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Title: The impact of competition on quality and prices in the English care 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. Considering the key institutional features, we use a theoretical model to assess the conditions under which further competition could increase or reduce quality. A dataset comprising the population of 10000 care homes was used. We constructed distance/travel-time weighted competition measures. 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, with only a residual number of (publicly-supported) residents placed directly in publicly-owned homes (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).

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.

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; Grabowski 2004; 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. 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.

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. The four-category quality rating of the home is determined after inspection visits, documentary returns made by the care home and by other data. It covers seven key lines of regulatory assessment (KLORA) about the quality of: individual health and personal care needs support; daily life and social activities; staffing (training and numbers); environment (safe, well-

[1] See Forder and Allan (2011).

maintained and comfortable); resident home choice and information; management (openness, effectiveness and quality assured); and complaints and protection.[2] The ratings were publicly available and listed on many care home directory websites in addition to the regulator's website. This measure is also a proxy for an underlying quality or utility gain construct. A significant positive relationship between quality ratings and the social care-related quality of life (SCRQoL) of a sample of care home residents has been found (Netten, Beadle-Brown et al. 2010).

We calculated competitiveness/concentration for each home directly, avoiding the need to rely on administrative boundaries to identify markets.[3] Using homes' address (postcode), competitors were identified, with the total number of competitor places weighted by distance (straight-line and travel time adjusted).

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

[2] http://webarchive.nationalarchives.gov.uk/20100812003411/http://cqc.org.uk/_db/_documents/klora_care_homes_20090318153O.doc.

[3] Local authority-funded residents can be placed outside of the funding council's administrative boundary. In 2008, 26,220 (14.4%) supported over-65 residents were placed 'out of area' (NHS Information Centre 2008).

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 homes market has two main groups: (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). 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.

By and large, the self-pay market can be regarded as a conventional market, although all homes, regardless of payer, are required to meet minimum quality standards (assessed as outlined above) or face sanctions, including removal of operating licences. The publicly-supported market is a quasi-market (Bartlett, Propper et al. 1994). There is a wealth-based means-test whereby people with eligible assets (including housing assets for single person households) below a certain threshold receive council financial support (Wanless, Forder et al. 2006).

There are 152 councils in England that commission long-term care services. Exact commissioning practice varies between them, but generally involves the following process. Commissioners negotiate with care homes that are prepared to offer services in line with the council payment rate for that locality and other conditions. Local authority-supported placements are then made according to these terms for individual placements. In some cases, councils may block purchase places in advance. The contractual terms require that the home meets the minimum quality standards, but they generally do not involve any considerations for

higher quality beyond that level. There are no restrictions that the care home needs to be within the council's boundaries. On this basis, demand from councils is unlikely to be affected by quality choices made by homes above minimum quality.

Local authority commissioners work with potential LA-funded residents to find a place in their preferred care home. Potential residents are able to choose potential homes as long as the home meets the council's contractual terms. In this process, commissioners will focus on finding a vacancy in a care home that meets the minimum standards. We might expect potential residents to be influenced by the quality of homes they wish to use, but also by other factors, particular the home's location. Since a 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.

Individuals are often required to make a contribution to the local authority for their placement, but the amount of the charge reflects the person's means, not the characteristics of the placement (Wanless, Forder et al. 2006). Some councils also allow supported residents to opt for higher priced homes if a third-party (not the resident) can be found to pay the difference over the council price.[4] This could also mean that demand is affected by quality although the demand for higher quality would be tempered by the need for a third-party to pay a top-up on the price.

Local authorities appear to have some market power as suggested by the discounts they apparently secure 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 (Grabowski 2004; Mukamel and Spector 2002).

[4] The extent of topping up is unclear but as many as one third of local-authority funded placements could involve top-ups (Laing & Buisson 2010).

Self-payers have more freedom to choose homes at their preferred price-location/type-quality point, but it is worth noting that almost all homes currently operate with a mix of self-pay and local authority residents (Laing & Buisson 2010). As such, local authority commissioning practices are likely to influence self-payer purchasing options.

The NHS also funds places in care homes, but without charges (or third-party top-ups) for residents. The process and terms are similar to LA-funded placements, although the prices that the NHS will pay are often slightly higher.

Much of the industry comprises single home providers or small multi-home organisations, although there are some large chains. Around 15 per cent of the market is supplied by non-profit providers. However, many 'for-profit' providers, particularly the single home or small multi-home organisations can be regarded as having some non-profit motivation (Matosevic, Kendall et al. 2000; Knapp, Hardy et al. 2001; Netten, Darton et al. 2001; Kendall, Matosevic et al. 2003).

Theoretical considerations

The care homes market can be characterised as monopolistically competitive with both horizontal and vertical differentiation. In general in the literature, the effects of increased competition on quality are ambiguous *a priori* in this case (Tirole 1988 ; Gaynor and Town 2011; Propper and Leckie 2011). We use a simple model – based in part on that of (Gaynor and Town 2011, p 52) – to consider whether the key institutional features outlined above add further insight to the standard result.

Demand for care home services is influenced by the level of disability and ill-health in the population (σ_i) and by the wealth of potential service users (θ_i) (Darton, Forder et al. 2010). The latter will have a negative effect on council demand and a positive effect on self-pay

demand (due to the means-test on public support). Moreover, an increase in the number of providers N in a local market will reduce the demand faced by incumbent providers *i*; therefore: $\frac{\partial x_i}{\partial N} < 0$.

Suppose that the profits of care home i are:

$$\pi_i = p_i^c x_i^c(q_i, d_i, p_i^c, \theta_i, \sigma_i) + p_i^s x_i^s(q_i, d_i, p_i^s, \theta_i, \sigma_i) - c_i(q_i)(x_i^c + x_i^s) - F(q_i) \qquad (1)$$

Where p_i^k are prices and x_i^k demand from councils purchasers $(k = c)$ and self-pay purchasers $(k = s)$. Homes set one level of quality[5] $q \geq \underline{q}$ at or above the minimum $\underline{q}$ enforced by the regulator, and operate in one location d. Marginal costs c_i generally rise with quality, as do (sunk) fixed costs F. For convenience, we assume that $F\left(\underline{q}\right) = 0$, and $F_q > 0$ and $F_{qq} > 0$.

