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Abstract
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Keywords: Care homes; market concentration; price; supply; quality.

JEL codes: H75; I11; L22

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1. Introduction

The performance of the care home sector is an important policy concern given the 'marketization' of long-term care services (Spasova, Baeten *et al*. 2018). In most countries where there is substantial non-public provision of care homes, the state intervenes in the sector through regulation of supply, negotiation of prices for publicly funded residents and monitoring and publicising quality (e.g. U.S. Government Accountability Office 2018). In addition, competition authorities have examined the care home sector in relation to a range of issues, including the difficulties faced by care home consumers in 'shopping around', cross-subsidisation from private payers to publicly supported residents, and the existence of large for-profit multi-home providers (e.g. Competition and Markets Authority (CMA) 2017).

Institutional settings differ between countries and are reflected in the research literature. Much of the economics literature on care home markets concerns the US and the UK (usually England) where the for-profit sector dominates and where a major focus of research has been the impact of competition on quality. In the rest of Europe, despite increasing reliance on markets, not-for-profit care homes tend to outnumber for-profit homes (Spasova, Baeten *et al*. 2018) and most studies are not concerned with competition but instead examine aspects of the not-for-profit sector e.g. Dewaelheyns *et al*. 2009 (Flanders); Farsi and Filippini 2004 (Switzerland).[2] In this paper, we analyse the English care home market and examine the relationship between local market competition and supply and price as well as quality. This broader focus is justified by the English public funding arrangements, which differ from those in the US.

In the UK, the market for care home places for older people is dominated by privately owned care homes. In 2016, 80% of older (65 years and over) care home residents lived in homes run by for-profit operators, only 7% lived in publicly-owned homes and the remainder lived in homes run by not-for-profit organisations such as charities (Laing 2017).[3] Over half of care home residents receive means-tested public help with their care home fees through their Local Authority (LA) (Laing 2017). LAs purchase care home places mainly[4] on behalf of residents whom they fund. These negotiations take various forms: agreeing fees in advance for pre-

[2] An exception is Martin and Jérôme (2016) who analyse the for-profit sector in France concluding that nursing homes which are part of a chain may be less cost-efficient than those which are not part of a chain.
[3] At 3%, the proportion of English care home places in publicly owned care homes is less than half that for the UK as a whole (CMA, 2017. Table 2.2).
[4] They may also procure places for self-funders who lack the capacity to negotiate with a care home and have no-one who can do so on their behalf. Some nursing home places are supported by payments from the National Health Service (NHS), as discussed in Section 3.

booked places ("block" contracts) sometimes with flexibility for additional payments for high dependency residents, "spot" contracts negotiated on a case-by-case basis often starting with a "benchmark" price set by the LA; and reverse auctions through which providers compete on price and quality for publicly funded residents (CMA 2017). LAs reportedly pay fees between 25% and 50% lower than the fees paid by residents who fund themselves and while LA fees generally cover operating costs, capital costs are primarily recouped through self-payers (CMA 2017). Occupancy rates are high at an average of over 90% for the UK as a whole in 2016/17, but capacity is falling (Laing 2017). A large majority of UK care home residents are long-term residents.[5]

The 2014 Care Act (Section 5) introduced a duty on English[6] local authorities to "*promote the efficient and effective operation of a market in services for meeting care and support needs*" having regard to (amongst other things) "*the importance of ensuring the sustainability of the market*" and "*fostering continuous improvement in the quality of such services*."[7]. A recent CMA report concluded that the parts of the care home industry that supply primarily LA-funded demand for care home places are not sustainable at the current level of fees for LA-funded residents. CMA recommended that an effective procurement strategy should, amongst other things, encourage competition amongst care homes "*based on delivering good outcomes for residents* […] *and value for money for LAs and the taxpayer*" (CMA 2017 p.43). Against this background, any concentration of the local supply of care home places in the hands of a relatively small number of providers would be a concern.

In the US, states have required providers to obtain a Certificate of Need (CON) before entering the market or expanding existing nursing home capacity, as one means to contain Medicaid and Medicare expenditure. No equivalent exists in England, where LA spending on long-term care is governed through individual assessments of need for care followed by a means test to establish entitlement to financial help with care costs. Rules for receiving financial help are set nationally with little scope for LAs to deviate from them. Descriptors of need in the 2014 Care Act promote consistency in care needs assessments across LAs. Ensuring an adequate supply

[5] Comprehensive figures are not available but a 2012 survey of a large chain of homes found that 94% of its UK care home residents were admitted for 'long-term care' with only 1.2% admitted for intermediate, sub-acute, convalescent or rehabilitative care, the remainder for respite or end-of-life care (Centre for Policy on Ageing, 2012).
[6] Social care is a devolved function so arrangements in Wales, Scotland and Northern Ireland deviate from those in England.
[7] http://www.legislation.gov.uk/ukpga/2014/23/section/5

of good quality care home places at prices that individuals and LAs can afford is a major policy concern, against a background of reportedly high numbers of homes at risk of insolvency.

In the US, the relationship between various measures of competition and quality in care homes is the main subject of research, since price and supply are primarily determined by Medicare/Medicaid rules and CON laws (Zhao 2016).[8] Exploiting the introduction of new requirements to make quality information more accessible to consumers, Zhao (2016) found that for lower market concentration to improve quality, good information on quality has to be available to consumers. Gabrowski *et al.* (2011) found that a lack of competition in the nursing home market may explain the limited impact of the Nursing Home Quality Initiative report card on nursing home quality. One-year improvements in reported nursing home quality have been found to be greatest in least concentrated markets especially those with relatively low occupancy rates (Castle *et al.* 2007). Starkey *et al.* (2005, cited in Forder and Allan 2011) found that States with CON laws and hence less contestable markets had lower quality but the effects of market concentration on quality were statistically insignificant. Zinn (1994) investigated whether market concentration resulting from the CON laws and the consequent reduced competition from new entrants was detrimental to care home quality. She found that some mechanisms for promoting competition in the nursing home market improve quality but that quality can be higher in more concentrated markets, due to the buyer power of public authorities impeding the exercise of supplier power. Motivated by theoretical considerations set out in Hirth (1999), competition from not-for-profit care homes was found empirically to be associated with higher quality in the for-profit sector (Gabrowski and Hirth 2003).

Like the US, the UK literature has been concerned with quality but, because of the different institutional setting, has also examined the link between concentration and the price paid for LA-funded care home residents. Forder and Netten (2000) found that those prices fell as the number of providers in the local market increased but, in a wide-ranging review of studies of the effect of competition on price and quality in care home markets, Forder and Allan (2011) conclude that competition often reduces prices only to a modest degree. Evidence on the effect of competition on quality is more mixed and they suggest this may be because, once minimum standards are met, public purchasers seek the cheapest supplier. They also highlight the varying extent to which previous research has addressed simultaneity between competition and price or quality. In their subsequent analysis of the English care home market (Forder and Allan

[8] There is a limited US literature on competition and price. For instance, Nyman (1994) found that market concentration, attributed to the CON laws, raised the prices that self-payers pay relative to Medicaid reimbursement rates.

2014), in which they take account of this simultaneity, they find that competition reduces both price and quality, arguing that competition can push prices down to the level at which no more than minimum quality standards are achievable.

In this paper, our aim is to identify LA-level local characteristics that affect the degree of market concentration and the associations between that tendency towards high concentration and the jointly determined outcomes of the supply, average prices for LA-funded care home residents and quality of care home places. We highlight the LA characteristics which facilitate or inhibit the discharge of the new duty of 'market shaping' that has been placed on LAs (Department of Health and Social Care 2018).

We make three new contributions to the literature on competition in the English care home market. First, we bring supply into the picture, both because supply is an important market outcome in the English setting and because of the new statutory responsibility placed on LAs to promote a flourishing market. We are unaware of any previous attempts to investigate the influence of competition on the supply of care home beds, although there is a parallel in the seminal contribution of Joskow (1980) for the US hospital market. The neglect of supply is perhaps understandable where supply is directly controlled by the state but that is not the case in England where there is no analogue of the US CON system, and supply shortages are a major policy concern.

Second, we take account of the important role of care home chains, where multiple homes within the local area have common ownership and consequently may avoid competition with each other. Chains have been neglected in the UK literature, but in the US Hirth *et al.* (2019) showed that treating homes within a chain as a single entity greatly changes the empirical picture of market concentration, increasing the number of counties classed as concentrated by over a fifth. They suggest that researchers should take account of common ownership of homes when constructing measures of market structure, and we follow that recommendation. We also allow for the possibility that homes offering different services – specifically those that offer nursing services and those that do not – may not be in direct competition.

