on whether residents are self-payers or council-supported means that we cannot directly address the question of whether the self-pay market is more (or less) price elastic with respect to competition than the council-supported market. We might speculate that the self-pay market is more quality-sensitive than the supported market, but this hypothesis cannot be tested in this analysis. In any case, however, it is clear that whatever the relative price- and quality-elasticity of demand, areas with both greater levels of underlying demand (i.e. given price and quality) and lower levels of existing supply will be more profitable for new entrants.

We can nonetheless make some headway with this question by recognising that homes with relatively high prices in the market are more likely to have self-pay residents than homes in the lower part of the price distribution. Councils are not in a position to pay premium prices. Quantile regression can therefore be used to determine whether there is a difference in the relationship between price and net supply of places for homes in the top part of the price distribution compared to those in the bottom half. We estimate the counterpart of the 'price' equation at the 25th, 75th and 90th percentiles of the price distribution.[1] We control for endogeneity by using the predicted value of the bed-supply variable for each home as estimated from a first-stage reduced form regression with both the included variables and the excluded instruments.

The care homes market

Slightly more than a third of the 10,000 care homes in England for older people are registered for nursing as well as personal care. Half of these homes are single-home businesses, with 15% of homes belonging to organisations with more than 45 homes. As of 2010, Southern Cross had the greatest number of homes; Bupa, Four Seasons and Barchester all had more than 100 homes for older people. Table 2 gives details of the prices charged by care homes. Table 3 reports numbers of places in these homes. The individual care homes data do not record whether people are self-payers or are (at least partly) council-supported, but survey data suggest that 40% of residents nationally are self-payers.

Table 2. Prices per week – by registration type

Reg type	mean	sd	p1	p50	p99
Personal care	463	102	330	438	791
Nursing	638	174	369	612.5	1125
Total	529	158	334	485	1000

Source: Laing and Buisson database 2010

[1] The *qreg* process in Stata 12 is used for this purpose.

Table 3. Home size: total places – by registration type

Reg type	mean	sd	p1	p50	p99
Personal care	29	15	4	26	78
Nursing	50	24	17	45	140
Total	37	21	6	32	110

Source: CQC

Results

Price analysis

Table 4 presents the results of the price estimation, using transaction-averaged house prices (Model A). Table 5 shows the results with council tax-imputed house prices (Model B). As to individual home-level factors, homes registered for nursing averaged around £135 p.w. higher than homes with personal care only. On average older care homes (time since registered) had lower prices than newer homes, but the effect was relatively small. As expected, wealth and need factors were strong positive predictors of the prices that care homes can charge. The results were very similar between Model A and Model B, particularly for the 20km bed supply variable. On balance, Model B produces the slightly better results by virtue of slightly better diagnostics.

Table 6 summarises the estimated relationship between local bed supply and prices. The x-axis has weighted per capita bed supply. Due to the weighting, we cannot exactly interpret these values as the number of beds per head of population 65+, but they are indicative of the un-weighted rates. The sample mean value is 0.041. In both the 10km and 20km cases, the elasticity of price in relation to bed supply is 1.10 and 1.26 respectively.

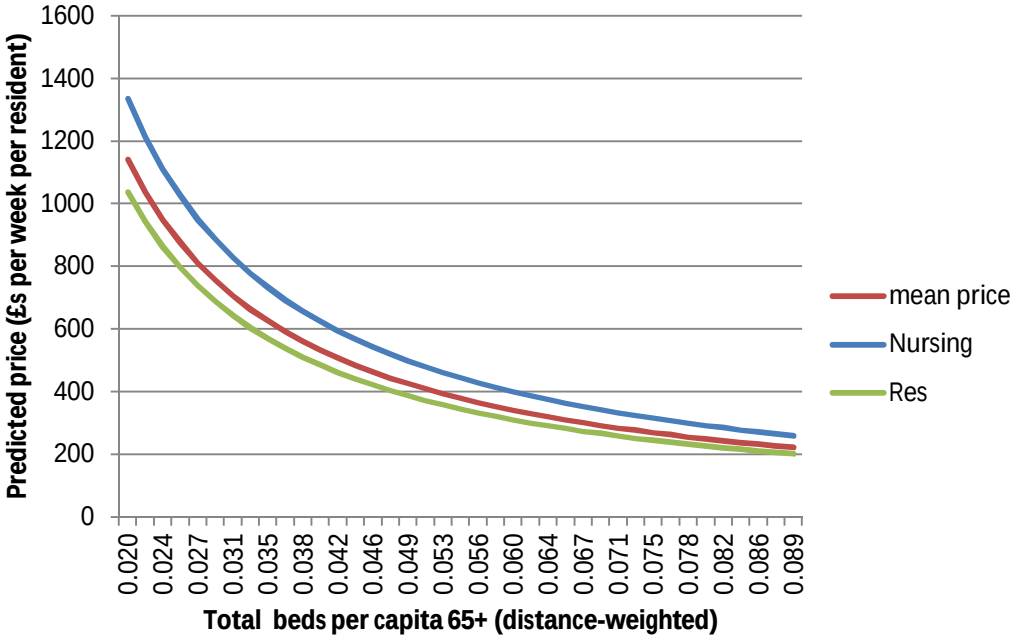
Table 4. Model A: Price estimation – mean price (log), 2SLS

