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Competition in the English nursing homes market

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Abstract

This study assesses the impact of competition on quality and price in the English care/nursing homes market. We develop a theoretical model; the main hypothesis is that increased competition could reduce the quality of publicly-funded beds. A dataset comprising the population of 10000 care homes was used. We constructed a distance and travel-time weighted competition measure. Instrumental variable estimations, used to account for the endogeneity of competition, showed quality and price were reduced by greater competition. Further analyses suggested that the negative quality effect worked through the effect on price – higher competition reduces revenue which pushes down quality.

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Introduction

Market mechanisms and competition has been introduced into the long-term care systems of many countries, replacing hitherto public bureaucratic, non-profit or other non-market arrangements (Fernandez, Forder et al. 2011). The importance of markets in the care homes sector in England has increased markedly in the last 30 years; by 2010 over 90% of all placements were made in the care homes market (Laing & Buisson 2010). This paper seeks to assess the impact of market competitiveness on quality and prices.

Whole-market metrics of concentration indicate that the English care homes market is highly competitive (Forder and Allan 2011). There are over 10,000 care homes serving a resident population of just over 300,000 older people. Much of the industry comprises single home providers or small multi-home organisations, although there are some large chains.

Two distinct funding groups exist – individual self-payers and public authorities purchasing care on behalf of (low income) residents. In 2010 40% of placements in private (for- and non-profit) care homes in England were self-funded. Other than a small proportion of placements made by the National Health Service (around 8%), the remaining placements were made by commissioners in local councils.

An independent regulator licences homes to take residents and inspects homes to ensure that licence conditions are met. Individual self-payers are largely price-takers in the market. Local authorities, however, have not insignificant power as the dominant purchaser and appear to secure sizeable discounts compared to self-pay rates (Office of Fair Trading 2005). Similar price differentials are seen between public (Medicaid) and private payers in the US nursing home market (Mukamel and Spector 2002; Grabowski 2004).

Despite market forces playing a crucial role in the provision of care homes in England, there is very little work that has examined the impact of competition. Forder and Netten (2000) found a mean price elasticity of competition for English residential and nursing home placements of -0.04, while for providers in London authorities the mean price elasticity was -0.08. Gage et al. (2009) found a positive association between price charged and quality ratings, but Netten and colleagues (2003) found no relationship between the quality of the home and the likelihood of closure, although (low) price was seen as an important contributory factor. Another study found that larger homes were associated with lower quality, suggesting a link between quality and (lower) prices as providers exploit economies of scale (Torrington 2007).

There is a larger US evidence base on the impact of competition on nursing home price (Nyman 1994; Mehta 2006; Mukamel and Spector 2002) and quality (Nyman 1994; Zinn 1994; Starkey, Weech-Maldonado et al. 2005; Gammonley, Zhang et al. 2009; Zinn, Mor et al. 2009). This literature suggests that price effects of competition are small and the effects of competition on quality are mixed.[1] Studies that looked at the relationship between quality and market concentration as measured (predominantly) by a county level Herfindahl index found that more competition led to reduced quality (e.g. Grabowski 2004). One study (Castle, Engberg et al. 2007) found the opposite. By contrast most studies that look at indicators of market contestability – e.g. use of CON regulations and other indicators of excess demand – suggest that the least contested markets (e.g. where excess demand can persist) produce lower quality than markets with higher contestability. Indeed, a number of studies (Nyman 1994; Zinn 1994; Starkey, Weech-Maldonado et al. 2005; Gammonley, Zhang et al. 2009; Zinn, Mor et al. 2009) found apparently conflicting results – of lower concentration and also lower contestability (or at least greater excess demand) being associated with decreased quality – at the same time.

The paucity of appropriate 'quality' measures, problems of market definition and little account of the potential endogeneity of competition measures are limitations of some of the literature.

[1] See Forder and Allan (2011).

This paper examines the impact of competition in the English care homes market. We used the population of just over 10,000 care homes in England identified using data from the regulator, the Care Quality Commission (CQC). Quality was measured by the CQC's quality rating of the home.

Using homes' address (postcode) competitors were identified and distance (straight-line and travel time adjusted) between each home was calculated. We were therefore able to calculate competitiveness/concentration for each home, and not rely on administrative boundaries to identify markets.

The behaviour of each provider is likely to affect the behaviour of competitors, and therefore affect the level of competitiveness locally (Bresnahan 1989; Forder 2000). In principle, nonetheless, the level of competition in any given locality will be strongly related to underlying demand and supply characteristics, including the factors affecting barriers to entry and exit. These characteristics will vary geographically and therefore the competition any one provider faces will be a function of these characteristics in its locality and also the characteristics of neighbouring localities (as they also affect the circumstances of competitors). Summary statistics of the latter can serve as instrumental variables to address the endogeneity problem.

The rest of the paper is organised as follows. Section II discusses the institutional characteristics of the care homes market. Section III develops a conceptual model to link the empirical analysis to the underlying economic theory. Sections IV presents and discusses the data, and the results of the analysis follow in section V. The implications of the main findings are then discussed.

Institutional characteristics of the care market

The care market can be usefully distinguished into two parts: (1) *publicly-supported* residents where services are commissioned by public authorities (local councils) on behalf of service users; and (2) *self-payers* (those who do not qualify for public support). By and large, the self-pay market can be regarded as a conventional market. The publicly-supported market is a quasi-market (Bartlett, Propper et al. 1994).

There are 153 councils in England that commission long-term care services. Exact commissioning practice varies between them, but generally involves the following process. Commissioners negotiate in advance with care homes that are prepared to offer services at the council payment rate. Thereafter, places are called-off as they are needed under the terms of the 'framework contract', although in some cases, councils may block purchase places in advance. In choosing the homes on their supported list, commissioners make judgements about the quality of the home, but often the focus is on whether or not homes meet minimum quality standards.

In negotiating with the council, the prospect of securing a framework contract and the agreed payment rate are only minimally affected by the home's quality being above the minimum standard. So pricing is unlikely to be affected by quality choice. Once the framework contract is in place, however, we might expect that service users are influenced by the quality of homes they wish to use. So demand at any price might be affected by quality; even then, since care home admission is usually prompted by some health crisis (sometimes described as a 'distressed purchase'), the availability of a vacancy in any local home is often seen as an overriding priority. The extent to which total revenue for any home is dependent on quality is difficult to assess *a priori*, but likely to be modest.