Third, we introduce a new econometric approach, which recognises that the supply of care home places, the prices paid by LAs, care home quality and the degree of concentration in the care home market are potentially all jointly determined outcomes in a market equilibrium, or at least jointly influenced by the same equilibrating forces. We then use the results of our econometric analysis of the exogenous determinants of these outcomes to construct a measure

of the impact on supply, quality and price of being in an area whose characteristics make it vulnerable to high or low concentration in the care home market. This contrasts with much previous research on competition in the care home market which has taken a narrower approach, seeking to establish the causal effect of the competition outcome on other market outcomes (usually focused on price and/or quality) without recognising explicitly that all these outcomes may be jointly determined within an overall equilibrium. The focus on factors which tend to promote or curtail concentration also makes sense from a policy point of view, since LAs do not have the power to directly restrain market concentration – they can only try to create an environment favourable to competition.

The paper is organised as follows. Section 2 sets out our econometric approach to estimating the influence of LA characteristics on market outcomes and to gauging the impact of a tendency towards low or high market concentration on price, supply and quality. In Section 3 we outline relevant details on the regulation and funding of care home places in England. Data, measurement of market outcomes and area characteristics are discussed in Section 4. Section 5 presents econometric results relating market concentration to LA characteristics and examines the impact of susceptibility to market concentration on price, supply and quality. In Section 6 we assess the robustness of our results in three respects: the choice of parameters that control the construction of our impact measures; the treatment of chained care homes; and the role of publicly-run care homes. Section 7 concludes.

2. The econometric approach

A full multi-market model of local market concentration (C), supply of care home places[9] (S), price (P) and quality (Q) would be immensely complex. In each LA area there are multiple buyers (the LA, a large number of private individuals and to a small extent the National Health Service (NHS)) and multiple potential suppliers (individual entrepreneurs and larger-scale chains). The observed long-run equilibrium outcome for C, S, P and Q is produced by the reaction functions of each player with respect to the potential actions of every other player in the market, with respect to each decision variable. For potential suppliers, these decisions include entry and price, quality and capacity. For LAs they include decisions on the level of need to qualify for care subsidy and the reservation price they pay in the market. For private

[9] Strictly speaking, this is potential supply, measured as care home capacity. Actual delivered supply is slightly less, due to transient shortfalls in occupancy. The capacity definition of supply seems more appropriate to the medium and long-term policy perspective.

(non-subsidised) buyers, decisions include choice of price and quality and the potential alternative of substitutes such as care delivered in private households.

The research literature adopts one of two approaches: either ignoring the endogeneity of *C*, or using an instrumental variables (IV) to estimate a 'causal effect' of *C*. In our view, both approaches are open to question. In particular, estimating regressions of *S*, *P* and *Q* on *C*, with IVs used to address the endogeneity of *C* will not identify this underlying structure and, in our view, it is hard to justify the claim that a causal impact of market concentration on supply, price and quality can be achieved in this way. This is a more fundamental issue than conventional doubts about instrument validity – it is far from clear what a causal effect would mean in this case, where *C*, *S*, *P* and *Q* are jointly determined as outcomes produced by market equilibrating forces. Moreover, even if we could clearly define and empirically identify such a causal effect, it would not shed much light on policy questions, since public authorities cannot directly control market concentration but only attempt to create conditions to promote competition.

The quest for an elusive causal impact identified by econometric IV technology has distracted attention from another, more modest reduced form approach to understanding the connection between concentration and other market outcomes. The nature of the equilibrium in a particular area (or movements towards such an equilibrium) will be determined by the basic exogenous characteristics of that area, $\boldsymbol{X}$. Instead of asking the question: "what is the causal impact of market concentration on *S*, *P* and *Q*?", we ask the much clearer question: "what is the impact on *S*, *P* and *Q* of the exogenous area characteristics that tend to produce high levels of market concentration?". We argue that answers to the former question are questionable in a setting with general equilibrating forces, while it is possible to give clear answers to the latter using straightforward econometric analysis.

Define $F(C \mid \boldsymbol{X})$ as the distribution function of market concentration conditional on area characteristics. We say that a tendency to high market concentration is any configuration of area characteristics $\boldsymbol{X}$ such that $\Pr(C > c_H \mid \boldsymbol{X}) > \rho$, where c_H is a pre-specified threshold above which the degree of concentration is regarded as high and ρ is the probability we require for high concentration to be regarded as likely. Similarly, a tendency to low concentration entails a set of characteristics $\boldsymbol{X}$ such that $\Pr(C < c_L \mid \boldsymbol{X}) > \rho$, where c_L is the low concentration threshold.

Define binary indicators of high and low concentration risk:

$$\xi_H(\boldsymbol{X}) = \mathbb{I}(1 - F(c_H \mid \boldsymbol{X}) > \rho)\,; \quad \xi_L(\boldsymbol{X}) = \mathbb{I}(F(c_L \mid \boldsymbol{X}) > \rho) \tag{1}$$

where $\mathbb{I}(.)$ is the indicator function, and let *Y* denote any of the equilibrium outcomes *S*, *P* and *Q*. Our impact measure, δ, is the percentage difference in expected value of *Y* between areas with high and low vulnerability to market concentration:

$$\delta \;=\; 100 \times \frac{\mathrm{E}(Y \mid \xi_H(\boldsymbol{X}) \;=1) \;-\; \mathrm{E}(Y \mid \xi_L(\boldsymbol{X}) \;=1)}{\mathrm{E}(Y \mid \xi_L(\boldsymbol{X}) \;=1)} \tag{2}$$

We then define corresponding empirical binary indicators:

$$\hat{\xi}_H(\boldsymbol{X}) \;=\; \mathbb{I}\big([1-\hat{F}(c_H \mid \boldsymbol{X})] \;>\; \rho\big) \tag{3}$$

$$\hat{\xi}_L(\boldsymbol{X}) \;=\; \mathbb{I}\big(\hat{F}(c_L \mid \boldsymbol{X}) \;>\; \rho\big) \tag{4}$$

where $\hat{F}(.)$ is an estimate of $F(C \mid \boldsymbol{X})$ derived from an econometric model of market concentration. In a dataset with areas indexed by *i*, our empirical estimate of δ is:

$$\hat{\delta} = 100 \times \left[\frac{\sum_i Y_i \hat{\xi}_H(\boldsymbol{X}_i) \sum_i \hat{\xi}_L(\boldsymbol{X}_i)}{\sum_i \hat{\xi}_H(\boldsymbol{X}_i) \sum_i Y_i \hat{\xi}_L(\boldsymbol{X}_i)} - 1\right] \tag{5}$$

In implementing this, we use several variants of the regression model of *C* on $\boldsymbol{X}$ to construct $\hat{F}(C \mid \boldsymbol{X})$, allowing for both heteroskedasticity and non-normality in alternative ways. For our primary results, we specify $\rho = 0.6$ and our choice of c_L, c_H (discussed in Section 4.2) is guided by the empirical distribution of *C* to ensure adequate statistical reliability. Section 6 examines the sensitivity of $\hat{\delta}$ to the choice of c_H, c_L and ρ. Estimated impacts are expressed as percentage differences and confidence intervals are constructed by bootstrapping with 500 replications.

3. Regulation and funding of the care home market in England

In England the Care Quality Commission (CQC) registers, monitors, inspects and rates the quality of care homes. Care homes register with CQC as homes which do or do not provide nursing care. Those which do provide nursing care (often referred to as nursing homes) cater for people who need care from a registered nurse. Usually they will also need help with personal care such as washing, dressing etc. Care homes which do not offer nursing care are referred to as residential homes. A nursing home must meet certain standards for on-site availability of a registered nurse, but not all its places are necessarily occupied by people with nursing care needs. Someone needing only personal care could choose a nursing home or a residential home. Anyone needing nursing care would need to find a place in a nursing home.

Older people can get state help with care home fees. They must first be assessed as needing nursing and/or non-nursing care in a care home. Assessments for nursing care are the

responsibility of the National Health Service (NHS). Local Authorities assess needs for non nursing care. For care home residents assessed as needing nursing care, a small proportion with complex and long-term health conditions are entitled to have their fees met in full by the NHS, the remainder are eligible for a flat rate non-means-tested contribution from the NHS (known as NHS Funded Nursing Care). Only those with sufficiently low income and capital assets are entitled to any further LA funding (which may be additional to NHS Funded Nursing Care). For this group, LAs procure care home places, pay the care home and collect required contributions from the care home resident. Most care home residents who previously owned their homes are disqualified from state help with their care costs because the value of their home is included in the capital test. Only those others whose incomes fall below the care home fee plus a small margin (and excluding the NHS contribution where relevant) are entitled to state help, but they still have to contribute most of their income towards the care home's fee.

