The Impact of Competition on Management Quality:

Evidence from Public Hospitals

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Abstract: Testing the causal effect of product market competition on management quality (and firm performance) is confounded by the endogeneity of market structure. To address this we analyze the English public hospital sector where entry and exit are controlled by the central government. Because closing hospitals in areas where the governing party has a small majority ("marginals") is rare due to the fear of electoral defeat, we can use political contestability as an instrumental variable for the number of hospitals in a geographical area. We find that management quality - measured using a new survey tool - is strongly correlated with financial and clinical outcomes (such as survival rates from emergency heart attack admissions). We find that higher competition is positively correlated with management quality, and this relationship strengthens when we instrument the number of rival hospitals with whether these rivals are located in marginal districts. Adding a rival hospital increases management quality by 0.4 standard deviations and increases heart-attack survival rates by 9.5%. We confirm the validity of our IV strategy by conditioning on *own* hospital marginality and running a placebo test of marginality on schools, a public service where the central government has no formal influence.

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In the US, and almost every other nation, healthcare costs have been rapidly rising as a proportion of GDP (e.g. Hall and Jones, 2007). Since a large share of these costs are subsidized by the taxpayer, and this proportion is likely to increase in the US under planned healthcare reforms[1], there is great emphasis on improving efficiency. Given the large differences in hospital performance across a wide range of indicators, one route is through improving the management practices of hospitals.[2] Economists have long believed that competition is an effective way to improve management and therefore productivity. Adam Smith remarked "monopoly .... is a great enemy to good management".[3] But analyzing this relationship has been hampered by two factors: the endogeneity of market structure and credibly measuring management practices. In this paper we seek to address both of these problems.

To generate exogenous changes in market structure we exploit the fact that hospital exit and entry are strongly influenced by politics in publicly run healthcare systems. Closing a hospital in any system tends to be deeply unpopular. In publicly run systems like the UK National Health Service (NHS), political competition offers a potential instrumental variable. The governing party is deemed to be responsible for the NHS and voters tend to punish this party at the next election if their local hospital closes down.[4] There is anecdotal evidence that governments respond to this. For example, *The Times* newspaper (September 15th, 2006) reported that "*A secret meeting has been held by ministers and Labour Party officials to work out ways of closing hospitals without jeopardising key marginal seats*". Hospital openings and closures in the NHS are centrally determined by the Department of Health.[5] If hospitals are less likely to be closed in areas because these are politically

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[1] The Centres for Medicare and Medicaid Services estimates that the Federal share of healthcare expenditure will rise from 27% in 2009 to 31% in 2020. Including states and cities, the public sector will pay for nearly half of America's health care (see *The Economist* July 30th 2011 "Looking to Uncle Sam").

[2] There is substantial variation in hospital performance even for areas with a similar patient intake – e.g. Kessler and McClellan (2000), Cutler, Huckman and Kolstad (2009), Skinner and Staiger (2009) and Propper and Van Reenen (2010). This variation is perhaps unsurprising as there is also huge variability in productivity in many other areas of the private and public sector (e.g. Foster, Haltiwanger and Syverson, 2008 and Syverson 2011).

[3] *The Wealth of Nations*, Book 1, Chapter XI Part 1, p.148. There is a large theoretical and empirical literature on productivity and competition, for example see Nickell (1996), Syverson (2004), Schmitz (2005), Fabrizio, Rose and Wolfram (2007) and the recent survey by Holmes and Schmitz (2010).

[4] A vivid example of this was in the UK 2001 General Election when a government minister was overthrown by a politically independent physician, Dr. Richard Taylor, who campaigned on the single issue of "saving" the local Kidderminster Hospital (where he was a physician) which the government planned to scale down (see http://news.bbc.co.uk/1/hi/uk_politics/2177310.stm).

[5] Closures occur in the NHS because since the mid-1990s there has been a concentration of services in a smaller number of public hospitals. One factor driving this rationalization has been the increasing demand for larger hospitals due to the benefits from grouping multiple specialities on one-site (Hensher and Edwards, 1999), a process that has also led to extensive hospital closures in the US (Gaynor, 2004). Another factor has been the dramatic population growth in suburbs since World War II, far from the city centres where many hospitals were founded. The vast majority of hospital care in

marginal districts (“constituencies”), there will be a relatively larger number of hospitals in marginal areas than in areas where a party has a large majority. Similarly, new hospitals are more likely to be opened in marginal areas to obtain political goodwill. In equilibrium politically marginal areas should benefit from a higher than expected number of hospitals. Clear evidence for this political influence on market structure is suggested in Figure 1 which plots the number of hospitals per person in English political constituencies against the winning margin of the governing party (the Labour Party in our sample period). Where Labour’s winning margin is small (under 5 percentage points) there are about 10% more hospitals than when it or the opposition parties (Conservatives and Liberal Democrats) have a large majority (over 5 percentage points). To exploit this potential variation, we use the share of government-controlled (Labour) marginal constituencies as an instrumental variable for the numbers of competitors a hospital faces.[6] Using a geographically based definition of a hospital market, we can identify the political marginality of the markets of the hospital’s rivals. This will determine the number of rivals that the hospital faces.