We assume that providers maximise utility, Z_i:

$$Z_i = \pi_i(q_i) + m_i(q_i)x_i \qquad (2)$$

which includes profits but also reflects non-profit motivation in form of gaining utility from quality $\left(m_q > 0, m_{qq} < 0\right)$ with $m\left(\underline{q}\right) = 0$. Note that $x_i = x_i^c + x_i^s$.

The dominant purchasing power of the council purchaser allows a degree of price setting as regards p_i^c. In this case we assume that the council price is set through a collective bargaining process. Suppose that this process results in prices set at: $p^c = c_i\left(\underline{q}\right) + \eta(N) = \rho(N)$. Here $\eta(N) > 0$ is a market power function with $\eta_N \leq 0$ and where prices fall slowly with N so that no provider experiences a demand increase when new providers enter the market. We also assume that the council price does not vary with quality above the minimum i.e. $\rho_q = 0$.

[5] We assume a single quality at the home level. It might be possible for homes to differentiate quality in terms of amenities like room size between residents but our definition of quality is more fundamentally covering many aspects of quality of life of residents.

Providers are left to choose self-pay price and quality (after the location decision). The first order condition with respect to quality choice is:

$$Z_q = \rho_i x_q^c + (m_i - c_i)x_q^c + p_i^s x_q^s + p_q^s x_i^s + (m_i - c_i)x_{q_i}^s + \left(m_{q_i} - c_{q_i}\right)x_i - F_{q_i} = 0 \quad (3)$$

with the equivalent for price. Solving the first order conditions together gives optimal quality and price in partial reduced form: $q_i^* = q_i^*(N_i, d_i, \sigma_i, \theta_i)$ and $p_i^{s*} = p_i^{s*}(N_i, d_i, \sigma_i, \theta_i)$. Council-funded places will be priced at: $p_i^{c*} = \rho(N_i, d_i, \sigma_i, \theta_i)$.

Since council purchasers are not (much) interested in quality above the minimum in this model (i.e. assuming that $x_q^c = 0$, $q > \underline{q}$, in the limit case), quality in markets with a high proportion of council-funding eligible people is likely to be lower than quality in markets with a high proportion of potential self-payers (who do care about quality). The proportion of council eligible people will be negatively correlated with wealth, and therefore we expect that $\frac{\partial q_i^*}{\partial \theta_i} > 0$.

The impact of competitors N_i on quality is indeterminate in the general case when we cannot sign Z_{qN}:[6]

$$Z_{qN} = \rho_i x_{qN}^c + \rho_N x_q^c + p_i^s x_{qN}^s + p_N^s x_q^s + p_q^s x_N^s + p_{qN}^s x_i^s + (m_i - c_i)\left(x_{qN}^c + x_{qN}^s\right) \quad (4)$$
$$+ \left(m_{q_i} - c_{q_i}\right)(x_N^c + x_N^s)$$

where $\rho_N < 0$ and $x_N^c < 0$. The sign of this function is indeterminate without further assumptions.

With a range of payer types with differing preference for quality, the market is likely to stratify by quality. The impact of competition is clearer when we focus just on markets with predominantly council-supported payers i.e. those markets with low population wealth θ^L.

[6] 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, i.e. $Z_p(q, p, N, d, \sigma) = 0$ and $Z_q(q, p, N, d, \sigma) = 0$.

Consider the limit case of homes that only secure council-supported residents (and where there are no third-party top-ups involved). Suppose also that council-funded purchases are completely unconcerned with quality above the minimum, such that $x_q^c = 0$ (and so $x_{qN}^c = 0$). Using the first order condition (3) at $x^s(\theta^L) = 0$, and substituting into (4), we have:

$$Z_{qN}(x_i^s = 0) = F_{q_i}\frac{x_N^c + x_N^s}{x^c} + \left[p_N^s x_q^s + p_q^s x_N^s\right] + (p_i^s + m_i - c_i)\left(x_{qN}^s - x_{q_i}^s\frac{x_N^c + x_N^s}{x^c}\right) \quad (5)$$

The first two terms are likely to be negative, but the last is positive[7]: following an increase in competition, there is an incentive to raise quality and thereby secure more financially lucrative self-payers. But this effect is mitigated somewhat by the lower self-pay prices available after greater competition and the reduced number of residents over which to spread the extra fixed costs of quality. If the potential to attract self-payers is effectively zero e.g. $x_q^s(\theta^L) = 0$, then (5) reduces to: $Z_{qN}(x_i^s = 0) = F_{q_i}\frac{x_N^c}{x^c} < 0$. With usual concavity assumptions, $Z_{qq}^c < 0$, the comparative statics in this case are $\frac{\partial q_i}{\partial N_i} = -\frac{Z_{qN}^c}{Z_{qq}^c} < 0$ i.e. increased competition reduces quality. With extra competition, homes face lower demand and have less opportunity to spread the additional (fixed) costs of extra quality. Providers choose quality above the minimum because they value quality – with q_i^* set by $\left(m_{q_i} - c_{q_i}\right)x_i = F_{q_i}$. It is also possible that the break-even constraint will bind at quality levels below q_i^*, however. Indeed, as competition increases and the council price ρ tends to the marginal cost level, so quality is constrained down towards the minimum. Even in local markets with some self-payer demand, quality may be constrained downwards by the effect of additional competition lowering ρ if the potential number of self-payers is limited: As $N \to \infty$, any quality above the minimum would incur a loss on council-

[7] As based on the model by Gaynor and Town, whereby demand for home i is given by the product of market share s_i and total market demand D_i, that is: $x_i = s_i(q_i)D(q_i)$ and $x_q = sD_q + Ds_q$. Here $s_q > 0$ and we would expect $s_{qN} > 0$ (in that for a monopolist $s_q(N = 1) = 0$, as $s(N = 1) = 1$ and in a more competitive market, $s_q(N > 1) > 0$). With $D_q \to 0$, this suggests that $x_{qN} = Ds_{qN} + s_N D_q > 0$. As regards price, for a monopolist, $p_q(N = 1) = P_q > 0$ where P_q is the maximum increase in price that the market will pay for increased quality. For a competitive market, $p_q(N > 1) \leq P_q$ so $p_{qN} \leq 0$.

funded clients and this would have to be offset by profits on self-pay clients. If there were few self-payers quality would be constrained to be near to the minimum. With decreasing average costs (with scale) providers in this case would not just focus on the self-pay market.