Procurement of care home places by the 152 English LAs with adult social services responsibilities generally involves each individual LA negotiating with care homes in its area. The cost of NHS care home funding falls on NHS Clinical Commissioning Groups (CCGs) of which there are some 190 in England. For procurement of nursing home places for people entitled to full NHS funding, CCGs reportedly combine into larger geographical groups to negotiate fees that are not much above those that LAs pay for residents they support (Laing, 2017). The respective roles of the NHS and LAs in procurement of nursing home places for self-funding residents entitled only to the flat rate NHS subsidy is less clear but neither body has any particular financial incentive to exert downward pressure on fees in such cases.

4. Data

4.1 Data sources

Most of the data we use come from CQC records on care homes registered as active in January 2016. We focus on care homes for older people and select those that, in January 2016, were registered as offering services for people aged 65+ and/or people with dementia.[10] CQC data distinguish between homes that do and do not offer nursing care and provide the total number of beds in each care home. They also provide some information used to establish whether each care home is one of a group with a common owner. Since it is not compulsory for care homes to provide such information to CQC, we link data from an annual industry survey of the care

[10] Since dementia predominantly affects older people, care homes which offer services for people with dementia are included even if they did not report specifically that they offer services for people aged 65+.

home market (Laing 2017) to the CQC data at care home level. We refer to homes whose owner has more than one home in the *same* LA as 'chained'. The same source is also used to identify the sector (for-profit or not-for-profit) of each care home. CQC data are also a source of information on care home quality. Since October 2014 the CQC rating system has classified care homes as (1) inadequate, (2) requiring improvement, (3) good or (4) outstanding.[11]

Table 1 summarises the characteristics of English care homes for older people or people with dementia that were active in January 2016 and used in our analysis. Of the 11,336 care homes, 63% provided residential care only and 37% provided nursing care. Over three-quarters of residential care homes were for-profit organisations; amongst nursing homes the percentage reached 88%. Nearly 70% of nursing homes were chained compared with just under 50% of residential homes. On average nursing homes had more beds than residential homes (51 compared with 27) and chained homes had more beds than unchained homes (43 compared with 28 when nursing and residential homes are taken together). In the care home market as a whole, around two-thirds of care homes were rated 'good' or 'outstanding' and there is very little difference in these proportions between chained and non-chained homes. The proportion rated good or outstanding is higher (71%) for residential homes than for nursing homes (62%). In the residential care home market, quality seems to be higher among chained homes; 74% are rated good or outstanding compared with 68% of non-chained homes.

Table 1: The composition of the English care home market for older people and those with dementia, January 2016

	All care homes	Nursing homes	Residential homes
Number of active care homes	11,336	4,246	7,090
% for-profit	81	88	76
% chained	56	69	48
Average number of beds			
overall	36	51	27
among chained care homes	43	55	32
among non-chained care homes	28	42	23
% rated good/outstanding*			
overall	67	62	71
among chained care homes	68	62	74
among non-chained are homes	66	61	68

*Excludes 885 homes which had not been rated by CQC since before October 2014 when the rating system changed.

[11] The overall measure synthesises ratings in five domains: caring, effective, responsive, safe and well-led. See Barron and West (2017) for details.

Of the 11,336 care homes, 6,351 were chained (in 856 chains). Of those, 30% were part of chains that owned both nursing and residential homes in the LA, 31% were in chains owning only nursing homes and 39% belonged to chains owning only residential care homes.

CQC data do not contain information on the prices care homes charge, whether to LA-funded residents or to those who fund themselves. However we are able to make use of data on the average gross (before resident contributions) cost to each LA of care home residents aged 65+ whom they support on a long-term basis. Since we are interested in LA characteristics which influence market outcomes at the LA level this is appropriate for the econometric analysis which is conducted at the LA level. Implicitly we are assuming that the boundaries of each care home market are coterminous with LA boundaries. This is appropriate given our focus on the market that LAs are required to 'shape' and on the prices paid by LA-funded residents, who are mostly placed in care homes within the LA funding them[12]. Although other approaches to defining the boundary of the market have been used (e.g. Forder and Allan 2014), using geopolitically defined areas has the advantage that "*the choice of political boundary is exogenous to other factors that could influence market size, such as quality or nursing home amenities*" (Bowblis and North 2011). Data from 148 (out of 152) English LAs were used.[13]

4.2 Market concentration measures

We measure local market concentration by means of the commonly-used Herfindahl-Hirschman index (Hirschman, 1964):

$$C = \sum_{i=1}^{N} v_i^2 \tag{6}$$

where v_i is the market share of firm (care home) i in a market of N firms. As the number of firms increases, and if market shares all approach very small fractions, C tends to zero. Where shares are expressed as proportions, $C = 1$ means that all supply is provided by a single monopolist. The inverse of the HHI is interpretable as the effective numbers of suppliers in a hypothetical market where each has the same market share. A market with $C > 0.1$ is sometimes considered concentrated, and $C > 0.2$ highly concentrated (Competition Commission and Office of Fair Trading 2010). For our purposes market shares correspond to the share of total supply of care home beds in the LA which are owned by each care home or chain (when

[12] Out-of-LA placements do occur especially in LAs with a limited supply of care homes, but negotiation of fee levels for LA-funded residents tends to be with care homes within the LA concerned.

[13] Due to their peculiar nature, Isles of Scilly and City of London were excluded from the analysis. We also excluded Hammersmith and Fulham because of the presence of only one (LA-run) care home in the residential market and Islington because of missing quality rating for the only two residential care homes.

combining care homes belonging to the same chain). Since occupancy rates in care homes are typically high (CMA 2017) shares of available beds are close to shares of volumes sold. For each local market, we derive a measure of *C* for the care home market as a whole (*overall*) and by care home type (*nursing*, *residential*). We treat each care home as a separate entity that competes with all other care homes in the LA or, alternatively, consider care homes within the same chain as part of the same entity giving a chain-adjusted index (Hirth *et al.* 2019). We call the measure of market concentration for the former C_{ind} and for the latter C_{chain}. Appendix Figure A1 shows the geographical distribution of concentration levels.

Previous research (Forder and Allan 2011, Forder and Allan 2014) has concluded that care home markets in England are generally not highly concentrated. However we find this to be much less so when market concentration is assessed at the chain level and when nursing and residential care homes are treated as belonging to separate markets. There is considerable variation in concentration across LAs, and concentration is higher within nursing home markets than residential care markets. The importance of chains is particularly evident in the nursing home market (Table 2). When concentration is measured at the individual care home level, just over 25% of local nursing home markets have *C* above 0.1, indicating they can be considered concentrated. When market concentration is assessed at chain level (C_{chain}), median concentration in the nursing home market almost reaches the threshold of 0.1, the average concentration level is 0.125 and for 25% of markets it exceeds 0.147.

Table 2: Summary LA- level statistics of the Herfindahl-Hirschman index of market concentration

	1st quartile	Median	Mean	3rd quartile
		All care homes		
Care homes per LA	29.5	49.5	76.5	92.0
C_{ind}	0.014	0.028	0.038	0.047
C_{chain}	0.035	0.053	0.066	0.077
		Nursing homes		
Care homes per LA	11.5	17.0	28.6	37.5
C_{ind}	0.033	0.068	0.089	0.108
C_{chain}	0.067	0.099	0.125	0.147
		Residential homes		
Care homes per LA	17.5	31.0	47.9	57.0
C_{ind}	0.024	0.040	0.061	0.082
C_{chain}	0.045	0.076	0.107	0.124

Note: Based on data for 148 LAs.

For the care home market as a whole, the effect of moving from a C_{ind} to a C_{chain} measure is to increase average market concentration by 74%. It increases measured concentration by 50% or

more in 68% of LAs, by 100% or more in 41% of LAs and by 200% or more in 23% of LAs. In our view, it is implausible to regard care homes within the same local chain as competing freely, so we conduct our main analysis using C_{chain} as the primary measure of concentration. Section 6.2 gives alternative results based on C_{ind}.