Theoretical model

Allowing for the potential for horizontal and vertical differentiation, we can write a general demand function for provider *i*:

$$x_i = x_i(x_1, d_1, q_1, \dots, x_{i-1}, d_{i-1}, q_{i-1}, \dots, x_{i+1}, d_{i+1}, q_{i+1}, \dots, x_N, d_N, q_N, p_i, d_i, q_i; \sigma_i(d_i, q_i) \quad (1)$$

where there are *N* – 1 other providers in the market. Here *d* is the geographical location of the provider and *q* is the provider's quality. The minimum quality standard required by the regulator is $\underline{q}$. Also, σ_i is a vector of needs-related characteristics of the location. We assume that, $\frac{\partial x_i}{\partial x_j} < 0$, where the strength of this relationship is mediated by the difference in the location and quality of providers *i* and *j*.

Other things equal, any additional provider that enters the market will reduce the demand faced by provider *i*; therefore: $\frac{\partial x_i}{\partial N} < 0$. This is a standard result where there is (horizontal) product differentiation and Bertrand equilibriums. These inequalities also hold in the Cournot oligopoly case (without differentiation).

Profits are:

$$\pi_i = p_i x_i(q_i, p_i, d_i) - c_i(x_i, q_i) x_i(q_i, p_i, d_i) - F(q_i) \quad (2)$$

Costs are:

$$C_i = c_i(q_i) x_i \ + F(q_i) \quad (3)$$

where $c_x < 0$ and $c_{xx} > 0$. Also $c_q > 0$, $c_{qq} > 0$ and $c_{qqq} = 0$. In addition, $c_{qx} = 0$. Fixed costs, assumed to be sunk, are increasing in quality, $F_q > 0$ and $F_{qq} > 0$. As such, unit costs are:

$$\bar{c}_i(q_i) = c(q_i) + \frac{F(q_i)}{x_i} \quad (4)$$

Providers are assumed to value the quality of each unit of output. Assume that providers maximise utility, Z_i:

$$Z_i = \pi_i(q_i) + m_i(q_i) x_i \quad (5)$$

subject to a total cost break-even constraint, $\pi_i = 0$ in the long-run, and a marginal cost break-even in the short run: $p_i \geq c_i$. We assume that $m\left(\underline{q}\right) = 0$, where $\underline{q}$ is the minimum quality requirement as set by the regulator. As providers value quality, we assume: $m_q > 0$ and $m_{qq} < 0$.

Providers choose entry and geographical location. Providers then choose price and quality. We assume this latter choice is simultaneous although this is obviously a simplifying assumption. Nonetheless, it has been shown for this type of problem that assuming a sequential choices of quality, then price, does not qualitatively change the result in representative cases (Brekke, Siciliani et al. 2010).

The first order condition with respect to price choice is:

$$Z_p = x_i + (p_i - c_i + m_i)x_p = 0 \tag{6}$$

with the usual second order condition:

$$Z_{pp} = 2x_p + (p_i - c_i + m_i)x_{pp} < 0 \tag{7}$$

which we assume is negative. The first order condition with respect to quality choice is:

$$V \equiv Z_q = (p_i - c_i + m_i)x_{q_i} + \left(m_{q_i} - c_{q_i}\right)x_i - F_{q_i} = 0 \tag{8}$$

Or, solving using (6):

$$V \equiv Z_q = -\frac{x_i}{x_p}x_{q_i} + \left(m_{q_i} - c_{q_i}\right)x_i - F_{q_i} = 0 \tag{9}$$

The second order conditions are assumed to be negative: $Z_{qq} < 0$ and $Z_{pp} < 0$ e.g. for quality

$$\frac{\partial V}{\partial q} \equiv Z_{qq} = (p_i - c + m)x_{qq} + \left(m_{qq} - c_{qq}\right)x_i + 2\left(m_q - c_q\right)x_{q_i} - F_{qq} \tag{10}$$

where $xc_{qN} = 0$.

Using (9), the second order effect with respect to *N* is:

$$\frac{\partial V}{\partial N} \equiv Z_{qN} = (m_{q_i} - c_{q_i})x_N - \frac{(x_p x_N - x x_{pN})}{{x_p}^2} x_{q_i} - x_{qN} \frac{x_i}{x_p} \quad (11)$$

with an equivalent differential for prices i.e. Z_{pN}. We cannot determine the sign on Z_{qN} given the assumptions we have made.

Solving the two first order conditions together gives optimal quality and price: $q^* = q^*(N, d, \sigma)$ and $p^* = p^*(N, d, \sigma)$. A change in the number of providers in the market will affect both optimal price and quality. In keeping with the literature, the impact of competitors *N* on quality is indeterminate in the general case when we cannot sign Z_{qN}; we have: $\frac{\partial q}{\partial N} = -\frac{Z_{qN}Z_{pp} - Z_{pN}Z_{qp}}{Z_{qq}Z_{pp} - Z_{pq}Z_{qp}}$, using Cramer's rule over the implicit functions, (6) i.e. $Z_p(q, p, N, d, \sigma) = 0$ and (8) i.e. $Z_q(q, p, N, d, \sigma) = 0$.

The problem is more tractable if we explicitly distinguish the council supported and self-pay markets (although recognising that providers can operate in both these sub-sectors). Take the council supported market. We can begin with the limit case where council commissioners set (local) market-wide prices and have no preferences for quality of provision once it is above the minimum standards, $\underline{q}$, required by the regulator, i.e. $x_q = 0$ for $q \geq \underline{q}$. In this case, the first order condition (8) reduces to:

$$(m_q - c_q)x_i = F_{q_i} > 0 \quad (12)$$

This condition requires that $m_q - c_q > 0$. In this case, providers need to gain utility from producing good quality services; otherwise, quality would always be produced at the lowest level. It follows that:

$$Z_{qN}^c = (m_{q_i} - c_{q_i})x_N < 0 \quad (13)$$

and

$$Z^c_{qq} = (m_{qq} - c_{qq})x_i - F_{qq} < 0 \quad (14)$$

Here the superscript *c* refers to the council supported market. In this case, we characterise pricing setting across the local market as the result of some form of collective bargaining process between the council and local providers. Suppose that this process results in prices set at: $p^c = \sum_{i=1}^{N^c} \frac{c_i(\underline{q})}{N^c} + \eta(N^c) = \rho\left(N^c, \underline{q}\right)$. Here $\eta(N^c) > 0$ is a market power function with $\eta_{N^c} \leq 0$ and where prices fall slowly with N^c so that no provider experiences a demand increase when new providers enter the market. For our immediate purpose, we do not need to make any further assumptions about the nature of the pricing function; it is sufficient that provider price-taking means that $Z^c_q = \left(\rho\left(N^c, \underline{q}\right) - c_i + m_i\right)x_{q_i} + (m_{q_i} - c_{q_i})x_i\left(\rho\left(N^c, \underline{q}\right)\right) - F_{q_i}$ and therefore $Z^c_{qp} = 0$. In this case the differential of the impact of competitor numbers on quality is: $\frac{\partial q^c}{\partial N} = -\frac{Z^c_{qN}}{Z^c_{qq}} < 0$, which can now be unambiguously signed i.e. an increase in the number of competitors reduces quality. This result is in contrast to the usual opposite result when prices are fixed for two reasons. First, providers care about quality in their own right i.e. $m_q > 0$ and secondly, demand is not a function of quality (at minimum quality or above; below minimum quality, demand is zero).