	10 Km			20 Km		
	Coeff	**SE**	**Prob**	**Coeff**	**SE**	**Prob**
Weighted bed supply (log)	-1.095	0.173	<0.001	-1.255	0.145	<0.001
Home level						
Registration length	-0.006	0.002	0.001	-0.006	0.001	<0.001
Registration length (sqrd)	1.42E-04	3.42E-05	<0.001	1.18E-04	2.45E-05	<0.001
Nursing home	0.252	0.008	<0.001	0.259	0.006	<0.001
Dementia clients	0.071	0.012	<0.001	0.058	0.008	<0.001
Voluntary sector	-0.008	0.013	0.543	0.004	0.009	0.676
Care home group 2-9	0.039	0.010	<0.001	0.036	0.007	<0.001
Care home group 10-19	0.029	0.015	0.055	0.033	0.011	0.003
Care home group 20-49	0.002	0.020	0.904	0.033	0.013	0.010
Care home group 50+	0.064	0.013	<0.001	0.070	0.009	<0.001
Area level						
Average house price	4.99E-07	5.85E-08	<0.001	4.19E-07	4.56E-08	<0.001
Average house price (sqd)	-1.57E-13	3.21E-14	<0.001	-1.27E-13	2.39E-14	<0.001
Percent living alone	0.151	0.022	<0.001	0.125	0.015	<0.001
Percent older population	0.005	0.001	<0.001	0.006	0.001	<0.001
Total population sq	4.51E-09	2.36E-09	0.056	3.96E-09	1.69E-09	0.019
Deprivation rank (log)	-0.049	0.012	<0.001	-0.032	0.007	<0.001
Percent taking Pension Credit	-0.575	0.086	<0.001	-0.421	0.053	<0.001
Percent claiming AA	1.031	0.164	<0.001	0.534	0.074	<0.001
Region						
East of England	0.072	0.020	<0.001	0.038	0.017	0.023
London	0.012	0.032	0.708	-0.071	0.032	0.026
North East	0.160	0.035	<0.001	0.171	0.027	<0.001
North West	0.087	0.021	<0.001	0.080	0.015	<0.001
South East	0.232	0.019	<0.001	0.208	0.012	<0.001
South West	0.151	0.016	<0.001	0.154	0.012	<0.001
West Midlands	-0.096	0.025	<0.001	-0.124	0.021	<0.001
Yorkshire and The Humber	0.139	0.027	<0.001	0.131	0.019	<0.001
Constant	2.870	0.513	<0.001	2.300	0.439	<0.001
Underidentification test (Anderson canon. corr. LM statistic):			425.491			447.781
Chi-sq(3) P-val =			0			0
Weak identification test (Cragg-Donald Wald F statistic):			222.898			235.204
Stock-Yogo weak ID test critical values: 5% maximal IV relative bias			19.93			19.93
Sargan statistic (overidentification test of all instruments):			0.045			2.367
Chi-sq(1) P-val			0.8328			0.1239
Endogeneity test of endogenous regressors:			136.86			122.821
Chi-sq(1) P-val			0			0
Ramsey/Pesaran-Taylor RESET test			0.55			2.08
Wald test P-val			0.457			0.1492