The thresholds c_L and c_H defining low and high concentration need to be chosen carefully to ensure adequate statistical precision in the estimation of $\hat{\delta}$. If c_L is too low or c_H too high, there will be few observations in the high and low concentration categories and consequently a large sampling variance of $\hat{\delta}$. Interpretation and comparison of results is most straightforward if we use the same absolute values c_L, c_H for the nursing and residential care home sectors, rather than, say, quartile points of their respective distributions. Inspection of Table 2 for the chain-adjusted concentration index suggest $c_L = 0.05$ and $c_H = 0.125$ as a good choice, and we use those values for our main results.[14]

4.3 Other market outcomes

Supply (*S*) is defined as the ratio of the total number of beds offered by active care homes in the LA to the total population aged 65 and over (in thousands), the latter taken from the Office for National Statistics (ONS) LA-level population estimates for 31st December 2015.

Price (*P)* is measured using data on the unit costs of LA-funded care from the Adult Social Care Finance Return (ASC-FR) for the financial year 2015/16[15]. We use weekly unit costs to the LA for older care home residents it supports on a long-term basis, distinguishing nursing and residential care homes. The cost measure excludes any NHS nursing care contribution because we are interested in the cost to LAs. On average this cost was about £572 per week and was similar for nursing and residential homes.[16]

Quality (*Q*) is a bed-weighted average (across nursing homes, residential homes or both) of the CQC overall quality ratings (on a scale of 1 to 4) for each care home in the LA, using the most recent rating available within the period October 2014-December 2016. The 885 care homes without a rating in this period are excluded from the construction of *Q*. *Q* is scaled to have a maximum possible value of 100. Despite the coarse nature of the quality ratings for individual

[14] For the combined market, the concentration distribution is strongly left-shifted relative to the nursing and residential markets separately. As a result, statistical precision is lower for the combined market results when using $c_L = 0.05$ and $c_H = 0.125$. In Table 5 below, we also present for comparison alternative estimates for the combined market using the lower and upper quartile points 0.035 and 0.077.

[15] Made available by the Health and Social Care Information Centre (HSCIC), through NHS Digital.

[16] Residential care costs are higher when services are provided "in house" i.e by LA-run homes. There are 76 LAs that offer in-house residential services. The average cost associated with them is about £1,350 per week. In these 76 LAs, the cost associated with "external" residential services (i.e. non LA-run homes) was much less at about £555.

care homes, there is considerable variation in average quality between LAs. Appendix Table A1 contains descriptive statistics for the supply, price and quality market outcomes.

4.4 Measures of area level characteristics

The market outcomes *S*, *C*, *P* and *Q* are all ultimately driven by to area characteristics. Our aim is to define a set of basic exogenous and observable variables, $\boldsymbol{X}$, that capture the conditions that characterise the nature of the equilibrium in a local market. We generated local market-level measures of these variables from multiple administrative sources.

We began with an extended set of covariates which included, in addition to the final set of covariates detailed below, the following area-level indicators: average (self-reported) health status; the population proportion of informal carers; the Index of Multiple Deprivation; mortality rates, overall life-expectancy (LE) and healthy LE at old-age; average state pension weekly payment; population structure with respect to age, social class, education, occupation, housing tenure and ethnicity. A number of other area-specific variables such as the number of people receiving disability benefits, social care expenditure on older people, and client contributions to LA-supported services, were not used because they are clearly not exogenous to the workings of the social care system.[17]

Our strategy in developing an econometric model for market concentration was to select the subset of $\boldsymbol{X}$ containing all candidate covariates which were found to be statistically significant in a linear reduced form regression for any of *C*, *P*, *Q* or *S*. The variables listed above were all statistically insignificant in regressions for each of the four market outcomes. The remaining vector of covariates, $\boldsymbol{X}$, comprises the following:

Potential demand. Current and foreseeable future demand for care home places is not directly measureable but is important for current suppliers and potential new entrants to the market. We use a proxy constructed as the number of women aged 75 years and older living alone (source ONS Census 2011). We choose age 75 because demand for care increases significantly with age; women because they are more likely than men to survive their spouse and need formal care; and living alone because they are less likely to have access to informal care.

Low-income demand. Low-income care home residents are likely to be LA funded. Since LAs' large-scale purchasing of care home places gives them considerable market power, the prevalence of low-income people within the older population is clearly relevant to suppliers'

[17] We were also not able to use data on central government grants to LAs for older people's social care because they are not separately identified in the available data, and they are, in any case, not ring-fenced for social care purposes.

decisions. We use the proportion of the over-65 population who receive the means-tested Pension Credit benefit (data at LA level are not available for the more appropriate over-75 population). The numerator is taken from the Department for Work and Pension (DWP) Statistics of February 2015; the denominator is derived from ONS local population estimates.

Local income is measured as the LA average of income from employment and asset ownership from ONS Gross Disposable Household Income (GDHI) statistics.[18]

House prices are potentially important for both sides of the market. Property values determine the estate component of new suppliers' potential costs, and they also affect the resources available to home owners who sell their homes to finance a move into a care home. We use the ONS index, which is based on 2015 property transactions, adjusted for differences in the characteristics of properties.[19]

Political control. We capture the political composition of LA councils prior to the elections of 7 May 2015,[20] distinguishing Conservative party control and Labour party control, from a combined reference category of no overall political control or Liberal Democrat control.

Location. We distinguish LAs in the South of England (London included) and LAs belonging to a metropolitan borough. We also include a measure of urbanisation of the LA, constructed as the proportion living in urban areas, derived from the ONS 2011 rural-urban classification (RUC) of Local Authority Districts[21] combined at LA levels using ONS lookup tables.

Table A2 of the Appendix shows bivariate correlations of the outcome variables and Table A3 reports descriptive statistics for the set of exogenous variables $\boldsymbol{X}$.

5. Econometric analysis

Following initial selection of the covariates $\boldsymbol{X}$, we consider two alternative models for the concentration measure *C*, linear and logarithmic:

$$C_i = \beta_0 + \boldsymbol{X}_i\beta_1 + u_i \tag{7}$$

$$\ln(C_i) = \beta_0 + \boldsymbol{X}_i\beta_1 + u_i \tag{8}$$

Initially, these models are estimated by least squares, on the assumption of homoskedasticity for the error term u_i. However, the impact measure δ is sensitive to departures from the

[18] Source: https://www.ons.gov.uk/economy/regionalaccounts/grossdisposablehouseholdincome
[19] Source:https://www.gov.uk/government/statistical-data-sets/uk-house-price-index-data-downloads-january-2017#download-the-data
[20] Source: http://www.gwydir.demon.co.uk/uklocalgov/makeup2015.htm
[21] Source: https://ons.maps.arcgis.com/home/item.html?id=0560301db0de440aa03a53487879c3f5

canonical homoskedasticity and normality assumptions, so we apply the Breusch-Pagan test for heteroskedasticty and the Jarque-Bera test for non-normality of the regression residuals.

The results are shown in Table 3. Homoskedasticity is emphatically rejected in every case for the linear model, but never for the logarithmic model. The normality assumption is also rejected clearly for the linear model, but the outcome is more mixed for the log model, since normality is rejected in the case of nursing homes but not for residential homes nor for care homes overall. Comparing the two models in terms of root mean square error for *C*, the linear model provides a better fit, substantially so in the case of residential care homes.[22]

Table 3: Diagnostic information for linear and logarithmic regression models of market concentration (chain-adjusted)

	All care homes		Nursing homes		Residential homes	
	Linear	Log	Linear	Log	Linear	Log
Homoskedasticity $\chi^2(1)$ §	73.0	1.59	69.0	0.18	168.3	0.26
P-value	*0.000*	*0.208*	*0.000*	*0.675*	*0.000*	*0.607*
Residual normality $\chi^2(2)$ †	67.7	1.92	453.0	8.93	575.8	1.74
P-value	*0.000*	*0.382*	*0.000*	*0.012*	*0.000*	*0.419*
RMSE for *C*	0.0326	0.0440 ⁋	0.0753	0.0754 ⁋	0.0779	0.1268 ⁋

Notes: § Breusch-Pagan Lagrange Multiplier test for heteroskedasticity with variance proportional to squared fitted value; † Jarque-Bera Lagrange Multiplier test for 3rd and 4th moment departures from normality; ⁋ For log models, calculated as s.d.$(C_i - exp[\boldsymbol{X}_i\beta + \sigma^2/2])$, based on the formula for the standard deviation of a lognormal variate.