This result requires that providers have market power i.e. $p_i > c_i$, or in other words that $\eta(N^c) > 0$. Otherwise, in the limit case where $\eta(.) = 0$, the break-even constraint is binding and providers have no choice but to produce at $q = \underline{q}$ (in the long run, the constraint would bind relative to average costs). It also follows that where providers do have market power and this is related to the total number of providers in the market (in a smoothly differentiable way), $\eta_{N^c} < 0$, that a reduction in the number of providers will allow higher quality to be produced.

Intuitively, where council commissioners operate in very competitive markets, price can be pushed down to near marginal cost level. In this circumstance, providers cannot set quality above minimum levels even if that were their preference.

A relaxation of the assumption about demand means we can no longer unambiguously sign Z_{qN} as defined in (11). Nonetheless, with economies of scale and providers facing a reducing share of demand as provider numbers increase for any change in quality (i.e. if $x_{qN} \leq 0$) we might still expect $Z_{qN} < 0$ and therefore $\frac{\partial q^c}{\partial N} < 0$, even if the break-even constraint does not bind.

In the self-pay market, prices are set by providers, and they compete on both price and quality. In this case, the sign on $\frac{\partial q^S}{\partial N}$ (*S* for self-pay) is indeterminate without more structure to the problem. Even then, the sign on $\frac{\partial q^S}{\partial N}$ appears to be highly sensitive to particular assumptions; for example, in a symmetrical Salopian model, different assumptions about cost substitutability between output and quality and marginal utility of income can reverse the direction of effect (Brekke, Siciliani et al. 2010).

With regard to the empirical analysis, this theory makes two important contributions. First, it seems likely that in the council supported sector of the market, additional competition will lead to a reduction in quality. Second, this theoretical framework gives us a basis for specifying an empirical model. In particular, we can specify an empirical model using the optimal quality and price functions, q^* and p^*implicitly defined by (6) and (8), as follows:

$$q_i^* = q_i^*(p_i^*, x_{-i}(q_i, p_i), q_{-i}(q_i, p_i), d_{-i}(d_i), d_i^*, \sigma_i) \quad (15)$$

and

$$p_i^* = p_i^*(q_i^*, x_{-i}(q_i, p_i), q_{-i}(q_i, p_i), d_{-i}(d_i), d_i^*, \sigma_i) \quad (16)$$

We are explicit that optimal price and quality are functions of optimal location choice d^* made at the time of market entry. Partial reduced-form versions of (15) and (16) can be derived by cross-substitution for q_i^* and p_i^*.

Since our aim is to estimate the impact of competition on quality and price, we need to find a practical way to specify this problem. A conventional approach is to assume that the effect of competition can be summarised using the Herfindahl-Hirschman index (HHI): $H = \frac{\sum_{i=1}^{N} x_i^2}{\left(\sum_{i=1}^{N} x_i\right)^2}$, noting that, if providers all operated with the same (weighted or unweighted) output, the HHI reduces to an inverse measure of the number of competitors: $H_i = \frac{N\bar{B}^2}{(N\bar{B})^2} = \frac{1}{N}$.

We can account, to some extent, for the horizontal differentiation of providers by weighting output for the distance and/or for travel times: $\Delta d_{ij} = \left|d_i - d_j\right|\left|0.5t_i + 0.5t_j\right|$ for all j, where t is the normalised predicted travel time per kilometre for the local authority where care home j is located. We use an inverse square-root weighting on distance and travel time in the Herfindahl i.e. $H_i = \frac{\sum_{j=1}^{N} B_{ij}^2}{\left(\sum_{j=1}^{N} B_{ij}\right)^2}$ where $B_{ij} = \frac{x_j}{\Delta d_{ij}^{0.5}}$ i.e. $B_{\Delta d_{ij}} < 0$ and $B_{\Delta d_{ij} \Delta d_{ij}} > 0$. Furthermore, a maximum range for competitors is implemented; providers located outside this range are assumed to have no competitive effect. Different maximum range specifications were used: 5, 10 or 20km and their travel time-weighted equivalents. Potentially, the impact of competitors should also be weighted in terms of the vertical differentiation of providers. As outlined below, we have a categorical quality classification of providers, but the intuitive basis for weighting in this case is less strong. One strategy is to proceed without re-weighting for quality differences.

As a reasonable approximation, we can assume that the effects of competition can be summarised by the HHI where this is determined by the interplay of location, quality and price decisions:

$$H_i = H_i(x_i, x_{-i}(q_i, p_i), q_{-i}(q_i, p_i), d_{-i}, d_i) \cong \frac{1}{N_i} \tag{17}$$

Using (15) and (16), after cross-substitution for q_i^* and p_i^*, and adding an independent error, we have functions to be estimated:

$$q_i^* = q_i^*(H_i, \sigma_i) + \varepsilon_i^q \tag{18}$$

and

$$p_i^* = p_i^*(H_i, \sigma_i) + \varepsilon_i^p \tag{19}$$

To summarise, our main empirical hypotheses are:

H1. For council-supported places, particularly where providers have modest market power, we expect competition to reduce quality i.e. $q_N^c < 0$, which means, given the inverse relationship between H_i and N_i, that we hypothesise that $q_H^{*c} > 0$ in (18)and (19).

H2. For the self-pay market, we cannot sign, *a priori*, the differential q_N^S. However, we do expect that $q_N^c \neq q_N^S$ and therefore that $q_H^{*c} \neq q_H^{*S}$, which we can test empirically.

H3. Overall, given the higher proportion of council-supported places, we expect for the whole market that $q_H^* > 0$.