Table 5. Model B: Price estimation – mean price (log), 2SLS

	10 Km			20 Km		
	Coeff	**SE**	**Prob**	**Coeff**	**SE**	**Prob**
Weighted bed supply (log)	-0.852	0.092	<0.001	-1.251	0.118	<0.001
Home level	-0.007	0.001	<0.001	-0.006	0.001	<0.001
Registration length	1.42E-04	3.14E-05	<0.001	1.22E-04	2.66E-05	<0.001
Registration length (sqrd)	0.259	0.007	<0.001	0.260	0.006	<0.001
Nursing home	0.063	0.009	<0.001	0.057	0.008	<0.001
Dementia clients	0.003	0.010	0.762	0.005	0.008	0.55
Voluntary sector	5.14E-07	3.53E-08	<0.001	3.73E-07	3.01E-08	<0.001
Care home group 2-9	0.182	0.018	<0.001	0.159	0.014	<0.001
Care home group 10-19	0.004	0.001	<0.001	0.006	0.001	<0.001
Care home group 20-49	4.22E-09	2.28E-09	0.064	3.97E-09	1.83E-09	0.029
Care home group 50+	-0.034	0.008	<0.001	-0.029	0.007	<0.001
Area level	-0.484	0.059	<0.001	-0.420	0.051	<0.001
Average house price	0.781	0.102	<0.001	0.513	0.073	<0.001
Percent living alone	0.089	0.015	<0.001	0.042	0.015	0.005
Percent older population	0.034	0.022	0.12	-0.074	0.028	0.007
Total population sq	0.116	0.024	<0.001	0.165	0.024	<0.001
Deprivation rank (log)	0.059	0.013	<0.001	0.074	0.012	<0.001
Percent taking Pension Credit	0.216	0.013	<0.001	0.212	0.011	<0.001
Percent claiming AA	0.153	0.014	<0.001	0.162	0.011	<0.001
Region	-0.072	0.017	<0.001	-0.125	0.018	<0.001
East of England	0.104	0.018	<0.001	0.127	0.016	<0.001
London	0.036	0.009	<0.001	0.037	0.007	<0.001
North East	0.034	0.012	0.004	0.034	0.010	0.001
North West	0.014	0.016	0.385	0.032	0.013	0.014
South East	0.072	0.010	<0.001	0.069	0.009	<0.001
South West	3.600	0.284	<0.001	2.324	0.363	<0.001
West Midlands	-0.852	0.092	<0.001	-1.251	0.118	<0.001
Yorkshire and The Humber	-0.007	0.001	<0.001	-0.006	0.001	<0.001
Constant	1.42E-04	3.14E-05	<0.001	1.22E-04	2.66E-05	<0.001
Underidentification test:			572.446			1145.416
Chi-sq(3) P-val =			0			0
Weak identification test:			211.456			483.172
Stock-Yogo weak ID test critical values: 5% maximal IV relative bias			13.91			13.91
Overidentification test			3.618			4.116
Chi-sq(2) P-val			0.1638			0.1277
Endogeneity test of endogenous regressors:			156.625			149.883
Chi-sq(1) P-val			0			0
Ramsey/Pesaran-Taylor RESET test			1			1.17
Wald test P-val			0.3174			0.2798

Table 6. The effect of bed supply on prices – whole market



Quantile price regression

An alternative price specification can be generated by quantile regression. This approach allows us to estimate parameters for predicting some quantile for the price distribution; for example, we can look at the 25th, 75th percentile or even the 90th percentile of the price distribution. This approach better approximates the demand and competition effects on homes with prices away from the average. In particular, it allows us to better distinguish between council-supported and self-payers. We implemented the same specification as above using predicted net supply from a first-stage estimation of that variable in the (second-stage) quantile regression. In the first-stage regression of net supply, we used the same instrumental variables as above.

The results are given below using transaction-averaged house prices. The versions with council-tax predicted house prices were very similar and not reported here to save space; they are available from the authors on request. Table 7 for the 75th percentile, Table 8 for the 90th percentile and Table 9 for the 25th percentile. They show that there is relatively little difference; the elasticity of price is slightly smaller in absolute terms at the 90th percentile (-0.93 at the 10km range) than for the mean regression results (-1.10 at 10km), although the 95%confidence intervals overlap.

Table 7. Quantile regression – 75th percentile, dep var: mean price (log)

	75th, 10km			75th, 20km		
	Coeff	SE	Prob	Coeff	SE	Prob
Weighted bed supply (log)	-1.071	0.119	<0.001	-1.210	0.127	<0.001
Home level						
Registration length	-0.007	0.001	<0.001	-0.008	0.001	<0.001
Registration length (sqrd)	0.000	0.000	<0.001	0.000	0.000	<0.001
Nursing home	0.285	0.006	<0.001	0.292	0.005	<0.001
Dementia clients	0.067	0.008	<0.001	0.055	0.007	<0.001
Voluntary sector	-0.008	0.009	0.383	0.005	0.008	0.523
Care home group 2-9	0.034	0.007	<0.001	0.029	0.007	<0.001
Care home group 10-19	0.038	0.011	<0.001	0.041	0.010	<0.001
Care home group 20-49	0.041	0.014	0.002	0.070	0.011	<0.001
Care home group 50+	0.075	0.009	<0.001	0.081	0.008	<0.001
LSOA level						
Average house price	0.000	0.000	<0.001	0.000	0.000	<0.001
Average house price (sqd)	0.000	0.000	<0.001	0.000	0.000	<0.001
Percent living alone	0.145	0.016	<0.001	0.120	0.014	<0.001
Percent older population	0.006	0.001	<0.001	0.006	0.001	<0.001
Total population sq	0.000	0.000	<0.001	0.000	0.000	<0.001
Deprivation rank (log)	-0.050	0.008	<0.001	-0.033	0.006	<0.001
Percent taking Pension Credit	-0.579	0.062	<0.001	-0.432	0.049	<0.001
Percent claiming AA	1.042	0.114	<0.001	0.556	0.066	<0.001
Regional						
East of England	0.065	0.014	<0.001	0.036	0.015	0.013
London	0.003	0.023	0.905	-0.073	0.028	0.009
North East	0.159	0.025	<0.001	0.169	0.024	<0.001
North West	0.060	0.015	<0.001	0.054	0.013	<0.001
South East	0.223	0.013	<0.001	0.200	0.011	<0.001
South West	0.148	0.012	<0.001	0.153	0.011	<0.001
West Midlands	-0.100	0.018	<0.001	-0.123	0.018	<0.001
Yorkshire and The Humber	0.117	0.019	<0.001	0.111	0.017	<0.001
Constant	3.034	0.353	<0.001	2.525	0.385	<0.001
N	8755			8755		
Pseudo R2	0.428			0.428		