Given these results, we retain both models for the purposes of estimating the impact measure δ. For the log model (8), $\hat{\delta}$ is constructed using $\hat{F}(c \mid \boldsymbol{X}) = \Phi\left(\left(\ln(c) - \hat{\beta}_0 - \boldsymbol{X}_i\hat{\beta}_1\right)/\hat{\sigma}_u\right)$, where $\Phi(.)$ is the N(0,1) distribution function. In the case of linear regression (7), we generalise the model to accommodate heteroskedasticity of the form:

$$var(u_i|\boldsymbol{X}_i) = \exp(\gamma_0 + \boldsymbol{X}_i\gamma_1) \tag{9}$$

and re-estimate using two-step generalised least squares. We then construct standardised residuals:

$$e_i = (C_i - \hat{\beta}_0 - \boldsymbol{X}_i\hat{\beta}_1)/\exp(\hat{\gamma}_0 + \boldsymbol{X}_i\hat{\gamma}_1) \tag{10}$$

[22] It is unsurprising that the linear model gives a slightly lower RMSE since that is the fitting criterion that it minimises, whereas the log regression minimises the RMSE for *ln C*. Nevertheless, the much better fit for the linear model in the residential sector is striking.

and calculate the nonparametric empirical distribution function $\hat{\Psi}(e)$. $\hat{\delta}$ is then constructed using $\hat{F}(c \mid \boldsymbol{X}) = \hat{\Psi}((c - \hat{\beta}_0 - \boldsymbol{X}_i\hat{\beta}_1)/\exp(\hat{\gamma}_0 + \boldsymbol{X}_i\hat{\gamma}_1))$, to avoid the conventional normality assumption.

Parameter estimates for the heteroskedastic linear model are presented in Table 4; the estimated skedasticity functions are set out in Appendix Table A4. The (qualitatively similar) results for the logarithmic model are in Appendix Table A5. The results indicate that low potential demand (proxied by the number of women aged 75+ living alone) and a high proportion of low-income members of the older population (Pension Credit recipients) are important drivers of market concentration in both market sectors. The estimated elasticities, evaluated at mean values, of market concentration with respect to potential demand are -.20 (residential) and -.29 (nursing); and with respect to the low-income proportion are .30 (residential) and .46 (nursing). One way to interpret these estimates is that lower demand means fewer homes overall, making it easier to 'monopolise' the market, while more low-income people gives rise to a greater need to monopolise to withstand monopsonistic LA demands.

Average earned and investment income has a highly significant positive impact on concentration in the residential care sector and overall (elasticities 1.44 and 0.91 respectively). Our interpretation of this is that income acts as a proxy for the general level of economic development of the local area, and consequently as an indicator of local opportunities open to potential entrepreneurs. Other things equal, the stronger are those opportunities, the lower is the potential flow of new entrants into the care home market and consequently the higher is equilibrium market concentration. Against this, is the lack of any evidence of an income effect in the nursing home sector, but the nursing home sector is more specialist and more concentrated, possibly offering less scope for entry to entrepreneurs in general.

The average house price is arguably best interpreted as a measure of the estate costs component of actual and potential care suppliers. It is estimated to have a positive impact (significant at the $P = 0.015$ level) in the nursing care sector, with an elasticity of 0.42, but the evidence for any effect in the residential care sector is very weak.

Political factors are not significantly associated with concentration for the market as a whole nor in the market for residential homes. There is some weak evidence of higher concentration in nursing home markets in LAs controlled by the Conservative party.

There is a consistently negative sign for the urbanisation coefficients, which would be consistent with the hypothesis that the economies of agglomeration which characterise urban

areas also reduce the costs of coordinating a chain. However, none of these coefficients is close to statistical significance at conventional levels. Other aspects of location (London and the South-East and metropolitan boroughs) also have no significant impact on concentration.

Table 4: 2-step GLS estimates of linear regression models for concentration measure C_{chain}

Covariate	All care homes	Nursing homes	Residential homes
Potential demand	-0.016***	-0.035***	-0.020***
(No. of women aged 75+ and living alone/10,000)	(0.002)	(0.004)	(0.004)
Low-income proportion in older population	0.132***	0.221***	0.123
(proportion over 65s on Pension Credit)	(0.044)	(0.085)	(0.088)
Average income	0.035***	-0.000	0.090***
(all ages, from earnings and assets, £0,000)	(0.010)	(0.021)	(0.023)
Average house price	0.006	0.023**	0.007
(£'00,000)	(0.005)	(0.009)	(0.007)
Conservative-controlled LA	0.003	0.022*	-0.015
	(0.006)	(0.013)	(0.011)
Labour-controlled LA	0.002	0.004	0.020
	(0.006)	(0.010)	(0.014)
London and South-East	-0.005	-0.016	-0.011
	(0.006)	(0.013)	(0.011)
Metropolitan borough	-0.002	-0.017	-0.008
	(0.006)	(0.011)	(0.013)
Urbanisation	-0.023	-0.007	-0.036
(proportion of population in urban areas)	(0.017)	(0.034)	(0.033)
Intercept	-0.007	0.056	-0.046
	(0.018)	(0.039)	(0.038)

Notes: Linear regression estimated by 2-step GLS with heteroskedasticity of multiplicative exponential form. Standard errors in parentheses. Statistical significance: * = 10%, ** = 5%, *** = 1%. Estimated parameters of the skedasticity function $\exp(\gamma_0 + \boldsymbol{X}_i\gamma_1)$ are given in Appendix Table A4.

Table 5 reports results of the $\hat{\delta}$ measures for supply, price and quality, for the care home market overall (column 1) and separately for the nursing and residential sectors (columns 2 and 3). The estimates are accompanied by nonparametric bias-adjusted bootstrap standard errors, where the whole process of model estimation and calculation of $\hat{\delta}$ is repeated in each of the 500 bootstrap replications. These impact parameters $\hat{\delta}$ are interpreted as the average effect on expected supply, price or quality of moving from area characteristics that make probable a low ($C_{\text{chain}} < 0.05$) degree of market concentration to characteristics that make probable a high degree of concentration ($C_{\text{chain}} > 0.125$) (where "probable" in this case means a probability of at least $\rho = 0.6$). The effect of varying these definitions is considered in Section 6.

The linear and logarithmic versions of the concentration model produce similar results, except for the nursing home sector where the estimated effects are smaller and not statistically significant. The effect of moving from probable low market concentration to probable high concentration is to produce a very large estimated supply reduction, of over 60% in the residential sector but a small and statistically insignificant estimated fall in the nursing home sector. The large supply effect in the residential care home sector is extremely important for LAs with their need to ensure adequate numbers of care home places, but it has been missed by much of the published research literature, with its primary focus on price and quality.

Table 5 also shows a large positive impact of conditions favouring concentration on the average price that LAs pay, of around 33% for the residential sector and 16% for the nursing home sector for our preferred linear heteroskedastic model. The impact of concentration on quality is not statistically significant for either model specification in any of the markets. Results for the combined market based on the thresholds c_L = 0.05, c_H = 0.125 have wide confidence intervals, but are broadly consistent with sector-specific findings.

The association of restricted supply and increased price with conditions favouring market concentration is large but consistent with the predictions of standard microeconomic theory.

The much larger response of supply than price in the residential sector is striking and is interpretable as a consequence of LAs' considerable market power to resist price rises, but limited ability to resist withdrawal of supply. Nursing homes are different from residential homes in this respect, since places are often funded partly or wholly by the NHS, whose budgeting and decision-making is not confined within LA areas.

Table 5: Estimated impact measures for supply, price and quality computed from heteroskedasticity-adjusted linear model and logarithmic model

Impact measure	All care homes $c_L = 0.035$, $c_H = 0.077$	$c_L = 0.05$, $c_H = 0.125$		
		All care homes	Nursing homes	Residential homes
	Heteroskedastic linear model			
$\hat{\delta}_S$	-34.0***	-44.1***	-9.3	-64.1***
	(6.3)	(12.8)	(10.4)	(4.9)
$\hat{\delta}_P$	28.7***	53.8***	16.5***	33.9***
	(7.2)	(19.2)	(5.7)	(9.1)
$\hat{\delta}_Q$	2.3	-0.8	1.2	4.1
	(2.1)	(10.8)	(1.9)	(3.2)
	Logarithmic model			
$\hat{\delta}_S$	-39.6***	-45.9***	-5.3	-62.5***
	(4.9)	(9.5)	(11.1)	(5.7)
$\hat{\delta}_P$	26.3***	42.1***	10.3	33.3***
	(6.5)	(15.3)	(6.1)	(8.7)
$\hat{\delta}_Q$	2.8	-2.2	2.5	2.8
	(2.0)	(5.6)	(1.9)	(2.6)

Notes: $\rho = 0.6$. Bootstrapped (500 replications) standard errors in parenthesis. Statistical significance: * = 10%, ** = 5%, *** = 1%.