A second problem in examining the impact of competition on management is measuring managerial quality. In recent work we have developed a survey tool for quantifying management practices (Bloom and Van Reenen, 2007; Bloom et al, 2009). The measures, covering incentives, monitoring, target-setting and lean operations, are strongly correlated with firm performance in the private sector. In this paper we apply the same basic methodology to measuring management in the healthcare sector. We implement our methods in interviews across 100 English acute (short term general) public hospitals, known as hospital trusts, interviewing a mixture of 161 clinicians and managers in two specialities: cardiology and orthopaedics. We cover 61% of all National Health Service providers of acute care in England.

We show that our management practice scores are correlated with better clinical quality, faster access and better financial performance. While not causal, this suggests that the management measure has informational content. We then examine the causal impact of competition on management quality and health outcomes using our political instrumental variables. We are careful to condition on a wide range of confounding influences to ensure that our results are not driven by other factors (e.g. hospital financial resources, different local demographics, the severity of patient

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the UK is provided in public hospitals. Private hospitals operate in niche markets, particularly the provision of elective services for which there are long waiting lists in the NHS.

[6] Each constituency returns a single member of parliament (MP) to the British House of Commons under a first past the post system. The party with a majority of MPs forms the government headed by the Prime Minister.

medical conditions, etc.). We find a significant and positive impact of greater local hospital competition on management practices.

Our instrument is valid as long as political competition has no direct impact on the quality of management. But in marginal constituencies politicians might increase the financial resources of the local hospitals, or try to put direct pressure onto managers to improve performance. However, in England, the first route is less likely. Health care funding is allocated to a local area rather than to hospitals, and the allocation is on a per capita basis and by means of a formula based on local need for health care which does not change with the electoral cycle.[7] We test for, and find no evidence for, the impact of political marginality on financial resources of the hospital. To investigate the second route - direct political pressure through non-financial means - we present two pieces of evidence. First, we exploit the fact that it is political marginality around *rival* hospitals' patient catchment areas that determines the number of competitors a hospital faces. Although this overlaps with the hospital's own exposure to political marginality, the overlap is not 100%. So we can include hospital own-political marginality as an additional control even when using our IV, which is the marginality of rival hospitals. Our results are robust to this experiment.

As a second test of the validity of the political instrument, we run a placebo test on state secondary schools in the UK (these take children from the ages of 11 to 18 so are like combined middle and high schools in the US). Unlike hospitals, school entry and exit is determined by the Local Education Authority (LEA) rather than by the central government. This means that national political marginality should have no impact on school openings and closures. However, since schooling has a high profile on the national political agenda, if national politicians could have a way of influencing outcomes at local level they will try to do this for schools located in marginal political districts (as well as hospitals). Reassuringly, we find that neither school numbers, expenditure or test scores are boosted by political marginality, suggesting that increased hospital numbers is the key channel from political marginality to improved performance.

Why should competition improve management practices in hospitals? The obvious mechanism that we model in the next section is simply through competition for patients. In the UK when a General Practitioner (the local "gatekeeper physician" for patients) refers a patient to a hospital for treatment

[7] The key components of the "resource allocation" formula are local area population, demographics and socio-economic status. The formula is revised infrequently and revision dates do not coincide with national elections.

she has the flexibility to refer the patient to any local hospital. Having more local hospitals gives greater choice for General Practitioners and so greater competition for hospitals. Since funding follows patients in the NHS, hospitals are keen to win patient referrals as this has private benefits for senior managers (e.g. better pay and conditions), and reduces the probability that they will be fired. Reforms in the early 1990s ("the Internal Market") and in the 2000s (under Tony Blair) strengthened these incentives. Recent research suggests that competition through patient choice has improved performance. Gaynor et al (2010) look at hospital quality before and after the introduction of greater patient choice in England. They find that hospitals located in areas with more local rivals responded by improving quality to a greater extent than those in less competitive areas. This suggests that the mechanism we identify is operating through greater demand sensitivity translating into sharper managerial incentives to improve.