Table 8. Quantile regression – 90th percentile, dep var: mean price (log)

	90th, 10km			90th, 20km		
	Coeff	SE	Prob	Coeff	SE	Prob
Weighted bed supply (log)	-0.927	0.132	<0.001	-1.007	0.158	<0.001
Home level						
Registration length	-0.008	0.001	<0.001	-0.009	0.001	<0.001
Registration length (sqrd)	0.000	0.000	<0.001	0.000	0.000	<0.001
Nursing home	0.314	0.007	<0.001	0.320	0.007	<0.001
Dementia clients	0.092	0.009	<0.001	0.078	0.009	<0.001
Voluntary sector	-0.013	0.011	0.224	-0.004	0.010	0.714
Care home group 2-9	0.038	0.008	<0.001	0.035	0.008	<0.001
Care home group 10-19	0.035	0.012	0.003	0.038	0.012	0.001
Care home group 20-49	0.065	0.015	<0.001	0.099	0.014	<0.001
Care home group 50+	0.083	0.011	<0.001	0.089	0.011	<0.001
LSOA level						
Average house price	0.000	0.000	<0.001	0.000	0.000	<0.001
Average house price (sqd)	0.000	0.000	<0.001	0.000	0.000	<0.001
Percent living alone	0.153	0.018	<0.001	0.132	0.017	<0.001
Percent older population	0.004	0.001	<0.001	0.004	0.001	<0.001
Total population sq	0.000	0.000	<0.001	0.000	0.000	0.001
Deprivation rank (log)	-0.036	0.009	<0.001	-0.018	0.008	0.014
Percent taking Pension Credit	-0.518	0.069	<0.001	-0.381	0.062	<0.001
Percent claiming AA	0.932	0.128	<0.001	0.493	0.084	<0.001
Regional						
East of England	0.089	0.015	<0.001	0.065	0.018	<0.001
London	0.028	0.026	0.283	-0.028	0.035	0.426
North East	0.122	0.027	<0.001	0.123	0.029	<0.001
North West	0.036	0.016	0.027	0.025	0.016	0.113
South East	0.234	0.015	<0.001	0.212	0.014	<0.001
South West	0.162	0.013	<0.001	0.164	0.014	<0.001
West Midlands	-0.083	0.019	<0.001	-0.100	0.023	<0.001
Yorkshire and The Humber	0.101	0.021	<0.001	0.088	0.021	<0.001
Constant	3.485	0.395	<0.001	3.161	0.481	<0.001
N	8755			8755		
Pseudo R2	0.415			0.415		

Table 9. Quantile regression – 25th percentile, dep var: mean price (log)

	25th, 10km			25th, 20km		
	Coeff	SE	Prob	Coeff	SE	Prob
Weighted bed supply (log)	-1.160	0.101	<0.001	-1.321	0.126	<0.001
Home level						
Registration length	-0.002	0.001	0.011	-0.002	0.001	0.022
Registration length (sqrd)	0.000	0.000	<0.001	0.000	0.000	0.001
Nursing home	0.207	0.005	<0.001	0.214	0.005	<0.001
Dementia clients	0.062	0.007	<0.001	0.049	0.007	<0.001
Voluntary sector	-0.002	0.007	0.834	0.009	0.008	0.225
Care home group 2-9	0.044	0.006	<0.001	0.040	0.006	<0.001
Care home group 10-19	0.028	0.009	0.001	0.032	0.009	0.001
Care home group 20-49	-0.012	0.011	0.284	0.021	0.011	0.053
Care home group 50+	0.063	0.007	<0.001	0.071	0.008	<0.001
LSOA level						
Average house price	0.000	0.000	<0.001	0.000	0.000	<0.001
Average house price (sqd)	0.000	0.000	<0.001	0.000	0.000	<0.001
Percent living alone	0.130	0.013	<0.001	0.100	0.012	<0.001
Percent older population	0.006	0.001	<0.001	0.006	0.001	<0.001
Total population sq	0.000	0.000	0.004	0.000	0.000	0.022
Deprivation rank (log)	-0.054	0.007	<0.001	-0.036	0.006	<0.001
Percent taking Pension Credit	-0.566	0.049	<0.001	-0.402	0.045	<0.001
Percent claiming AA	1.143	0.095	<0.001	0.619	0.064	<0.001
Regional						
East of England	0.055	0.011	<0.001	0.022	0.014	0.129
London	0.009	0.018	0.631	-0.076	0.027	0.005
North East	0.193	0.021	<0.001	0.201	0.023	<0.001
North West	0.105	0.012	<0.001	0.097	0.013	<0.001
South East	0.214	0.011	<0.001	0.188	0.011	<0.001
South West	0.118	0.009	<0.001	0.121	0.010	<0.001
West Midlands	-0.118	0.015	<0.001	-0.147	0.018	<0.001
Yorkshire and The Humber	0.156	0.016	<0.001	0.147	0.016	<0.001
Constant	2.525	0.297	<0.001	1.942	0.382	<0.001
N	8755			8755		
Pseudo R2	0.318			0.318		