In practice we would expect: council-funded purchasers to be somewhat concerned with quality; for there to be some sensitivity of self-pay demand even at the low end of the market; and for providers to operate with a mix of payers. Therefore, the effects of increased competition will be generally ambiguous. Nonetheless this limit case result does show that a negative effect is possible in this model.

Competition

In keeping with the literature on monopolistically competitive markets, we can assume that local markets tend to zero profits in order to define the number of providers in the long-run. Suppose that care home i operates in local market g, which can be defined as including any purchasers and other providers within range of home i.[8] The number of beds supplied to that market in the long run, differentiating payer type, B^k, is determined where average profits of homes in the market are zero, and can be found by solving the system:

$$\pi_g^V\left(\theta_g, \sigma_g, d_g, B_g^c, B_g^s, \theta_{-g}, \sigma_{-g}, d_{-g}, B_{-g}^c, B_{-g}^s\right) = F(\theta_g, \sigma_g) \qquad (6)$$

where the $-g$ subscript refers to any market other than g that influences behaviour in g. The term on the left hand side is profit with respect to variable costs only. Total beds supplied is: $B_g = B_g^c + B_g^s$. The level of competition in market g is then $N_g = N_g(B_g)$.

Given home i's quality and price, the level of competition faced by home i will be directly correlated with N_g i.e.:

[8] In other words each 'market' is unique to provider *i*.

$$N_i = N_i\left(N_g(q_i, p_i), \theta_g, \sigma_g, d_g, \theta_{-g}, \sigma_{-g}, d_{-g}\right) \quad (7)$$

Generally we would expect the number of competitors to increase with need-related characteristics σ_g, such that $\frac{\partial N_i}{\partial \sigma_{g=i}} > 0$. However, the effect of an increase in wealth θ_g is more difficult to anticipate, not least because the effect on beds supplied to meet council-funded demand is likely to be opposite the effect on beds for self-payers. We cannot sign $\frac{\partial N_i}{\partial \theta_{g=i}}$ *a priori*.

Hypotheses

We have the following main empirical hypotheses:

H1. In general the effect of competition on quality is ambiguous. However, there are circumstances where markets with predominantly council-funding could show a negative relationship between quality and competition i.e. $\frac{\partial q_{i \in C}}{\partial N_i} < 0$ where C is the set of markets g where council funding dominates.

H2. In council-funded only markets, the impact of competition on quality works through price, and therefore $\frac{\partial q_{i \in C}}{\partial N_i}\left(p_i(N_i)\right) = 0$

H3. For the self-pay market, we cannot sign the differential q_N^S. However, we do expect that $q_N^C \neq q_N^S$.

H4. For the whole market we hypothesise that $p_N^* < 0$. 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.

Empirical specification

We used a weighted Herfindahl-Hirschman index (HHI): $H_i = \frac{\sum_{j=1}^{N_i}(w_{ij}B_j)^2}{\left(\sum_{j=1}^{N_i} w_{ij}B_j\right)^2}$ as a competition measure (with weight w_{ij}). The HHI is inversely correlated with the number of competitors N_i in a market and therefore the signs of our above hypotheses are reversed with respect to H_i. Note that, if providers all operated with the same output (beds), the HHI reduces exactly to an inverse measure of the number of competitors: $H_i = \frac{N(\overline{w_\iota B_\iota})^2}{(N\overline{w_\iota B_\iota})^2} = \frac{1}{N}$.

We sought to account for the horizontal differentiation of providers by weighting output for 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 used an inverse square-root weighting on distance and travel time in the Herfindahl, i.e. $w_{ij} = \frac{1}{\Delta d_{ij}^{0.5}}$. Furthermore, a maximum range for competitors was implemented; providers located outside this range were assumed to have no competitive effect (which therefore defines N_i). Ranges of 10 and 20km were used with their travel time-weighted equivalents. Potentially, the impact of competitors should also be weighted in terms of the vertical differentiation of providers, but with a categorical quality classification of providers in the data, the intuitive basis for weighting in this case is less strong. Our strategy was to proceed without re-weighting for quality differences, although we did use exogenous shift factors for quality in the model.

Similarly, we might want to make allowance for different 'types' of provider e.g. primary client type, home type (nursing vs residential), organisational affiliation, and also for location by council administrative area. We proceeded in this case, by using intercept dummies for type rather than modifying the competition weight. Ideally we would weight the distance variables

between each home of the same type to be greater than between homes of different types. We might have also weighted competition differently if competitor beds were in a different local authority (especially relevant for those near boundaries). Although there is no restriction on local authorities funding placements in homes outside the authority area, it is possible that any differences in LA policy might work through as a competition effect. This effect would be modest if neighbouring local authorities tend to adopt similar policies, as anecdotal experience suggests. The general problem was that the resultant matrix of weights for these effects would quickly become complicated with arbitrary weights.

The partial reduced-form equations – the solutions to (3) – for quality can be used in the estimation, substituting the HHI (H_i) for N_i

$$q_i^* = q_i^*(H_i, \sigma_i, \theta_i) + \varepsilon_i^q \quad (8)$$

We only observe home-average price, p_i, not price by payer-type in the data and therefore we combine the reduced-form price equations above to give:

$$p_i^* = p_i^*(H_i, \sigma_i, \theta_i) + \varepsilon_i^p \quad (9)$$

There is a potential to see spurious associations between quality and our competition variable in the data. Suppose that competition is greater for markets with mostly council-funded demand compared to markets with mostly self-pay demand, such that $\frac{\partial H_i}{\partial \theta_i} > 0$. Furthermore, as noted above, we anticipate that $\frac{\partial q_i^*}{\partial \theta_i} > 0$. Any omitted wealth-related factor in (8) or (9) may then result in an apparent positive relationship between HHI and quality (i.e. $\frac{\partial q_i}{\partial H_i} > 0$) that was due to differences in payer composition rather than a competition effect. It is important therefore to control for exogenous factors, and in particular to include variables for all wealth-related factors θ_i in the empirical model.