6. Robustness checks

In this Section we assess the sensitivity of our results to the choice of values for the parameters used in constructing measures of tendency towards high/low concentration, to whether concentration takes account of locally chained care homes and to the exclusion of NHS and LA-run care homes. The main focus is on the $\hat{\delta}$ impact measures but estimates of the variant models involved in these robustness experiments are given in the Appendix.

6.1 Sensitivity to c_H, c_L and ρ

The construction of impact measures rests on two elements that we set *a priori* – a definition of what constitutes high and low concentration (c_H, c_L), and a definition of a high conditional probability of such a level. Table 6 shows alternative results for a grid of concentration thresholds c_H, c_L, set as the 10/90, 20/80 and 30/70 percentiles of the sector-specific concentration distributions[23], and $\rho = 0.6, 0.7, 0.8$.

The estimated impacts on *P*, *Q* and *S* are remarkably robust in qualitative terms with respect to choices for c_H, c_L and ρ. The general picture remains one of large price and supply effects,

[23] Relevant percentile thresholds (10th, 20th, 30th, 70th, 80th, 90th respectively) are: nursing homes - 0.038, 0.060, 0.073, 0.132, 0.153, 0.249; residential homes: 0.031, 0.040, 0.052; 0.116, 0.145, 0.223.

much greater responsiveness of supply for residential care homes than nursing homes, and little evidence of any effect on quality.

Table 6: Effect of varying parameters c_H, c_L and ρ on $\hat{\delta}_S$ $\hat{\delta}_P$ and $\hat{\delta}_Q$ (heteroskedastic linear model for C_{chain})

	Nursing care homes			Residential care homes		
	$\rho = 0.6$	$\rho = 0.7$	$\rho = 0.8$	$\rho = 0.6$	$\rho = 0.7$	$\rho = 0.8$
Supply S						
$c_L, c_H = p_{10}, p_{90}$	-24.8	-29.2	§	-77.3	-77.3	-76.3
$c_L, c_H = p_{20}, p_{80}$	-30.9	-56.3	-43.4	-69.3	-75.7	-78.9
$c_L, c_H = p_{30}, p_{70}$	-17.6	-34.6	-46.8	-63.3	-65.8	-67.2
Price P						
$c_L, c_H = p_{10}, p_{90}$	20.2	19.2	§	36.9	43.1	63.3
$c_L, c_H = p_{20}, p_{80}$	30.2	32.7	26.5	30.0	33.3	42.3
$c_L, c_H = p_{30}, p_{70}$	23.5	33.5	33.2	32.2	30.7	33.2
Quality Q						
$c_L, c_H = p_{10}, p_{90}$	13.4	13.3	§	-9.0	-7.8	-0.9
$c_L, c_H = p_{20}, p_{80}$	4.9	10.4	7.3	-2.0	-4.6	-3.5
$c_L, c_H = p_{30}, p_{70}$	3.5	7.2	12.5	4.3	-0.4	0.3

Notes: § insufficient data points for estimation. Estimates based on 2-step GLS heteroskedastic regression with empirical cdf of standardised residuals used to estimate $F(.)$. p_{10} ... p_{90} are 10^{th} ... 90^{th} percentiles of the empirical distribution of C_{chain}.

6.2 The role of chains

As we have seen, adjustment for chained care homes substantially increases measured concentration in the care home market. Table 7 compares the concentration impact estimates obtained when concentration is measured using C_{ind} with those obtained using C_{chain} (as in Table 5).

The differences are particularly striking for the nursing home sector, where the estimated supply and price effects are greatly increased and more strongly significant, and a slightly larger estimated quality effect appears statistically significant at the 5% level. For the residential care home sector, the only major change is a doubling of the price effect to reach roughly the same magnitude as the estimated supply effect. This suggests that the existing research literature (which generally relates to the combined care home market and makes no allowance for chains) may tend to overestimate price effects through biases originating in both sectors of the market.

Table 7: Effect of using concentration measure C_{chain} and C_{ind} on $\hat{\delta}_S$ $\hat{\delta}_P$ and $\hat{\delta}_Q$ (heteroskedastic linear model)

	No competition within chains (C_{chain})		Competition within chains (C_{ind})	
	Nursing care homes	Residential care homes	Nursing care homes	Residential care homes
$\hat{\delta}_S$	-9.3	-64.1***	-41.1***	-69.1***
	(10.4)	(4.9)	(11.1)	(6.5)
$\hat{\delta}_P$	16.5***	33.9***	32.3***	65.3***
	(5.7)	(9.1)	(7.8)	(19.7)
$\hat{\delta}_Q$	1.2	4.1	7.7**	1.7
	(1.9)	(3.2)	(3.1)	(10.4)

Notes: c_L = 0.05, c_H = 0.125, ρ = 0.6. Bootstrapped (500 replications) standard errors in parenthesis. Statistical significance: * = 10%, ** = 5%, *** = 1%. Parameter estimates using concentration measure C_{ind} are reported in Table A6.

6.3 The role of publicly-run care homes

We firstly disregard 23 NHS-run care homes, on the assumptions that NHS care homes beds are available to NHS funded clients only and NHS activity in the market does not produce spillover effects. We then further disregard the 414 LA-run care homes (24 nursing and 390 residential). *C*, *Q* and *S* are computed ignoring the excluded public care homes.[24]

Table 8 reports impacts, using C_{chain}, re-estimated after excluding NHS and LA-run care homes. The model estimates underlying these impacts are set out in Appendix Tables A7 and A8. The impacts are comparable with the two leftmost columns in Table 7. For residential care homes, the effect of disregarding NHS homes is marginal, given their minimal role in the sector.[25] There is a slightly larger change for the nursing home market, where the estimated price effect rises from 16.5% to 20.3%, but the qualitative picture remains much the same.

The effect of further disregarding LA care homes is again quite modest, and mainly affects the results for the market for residential care homes (where LA run care homes mainly operate), with $\hat{\delta}_s$ reduced slightly. When examining the impact on price after excluding LA-run care homes, we consider two alternative price definitions: the overall average price as previously used; and the average price paid for clients placed in care homes other than those owned by the

[24] As expected, concentration increases overall and by setting-type when disregarding publicly-run care homes. Overall Q tends to be marginally higher when publicly-run care homes are excluded. In the nursing market, Q is slightly higher when NHS-run care homes are excluded but slightly lower when LA-run care homes are further disregarded from the analyses. In the residential market, Q tends to be lower when excluding LA-run care homes. Noticeable also is the increased variability around the mean of Q in this type of home. S reduces when disregarding from the numerator the contribution made by publicly-run care homes.

[25] Of the 23 NH-run care homes in the market, 14 are nursing and 9 residential.

LA[26]. Using the former price measure, the effect of excluding LA run residential homes on the estimated price impact is to raise the estimate by almost 6 percentage points. However using the latter price measure, the price impact is close to that when only NHS runs are excluded and when no homes are excluded.

Table 8: Effect of excluding publicly-run care homes on $\hat{\delta}_S$ $\hat{\delta}_P$ and $\hat{\delta}_Q$ (heteroskedastic linear model for C_{chain})

	Disregarding NHS-run care homes		Disregarding NHS+LA-run care homes	
	Nursing	Residential	Nursing	Residential
$\hat{\delta}_S$	-11.9	-64.5***	-14.4*	-59.7***
	(11.1)	(4.8)	(8.6)	(7.7)
$\hat{\delta}_P$ (average *P*)	20.3***	34.3***	15.3***	41.9***
	(5.5)	(10.0)	(5.0)	(10.4)
$\hat{\delta}_P$ (external *P*)				36.0***
				(10.3)
$\hat{\delta}_Q$	2.5	3.3	4.2**	2.2
	(2.2)	(3.0)	(2.1)	(3.1)

Notes: Bootstrapped (500 reps) standard errors in parenthesis. Statistical significance: * = 10%, ** = 5%, *** = 1%. Standard settings: c_L = 0.05, c_H = 0.125, ρ = 0.6. "Average *P*" is (as in previous analysis) the overall gross price LAs pay to support clients in any care home. "External *P*" is the average price paid by LAs to support clients in non-LA-run care homes only.

7. Conclusions

This paper makes three main contributions. First, we extend the literature on concentration in the care home market to bring in the important issue of supply effects, alongside price and quality. For the English market, we find that local area characteristics associated with a probable high rather than low market concentration produces a large (over 60%) reduction in the supply of residential care home places and a much smaller (and statistically insignificant) fall in nursing home places. In the context of LAs' duties to shape the care home market, it is important to recognise such large differences which primarily result from factors outside the control of a LA – its economic and demographic composition for example.

