

Regression results

Specifications

The main analysis is based on regressions of the following form

$$C_{it} = \beta X_{it} + \alpha P_{it} + \psi_i + \epsilon_{it} \quad (1)$$

where proportion of care homes C for a local authority i in a time period t , P_{it} is the average of the house prices, ψ are dummy variables for the respective local planning authorities, and ϵ represents an error term that is identically and independently distributed. X_{it} represents a vector with different observable variables that characterize the composition of local long term care markets and that we use as main controls in some of our specifications.

The parameter of interest, α , may be interpreted as a causal effect of the house prices on the distribution of care homes, only if P_i is exogenous so that $Cov(P_i, \epsilon_i) = 0$. Yet, a potential element that can lead to inconsistent estimations of α may be the presence of unobserved variables that confound the effect of the house prices on the proportion of care homes.

For tackling with these problems we adopt an instrumental variables approach and instrument the house prices with instruments referred to the variation of restrictiveness in the planning regulations. The measure that we use is the rate of refusal of major projects. It is normally used in the literature and reflects the share applications corresponding to projects that entail 10 or more dwelling that are rejected by a local authority during a year.

A potential problem with this instrument is that is procyclical and this may entail endogeneity concerns. In order to address them we use two identification strategies based on the variation in the rate of delay of projects before and after a planning reform aimed at speeding up the planning processes and the share of local political power. The specific instruments that we use are the change in the delay rate before and after the reform and the share of Labour voters in the local authority.

In addition to the planning regulations, there may be other drivers that entail restrictions in the supply of houses and thus may lead to increases in the house prices. Physical constraints may be an example of those and should be included in the estimation. We use the share of developable land to express the extent of physical constraints. A potential limitation referred to this variable is that the availability (or scarcity) of this type of land can be the result of elements that also affect the house prices and therefore may imply endogeneity. For addressing this problem, the historic population density can be used as an instrument for identifying the share of developable land since it may show the early forms of agglomeration. I use the historic population density in 1911.

Considering these caveats specification for estimating the first stage fitted values of the house prices is expressed

$$P_{it} = \delta Z_{it} + \beta \chi_{it} + \eta_i + \psi_i + u_{it} \quad (2)$$

where Z refers to the planning regulation instrument, χ the controls associated with the physical constraints and ψ binary variables for each planning authority. In addition to the specification developed by [Hilber and Vermeulen \(2016\)](#), we include an additional control η corresponding to the share of Labour voters for each local authority in the last national election in June 2015.

All the variables included in the analysis are summarised in [Table 1](#)

IV results

[Table 2](#) presents evidence corresponding to the validity of each of the instruments considered. Results from the first stage report the expected effect of planning regulations on prices. Local controls are expressed in terms of whether the local planning authority is a unitary authority, with more competencies and tax discretion, or not.¹

[Table 3](#) reports the results of the second stage. The second column associated with the share of Labour votes controls for share of Labour voters in the last election in 2015.

Robustness

One may argue that these effects are not correctly measured since the decision of entry in the market entails certain lags. For instance, providers may make their decision of entry

¹The use of controls local planning authorities leads to problems of collinearity. Alternatively we use controls related to the type of local authority. We control for single tier local authorities - eg. unitary authorities which may have greater discretion on issues related to housing markets such as the council tax.