H4. For the whole market we hypothesise that $p_H^* > 0$ (again bearing in mind the inverse relationship between H_i and N_i). This is a standard result where prices are set by providers or follows from our definition of $p^c = \rho\left(N^c, \underline{q}\right)$ when prices are set by the public authorities.

H5. If the impact of competition on quality works through price, then $q_H^*\big(p(H)\big) = 0$.

Data and empirical approach

Price data comes from the Laing & Buisson Care Homes Contacts dataset which contains information on all care homes across the United Kingdom up to July 2010. The CQC dataset of registered adult social care services contains 10,470 care homes, of which 963 homes are run by public authorities. Using postcode, number of registered beds and telephone numbers we were able to match 98.4% of these care homes with the Laing & Buisson dataset giving a dataset of 10,302 care homes in England.

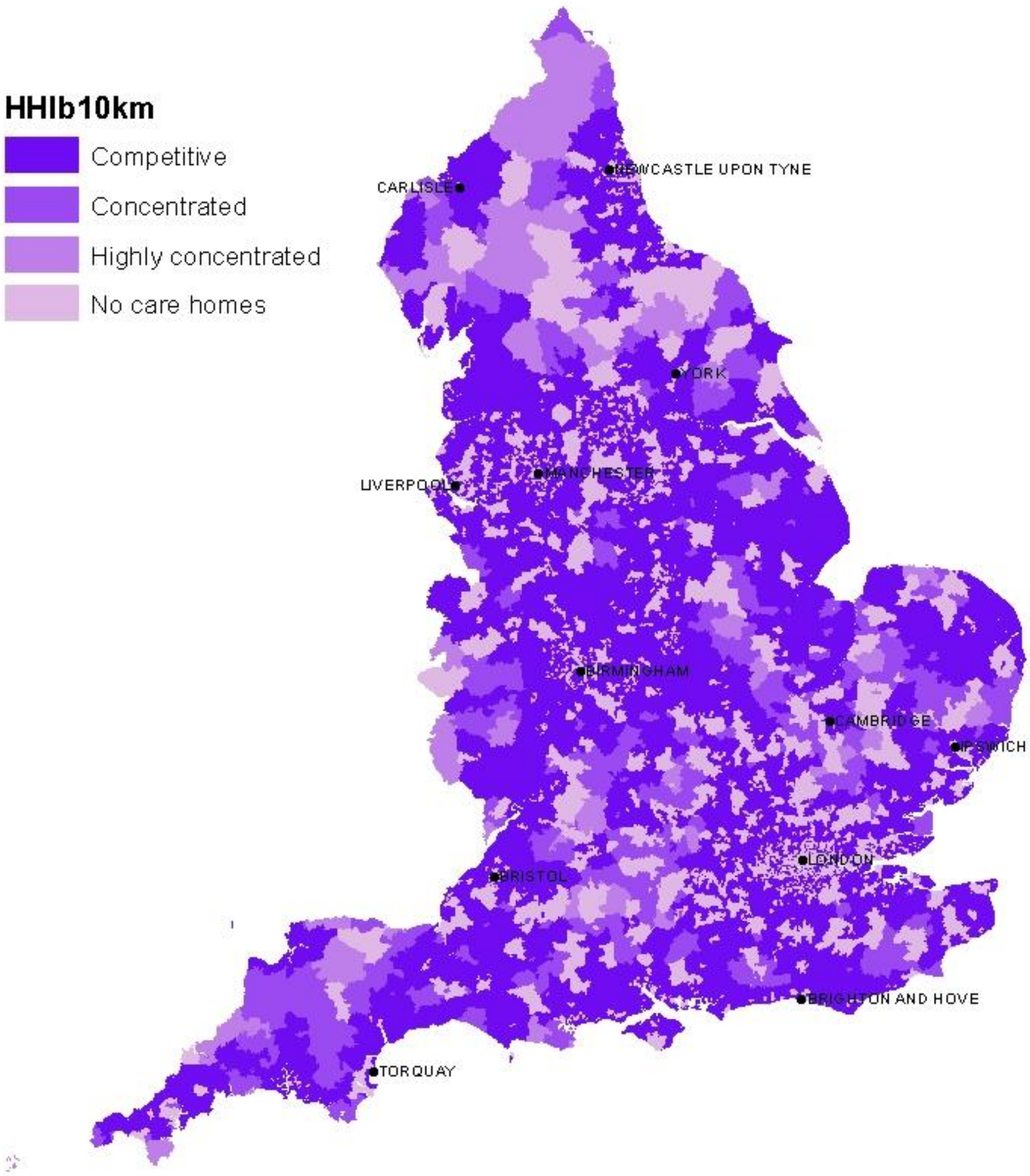
Figure 1 shows the average level of competition in England at the Medium Super Output Area (MSOA) level. MSOA level of competition is found by taking the average level of competition (HHI) from all the care homes that are located in each MSOA; in this case we used the travel time-weighted HHI at a 10km range. As of 2010, all 10302 care homes were located in 4588 (out of 6781) MSOAs. The figures are scaled according to the official measurement of competition where a market with a HHI of less than 0.1 is considered competitive, over 0.1 is considered concentrated, and over 0.2 is considered highly concentrated (Competition Commission and Office of Fair Trading 2010).

Distance weighting of the HHI shows markets to be more concentrated/less competitive than they would be with no distance weighting – even so, we see a high level of competition indicated. With a market size defined by a radius of 10km, 4,152 MSOAs (90.50%) have an average level of competition that would be considered to be competitive by the OFT. If market size were extended to a 20km radius then only 10 (0.22%) MSOAs have an average level of competition that is non-competitive according to the OFT.

Regarding price data, only summary (average) home level statistics are available, although there is a good degree of heterogeneity between homes on this measure[2]. Quality is measured using the CQC's four-level quality ratings ('star ratings') measure. This determination is made on the basis of inspection results and other data; previous studies have shown a reasonable

[2] The L&B prices directory contains minimum and maximum prices by room type (single and other) and client-type (nursing or residential). A blended (mean) price was constructed by taking the crude average of min and max price for the service (client and room) types available in the home. Information on the number of beds of each type for each home was not available, only whether or not the service was provided.

Figure 1. Competitiveness – England, by MSOA



degree of inter-rater reliability in this assessment (Netten, Beadle-Brown et al. 2010). In view of the low number of 0-rated homes, this category was combined with 1-star homes. Table 1 reports price and quality descriptive information for the sample, including the crude relationship between price and quality.