'Cost' regression results

The unit costs of providing social care differ between areas, being determined mainly by the price of capital and labour in any locality. Unit costs of services are not directly observable; we have prices but these also include profits and other overheads. Price, nonetheless, can be used as a proxy for cost for the purpose of calculating how they vary between areas according to cost pressures beyond the control of the provider. In this way, we run a regression of price using only those cost-relevant factors that apply at an area level, not a provider level, as independent variables. The only exception is that we include a dummy variable for nursing homes rather than (personal care) residential homes on the basis that staff mix tends to be different for regulatory reasons.

We use a GLM regression with a log link function. A Park test indicated that an inverse Gaussian error distribution was appropriate. The results are given in Table 10, using transaction-averaged house prices and in Table 11 for council tax-imputed house prices.

Table 10. Model A: GLM regression, dep var: mean price (log link)

	Coeff	Std Error	P
Nursing home	0.305	0.005	<0.001
Mean house prices	1.58E-06	1.35E-07	<0.001
Mean house prices (sqrd)	-1.30E-12	2.55E-13	<0.001
Mean house prices (cubed)	3.09E-19	1.05E-19	0.003
Rank of deprivation index	6.29E-07	4.25E-07	0.139
AA uptake rate	0.163	0.047	0.001
Const	5.828	0.018	<0.001
Log pseudolikelihood	-93413.2		
BIC	-82788.2		

Table 11. Model B: GLM regression, dep var: mean price (log link)

	Coeff	Std Error	P
Nursing home	0.306	0.005	<0.001
Mean house prices	2.77E-06	1.59E-07	<0.001
Mean house prices (sqrd)	-4.02E-12	3.70E-13	<0.001
Mean house prices (cubed)	1.84E-18	2.47E-19	0.000
Rank of deprivation index	-9.82E-07	4.45E-07	0.028
AA uptake rate	0.202	0.048	0.000
Const	5.745	0.020	<0.001
Log pseudolikelihood	-93423.6		
BIC	-82798.3		

Table 12 shows the predicted price from the cost factors estimation as it differs on average between regions. Not surprisingly, predicted prices are highest in London and lowest in the North East. Table 13 shows this information using Model B results.

Table 12. Predicted 'cost' price, by region (Model A)

Region	Price			Deviation from England	
	Mean	Median	sd	Mean	Median
East Midlands	486	480	32	-27	-23
East of England	525	518	46	12	15
London	564	549	59	51	46
North East	469	461	29	-44	-42
North West	481	472	38	-32	-31
South East	544	535	52	31	32
South West	522	517	37	9	14
West Midlands	489	480	38	-23	-24
Yorkshire and The Humber	479	471	36	-34	-33
Total	513	503	54	0	0

Table 13. Predicted 'cost' price, by region (Model B)

Region	Price			Deviation from England	
	Mean	Median	sd	Mean	Median
East Midlands	487	481	34	-25	-31
East of England	524	518	41	12	6
London	553	548	38	41	36
North East	470	460	30	-42	-52
North West	489	479	40	-23	-33
South East	541	539	43	29	26
South West	516	512	34	4	0
West Midlands	497	489	40	-15	-24
Yorkshire and The Humber	480	472	37	-32	-40
Total	512	507	47	0	-6

Net supply price difference

Net supply price difference is demand price less cost. The former is calculated using the price equation from either Table 4 (Model A) or Table 5 (Model B). In this prediction, we wish to produce an all homes type price so all home level characteristics are held at constants. In theory predicted prices could be calculated at the LSOA level, but interpretation of the results is more meaningful at higher, i.e. more aggregated geographical areas, such as 6781 middle-level super output areas (MSOAs) or postcode districts. Two approaches to exemplification are available with this in mind. Either the price equation is calculated at LSOA level and averaged at higher geographies or the price equation is applied using the aggregated (e.g. MSOA) level area variables in the tables (noting that home level variables are held at national average constant value. The log bed supply variable is calculated using CQC care home registration data and is available from the authors at aggregated levels). These approaches will produce slightly different results but will give predicted price at the MSOA level. The same procedure can be applied for the cost equation. Net supply price difference at the aggregated level is the difference: predicted price less predicted cost.

At the MSOA level, the median value of net supply price difference is just below zero (-£4 per week). The slightly skewed distribution gives a mean value of between £13 and £17 per week.