Table 1: Summary statistics

	Obs	Mean	Minimum	Maximum	St.Dev
Care homes per 1000 population over 65	945	1.6678	0.4255	4.0611	0.5416
Average house prices	945	268564	91157	2170757	179558
Share of population 85+	945	0.0025	0.0002	0.0122	0.0016
Share of population receiving Attendance Allowance	945	0.0106	0.0043	0.0263	0.0039
Share of population with pension credits	945	0.0339	0.0130	0.0705	0.0100
Share of female claiming for JSA	945	0.0047	0.0007	0.0185	0.0032
Share of population with income support	945	0.0122	0.0028	0.0402	0.0059
HHI	945	0.0320	0.0064	0.4873	0.0352
Share of Labour voters 2015	945	0.2810	0.0698	0.7301	0.1448
Rate of refusal major projects	945	0.2563	0.0732	0.5090	0.0879
Rate of delay change	945	-0.0376	-0.6345	0.5310	0.2197
Historical share of Labour voters	945	0.1625	0.0010	0.4103	0.0886
Proportion of care homes (bad quality)	945	0.1905	0.0000	0.6585	0.1232
Proportion of care homes (good quality)	945	0.5597	0.0000	4.7143	0.5940
Average expenditure per capita	945	41004	2067	131972	29378
Share of developable land developed in 1990	945	0.2729	0.0090	0.9621	0.2356
Population density in 1911	945	774.7089	3.2504	22028.7969	2633.3879

Table 2: First stage results, dependent variable house prices (log)

Average house prices (log)			
	Refusal rate	Change delay rate	Labour share
	3.142*** (0.161)	-0.561*** (0.085)	-2.312*** (0.341)
Local Authority controls	No	No	No
Observations	945	945	945
F(excluded instruments)	206.5***	47.26***	58.04***
Cragg-Donald Wald F statistic	641.31	192.83	392.1
Kleibergen-Paap Wald rk F statistic	206.5	47.26	58.04
Hansen J statistic	5.458**	1.918	10.117***

Notes: Additional controls include the share of Labour voters in 2015. Robust standard errors are presented in parentheses. Standard errors are clustered at local planning authority level. ***/**/*/+ denote significance levels at 1%, 5%, 10% and 15%.

on the basis of past house prices rather than the existing in the market. Furthermore using contemporaneous prices may lead to reverse causality issues. Care homes may constitute an amenity in the area that may increase the value of the properties located there. In order to tackle with this problem, Table 4 shows the results of the effects of

Table 3: Second stage results, effects of house prices on care homes entry

	OLS		IV	
	(1)	(2)	(3)	(4)
Average prices (log)	0.270*** (0.038)	0.048 (0.154)	-0.332*** (0.096)	-0.188** (0.094)
Main controls	No	Yes		
Local Unitary Authority controls	No	No	No	No
Observations	945	945	945	945
F	51.27***	29.69***		
R2	0.0516	0.2129		

Notes: Main controls include: Share of people 85+, Share of people receiving Attendance Allowance, Share of people with pension credits, Share of females claiming for Job Seekers Allowance, Share of adults with income support, Herfindahl-Hirschmann Index. Additional controls include the share of Labour voters for 2015. Robust standard errors are presented in parentheses. Standard errors are clustered at local planning authority level. ***/**/*/+ denote significance levels at 1%, 5%, 10% and 15%.

lagged house prices on care homes entry.

We run alternative robustness tests of our results based on different subsamples of our initial sample of analysis. A plausible concern may be the presence of some outliers in the distribution of care homes. In order to overcome the potential influence of these observations we remove from the sample the top and bottom 5% of the care homes.

Likewise, we also consider a sample without the planning authorities belonging to the region of London. The results of these analyses are shown in Table 5. The specifications corresponding to each of the columns are identical to the specifications that resulted in the estimates presented in Table 3. The order of the columns follow the same order as Tables 3 and 4

Alternative mechanisms

The positive effect of prices on the entry of care homes may be indicative of a transfer in the demand from the public to the self funded clientele. We then test the effect of the house prices on the level of per capita expenditure that local authorities spend on residential care. Rather than the whole adult population, we restrict our analysis to the population who is 65 or more since this is the segment of population more likely to demand these services. Results are reported on Table 6

An alternative channel can be the distribution of care homes by their level of quality.