To account for demand and cost-shift factors, a range of home-level variables were used, including: primary client type (dementia or old age); home type (nursing home or residential

Table 1. Quality ratings and average care home prices

			Home-average price (£ per week)		
Star rating	**n**	**%**	**mean**	**median**	**SD**
0/1*	1217	13.8%	£522	£475	£163
2*	5963	67.7%	£526	£482	£157
3*	1631	18.5%	£572	£521	£191
Residential (personal care)	5414	61.4%	£466	£440	£111
Nursing	3397	38.6%	£642	£614	£181
All homes	8811	100.0%	£534	£488	£166

home); organisational affiliation (multi-home organisations); whether the home was purpose built and length of time in business. In addition, we matched in characteristics pertaining to the neighbourhood of the home (specifically, summary characteristics at the lower super output area, LSOA): percentage older people in the population, percentage living alone; and ranking on the multi-deprivation scale. Furthermore, using transactions data on house sales from the Land Registry, average house price for LSOAs was used. Descriptive statistics are in Table 2.

Care homes are located into 9 regions (London, East Midlands, East of England, South East, North East, North West, South West, West Midlands and Yorkshire and the Humber).

The analysis focused on homes for older people or those with dementia. The CQC database has 9236 (non-publicly run) homes listed with this primary client grouping. Price data were missing for 531 of these homes (5.7%)[3]. A further 14 cases had missing home level data (e.g. registration year) or local house price data, giving 8691 cases for the price analysis (5.9% missing). Quality ratings were missing for 208 of these homes giving 8483 for the quality analysis (8.2% missing).[4]

[3] Approximately 1% of prices in the data were believed to be miscoded or in error as was apparent from their very low values (below any feasibly sustainable price in this sector). These outliers were treated as missing. There were also 9 homes with prices over £2000 per week; as these are likely to be specialist providers, they were also excluded.
[4] We consider the implications of missing data below.

Table 2. Independent variables – descriptive statistics

Variable	N	Mean	SD	Min	Max
Endogenous					
Average price (log)	8691	6.23	0.27	5.78	7.55
Star rating	8483	2.05	0.57	1.00	3.00
HHIa 10km	8691	0.05	0.07	0.01	1.00
HHIa 20km	8691	0.04	0.05	0.01	1.00
HHIb 10km	8691	0.02	0.02	0.00	0.81
HHIb 20km	8691	0.01	0.01	0.00	0.21
Exogenous					
Care Home level					
Voluntary	8691	0.10	0.30	0.00	1.00
Primary client: dementia	8691	0.14	0.35	0.00	1.00
Nursing home	8691	0.38	0.48	0.00	1.00
years since registration	8691	20.38	6.13	2.00	64.00
Purpose built	8691	1.25	0.44	1.00	2.00
Care home group 2-9	8691	0.16	0.37	0.00	1.00
Care home group 10-19	8691	0.07	0.26	0.00	1.00
Care home group 20-49	8691	0.06	0.23	0.00	1.00
Care home group 50+	8691	0.16	0.37	0.00	1.00
LSOA level					
House price	8691	225081.50	144027.90	43568.17	3264864.00
Percent population over 60/65	8691	24.94	8.52	2.10	69.40
Total population	8691	1620.37	327.79	814.00	6398.00
Index of multiple dep. score rank LSOA (log)	8691	16933.30	8755.68	1.00	32465.00
Percent long-term limiting illness	8691	21.12	5.91	5.69	48.13
Percent Health fairly good+	8691	23.08	3.53	10.85	37.26
Percent pension credit uptake	8691	0.24	0.14	0.01	1.11
Additional instruments					
House price MSOA (log)	8691	12.12	0.43	10.80	14.13
Index of multiple dep. score rank MSOA (log)	8691	9.58	0.69	4.16	10.38
Percent Long term ill squared MSOA	8691	2.93	0.24	1.80	3.58

Empirical specification and results

The theoretical model suggests that competition will have an endogenous relationship with both price and quality. We use distance-weighted HHI as our competition measure, as given in (17) above. Any home's output, given its location, is a function of its own quality and price and that of all its competitors: $x_i(p_i^*(\sigma_i, p_{-i}, q_{-i}), q_i^*(\sigma_i, p_{-i}, q_{-i}))$. The dependence of H_i on (own) price and quality suggests that there will be non-zero correlation between H_i and the error term ε_i in (18) and (19).

This correlation can be removed in an instrumental variables estimation where the predicted value of the *reduced-form* competition measure is used in (18) and (19). Solving the $N_i - 1$ optimal price and optimal quality equations and substituting gives $H_i^R(\sigma_i, \sigma_{-i})$, where σ_i are the exogenous demand and supply characteristics relating to provider *i* and σ_{-i} is a matrix of exogenous demand and supply characteristics for each of the $N_i - 1$ competitors. The latter (σ_{-i}) can serve as instruments in the IV estimation. We cannot observe this matrix directly but can instead substitute for a vector of demand and supply characteristics summarising the local areas in which competitors operate. In particular, we use characteristics summarised at the middle-level super output areas (MSOA) as instruments, specifically: MSOA-average house price, the MSOA-average multiple deprivation score and the percentage of long term ill in the MSOA-level population. The LSOA-level versions of these indicators are included as exogenous variables in the price and quality estimations; it is assumed that any remaining impact from the MSOA level will only affect competition.

Two-stage least squares (2SLS) estimators were used or if heteroscedasticity was indicated, the two step efficient generalised methods of moments (GMM) estimator was used instead. A log of price was used in the estimation. Both a 2SLS linear probability model (LPM) and an ordered probit model were used for the 3-category quality variable. In the latter case, the predicted value of HHI from a first stage estimation was used in the probit estimation. The whole system was bootstrapped (1000 reps) to produce standard errors for the coefficients.

The results of the price estimations – the partial reduced form of (19) – are presented in Table 3. Table 4 has the quality estimation results i.e. of (18), including both the LPM and ordered probit model (OP) results. We used both a distance-weighted HHI ("HHIa") and the travel time-adjusted version ("HHIb").[5]

Heteroscedasticity was present in half of the models estimated – as indicated in the tables. Otherwise, the models all satisfied under-identification, weak-identification and over-identification tests[6], except one price specification: the variant with 20km travel time competition: 20km – HHIb in Table 3.

The coefficients on the home and LSOA level characteristics had the expected signs in both the price and quality estimations. As for regional effects, homes outside London were significantly cheaper. On average homes in the Home Counties were next most expensive, other things equal.