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 (8) and (9). This endogeneity can be addressed using instrumental variables where the predicted value of the competition measure is used in (8) and (9). We have $H_i = H_i\left(N_g(q_i, p_i), \theta_g, \sigma_g, d_g, \theta_{-g}, \sigma_{-g}, d_{-g}\right)$ from (7) using the HHI in place of N_i, and therefore the terms $\theta_{-g}, \sigma_{-g}, d_{-g}$ can be potentially used as instruments, predicting H_i but not directly appearing in the structural equations (8) and (9), given H_i. We cannot observe these terms exactly but can instead substitute using a vector of demand and supply characteristics summarising the local areas in which competitors operate – see data below.

The two step efficient generalised methods of moments (GMM) estimator was used to estimate equations (8) and (9). A log of price was used in the estimation. Both a two step GMM linear probability model (LPM) and an ordered probit model were used for the multi-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.

We specifically consider hypothesis H2 using the following structural model for quality:

$$q_i^* = q_i^{*1}(H_i, p_i(q_i), \sigma_i) + \varepsilon_i^{q1} \qquad (10)$$

In view of the endogeneity of price, we substituted its predicted value into (10) using a first-stage reduced-form estimation.

Data

Price data comes from the Laing & Buisson Care Homes Contacts dataset which contains information on all care homes across the United Kingdom in July 2010. The CQC dataset of

registered adult social care services at September 30th 2010 contains 10,470 registered care homes for older people. 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-level 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. 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.[9] Quality is measured using the CQC's four-level quality ratings ('star ratings') measure. Previous studies have shown

[9] The L&B prices directory contains minimum and maximum prices by room type (single and shared) and client-type (nursing or residential). As such, any third party top-ups will be included in the price data but cannot be discerned. A blended (mean) price was constructed by taking the crude average of minimum and maximum 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.

a reasonable degree of inter-rater reliability in this assessment (Darton, Forder et al. 2010). In view of the low number of 0-rated homes (1.7%), this category was combined with 1-star homes.[10] 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 (θ_i, σ_i), a range of home-level variables were used, including: primary client type (dementia or old age); home type (nursing home or residential 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, we used National Statistics data collected using standard geographical classification, called *super output areas*. There are just over 32,800 Lower-layer super output areas or LSOAs in England. Matching to the address of each care home, we used averages for: total population, percentage of older people in the population, percentage of population with a long-term limiting illness, percentage reporting their health as fairly good, percentage of older population that received pension credit (a means-tested pension top-up), percentage living alone, and ranking on the multi-deprivation scale. Furthermore, to account for market composition two variables were included: first, using transactions data on house sales from the Land Registry, average house price for LSOAs was used; and second, a basic estimate of the proportion of care home residents that are self-funded in each Local Authority.[11] Descriptive statistics are in Table 2.

[10] Homes that are rated as having 0 stars would have to make improvements to their care home or else face further sanctions, which could include loss of registration (closure). As such, it seems reasonable to join these two star ratings together.
[11] See Forder and Allan (2013).

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 matched database has 9609 independent sector (non-public) homes. Price data were missing for 483 of these homes (5.0%). Approximately 1% (n=82) of prices in the data were very low, and so likely to have been in error/miscoded, being below any feasibly sustainable price. There were also 10 homes with prices over £2000 per week; as these are likely to be specialist providers and therefore not in competition with other care homes in their market area, they were also excluded. 329 of the care homes were not primarily aimed at either older people or people with dementia and 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 (9.6% missing). Quality ratings were missing for 208 of these homes giving 8483 for the quality analysis (11.7% missing).

Instruments

The instruments in the model (i.e. θ_{-g}, σ_{-g}) concern characteristics of markets beyond home i's local market. For this purpose we used indicators summarised at larger geographies, specifically for middle-level super output areas (MSOA): 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.

The instruments used for the price estimation in (10) 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.

Results

The results of the price estimations – the partial reduced form, (9) – are presented in Table 3. Table 4 has the quality estimation results i.e. of (8), including both the LPM and ordered probit model (OP) results. We used both a distance-weighted HHI ("HHIa") and the distance and travel time-adjusted version ("HHIb").[12]

The models all satisfied under-identification, weak-identification and over- identification tests[13], 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 0.22 at the mean level of competition i.e. a 10% increase in competitiveness would correspond to a 2.2% *decrease* in prices, a reduction of around £12 per week. Elasticity was slightly lower for the distance-weighted measure (0.16). Using the 20km market definition, elasticity levels were greater. This result is consistent with hypothesis H4.

[12] 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.
[13] For OP models a pseudo-Sargan test for over-identification was used based on the residuals calculated from the outcome-weighted predicted values from the estimation.

As regards hypothesis H1, we found that quality was positively related to concentration i.e. negatively related to competitiveness. 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 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.

As regard hypothesis H2 using the estimation of (10), the results are in the first two columns of Table 6, with both 10km and 20km travel-time specifications of competition. In these estimations, competition was insignificant, a result which is consistent with our hypothesis. 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 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; most homes that have the majority of their places publicly-funded will be in the lower part of the price distribution.[14] 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

[14] We would assume that publicly-funded placements that have a third party top-up are more likely to be in the higher part of the price distribution.

would then be negative. The results, given in the second part of Table 6, provide some support for hypotheses H3, with a significant negatively signed coefficient on the interaction term.

Payer-composition

The data did not allow direct observation of payer-composition in the locality of each home, raising the possibility of omitted variable endogeneity bias on the competition measure. We tackled this potential issue in three ways. First, we included a range of wealth factors in the empirical model that have been shown to be good predictors of payer-composition (Darton, Forder et al. 2010) e.g. house prices and rates of pension credit. Also, IV RESET tests give some indication of omitted variable problems but were not significant in any model. Second, *ex post* payer-composition (proportion of self-funded places) was available at local authority level (153 in England) and was included (although noting potential ecological fallacy issues at this level of aggregation). Third, we tried alternative instrumentation of HHI (H_i) in the model, specifically using primarily need-related excluded instruments: using proportion reporting ill-health at the MSOA level rather than house price at the MSOA level. The alternative models did not qualitatively change the results.

Other factors

The results show (Table 4) that the voluntary sector is associated with significantly greater levels of quality (and price) 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 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. There is a price premium associated with a placement in a care home that is part of an ownership group of 3 or more care homes, but no difference in quality.