A second possible mechanism is yardstick competition: with more local hospitals CEO performance is easier to evaluate because yardstick competition is stronger. The UK government actively undertakes yardstick competition, publishing summary measures of performance on all hospitals and punishing managers of poorly performing hospitals by dismissal (Propper et al, 2010).

Our paper contributes to the literature on competition in healthcare. Policymakers in many countries have experimented with various ways of increasing effective competition in healthcare to increase productivity. There is no consensus on the effects of competition on hospital performance. Our paper contributes to a more positive assessment of the role of competitive forces in healthcare and perhaps more widely in the public system (e.g. schools).[8]

Our work also relates to the literature on the effect of the political environment on economic outcomes. In a majoritarian system, such as the British one, politicians pay greater attention to areas where there is more uncertainty about the electoral outcome, attempting to capture undecided voters in such "swing states". Papers looking at electoral issues, such as List and Sturm (2006) examining environmental policy at the US state level, typically find that when election outcomes are more uncertain politicians target marginal areas to attract undecided voters.[9]

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[8] Positive assessments are also found in Kessler and McClellan (2000) for the US and Gaynor et al (2010) and Cooper et al (2011) for England. Overall, the evidence on competition in healthcare is mixed – for overviews see Dranove and Satherthwaite (2000), Gaynor and Haas-Wilson (1999) and Gaynor (2006).

[9] See also, for example, Persson and Tabellini (1999) and Milesi-Ferretti et al (2002) who show that politicians target different groups depending on political pressures, Nagler and Leighley (1992) and Stromberg (2008) who establish

The structure of the paper is as follows. The next section presents a simple model, Section II discusses the data, Section III describes the relationship between hospital performance and management quality, Section IV analyzes the effect of competition on hospital management, Section V discusses our placebo test on school and Section VI concludes.

I. A SIMPLE MODEL OF MANAGERIAL EFFORT AND COMPETITION

We first explore a simple model which reflects key features of the market we will examine in the empirical section. Consider the problem of the CEO running a hospital where price is nationally regulated and there are a fixed number of hospitals. She obtains utility (U) from the net revenues of the hospital (which will determine her pay and perks) and the costs of her effort, e. By increasing effort the CEO can improve hospital quality (z) and so increase demand, so $z(e)$ with $z'(e) > 0$. Total costs are the sum of variable costs, $c(q,e)$ and fixed costs F.

The quantity demanded of hospital services is $q(z(e), S)$ which is a function of the quality of the hospital and exogenous factors S that include market size, demographic structure, average distance to hospital, etc. We abbreviate this to $q(e)$. Note that there are no access prices to the NHS so price does not enter the demand function and there is a fixed national tariff p, paid to the hospital for different procedures

As is standard, we assume that the elasticity of demand with respect to quality (η_z^q) is increasing with the degree of competition (e.g. the number of hospitals in the local area, N). A marginal change in hospital quality will have a larger effect on demand in a more competitive marketplace because the patient is more likely to switch to another hospital. Since quality is an increasing function of managerial effort, this implies that the elasticity of demand with respect to effort (η_e^q) is also increasing in competition, i.e. $\frac{\partial \eta_e^q}{\partial N} > 0$. This will be important for the results.

Given this set-up the CEO chooses effort, e, to maximize:

$$U = pq(e) - c(q(e), e) - F \tag{1}$$

empirically that candidates allocate relatively more of their election campaign resources to swing states, and Clark and Milcent (2008) who show the importance of political competition in France for healthcare employment.

The first order condition can be written:

$$p\frac{\partial q}{\partial e} - \left(\frac{\partial c}{\partial q}\frac{\partial q}{\partial e}\right) - \frac{\partial c}{\partial e} = 0 \quad (2)$$

This can be re-arranged as:

$$\frac{e}{q} = \left(\frac{p-c_q}{c_e}\right)\eta_e^q(N) \quad (3)$$

Where $c_q = \frac{\partial c}{\partial q} > 0$, is the marginal cost of output and $c_e = \frac{\partial c}{\partial e} > 0$, is the marginal cost of effort. The managerial effort intensity of a firm (*e/q*) is increasing in the elasticity of output with respect to effort so long as price-cost margins are positive. Since effort intensity is higher when competition is greater (from $\frac{\partial \eta_e^q}{\partial N} > 0$), *this establishes our key result that managerial effort will be increasing in the degree of product market competition*. The intuition is quite standard – with higher competition the stakes are greater from changes in relative quality: a small change in managerial effort is likely to lead to a greater loss of demand when there are many hospitals relative to when there is monopoly. This increases managerial incentives to improve quality/effort as competition grows stronger[10].