[26] Prices LAs pay for places in publicly owned care homes are higher on average than for those in privately owned homes so when excluding LA run homes it is arguably better to exclude their prices too. Information is not available to allow us to construct a price for nursing home places which excludes those in homes run by LAs. Since there are very few LA run nursing homes, this is not a major limitation.

Our second contribution is to take account of the fact that some care homes within a LA have the same owner and so may not compete with one another. When such chains are taken into account, the measured degree of concentration in the care home market rises considerably. Moreover, the impact on supply and price of susceptibility to market concentration are substantially larger when the chain structure is ignored and all care homes are assumed to compete with one another. We also separate the market into care homes offering nursing care and those which do not. Again this raises measured concentration and it results in quantitatively different supply impacts of susceptibility to market concentration in the two sectors. A likely explanation for this difference is that, unlike the residential care sector, public purchasing of nursing home places is split between LAs and the NHS, which differ in their objectives and decision-making.

Our third contribution, on which these results rest, is to recognise in our econometric approach that the supply of care home places, the prices paid by LAs, the quality of care homes and the degree of market concentration are all joint outcomes of the same complex of equilibrating forces. Attempting to establish the causal effect of one of these market outcomes on another (e.g. concentration on price) risks missing the wider general equilibrium context. Instead, we seek to identify the associations between all four market outcomes and exogenous local area characteristics. This allows us to classify LAs by their inherent susceptibility to high or low concentration in the care home market and establish how the other three market outcomes differ according to the variation in these probabilities. In this framework, we find large negative supply impacts of conditions favourable to concentration, and substantially higher average prices also in LAs where conditions tend to promote market concentration. But the estimated impact on average quality is generally small and not statistically significant – unsurprisingly, given the mixed findings of previous research on quality effects in the care home market. Given LAs' new 'market shaping' duties this analytical approach based on the reduced-form has a great deal to offer. While there are potentially large benefits to be gained in terms of supply and price from fostering competition, many of the factors that cause an LA to face a highly concentrated local care home market are beyond the LA's immediate control.

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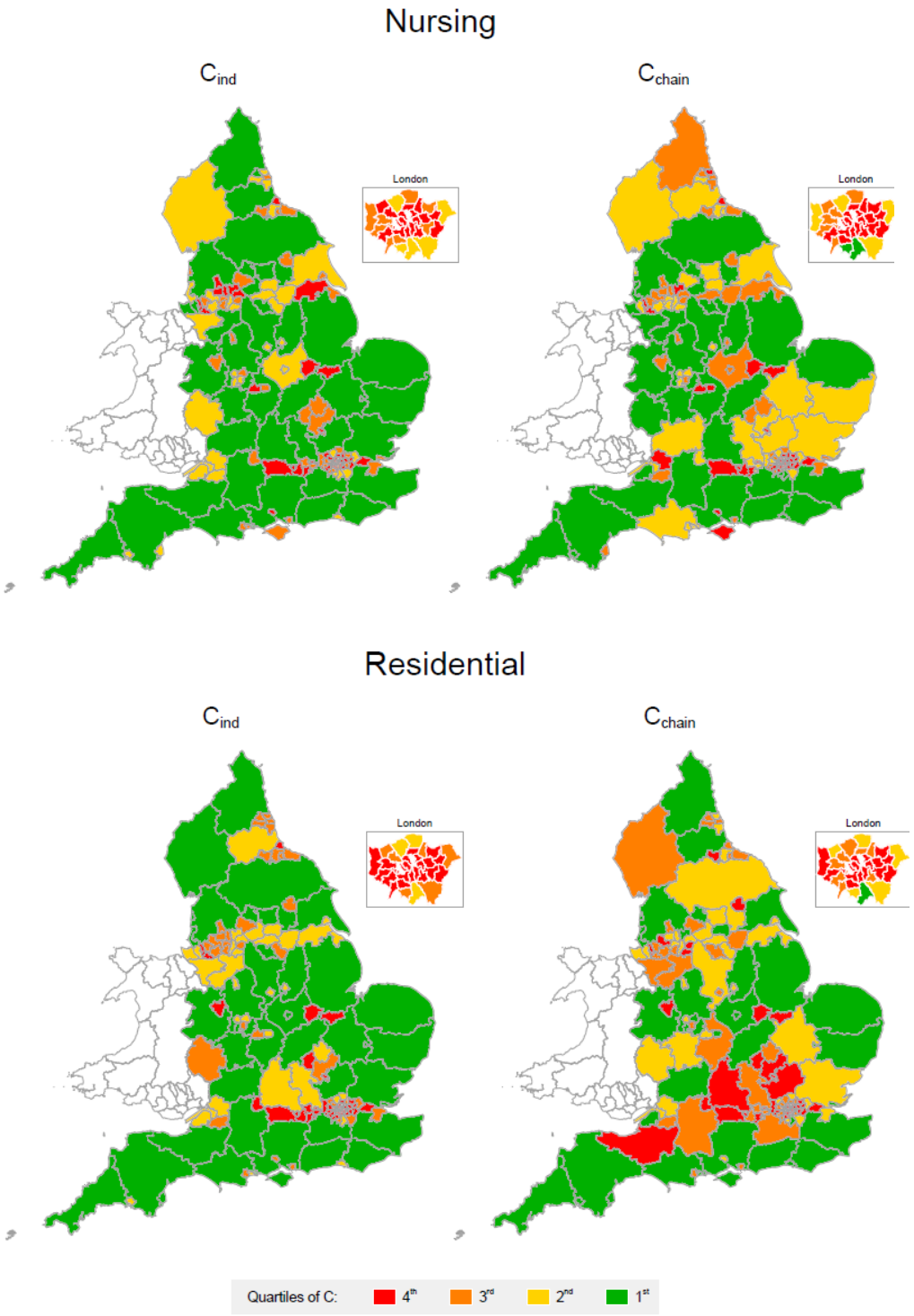
Appendix: Additional Figures and Tables

Figure A1: Level of concentration of the English care home market, by whether nursing or residential care



Notes: The 148 LAs were grouped into care-setting specific quartiles of C_{ind} (left) and C_{chain} (right), so that LAs belonging to the first quartile of C (the 25% (37 LAs) of LAs with the lowest C) are displayed in green; the 25% of LAs with the highest C are displayed in red.

Table A1: Summary statistics for supply, price and quality

	All care homes				Nursing homes				Residential homes			
	mean	sd	min	max	mean	sd	min	max	mean	sd	min	max
S	41.2	10.05	13.1	74.5	22.0	6.39	5.7	43.2	19.1	8.17	3.5	44.4
P	571.7	110.49	388.6	989.9	567.8	106.44	314.0	900.9	578.3	131.95	377.2	1130.8
Q	65.6	4.53	50.5	75.0	64.4	5.43	45.9	76.9	67.5	4.92	56.4	81.3

Based on data for 148 LAs.

Table A2: Bivariate Spearman correlations of market concentration, and supply, price and quality outcomes

	C_{ind}	C_{chain}	S	P	Q
			Overall		
C_{ind}	1				
C_{chain}	0.8336*	1			
S	-0.5197*	-0.5278*	1		
P	0.2772*	0.3713*	-0.4286*	1	
Q	0.1557*	0.1438*	-0.1719*	0.2186*	1
			Nursing		
C_{ind}	1				
C_{chain}	0.9806*	1			
S	-0.4473*	-0.4313*	1		
P	0.1662*	0.1921*	-0.1372*	1	
Q	0.1846*	0.1859*	-0.1869*	0.1283	1
			Residential		
C_{ind}	1				
C_{chain}	0.9867*	1			
S	-0.5998*	-0.5945*	1		
P	0.3207*	0.3259*	-0.4411*	1	0
Q	0.2011*	0.1988*	-0.2014*	0.2371*	1

Based on data for 148 LAs. * Statistical significance at 10% or lower.

Table A3: Descriptive statistics of area characteristics

	mean	sd	min	max
No. of women aged 75+ and living alone/10,000	1.0	0.85	0.1	4.5
% over 65s on Pension Credit	26.1	9.91	9.3	64.0
Average income (all ages, from earnings and assets, £ ,000 per year)	17.1	6.05	9.9	61.4
LA-average house price (£'00,000 2015 prices)	23.1	15.83	9.2	131.3
Council controlled by the Conservative party	0.3	0.46	0.0	1.0
Council controlled by the Labour party	0.5	0.50	0.0	1.0
London and South of England	0.4	0.50	0.0	1.0
Metropolitan Borough	0.2	0.43	0.0	1.0
% population living in urban area	86.8	17.42	30.8	100.0

Based on data for 148 LAs.

