Regression results

New variables included in the analysis

Our purpose is to test the effect of the house prices on the proportion of care homes in local long term care markets. Considering a local authority i during a time period t, the proportion of care homes C can be estimated with a simple regression model specified as follows.

$$C_{it} = \beta X_{it} + \alpha P_{it} + \psi_c + \epsilon_{it} \tag{1}$$

where X_{it} represents a vector with different observable variables that characterize the composition of local long term care markets and that we use as controls. Hence, on the one hand we define the demand for long term care in the local market by addressing a number of issues. Firstly, we include the proportion of people older than 85 and proportion of people that receive the attendance allowance[1] as proxies of the level of health dependency. Also, given the association between the financial needs and the funding support determined by the means-test, we incorporate the proportion of people that receive some sort of income support and the proportion of people that receive pension credits to reflect the payer composition within the local population. These variables have been previously used in the literature for these purposes (Darton et al., 2010; Forder and Allan, 2014). Likewise, given that long term care is a labour intense activity, we add the proportion of females that claim for job seekers' allowance in order to get a proxy for unemployment.

In addition to the former, X also includes a measure of the Herfindahl–Hirschman Index (HHI) to control for the competition between care homes in the local market. In our case, the HHI is a measure of concentration that reflects the squared shares of beds across all the providers in a local market. The values range from 0 to 1 where higher values

[1] This benefit aims to support those people with physical disabilities in UK that live independently and might require residential care services otherwise.

represent higher concentration and therefore less competition. We also include county fixed effects ψ_c associated with each local authority in order to capture unobservable variables associated with each local planning authority that may affect the entry of care homes.

P_{it} is the average of the house prices and ϵ represents an error term that is identically and independtly distributed. In this specification α is the parameter of interest and thus is interpreted as the impact of house prices on the proportion of care homes. Equation 1 can be estimated by OLS and will produce an unbiased estimate of α only if P_i is exogenous so that $Cov(P_i, \epsilon_i) = 0$. In case this occurs, this estimate may be effectively interpreted as a causal effect. Nonetheless, as we argue below, there may be elements that violate the former and introduce correlation between P_{it} and ϵ_{it} resulting in biased estimates of α. We address this concern by using an instrumental variables (IV) approach and estimating the two-least squares estimator of α.

Bias and prices specification

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 example, one may think about the effect of an unobserved shock that affects positively both the values of the properties and also incentivises the entries in the market given likely wealth effects. Hence, higher level of housing prices may result in wealth effects that lead to greater levels of consumption and also attract businesses. Hence the selection of an area by a care home provider is likely to be non-random and the effect of P_i may be associated partially with ϵ. In order to tackle with these potential problems, it is necessary to find an instrumental variable z that is uncorrelated with ϵ but is correlated with P_i.

The identification strategy for meeting this purpose is based on Hilber and Vermeulen (2016). The main underlying idea of their strategy consists of exploiting variability of various supply constraints associated with the local housing markets in England in order to explore how shocks on local earnings affect house prices considering the level of planning restrictiveness. Their findings confirm their initial hypothesis that tight supply regimes – e.g. with more regulatory constraints in the planning regulations, lead to increases in the prices.

We apply the former rationale and use these instruments linked to the supply constraints to address the concerns regarding the endogeneity of the house prices. For our identification we assume that these instruments, in addition of being correlated with

local earnings, are also correlated with the house prices. Considering this, the literature has normally considered two types of drivers to explain the high levels of prices.

The first group of factors are those referred to the restrictiveness associated with planning regulations. For UK several authors have shed light with regards to the effects of tight planning regulations on house prices suggesting a positive relationship that suggests that house prices are higher in those areas with more restrictive planning regulations. For measuring the level of restrictiveness we use the rate of refusal of major projects by a local planning authority during a year. This measure has been proposed normally for capturing the tightness of planning decisions and consists of the share of residential projects that entail 10 dwellings or more and that have been rejected over a period of a year. The local planning restrictiveness has been shown to be procyclical and this issue leads to endogeneous concerns.

In order to tackle with these we use two identification strategies based on the variation of a planning reform aimed at speeding up the planning processes and secondly 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.

On the other hand, a second type of factors is linked to existing physical constraints in the housing market. Thus another variable that is typically used is the share of developable land. For the analysis we include the share of all developable land that is already developed. 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, we specify equation 2 in order to estimate first-stage fitted values of the log house prices. The predicted values derived from this equation are used as instruments and incorporated in **??**in order to get a consistent estimate of α.

$$P_{it} = \delta Z_{it} + \beta \chi_{it} + \psi_c + u_{it} \tag{2}$$

All the variables 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

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

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.[2]

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

	Average house prices (log)			
	Refusal rate	Change delay rate	Labour share	Labour share
	3.213***	-0.545***	-3.001***	-2.063***
	(0.164)	(0.086)	(0.192)	(0.317)
Local Unitary Authority controls	Yes	Yes	Yes	Yes
Additional controls			No	Yes
Observations	945	945	945	945
F(excluded instruments)	382.97***	40.27***	246.29***	42.47***
Cragg-Donald Wald F statistic	803.155	92.210	565.55	97.108
Kleibergen-Paap Wald rk F statistic	382.970	40.267	246.29	42.475

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%.

Table 3 reports the results of the second stage. The second column associated with

[2]The 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.

the share of Labour votes controls for share of Labour voters in the last election in 2015.

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

	OLS		IV		
	No controls	Controls	Change delay rate	Labour share	Labour share
	(1)	(2)	(3)	(4)	(5)
Average prices (log)	0.270***	0.048	-0.053	0.245**	0.429^{+}
	(0.038)	(0.154)	(0.216)	(0.125)	(0.288)
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	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%.

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 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 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

Table 4: Robustness test, lagged prices

	OLS		IV		
	No controls	Controls	Change delay rate	Labour share	Labour share
	(1)	(2)	(3)	(4)	(5)
Lagged average prices (log)	-0.25***	0.056	-0.053	0.237**	0.416^{+}
	(0.039)	(0.151)	(0.219)	(0.121)	(0.275)
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	945
F	41.73***	26.49***			
R2	0.0424	0.2131			
Cragg-Donald Wald F statistic			90.586	642.005	110.643
Kleibergen-Paap Wald rk F statistic			38.311	269.761	49.582

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				
	OLS	OLS	IV	IV	IV	OLS	OLS	IV	IV	IV
	-0.146***	0.203***	0.168	0.183**	0.43**	-0.232***	0.088	0.044	0.314**	0.684
	(0.032)	(0.067)	(0.190)	(0.086)	(0.219)	(0.048)	(0.119)	(0.254)	(0.145)	(0.585)
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	841	841	841	841	841	849	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			81.390	552.080	101.174			80.132	492.903	33.315
Kleibergen-Paap Wald rk F statistic			35.692	245.877	41.813			31.793	239.974	19.815

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%.

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

Table 6: Effects on per capita residential expenditures

	OLS		IV		
	No controls	Controls	Change delay rate	Labour share	Labour share
	(1)	(2)	(3)	(4)	(5)
	-0.133	0.292	0.713 0.323	−1.783^{+}	
	(0.125)	(0.304)	(1.955)	(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

An alternative channel can be the distribution of care homes by their level of quality. 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 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***	0.13*	-1.02*	0.458**	0.317	0.032***	0.054**	-0.012	0.004	0.036
	(0.042)	(0.071)	(0.578)	(0.215)	(0.3)	(0.009)	(0.016)	(0.109)	(0.053)	(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

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