Summarising these results at a region level is helpful. Table 14 shows the net supply price difference for each of the nine regions of England, using transaction-averaged house prices (Model A). Table 15 is the version with council tax derived house prices (Model B). The regions are ordered in the table with lower to highest net supply difference. As suggested by the map (which uses Model A results), East Midlands, North East and North West all have negative supply price differences on average. The South East has the highest net supply price difference, suggesting that supply is low relative to demand, after accounting for the relatively high unit costs in this region. The tables also show a Mann-Whitney test of whether the mean value of this variable in each region is significantly different from the England mean value. It is different in all cases. It would also be possible to consider this information for smaller areas e.g. identifying blackspots. The two specifications of house price makes very little difference to the results, with only one difference in the order of the North East and East Midlands (where the mean values of net supply price difference are very similar anyway).

Table 14. Model A: Net supply price difference – mean and median by region

	Mean	Median	Std Dev	N	Mann-Whitney U
North East	-£39	-£49	£138.81	342	<0.001
East Midlands	-£38	-£49	£69.65	571	<0.001
North West	-£26	-£35	£78.38	922	<0.001
West Midlands	-£18	-£20	£74.69	735	<0.001
Yorkshire and The Humber	-£16	-£27	£113.23	694	<0.001
East of England	£38	£15	£117.18	733	<0.001
South West	£52	£30	£159.24	695	0.0328
London	£56	£53	£71.24	983	<0.001
South East	£70	£69	£135.58	1106	<0.001
England	£17	-£4	£116.98	6781	

Table 15. Model B: Net supply price difference – mean and median by region

	Mean	Median	Std Dev	N	Mann-Whitney U
East Midlands	-£38	-£48	£58.58	571	<0.001
North East	-£38	-£43	£133.24	342	<0.001
North West	-£33	-£40	£71.16	922	<0.001
West Midlands	-£26	-£26	£66.55	735	<0.001
Yorkshire and The Humber	-£19	-£26	£100.58	694	<0.001
East of England	£36	£20	£94.16	733	<0.001
South West	£50	£38	£140.44	695	<0.001
London	£52	£50	£61.84	983	<0.001
South East	£68	£71	£115.40	1106	<0.001
England	£13	-£4	£104.48	6781	

Concluding points

The analysis shows strong competition/supply effects on the pricing of care homes in England. In particular, areas with a high number of care home beds per capita tend to have lower prices, other things equal. Demand effects also appear to be strong, suggesting that levels of need for social care do vary significantly across the country. Finally, unit costs also show high variation between different areas of England.

The inter-play of these three factors makes it difficult to assess whether an area is well-served or poorly-served in terms of the availability of supply. Looking at per capita bed supply on its own does not account for differences in need/demand between areas, nor does it account for different levels of unit cost. In the main, the relative needs formula (RNF) that allocates per-capita funding to councils accounts for need and unit cost factors, compensating councils in proportion to the size of these factors locally. So councils with high-need populations and/or high unit costs receive greater per capita funding than others; these councils are therefore able to pay the higher supply prices required to meet need. Councils in low-need and/or low-cost areas have lower funding, but face lower market prices.

In this analysis we consider what price councils would have to pay in a given area after subtracting a unit cost factor – the net supply price difference. The results show that there is significant variation in net supply price difference between (small) areas of England. Net supply levels are therefore highly location specific. These local effects are strong enough such that there are discernible (statistically significant), if small, differences between English regions. In particular we are able to rank order net supply price difference by region. Going from the region with greatest supply relative to demand to the lowest , we have: the East Midlands, North East, North West, West Midlands, Yorkshire and The Humber, East of England, South West, London, and the South East. This ordering contrasts significantly with the headline total supply of beds in each region (Care Quality Commission 2011) and highlights the need for allowance to be made for the scale of demand as well as supply. Information of this nature could improve the functioning of social care markets. Standard economic theory suggests that the performance of markets is likely to be better aligned with the public interest if information imperfections can be reduced (Forder, Knapp et al. 1996)

Potentially the local supply (i.e. competition) effect on prices might differ between the self-pay and the council-supported sector. We are not able to distinguish self-pay and the council-supported prices directly, but quantile regression results suggest that there is only a very small difference, if at all, between the competition effect on prices at the 25th percentile compared with the effect at the 75th percentile.

Acknowledgements

The data for this project were mainly provided by ONS – see www.neighbourhood.statistics.gov.uk. House price data at LSOA level were kindly supplied by the Land Registry. Contextual material in the paper included results from the PSSRU dynamic microsimulation model (DMS), the main development of which was funded by the King's Fund and the Department of Health. The DMS uses material from the British Household Panel Survey,

which is copyright of the Institute for Social and Economic Research and from the English Longitudinal Survey of Ageing, which is copyright of the National Centre for Social Research, University College London and Institute for Fiscal Studies. Both datasets were made available via the UK Data Archive. See (Forder and Fernández 2012) The views expressed here and any errors and omissions are those of the authors alone.

References

Care Quality Commission (2011). The state of health care and adult social care in England 2010/11. London, The Stationery Ofice.