Discussion

The extensive use of markets and private providers – often with a high degree of public funding – are characteristics of the nursing home industry in many countries, not least in England. 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. 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 (or publicly-funded placements with third party top-ups) rather than public commissioners.

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.

We have sought to tackle some of the empirical challenges identified in the literature, namely, finding appropriate 'quality' measures, measuring competition and addressing potential endogeneity. Nonetheless, limitations need to be recognised in these regards. We rely on regulatory information on quality which is likely to be a noisy and potentially arbitrary proxy of the final utility gain from being in a care home. We also make a number of simplifying assumptions about the impact of competitors on each home. Furthermore, although we use instrumental variables methods to address simultaneity issues, these are notoriously sensitive to instrument specification.

As well as simultaneity, there were also potential endogeneity problems due to omitted variables, notably missing payer-composition variables at LSOA level. There is a potential issue with the competition variable embodying the effect of differences in payer composition on quality rather than competition effects. We addressed this problem by (a) using a range of wealth factors that have been shown to be good predictors of payer-composition (b) using payer-composition data at aggregated level (local authority) and (c) using alternative instruments for predicting HHI. In all cases, the result of a negative impact of competition on quality remained.

In addition there were a number of limitations in the data; in particular, only having home-level average prices, not individual resident prices, and the usual missing values. We did, however, perform a number of robustness checks in this regard: first, we included the price outliers; second, we used maximum or minimum prices in place of mean price; third, we separated out care homes rated as poor (0 stars) and adequate (1 star); fourth, we treated all poor rated care homes (0 stars) as missing; and fifth, we randomly assigned a quality rating to the additional

care homes that were missing quality ratings but had price information.[15] Our findings were not significantly altered in any of these scenarios.

There are a number of avenues which future work could take in this area. A relevant limitation to address with further work is in not accounting for the heterogeneous nature of care homes in directly mediating competition effects. In particular we could examine organisational effects more thoroughly by accounting for care homes being run by the same group in the measure of competition, or examine competition assuming differentiation of markets for nursing homes and residential homes and/or care homes predominantly for older people and for those with dementia. In further work we will explore weighting our competition measure for these differences in care home type. The intercept effects with regard to some factors – e.g. dementia homes – could also reflect different applicability or implementation of quality assessment by the regulator, or perhaps insufficient case-mix adjustment for dementia homes.

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) and to help with omitted variables (e.g. payer-composition) limitations. The analysis would also benefit from finer grained price data (for example, differentiating by payer type), but this is not currently available from administrative sources.

References

Bartlett, W., C. Propper, D. Wilson and J. Le Grand, Eds. (1994). Quasi-markets in the welfare state. Bristol, SAUS publications.

Baum, C. F., M. E. Schaffer and S. Stillman (2010). ivreg2: Stata module for extended instrumental variables/2SLS, GMM and AC/HAC, LIML and k-class regression.

Bresnahan, T. (1989). Empirical Studies of Industries With Market Power. Handbook of Industrial Economics. R. Schmalansee and R. Willig. Amsterdam, North Holland.

[15] We assumed various distributions of star ratings for the additional care homes: that they had a larger proportion of poor/adequate care homes (doubled to 26%), that they had a larger proportion of care homes rated as excellent (doubled to 38%), or that they followed the distribution of star ratings found in the data.

Castle, N. G., J. Engberg and D. Liu (2007). "Have Nursing Home Compare quality measure scores changed over time in response to competition? ." Quality and Safety in Health Care **Vol. 16**(no.3): pp185-191.

Comondore, V. R., P. J. Devereaux, Q. Zhou, S. B. Stone, J. W. Busse, N. C. Ravindran, K. E. Burns, T. Haines, B. Stringer, D. J. Cook, S. D. Walter, T. Sullivan, O. Berwanger, M. Bhandari, S. Banglawala, J. N. Lavis, B. Petrisor, H. Schunemann, K. Walsh, N. Bhatnagar and G. H. Guyatt (2009). "Quality of care in for-profit and not-for-profit nursing homes: systematic review and meta-analysis." BMJ: 339:b2732 doi:10.1136/bmj.b2732.

Competition Commission and Office of Fair Trading (2010). Merger Assessment Guidelines OFT1254/CC2 (revised), Competition Commission and Office of Fair Trading (http://www.oft.gov.uk/shared_oft/mergers/642749/OFT1254.pdf)

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

Fernandez, J., J. Forder and M. Knapp (2011). Long-term care. The Oxford Handbook of Health Economics. P. Smith and S. Glied. Oxford, Oxford University Press.

Forder, J. (2000). "Mental health: market power and governance." Journal of Health Economics **19**(6): 877-905.

Forder, J. and S. Allan (2011). Competition in the care homes market Discussion Paper 2814. London, Office of Health Economics

Forder, J. and S. Allan (2013). Explaining the fees gap between funding types in the English care homes market PSSRU Discussion Paper 2865, PSSRU, University of Kent

Gage, H., W. Knibb, J. Evans, P. Williams, N. Rickman and K. Bryan (2009). "Why are some care homes better than others? An empirical study of the factors associated with quality of care for older people in residential homes in Surrey, England." Health and Social Care in the Community **Vol. 17**(no.6): pp599-609.

Gammonley, D., N. J. Zhang, K. Frahm and S. C. Paek (2009). "Social service staffing in US nursing homes." Social Service Review **Vol. 83**(no.4): pp633-650.

Gaynor, M. and R. Town (2011). Competition in Health Care Markets NBER Working Paper No. 17208 (http://www.nber.org/papers/w17208.pdf)

Grabowski, D. C. (2004). " A longitudinal study of Medicaid payment, private-pay price and nursing home quality " International Journal of Health Care Finance and Economics **Vol. 4**(no.1): pp5-26.

Kendall, J., T. Matosevic, J. Forder, M. Knapp, B. Hardy and P. Ware (2003). "The motivation of domiciliary care providers in England: New concepts, new findings." Journal of Social Policy **32**(4): 489-512.

Knapp, M., B. Hardy and J. Forder (2001). "Commissioning for quality: Ten years of social care markets in England." Journal of Social Policy **30**(2): 283-306.

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

Matosevic, T., J. Kendall, J. Forder, M. Knapp, B. Hardy and P. Ware (2000). The motivations of domiciliary care providers. PSSRU, London School of Economics.