Competition

Competition decreases prices in care homes, using either the distance or travel time weighted HHI. For our preferred measure, 10km travel time adjusted HHI, the price elasticity of concentration was 0.21 at the mean level of competition i.e. a 10% increase in competitiveness would correspond to a 2.1% *decrease* in prices, a reduction of around £11 per week. Elasticity was slightly lower for the distance-weighted measure (0.15). Using the 20km market definition, elasticity levels were greater; they were smaller when using a 5km definition – see Table 5. This result is consistent with hypothesis H4.

Overall, we found that quality was positively related to concentration i.e. negatively related to competitiveness (hypothesis H3)[7]. This result held (at high significance levels) for both the LPM and ordered probit models, and for all of the concentration measures – see Table 4. The

[5] Travel time per kilometre is predicted using a general linear model regression of local council level travel time data using MSOA level population density and average house price as independent variables. The predicted values are then normalised by the average predicted travel time per km of the care home sample.
[6] For OP models a pseudo-Sargan test for under-identification was used based on the residuals calculated from the outcome-weighted predicted values from the estimation.
[7] We also carried our regressions assuming that the 208 missing quality ratings were either all 0/1* homes or all 3* homes – this change had almost no effect on the results.

ordered probit allows us to explore the effects of competition on the probabilities of homes having particularly star ratings. In other words, we could look at whether competition was more likely to affect the chances of homes having high quality (3*) as opposed to low (0/1*) or moderate (2*). Figure 2 shows elasticity estimates using the 10km HHIb measure; this result does not suggest that competition effects are focused on homes in particular parts of the quality distribution. With a 10% increase in concentration, we would see fewer 0/1* homes and more 3* homes – some 0/1* homes would become 2* (or 3* homes) and a similar proportion of 2* homes as those moving up from 0/1* would become 3* homes.

The theory above outlined conditions where we might expect the effects of competition on quality to be negative: quality might be relatively low in high competitiveness markets because commissioners can push down prices in those markets compared to less competitive areas. We test this hypothesis by assessing whether competition has a negative effect on quality after controlling for price in the estimation:

$$q_i^* = q_i^{*1}(H_i, p_i(q_i), \sigma_i) + \varepsilon_i^{q1} \tag{20}$$

In view of the endogeneity of price, we substituted its predicted value into (20) using a first-stage reduced-form estimation. The instruments used for the price estimation were: MSOA-average house price, the MSOA-average multiple deprivation score and the percentage of long term ill in the MSOA-level population. We also added mean house prices within a 20km radius of each home as an additional instrument.

The results are in the first two columns of Table 6, using both 10km and 20km travel-time specifications of competition. In these estimations, competition was insignificant, a result which is consistent with our hypotheses (see H5 above). To further explore this result we added an interaction term, multiplying the (predicted values) of competition and price. The aim was to assess whether the marginal effects of competition on quality differ according to the price band

Table 3. Price regression results

Market Radius	5km – HHIa (GMM)		5km – HHIb (GMM)		10km – HHIa (GMM)		10km – HHIb (2SLS)		20km – HHIa (2SLS)		20km – HHIb (2SLS)	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Competition												
HHI	0.962***	0.092	1.121***	0.103	2.990***	0.326	4.843***	0.582	19.579***	3.987	41.718***	11.707
Care Home level												
Dementia clients	0.045***	0.007	0.046***	0.007	0.042***	0.008	0.045***	0.009	0.041***	0.016	0.047***	0.017
Voluntary sector	0.043***	0.009	0.034***	0.008	0.035***	0.010	0.028***	0.009	0.028**	0.014	-0.014	0.024
Nursing home	0.257***	0.006	0.257***	0.006	0.252***	0.007	0.249***	0.007	0.245***	0.011	0.237***	0.016
Care home group 2-9	0.038***	0.007	0.036***	0.007	0.036***	0.008	0.037***	0.008	0.043***	0.013	0.036**	0.017
Care home group 10-19	0.053***	0.010	0.056***	0.010	0.053***	0.011	0.043***	0.012	0.058***	0.018	0.046*	0.024
Care home group 20-49	0.043***	0.013	0.045***	0.012	0.042***	0.015	0.035**	0.015	0.090***	0.019	0.077***	0.026
Care home group 50+	0.107***	0.008	0.103***	0.008	0.103***	0.009	0.089***	0.010	0.107***	0.015	0.081***	0.020
Registration length (log)	-0.081***	0.010	-0.074***	0.010	-0.085***	0.011	-0.076***	0.012	-0.073***	0.017	-0.062***	0.020
log Registration length sq	$4.7e^{-5***}$	$1.5e^{-5}$	$4.2e^{-5}$***	$1.6e^{-5}$	$4.6e^{-5}$***	$1.3e^{-5}$	$4.9e^{-5}$***	$1.4e^{-5}$	$3.5e^{-5}$**	$1.8e^{-5}$	$3.5e^{-5}$	$2.3e^{-5}$
Purpose built	0.011	0.007	0.010	0.006	0.016**	0.008	0.022***	0.008	0.038***	0.012	0.046***	0.017
LSOA level												
Percent older population	-0.004***	0.001	-0.004***	0.001	-0.007***	0.001	-0.006***	0.001	-0.013***	0.003	-0.013***	0.004
total population sq	$-5.8e^{-9}$***	$1.9e^{-9}$	$-4.2e^{-9}$**	$1.7e^{-9}$	$-7.9e^{-9}$***	$2.4e^{-9}$	$-8.5e^{-9}$***	$2.6e^{-9}$	$-1.7e^{-8}$***	$4.9e^{-9}$	$-2.1e^{-8}$***	$7.5e^{-9}$
Average house price (log)	-0.931***	0.186	-0.548***	0.171	-1.032***	0.210	-0.831***	0.208	-2.193***	0.428	-2.596***	0.767
log avg house price sq	0.040***	0.007	0.025***	0.007	0.045***	0.008	0.038***	0.008	0.094***	0.017	0.113***	0.032
Deprivation rank (log)	0.048***	0.007	0.031***	0.006	0.039***	0.007	0.020***	0.007	0.075***	0.015	0.052***	0.019
Percent long term ill	0.223***	0.032	0.190***	0.029	0.297***	0.042	0.290***	0.044	0.502***	0.096	0.484***	0.158
Percent health fairly good	-0.004**	0.001	-0.004***	0.001	-0.009***	0.002	-0.009***	0.002	-0.020***	0.004	-0.021***	0.007
Percent pension credit	-0.078***	0.011	-0.075***	0.010	-0.097***	0.012	-0.093***	0.013	-0.121***	0.023	-0.120***	0.033
Percent pension credit sq	0.469***	0.066	0.367***	0.058	0.472***	0.070	0.386***	0.065	0.822***	0.144	0.843***	0.226
Under-ident	345.034***		366.803***		215.503***		201.593***		68.484***		40.726***	
Weak Ident (F-test)	87.70***		88.05***		57.60***		48.20***		16.78***		13.12***	
Weak Ident (KP rk Wald F)	116.028[a]		130.296[a]		73.737[a]		70.316[a]		22.825[a]		13.783[b]	
Over-ident	1.019[NS]		2.561[NS]		3.613[NS]		1.764[NS]		2.386[NS]		11.873***	
Reset (functional form)	7.31***		3.96**		0.12[NS]		0.89[NS]		0.49[NS]		3.16*	