Table 4: Robustness test, lagged prices

	OLS		IV	
	(1)	(2)	(3)	(4)
Lagged average prices (log)	-0.25*** (0.039)	0.056 (0.151)	-0.357*** (0.107)	-0.193* (0.099)
Main controls	No	Yes	Yes	Yes
Local Unitary Authority controls	No	No	No	No
Observations	945	945	945	945
F	41.73***	26.49***		
R2	0.0424	0.2131		
Cragg-Donald Wald F statistic			157.422	348.978
Kleibergen-Paap Wald rk F statistic			38.926	58.353
Hansen J statistic			2.438	10.227***

Notes: Main controls include: Share of people 85+, Share of people receiving Attendance Allowance, Share of people with pension credits, Share of females claiming for Job Seekers Allowance, Share of adults with income support, Herfindahl-Hirschmann Index. Additional controls include the share of Labour voters for 2015. Robust standard errors are presented in parentheses. Standard errors are clustered at local planning authority level. ***/**/*/+ denote significance levels at 1%, 5%, 10% and 15%.

Table 5: Robustness tests, effects of house prices on care homes entry

	Top and Bottom 5% excluded				London Region excluded			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	-0.146*** (0.032)	0.203*** (0.067)	0.005 (0.129)	0.067 (0.115)	-0.232*** (0.048)	0.088 (0.119)	-0.36* (0.204)	0.477 (0.532)
Main controls	No	Yes			No	Yes		
Local Unitary Authority controls	No	No	No	No	No	No	No	No
Observations	841	841	841	841	849	849	849	849
F	20.30***	31.34***				23.68***	24.16***	
R2	0.0236	0.2254				0.0272	0.1961	
Cragg-Donald Wald F statistic			92.864	217.302			68.589	20.776
Kleibergen-Paap Wald rk F statistic			61.029	58.749			32.808	12.080
Hansen J statistic			0.756	5.833**			4.123**	6.329**

Notes: Main controls include: Share of people 85+, Share of people receiving Attendance Allowance, Share of people with pension credits, Share of females claiming for Job Seekers Allowance, Share of adults with income support, Herfindahl-Hirschmann Index. Additional controls include the share of Labour voters for 2015. Robust standard errors are presented in parentheses. Standard errors are clustered at local planning authority level. ***/**/*/+ denote significance levels at 1%, 5%, 10% and 15%.

In Table 7 we show the results derived from the effect of house prices on the distribution of care homes according to their quality rating.

Table 6: Effects on per capita residential expenditures

	OLS		IV		
	No controls (1)	Controls (2)	Change delay rate (3)	Labour share (4)	Labour share (5)
	-0.133 (0.125)	0.292 (0.304)	0.713 0.323 (1.955)	-1.783 ⁺ (0.812)	 (1.136)
Main controls	No	Yes	Yes	Yes	Yes
Local Unitary Authority controls	No	Yes	Yes	Yes	Yes
Additional controls				No	Yes
Observations		945	945	945	945
F	1.13	18.97***			
R2	0.0012	0.3488			
Cragg-Donald Wald F statistic			27.77	170.219	89.793
Kleibergen-Paap Wald rk F statistic			11.49	70.394	39.884

Table 7: Second stage results, effects on distribution of care homes by quality

	Good quality care homes					Bad quality care homes				
	OLS	OLS	IV	IV	IV	OLS	OLS	IV	IV	IV
	0.155*** (0.042)	0.13* (0.071)	-1.02* (0.578)	0.458** (0.215)	0.317 (0.3)	0.032*** (0.009)	0.054** (0.016)	-0.012 (0.109)	0.004 (0.053)	0.036 (0.071)
Main controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Local Unitary Authority controls	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Additional controls				No	Yes				No	Yes
Observations		945	945	945	945	945	945	945	945	945
F	13.54***	38.90***				13.71***	67.12***			
R2	0.0142	0.2335				0.0143	0.3577			
Cragg-Donald Wald F statistic			27.769	170.219	89.793			27.769	170.219	89.793
Kleibergen-Paap Wald rk F statistic			11.494	70.394	39.884			11.494	70.394	39.884

References

Hilber, C. A. and Vermeulen, W. (2016). The impact of supply constraints on house prices in england. *The Economic Journal*, 126(591):358–405.