Mehta, A. (2006). Spatial Competition and Market Definition in the Nursing Home Industry. working paper, Department of Economics, Boston University.

Mukamel, D. B. and W. D. Spector (2002). "The competitive nature of the nursing home industry: price mark ups and demand elasticities " Applied Economics **34**(4): pp413-420.

Netten, A., J. Beadle-Brown, B. Trukeschitz, A.-M. Towers, E. Welch, J. Forder, J. Smith and E. Alden (2010). Measuring the outcomes of care homes: Final report. Discussion Paper 2696 (Commissioned by the Office of National Statistics). Canterbury, PSSRU (http://www.pssru.ac.uk/pdf/dp2696_2.pdf)

Netten, A., R. Darton, A. Bebbington and P. Brown (2001). "Residential or nursing home care? The appropriateness of placement decisions." Ageing and Society **21**: 3-23.
Netten, A., R. Darton and J. Williams (2003). "Nursing home closures: effects on capacity and reasons for closure." Age and Ageing **Vol. 23**: pp332-337.
NHS Information Centre (2008). Community Care Statistics 2008 Supported Residents (Adults). Leeds.
Nyman, J. A. (1994). "The effects of market concentration and excess demand on the price of nursing home care " Journal of Industrial Economics **Vol. 42**(no.2): pp193-204.
Office of Fair Trading (2005). Care homes for older people in the UK: A market study. London, OFT.
Propper, C. and G. Leckie (2011). Increasing competition between providers in health care markets: the economic evidence. The Oxford Handbook of Health Economics. P. Smith and S. Glied. Oxford, Oxford University Press.
Starkey, K. B., R. Weech-Maldonado and V. Mor (2005). "Market competition and quality of care in the nursing home industry " Journal of Health Care Finance **Vol. 32**: pp67-81.
Stock, J. H. and M. Yogo (2005). Testing for weak instruments in linear IV regression. Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg. D. W. K. Andrews and J. H. Stock. Cambridge, Cambridge University Press**:** 80-108.
Tirole, J. (1988). The theory of industrial structure. Cambridge, MIT Press.
Wanless, D., J. Forder, J.-L. Fernandez, T. Poole, L. Beesley, M. Henwood and F. Moscone (2006). Securing Good Care for Older People: Taking a long term view. London, King's Fund
Zinn, J. (1994). "Market competition and the quality of nursing home care " Journal of Health Politics, Policy and Law **Vol. 19**: pp555-582.
Zinn, J., V. Mor, Z. Feng and O. Intrator (2009). " Determinants of performance failure in the nursing home industry " Social Science and Medicine **Vol. 68**: 933-940.

Tables and figures

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

Table 2. Independent variables – descriptive statistics

Variable	N	Mean	SD	Min	Max
Endogenous					
Average price	8691	528.48	158.05	323.00	1900.00
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	0.25	0.44	0.00	1.00
Care homes in organisational group: 3-9	8691	0.16	0.37	0.00	1.00
Care homes in organisational group: 10-19	8691	0.07	0.26	0.00	1.00
Care homes in organisational group: 20-49	8691	0.06	0.23	0.00	1.00
Care homes in organisational group: 50+	8691	0.16	0.37	0.00	1.00
LSOA level					
House price	8691	225081.50	144027.90	43568.17	3264864.00
Proportion population over 60/65	8691	0.25	0.09	0.02	0.69
Total population	8691	1620.37	327.79	814.00	6398.00
Index of multiple dep. score rank	8691	16933.30	8755.68	1.00	32465.00
Long-term limiting illness	8691	0.21	0.06	0.06	0.48
Health fairly good	8691	0.23	0.04	0.11	0.37
Over 60/65s pension credit uptake	8691	0.24	0.14	0.01	0.94
Proportion self-funded residents in LA	8691	0.53	0.10	0.001	0.81
Additional instruments					
House price MSOA	8691	201892.60	100534.70	48904.00	1374322.00
Index of multiple dep. score rank MSOA	8691	17068.96	7775.36	64.00	32244.60
Percent Long term ill MSOA	8691	19.33	4.56	6.07	35.77

Table 3. Price regression results

Market Radius	10km – HHIa		10km – HHIb		20km – HHIa		20km – HHIb	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Competition								
HHI	2.935***	0.346	4.933***	0.582	20.330***	4.161	39.239***	10.470
Care Home level								
Dementia clients	0.041***	0.009	0.044***	0.009	0.040***	0.016	0.047***	0.016
Voluntary sector	0.033***	0.010	0.026***	0.010	0.024*	0.014	-0.014	0.023
Nursing home	0.150***	0.027	0.157***	0.030	0.164***	0.059	0.187***	0.085
Care home group 3-9	0.034***	0.008	0.036***	0.008	0.042***	0.014	0.035**	0.016
Care home group 10-19	0.054***	0.012	0.044***	0.013	0.060***	0.018	0.048**	0.022
Care home group 20-49	0.047***	0.015	0.040***	0.015	0.093***	0.019	0.076***	0.025
Care home group 50+	0.104***	0.009	0.089***	0.010	0.107***	0.015	0.083***	0.019
Registration length (log)	-0.086***	0.011	-0.076***	0.012	-0.074***	0.018	-0.063***	0.019
log Registration length sq	$4.5e^{-5}$***	$1.4e^{-5}$	$4.7e^{-5}$***	$1.4e^{-5}$	$3.4e^{-5}$*	$1.8e^{-5}$	$3.5e^{-5}$	$2.2e^{-5}$
Purpose built	0.016**	0.008	0.022***	0.008	0.038***	0.012	0.043***	0.016
LSOA level								
Percent older population	-0.007***	0.001	-0.007***	0.001	-0.014***	0.003	-0.012***	0.004
total population sq	$-9.5e^{-9}$***	$2.7e^{-9}$	$-1.0e^{-8}$***	$2.8e^{-9}$	$-2.0e^{-8}$***	$5.5e^{-9}$	$-2.2e^{-8}$***	$7.4e^{-9}$
Average house price (log)	-1.166***	0.218	-0.950***	0.212	-2.435***	0.457	-2.639***	0.731
log avg house price sq	0.051***	0.009	0.043***	0.009	0.104***	0.019	0.115***	0.030
Deprivation rank (log)	0.049***	0.009	0.028***	0.007	0.095***	0.019	0.062***	0.020
Percent long term ill	0.016***	0.002	0.016***	0.002	0.028***	0.005	0.023***	0.007
Percent health fairly good	-0.010***	0.002	-0.010***	0.002	-0.022***	0.004	-0.019***	0.006
Percent pension credit	-0.628***	0.108	-0.622***	0.109	-0.809***	0.201	-0.765***	0.238
Percent pension credit sq	0.888***	0.148	0.813***	0.140	1.384***	0.278	1.320***	0.356
Proportion self-funded residents in LA (log)	0.007	0.005	0.007	0.006	-0.032**	0.015	-0.055**	0.025
Under-ident	116.805***		121.013***		60.978***		37.803***	
Weak Ident (F-test)	44.99***		44.98***		9.51***		5.35***	
Weak Ident (KP rk Wald F)	39.095[a]		41.536[a]		20.677[b]		13.020[c]	
Over-ident	2.594[NS]		1.019[NS]		2.477[NS]		13.769***	
Reset (functional form)	0.05[NS]		0.98[NS]		0.38[NS]		2.04[NS]	