n = 8691, all models include region dummies. [a] Exceeds 5% maximal IV bias and 10% maximal IV size, [b] Exceeds 10% maximal IV bias and 15% maximal IV size (Stock and Yogo 2005) Estimated using the ivreg2 command for Stata (Baum, Schaffer et al. 2010)

Table 4. Quality regression results

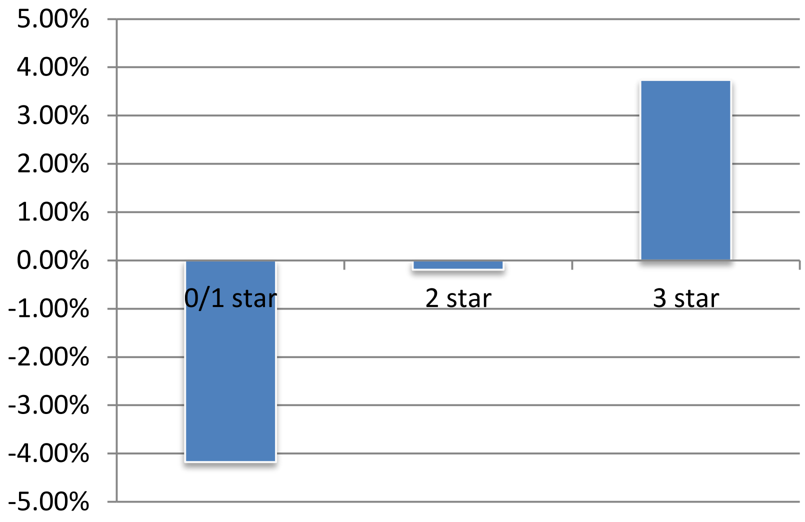
Market Radius	LPM 10km - HHIa		LPM 10km - HHIb		LPM 20km - HHIa		LPM 20km - HHIb		OP 10km - HHIb		OP 20km - HHIb	
	Coef.	S.E.	Coef.	S.E.	Coef.	Coef.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Competition												
HHI	1.598***	0.484	2.800***	0.832	8.440***	2.693	15.533***	5.735	5.892***	1.807	32.478***	11.987
Care Home level												
Dementia clients	-0.041**	0.018	-0.040**	0.018	-0.041**	0.019	-0.040**	0.019	-0.086**	0.037	-0.087**	0.037
Voluntary sector	0.156***	0.022	0.154***	0.022	0.152***	0.022	0.140***	0.024	0.320***	0.046	0.290***	0.047
Nursing home	0.002	0.014	-0.0003	0.014	0.004	0.014	0.001	0.015	-0.001	0.029	0.002	0.029
Care home group 2-9	-0.036**	0.018	-0.034**	0.018	-0.033*	0.018	-0.035*	0.018	-0.075**	0.036	-0.077**	0.036
Care home group 10-19	-0.012	0.026	-0.017	0.026	-0.008	0.026	-0.013	0.027	-0.033	0.054	-0.024	0.054
Care home group 20-49	-0.021	0.028	-0.026	0.028	0.003	0.028	-0.004	0.029	-0.054	0.057	-0.006	0.056
Care home group 50+	0.005	0.020	-0.003	0.020	0.008	0.020	-0.001	0.021	-0.008	0.042	-0.002	0.041
Registration length (log)	0.045***	0.016	0.052***	0.016	0.050***	0.017	0.052***	0.017	0.107***	0.033	0.108***	0.033
Purpose built	0.043***	0.017	0.047***	0.017	0.055***	0.017	0.057***	0.018	0.100***	0.035	0.119***	0.036
LSOA level												
Percent older population	0.003**	0.001	0.003**	0.001	0.001	0.001	0.001	0.001	0.006**	0.002	0.003	0.003
total population sq	$-2.14e^{-9}$	$4.2e^{-9}$	$-2.61e^{-9}$	$4.3e^{-9}$	$-5.67e^{-9}$	$4.8e^{-9}$	$-6.02e^{-9}$	$5.3e^{-9}$				
Average house price (log)	0.027	0.023	0.040*	0.023	0.048**	0.024	0.074***	0.026	0.083*	0.047	0.152***	0.052
Deprivation rank (log)	$1.18e^{-6}$	$1.3e^{-6}$	$-3.21e^{-7}$	$1.5e^{-6}$	$1.39e^{-6}$	$1.3e^{-6}$	$-2.03e^{-7}$	$1.6e^{-6}$	$-7.43e^{-7}$	$3.11e^{-6}$	$-1.81e^{-7}$	$3.25e^{-6}$
Percent health fairly good	-0.005	0.003	-0.006*	0.003	-0.006*	0.004	-0.007*	0.004	-0.013*	0.007	-0.014*	0.008
Percent living alone	0.023	0.032	0.004	0.030	0.032	0.033	-0.006	0.031	0.007	0.063	-0.011	0.062
Under-ident	188.425***		175.684***		98.414***		95.033***					
Weak Ident (F-test)	90.52***		78.28***		33.37***		22.11***		78.280***		22.110***	
Weak Ident (KP rk Wald F)	62.51[a]		59.04[a]		32.41[a]		31.99[a]					
Over-ident	0.951[NS]		0.467[NS]		0.815[NS]		3.696[NS]		0.437[NS]		4.133[NS]	
Reset (functional form)	0.11[NS]		0.18[NS]		0.26[NS]		0.16[NS]					

n = 8483, all models include region dummies . [a] Exceeds 5% maximal IV bias and 10% maximal IV size (Stock and Yogo 2005) LPM models estimated using the ivreg2 command for Stata (Baum, Schaffer et al. 2010)