Table A4: Estimated skedasticity functions for heteroskedastic linear models of C_{chain} (underlying Table 5)

Area characteristic	All care homes	Nursing homes	Residential homes
Potential demand	-0.625**	-0.493**	-0.354
(No. of women aged 75+ and living alone/10,000)	(0.246)	(0.246)	(0.246)
Low-income proportion in older population	5.238**	6.412**	2.095
(proportion over 65s on Pension Credit)	(2.645)	(2.645)	(2.645)
Average income	0.021	0.188	2.262***
(all ages, from earnings and assets, £0,000)	(0.622)	(0.622)	(0.622)
Average house price	0.317	0.066	-0.458*
(£'00,000)	(0.258)	(0.258)	(0.258)
Conservative-controlled LA	0.789	1.567***	-0.940*
	(0.552)	(0.552)	(0.552)
Labour-controlled LA	0.194	0.332	0.894
	(0.557)	(0.557)	(0.557)
London and South-East	-0.053	0.652	1.035**
	(0.525)	(0.525)	(0.525)
Metropolitan borough	-0.404	-0.380	0.334
	(0.558)	(0.558)	(0.558)
Urbanisation	-0.726	-1.269	-2.445
(proportion of population in urban areas)	(1.520)	(1.520)	(1.520)
Intercept	-8.312***	-7.081***	-7.581***
	(1.391)	(1.391)	(1.391)

N = 148 LAs. Standard errors in parentheses. Statistical significance: * = 10%, ** = 5%, *** = 1%.

Table A5: Estimated loglinear models of C_{chain} (underlying Table 5)

Area characteristic	All care homes	Nursing homes	Residential homes
Potential demand	-0.431***	-0.463***	-0.441***
(No. of women aged 75+ and living alone/10,000)	(0.048)	(0.047)	(0.064)
Low-income proportion in older population	1.311**	1.589***	1.019
(proportion over 65s on Pension Credit)	(0.514)	(0.510)	(0.684)
Average income	0.342***	-0.010	0.671***
(all ages, from earnings and assets, £0,000)	(0.121)	(0.120)	(0.161)
Average house price	0.043	0.113**	-0.035
(£'00,000)	(0.050)	(0.050)	(0.067)
Conservative-controlled LA	0.011	0.079	0.022
	(0.107)	(0.106)	(0.143)
Labour-controlled LA	0.138	0.054	0.254*
	(0.108)	(0.107)	(0.144)
London and South-East	0.038	-0.042	0.002
	(0.102)	(0.101)	(0.136)
Metropolitan borough	-0.026	-0.079	-0.130
	(0.108)	(0.107)	(0.144)
Urbanisation	-0.602**	-0.196	-0.387
(proportion of population in urban areas)	(0.295)	(0.293)	(0.393)
Intercept	-3.072***	-2.328***	-3.196***
	(0.270)	(0.268)	(0.360)

N = 148 LAs. Standard errors in parentheses. Statistical significance: * = 10%, ** = 5%, *** = 1%.

Table A6: Parameter estimates for heteroskedastic linear models of C_{ind} (underlying Table 7)

Area characteristic	Nursing care homes		Residential care homes	
	Regression	Skedasticity	Regression	Skedasticity
Potential demand	-0.035***	-0.246	-0.025***	-0.197
(No. of women aged 75+ and living alone/10,000)	(0.005)	(0.246)	(0.002)	(0.246)
Low-income proportion in older population	0.206***	7.614***	0.118***	5.817**
(proportion over 65s on Pension Credit)	(0.074)	(2.645)	(0.038)	(2.645)
Average income	-0.011	0.334	0.021**	-0.069
(all ages, from earnings and assets, £0,000)	(0.017)	(0.622)	(0.010)	(0.622)
Average house price	0.022***	0.108	0.013***	0.066
(£'00,000)	(0.007)	(0.258)	(0.004)	(0.258)
Conservative-controlled LA	0.018	1.314**	0.008	0.113
	(0.011)	(0.552)	(0.006)	(0.552)
Labour-controlled LA	0.002	0.468	0.008	-0.160
	(0.009)	(0.557)	(0.005)	(0.557)
London and South-East	-0.020*	0.226	-0.002	0.636
	(0.011)	(0.525)	(0.007)	(0.525)
Metropolitan borough	-0.020**	-0.457	-0.008	-1.597***
	(0.010)	(0.558)	(0.006)	(0.558)
Urbanisation	0.001	-2.827*	-0.010	0.969
(proportion of population in urban areas)	(0.034)	(1.520)	(0.016)	(1.520)
Intercept	0.042	-7.006***	-0.007	-9.488***
	(0.036)	(1.391)	(0.016)	(1.391)

N = 148 LAs. Standard errors in parentheses. Statistical significance: * = 10%, ** = 5%, *** = 1%.

Table A7: Parameter estimates for heteroskedastic linear models of C_{chain} excluding NHS run homes (underlying Table 8)

Area characteristic	Nursing care homes		Residential care homes	
	Regression	Skedasticity	Regression	Skedasticity
Potential demand	-0.036***	-0.454*	-0.021***	-0.271
(No. of women aged 75+ and living alone/10,000)	(0.004)	(0.246)	(0.004)	(0.246)
Low-income proportion in older population	0.223**	8.071***	0.114	1.576
(proportion over 65s on Pension Credit)	(0.089)	(2.645)	(0.086)	(2.645)
Average income	-0.002	0.068	0.090***	2.264***
(all ages, from earnings and assets, £0,000)	(0.021)	(0.622)	(0.023)	(0.622)
Average house price	0.021**	0.059	0.007	-0.440*
(£'00,000)	(0.009)	(0.258)	(0.007)	(0.258)
Conservative-controlled LA	0.025*	1.943***	-0.016	-0.887
	(0.013)	(0.552)	(0.011)	(0.552)
Labour-controlled LA	0.003	0.476	0.019	1.011*
	(0.010)	(0.557)	(0.013)	(0.557)
London and South-East	-0.014	0.798	-0.010	1.109**
	(0.013)	(0.525)	(0.012)	(0.525)
Metropolitan borough	-0.017	-0.383	-0.007	0.381
	(0.011)	(0.558)	(0.012)	(0.558)
Urbanisation	-0.008	-1.094	-0.037	-2.361
(proportion of population in urban areas)	(0.032)	(1.520)	(0.033)	(1.520)
Intercept	0.063*	-7.645***	-0.040	-7.750***
	(0.039)	(1.391)	(0.038)	(1.391)

N = 148 LAs. Standard errors in parentheses. Statistical significance: * = 10%, ** = 5%, *** = 1%.

Table A8: Parameter estimates for heteroskedastic linear models of C_{chain} excluding NHS and LA run homes (underlying Table 8)

Area characteristic	Nursing care homes		Residential care homes	
	Regression	Skedasticity	Regression	Skedasticity
Potential demand	-0.041***	-0.253	-0.028***	0.072
(No. of women aged 75+ and living alone/10,000)	(0.006)	(0.246)	(0.006)	(0.246)
Low-income proportion in older population	0.240**	8.646***	0.094	4.620*
(proportion over 65s on Pension Credit)	(0.103)	(2.645)	(0.112)	(2.645)
Average income	-0.020	0.398	0.089***	1.181*
(all ages, from earnings and assets, £0,000)	(0.023)	(0.622)	(0.027)	(0.622)
Average house price	0.030***	-0.155	0.002	0.002
(£'00,000)	(0.009)	(0.258)	(0.010)	(0.258)
Conservative-controlled LA	0.031*	1.999***	-0.006	-0.005
	(0.016)	(0.552)	(0.012)	(0.552)
Labour-controlled LA	0.006	0.575	0.012	1.576***
	(0.012)	(0.557)	(0.014)	(0.557)
London and South-East	-0.017	0.590	-0.015	0.649
	(0.015)	(0.525)	(0.015)	(0.525)
Metropolitan borough	-0.016	-0.716	-0.003	-0.160
	(0.013)	(0.558)	(0.014)	(0.558)
Urbanisation	-0.031	-0.887	-0.011	-2.899*
(proportion of population in urban areas)	(0.039)	(1.520)	(0.043)	(1.520)
Intercept	0.097**	-8.038***	-0.040	-7.791***
	(0.044)	(1.391)	(0.049)	(1.391)

N = 148 LAs. Standard errors in parentheses. Statistical significance: * = 10%, ** = 5%, *** = 1%.