n = 8691, all models include region dummies. [a] Exceeds 5% maximal IV bias and 10% maximal IV size, [b] Exceeds 5% maximal IV bias and 15% maximal IV size, [c] 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.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Competition												
HHI	1.743***	0.648	3.298***	1.163	11.886**	4.674	31.025**	14.322	6.955***	2.522	63.527**	32.274
Care Home level												
Dementia clients	-0.041**	0.018	-0.038**	-0.019	-0.039*	0.020	-0.033	0.022	-0.084**	0.037	-0.077**	0.038
Voluntary sector	0.157***	0.022	0.154***	0.022	0.151***	0.023	0.125***	0.030	0.320***	0.046	0.258***	0.053
Nursing home	-0.094	0.069	-0.090	0.070	-0.090	0.079	-0.071	0.106	-0.184	0.142	-0.138	0.142
Care home group 3-9	-0.034*	0.018	-0.032*	0.018	-0.029	0.019	-0.031	0.021	-0.071*	0.036	-0.071**	0.036
Care home group 10-19	-0.011	0.026	-0.017	0.027	-0.007	0.027	-0.016	0.030	-0.033	0.054	-0.031	0.054
Care home group 20-49	-0.021	0.028	-0.027	0.029	0.008	0.029	0.002	0.033	-0.057	0.058	-0.002	0.057
Care home group 50+	0.006	0.020	-0.004	0.021	0.007	0.021	-0.011	0.026	-0.009	0.042	-0.024	0.045
Registration length (log)	0.043***	0.016	0.051***	0.016	0.048***	0.017	0.058***	0.020	0.106***	0.033	0.119***	0.034
Purpose built	0.045***	0.017	0.049***	0.017	0.059***	0.018	0.068***	0.022	0.104***	0.035	0.141***	0.039
LSOA level												
Percent older population	$2.7e^{-4}$	0.002	$1.4e^{-4}$	0.002	-0.005	0.004	-0.007	0.006	$4.0e^{-4}$	0.005	-0.013	0.010
total population sq	$-3.3e^{-9}$	$4.7e^{-9}$	$-4.4e^{-9}$	$4.9e^{-9}$	$-1.1e^{-8}$	$6.3e^{-9}$	$-1.7e^{-8}$	$1.1e^{-8}$	$-9.6e^{-9}$	$1.0e^{-8}$	$-3.4e^{-8}$	$1.8e^{-8}$
Average house price (log)	0.015	0.025	0.027	0.024	0.045*	0.026	0.101**	0.041	0.056	0.049	0.205***	0.072
Deprivation rank	$4.9e^{-7}$	$1.8e^{-6}$	$-1.3e^{-6}$	$1.7e^{-6}$	$4.3e^{-6}$	$2.7e^{-6}$	$2.3e^{-6}$	$2.6e^{-6}$	$-2.7e^{-6}$	$3.4e^{-6}$	$4.6e^{-6}$	$4.4e^{-6}$
Percent long term ill	0.004	0.005	0.005	0.005	0.012*	0.008	0.015	0.010	0.010	0.010	0.029*	0.018
Percent health fairly good	-0.006	0.004	-0.007*	0.004	-0.011**	0.006	-0.015*	0.008	-0.015*	0.009	-0.030**	0.014
Percent living alone (log)	0.047	0.035	0.029	0.034	0.036	0.036	-0.025	0.047	0.059	0.071	-0.053	0.084
Percent pension credit (log)	-0.058*	0.030	-0.064**	0.030	-0.057*	0.032	-0.070*	0.038	-0.137**	0.063	-0.137**	0.065
Percent pension credit sq	-0.012	0.118	$-1.6e^{-4}$	0.118	0.148	0.148	0.331	0.231	0.012	0.248	0.677	0.417
Proportion SF residents (log)	0.017	0.018	0.016	0.018	-0.007	0.023	-0.036	0.036	0.034	0.038	-0.070	0.064
Under-ident	98.456***		101.241***		99.430***		109.045***					
Weak Ident (F-test)	13.33***		14.91***		16.32***		20.51***		42.29***		4.89***	
Weak Ident (KP rk Wald F)	32.686[a]		33.703[a]		33.168[a]		36.579[a]					
Over-ident	2.214^{NS}		1.210^{NS}		1.405^{NS}		2.236^{NS}		1.164^{NS}		3.218^{NS}	
Reset (functional form)	0.48^{NS}		0.51^{NS}		0.22^{NS}		0.14^{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 - 10km	HHIb - 10km	HHIa - 20km	HHIb - 20km
Mean	0.156	0.215	0.347	0.561
Median	0.084	0.137	0.209	0.397

Table 6. Quality regression – price interaction results (ordered probit models)