Table 5. Price regression results - elasticities

Competition measure	HHIa - 5km	HHIb - 5km	HHIa - 10km	HHIb - 10km	HHIa - 20km	HHIb - 20km
Mean	0.127	0.128	0.151	0.211	0.334	0.597
Median	0.066	0.078	0.080	0.134	0.201	0.419

Figure 2. Percentage change in probability of outcome given a 10% increase in HHI.



in which the home operates. We do not have a direct measure of the proportion of clients in each care home that are publicly-funded as opposed to self-funded. The price bracket in which the home operates is a fair indicator of this, however; i.e. most homes that have the majority of their places publicly-funded will be in the lower part of the price distribution. Where this is the case, the theoretical model suggests that the lower-priced homes market will show stronger negative effects of competition on quality than the higher-priced homes market. The sign of the interaction term of concentration (HHI) and price would then be negative. The results, given in the second part of Table 6, confirm the hypotheses (H1 and H2), with a significant negatively signed coefficient on the interaction term.

Other factors

The results show (Table 4) that the voluntary sector is associated with significantly greater levels of quality than the private sector. This finding is in line with the large, predominantly US, literature in this area (Comondore, Devereaux et al. 2009). Care homes that are primarily aimed at dementia clients and nursing homes have significantly lower levels of quality than their counterparts. The longer a care home has been registered and care homes that are purpose built are associated with higher quality.

Discussion

The extensive use of markets and private providers are characteristics of the nursing home industry in many countries, not least in England. Moreover, although many residents receive public subsidies and/or have their services commissioned by public bodies on their behalf, prices are often not heavily regulated. Most regulatory attention is focused on ensuring minimum standards of care are provided. And yet there is a relatively small literature investigating whether markets in long-term care 'work', and whether promoting competition is a beneficial policy. What research exists tends to paint a mixed picture.

This analysis found a negative effect of competition on quality; this result appears to be robust against a range of measures of competition. The four-category quality rating of the home, assessed by the regulator, is our quality measure. This rating is determined after inspection visits, documentary returns made by the care home and by other data. The ratings are publicly available and are listed on many care home directory websites in addition to the regulator's website. Recent research commissioned by the Office of National Statistics in England found a significant positive relationship between quality ratings and the social care-related quality of life (SCRQoL) of a sample of care home residents (Netten, Beadle-Brown et al. 2010).

Table 6. Quality regression – price interaction results

Market Radius	Price control				Interaction			
	10km		20km		10km		20km	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Competition								
Predicted HHI	3.498	2.675	-0.233	2.965	49.279**	21.121	121.288**	58.069
Predicted price (log)	0.481	0.719	1.276***	0.497	0.888	0.742	1.529***	0.504
Pred HHI*Pred price (log)					-7.374**	3.367	-19.478**	9.264
Care Home level								
Dementia clients	-0.109**	0.048	-	0.040	-0.116**	0.048	-0.149***	0.040
Voluntary sector	0.307***	0.050	0.285***	0.048	0.303***	0.050	0.285***	0.048
Nursing home	-0.124	0.180	-	0.126	-0.146	0.180	-0.322**	0.126
Care home group 2-9	-0.093**	0.043	-	0.039	-0.095**	0.043	-0.122***	0.039
Care home group 10-19	-0.054	0.063	-0.09	0.060	-0.057	0.063	-0.089	0.060
Care home group 20-49	-0.071	0.064	-0.101	0.063	-0.073	0.064	-0.099	0.063
Care home group 50+	-0.051	0.077	-0.125**	0.063	-0.058	0.077	-0.122*	0.063
Registration length (log)	0.129***	0.048	0.165***	0.043	0.127***	0.048	0.160***	0.043
Purpose built	0.089**	0.037	0.071**	0.036	0.086**	0.037	0.072**	0.036
LSOA level								
Percent older population	0.006***	0.002	0.006***	0.002	0.006***	0.002	0.006***	0.002
Average house price (log)	0.024	0.094	-0.069	0.077	0.012	0.094	-0.073	0.077
Deprivation rank	5.51e-07	3.07e-06	$2.55e^{-6}$	$2.72e^{-6}$	$5.8e^{-7}$	$3.1e^{-6}$	$2.9e^{-6}$	$2.7e^{-6}$
Percent health fairly good	-0.009	0.008	-0.004	0.007	-0.010	0.008	-0.007	0.006
Percent living alone	-0.012	0.065	-0.042	0.062	-0.018	0.066	-0.045	0.062
Weak Ident (F-test): HHI	69.90***		31.68***		69.90***		31.68***	
Weak Ident (F-test): Price	50.95***		50.95***		50.95***		50.95***	
Over-ident	1.33^{NS}		3.07^{NS}		1.66^{NS}		3.15^{NS}	

We argue that competition can have a negative effect on quality if it pushes prices in the market down to the level where providers can only sustain the costs of minimum quality. Although providers are assumed to want to produce higher quality, other things equal, this break-even constraint can bind in competitive markets. This result only occurs if commissioners/buyers are predominantly interested in cost rather than quality (or at least any quality improvement above the minimum standard). The empirical analysis offers some support for these hypotheses. In particular, a negative effect of competition on quality is *not* found when price is included in the quality estimation. There is also some indication that the higher price end of the market is more responsive to quality – higher prices are generally paid by self-payers rather than public commissioners.

Our general finding is in contrast to competition analyses in hospital markets, but can be explained by the different pricing systems used. Most hospital markets work with prospective payment systems that offer unambiguous incentives for low quality providers to improve quality (towards the average) as competition increases (Gaynor, Moreno-Senna et al. 2011).

The policy implications of this analysis on nursing home markets in England depend largely on judgements as to whether minimum quality standards are acceptable. If competition is pushing prices down such that providers are producing services at minimum quality, but this quality is acceptable to policy makers, then greater competition can be seen as beneficial. Such an interpretation can only be sustained, however, if we are confident that the (non-market) actions of the regulator are sufficient to maintain minimum quality levels. Without robust regulation, and without a change in public commissioning behaviour, quality would deteriorate below acceptable levels.

There are a number of avenues which future work could take in this area. The most obvious is to examine organisational effects more thoroughly by accounting for care homes being run by the same group in our measure of competition. This analysis uses cross-sectional data – it should be possible to add further waves in order to explore the dynamic properties of the market (although the policy backdrop is changing and this limits continuity). The analysis would also benefit from finer grained price data, but this is not currently available from administrative sources.

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