Darton, R., J. Forder, A. Netten, A. Bebbington, J. Holder and A. M. Towers (2010). "Slicing Up the Pie: Allocation of Central Government Funding of Care of Older People." Social Policy & Administration **44**(5): 529-553.

Fernandez, J. L. and J. Forder (2010). "Equity, efficiency, and financial risk of alternative arrangements for funding long-term care systems in an ageing society." Oxford Review of Economic Policy **26**(4): 713-733.

Forder, J. and S. Allan (2011). Competition in the English Care Homes Market. Canterbury, University of Kent PSSRU Discussion Paper DP 2820

Forder, J. and J. L. Fernández (2012). Analysing the costs and benefits of social care funding arrangements in England: technical report (2nd Edition), PSSRU, University of Kent and London School of Economics. PSSRU DP 2644/2 (http://www.pssru.ac.uk/pdf/dp2644~2.pdf)

Forder, J., M. Knapp and G. Wistow (1996). "Competition in the Mixed Economy of Care." Journal of Social Policy **25**(2): 201-221.

Laing & Buisson (2010). Care of Elderly People UK Market Survey 2010-11, 23rd Edition.

Wanless, D. (2006). Securing Good Care for Older People: Taking a long term view. London, King's Fund

Appendix 1

Table 16. Projected numbers of older people in the population with residential care need, various categories

	Older people with res care needs (RCN)	Older people in res care	RCN and net weekly income above £600	RCN and net weekly income below £600	RCN and non-housing wealth above £60,000	RCN and non-housing wealth below £60,000	RCN and gross housing wealth above £60,000	RCN and gross housing wealth below £60,000	RCN and any high resource*	RCN without high resources*
2009-10	356,000	297,000	6,000	350,000	105,000	251,000	92,000	264,000	174,000	182,000
2010-11	367,000	307,000	6,000	361,000	107,000	260,000	96,000	271,000	180,000	187,000
2011-12	379,000	318,000	6,000	373,000	112,000	267,000	98,000	281,000	187,000	192,000
2012-13	393,000	331,000	5,000	388,000	118,000	275,000	102,000	291,000	197,000	196,000
2013-14	406,000	342,000	5,000	401,000	123,000	283,000	110,000	296,000	205,000	201,000
2014-15	418,000	351,000	6,000	412,000	126,000	292,000	115,000	303,000	213,000	205,000
2015-16	431,000	362,000	5,000	426,000	129,000	302,000	117,000	314,000	220,000	211,000
2016-17	442,000	371,000	8,000	434,000	137,000	305,000	124,000	318,000	231,000	211,000
2017-18	453,000	380,000	7,000	446,000	143,000	310,000	130,000	323,000	242,000	211,000
2018-19	463,000	389,000	6,000	457,000	146,000	317,000	136,000	327,000	248,000	215,000

Source: PSSRU dynamic micro-simulation model projections

* High resource is having either income > £600 per week or either housing or non-housing assets > £60,000

Table 17. Projected numbers of older people with residential care need *excluding people in care homes*, various categories

	Older people with res care needs (RCN)	RCN and net weekly income above £600	RCN and net weekly income below £600	RCN and non-housing wealth above £60,000	RCN and non-housing wealth below £60,000	RCN and gross housing wealth above £60,000	RCN and gross housing wealth below £60,000	RCN and any high resource*	RCN without high resources*
2009-10	59,000	1,000	58,000	4,000	55,000	39,000	20,000	40,000	19,000
2010-11	60,000	1,000	59,000	4,000	56,000	39,000	21,000	40,000	20,000
2011-12	61,000	1,000	60,000	4,000	57,000	40,000	21,000	40,000	21,000
2012-13	62,000	1,000	61,000	5,000	57,000	41,000	21,000	41,000	21,000
2013-14	64,000	1,000	63,000	5,000	59,000	42,000	22,000	43,000	21,000
2014-15	67,000	1,000	66,000	5,000	62,000	45,000	22,000	46,000	21,000
2015-16	69,000	1,000	68,000	5,000	64,000	48,000	21,000	48,000	21,000
2016-17	71,000	1,000	70,000	6,000	65,000	51,000	20,000	51,000	20,000
2017-18	73,000	1,000	72,000	6,000	67,000	53,000	20,000	54,000	19,000
2018-19	74,000	1,000	73,000	6,000	68,000	54,000	20,000	55,000	19,000

Source: PSSRU dynamic micro-simulation model projections

* High resource is having either income > £600 per week or either housing or non-housing assets > £60,000

Appendix 2

Council tax is a property based tax levying a rate according to the assessed value of properties. For this purpose properties in England at valued in 8 bands A to H. Valuations are based on the price a property would have fetched if it had been sold on the open market on 1 April 1991:

Band A
Up to £40,000
Band B
£40,001 to £52,000
Band C
£52,001 to £68,000
Band D
£68,001 to £88,000
Band E
£88,001 to £120,000
Band F
£120,001 to £160,000
Band G
£160,001 to £320,000
Band H
£320,001 and above

ONS provide the number of properties in each LSOA according to their council tax band. ONS also provide house price data (all properties) at the MSOA level. To derive a 'house price' variable to reflect affluence, we could use the mid-points of the above valuation ranges multiplied by the respective proportion of properties in that band for each LSOA. However, these bandings are based on 1991 prices and would need to be up-rated. Also, there is the issue of a weight for the open-ended band H. Instead, we run a regression of MSOA level house prices (logged) on these proportions. Descriptive stats at the MSOA are given in Table 18 and the OLS regression results are in Table 19. The resulting equation can be used to predict house prices at LSOA level applying it to the LSOA level proportion of properties by tax band.