Market Radius	**Price control**				**Interaction**			
	10km		**20km**		**10km**		**20km**	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Competition								
Predicted HHI	3.509	3.861	-0.267	2.886	47.679**	21.248	115.325**	57.176
Predicted price (log)	0.314	0.859	1.038**	0.479	0.683	0.866	1.276***	0.484
Pred HHI*Pred price (log)					-7.114**	3.347	-18.528**	9.150
Care Home level								
Dementia clients	-0.103*	0.053	-0.137***	0.041	-0.108**	0.053	-0.138***	0.041
Voluntary sector	0.312***	0.052	0.292***	0.048	0.309***	0.052	0.293***	0.048
Nursing home	-0.228	0.195	-0.342**	0.163	-0.236	0.195	-0.337**	0.163
Care home group 3-9	-0.085*	0.048	-0.113***	0.039	-0.087*	0.048	-0.112***	0.039
Care home group 10-19	-0.042	0.068	-0.075	0.060	-0.044	0.068	-0.074	0.060
Care home group 20-49	-0.059	0.069	-0.088	0.066	-0.059	0.069	-0.086	0.066
Care home group 50+	-0.029	0.088	-0.093	0.065	-0.033	0.088	-0.090	0.065
Registration length (log)	0.119**	0.057	0.157***	0.044	0.116**	0.057	0.152***	0.044
Purpose built	0.095**	0.039	0.077**	0.036	0.093**	0.039	0.078**	0.036
LSOA level								
Percent older population	0.006	0.005	0.010***	0.003	0.006	0.005	0.009***	0.003
Average house price (log)	0.023	0.101	-0.053	0.076	0.014	0.101	-0.056	0.076
Deprivation rank	$-2.4e^{-6}$	$3.4e^{-6}$	$-1.5e^{-6}$	$3.3e^{-6}$	$-2.6e^{-6}$	$3.4e^{-6}$	$-1.3e^{-6}$	$3.3e^{-6}$
Percent long term ill (log)	-0.028	0.240	-0.227**	0.115	-0.039	0.240	-0.222*	0.115
Percent health fairly good	-0.008	0.011	0.001	0.007	-0.007	0.011	0.001	0.007
Percent living alone	0.126	0.200	0.022	0.170	0.116	0.201	0.023	0.170
Percent pension credit (log)	-0.092	0.084	-0.031	0.054	-0.091	0.084	-0.036	0.054
Proportion SF residents (log)	0.033	0.038	0.032	0.038	0.037	0.038	0.032	0.038
Weak Ident (F-test): HHI	36.13***		23.84***		36.13***		23.84***	
Weak Ident (F-test): Price	52.56***		52.56***		52.56***		52.56***	
Over-ident	1.903^{NS}		1.803^{NS}		2.172^{NS}		1.945^{NS}	

Figure 1. Competitiveness – England, by MSOA

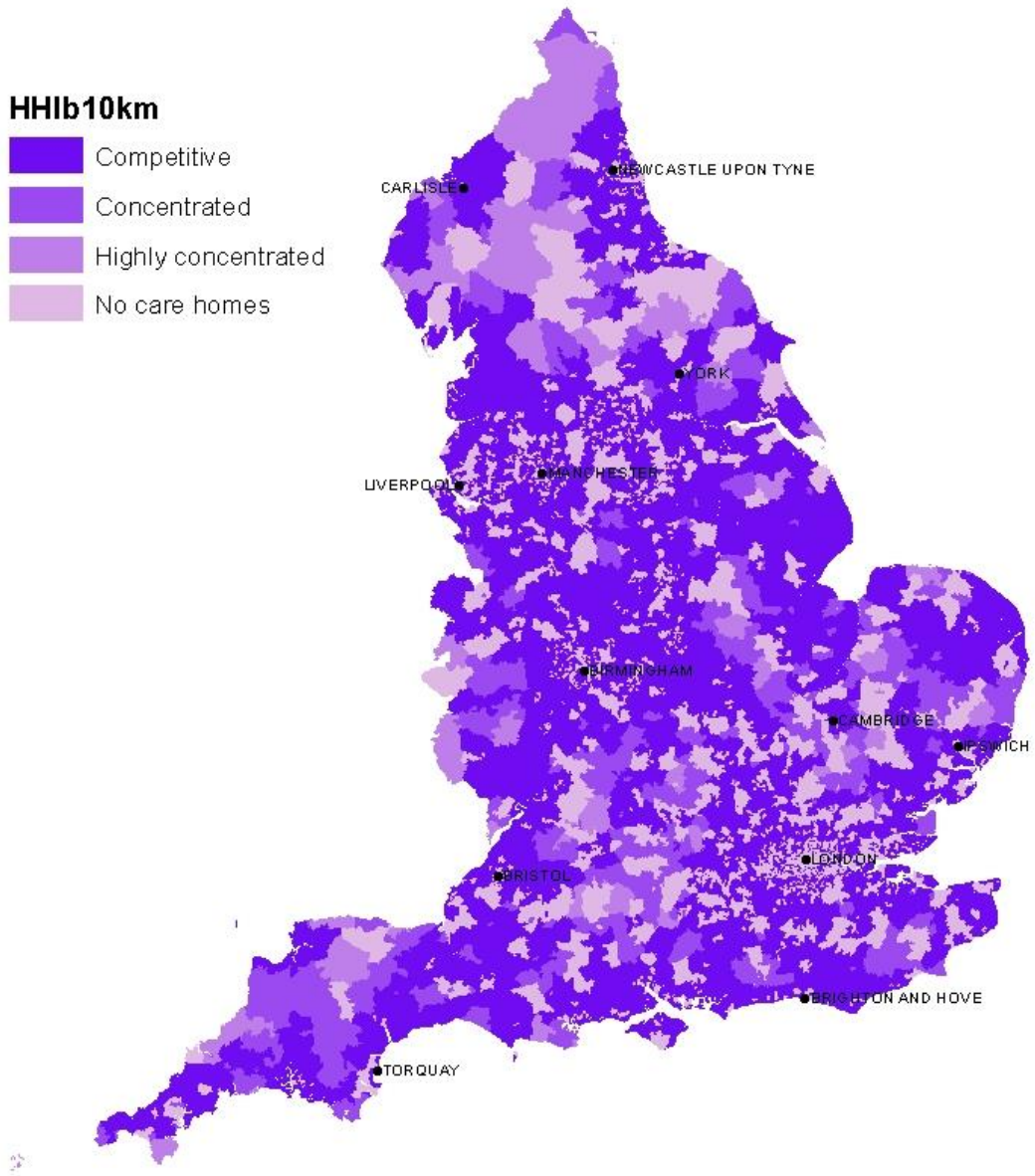

Figure 2. Percentage change in probability of outcome given a 10% increase in HHI.