Table 18. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
house price mean MSOA	6781	204983.2	118356.0	48904.0	1994682.0
house price mean MSOA (log)	6781	12.115	0.461	10.798	14.506
Council Tax Band – Prop of properties in MSOA					
Band A	6781	0.243	0.265	0.000	0.999
Band B	6781	0.194	0.130	0.001	0.799
Band C	6781	0.219	0.132	0.000	0.900
Band D	6781	0.155	0.115	0.000	0.859
Band E	6781	0.096	0.089	0.000	0.673
Band F	6781	0.051	0.062	0.000	0.519
Band G	6781	0.036	0.064	0.000	0.525
Band H	6781	0.005	0.022	0.000	0.617
Number of dwellings	6781	3346.426	756.161	1162	10170

Table 19. OLS regression results

	Coeff	Std. Err.	t
Council Tax Band - Percentage of properties in MSOA			
Band A	-2.590	0.065	-39.65
Band B	-2.027	0.066	-30.63
Band C	-1.837	0.066	-27.72
Band D	-1.454	0.069	-20.95
Band E	-1.238	0.069	-17.89
Band F	-0.903	0.127	-7.11
Band G	Ref		
Band H	2.308	0.173	13.38
Number of dwellings	2.830E-05	2.690E-06	10.53
Const	13.824	0.065	212.21
Dependent var	house price mean MSOA (log)		
Number of obs	6781		
F(8, 6772)	5699.59		
Prob > F	<0.0001		
R-squared	0.8707		
Adj R-squared	0.8705		
Root MSE	0.1657		

Appendix 3

Table 20. Descriptive statistics

	Mean	Std. Dev.	Min	Max	Source
Area					
Weighted bed supply 10Km	0.0410	0.0119	0.0000	0.1294	CQC
Weighted bed supply 10Km (log)	-3.1750	0.2963	-6.0154	-2.0262	CQC
Weighted bed supply 20Km	0.0403	0.0081	0.0031	0.0942	CQC
Weighted bed supply 20Km (log)	-3.1545	0.1828	-5.0783	-2.3296	CQC
House price (pred)	201801.8000	119824.7000	76718.7200	1293508.0000	ONS NESS
Percent living alone	0.4380	0.1165	0.1250	0.8764	ONS NESS
Percent living alone (log)	-0.8619	0.2729	-2.0794	-0.1319	ONS NESS
Percent older population	24.9235	8.5295	2.1000	69.4000	ONS NESS
total population	1620.2060	327.0556	814.0000	6398.0000	ONS NESS
total population sq	2732021	1573810	662596	40900000	ONS NESS
Deprivation rank	16934.6200	8758.8790	1	32465	ONS NESS
Deprivation rank (log)	9.4959	0.8827	0.0000	10.3879	ONS NESS
Percent taking Pension Credit	0.2422	0.1377	0.0129	1.1111	DWP
Percent claiming AA	0.1952	0.0624	0.0331	0.5610	DWP
East of England	0.1045	0.3059	0	1	ONS NESS
London	0.0693	0.2540	0	1	ONS NESS
North East	0.0568	0.2314	0	1	ONS NESS
North West	0.1466	0.3538	0	1	ONS NESS
South East	0.1932	0.3949	0	1	ONS NESS
South West	0.1390	0.3460	0	1	ONS NESS
West Midlands	0.0942	0.2922	0	1	ONS NESS
Yorkshire and The Humber	0.1024	0.3032	0	1	ONS NESS
Home					
Care home price	528.6929	157.9677	323.0000	1900.0000	Laing Buisson (LB)
Care home price (log)	6.2326	0.2662	5.7777	7.5496	LB
Registration length	20.3501	6.1736	1.0000	64.0000	CQC/LB
Registration length (sqrd)	452.2329	277.4341	1.0000	4096.0000	CQC/LB
Nursing home	0.3748	0.4841	0	1	CQC/LB
Dementia clients	0.1405	0.3475	0	1	CQC/LB
Voluntary sector	0.1317	0.3382	0	1	CQC/LB
Care home group 2-9	0.1624	0.3688	0	1	CQC/LB
Care home group 10-19	0.0722	0.2588	0	1	CQC/LB
Care home group 20-49	0.0555	0.2290	0	1	CQC/LB
Care home group 50+	0.1639	0.3702	0	1	CQC/LB
N	8756				