Price regulation is important for this result (see Gaynor, 2006). Usually the price-cost margins $(p - c_q)$ would decline when the number of firms increases which would depress managerial incentives to supply effort. In most models this would make the effects of increasing competition ambiguous: "stakes" are higher but mark-ups are lower (a "Schumpeterian" effect).[11]

II. DATA

The data used for the analysis is drawn from several sources. The first is the management survey conducted by the Centre for Economic Performance at the London School of Economics, which includes 18 questions from which the overall management score is computed, plus additional information about the process of the interview and features of the hospitals. This is complemented by external data from the UK Department of Health and other administrative datasets providing

[10] From equation (3) we also have the implication that managerial effort is increasing in the price-cost margin and decreasing in the marginal cost of effort, which is intuitive.
[11] For example, Raith (2003), Schmidt (1997) or Vives (2008).

information on measures of quality and access to treatment, as well as hospital characteristics such as patient intake and resources. Finally, we use data on election outcomes at the constituency level from the British Election Study. Descriptive statistics are in Table 1, data sources in Table B1 and further details in the Data Appendix.

II.A. Management Survey Data

The core of this dataset is made up of 18 questions which can be grouped in the following four subcategories: operations (3 questions), monitoring (3 questions), targets (5 questions) and incentives management (7 questions). For each one of the questions the interviewer reports a score between 1 and 5, a higher score indicating a better performance in the particular category. A detailed description of the individual questions and the scoring method is provided in Appendix A.[12]

To try to obtain unbiased responses we use a *double-blind* survey methodology. The first part of this was that the interview was conducted by telephone without telling the respondents in advance that they were being scored. This enabled scoring to be based on the interviewer's evaluation of the hospital's actual practices, rather than their aspirations, the respondent's perceptions or the interviewer's impressions. To run this "blind" scoring we used open questions (i.e. "can you tell me how you promote your employees"), rather than closed questions (i.e. "do you promote your employees on tenure [yes/no]?"). Furthermore, these questions target actual practices and examples, with the discussion continuing until the interviewer can make an accurate assessment of the hospital's typical practices based on these examples. For each practice, the first question is broad with detailed follow-up questions to fine-tune the scoring. For example, question (1) *Layout of patient flow* the initial question is "Can you briefly describe the patient journey or flow for a typical episode?" is followed up by questions like "How closely located are wards, theatres and diagnostics centres?".

The second part of the double-blind scoring methodology was that the interviewers were not told anything about the hospital's performance in advance of the interview. This was collected post interview from a wide range of other sources. The interviewers were specially trained graduate students from top European and US business schools. Since each interviewer also ran 46 interviews on average we can also remove interviewer fixed effects in the regression analysis.

[12] The questions in Appendix A correspond in the following way to these categories. Operations: questions 1-3, Monitoring: questions 4-6, Targets: questions 8-12, Incentives management: questions 7 and 13-18.

Obtaining interviews with managers was facilitated by a supporting letter from the Department of Health, and the name of the London School of Economics, which is well known in the UK as an independent research university. We interviewed respondents for an average of just under an hour. We approached up to four individuals in every hospital – a manager and physician in the cardiology service and a manager and physician in the orthopaedic service (note that some managers may have a clinical background and we control for this). There were 164 acute hospital trusts with orthopaedics or cardiology departments in England when the survey was conducted in 2006 and 61% of hospitals (100) responded. We obtained 161 interviews, 79% of which were with managers (it was harder to obtain interviews with physicians) and about half in each speciality. The response probability was uncorrelated with observables such as performance outcomes and other hospital characteristics (see Appendix B). For example, in the sixteen bivariate regressions of sample response we ran only one was significant at the 10% level (expenditure per patient).

Finally, we also collected a set of variables that describe the process of the interview, which can be used as "noise controls" in the econometric analysis. These included the interviewer fixed effects, the occupation of the interviewee (clinician or manager) and her tenure in the post.

II.B. Hospital Competition

Since patients bear costs from being treated in hospitals far from where they live, healthcare competition always has a strong geographical element. Our main competition measure is simply the number of other public hospitals within a certain geographical area. In our baseline regression we define a hospital's catchment area as 15km. 15km is a sensible baseline as, in England, the median distance travelled by patients for care is just above 15km (Propper et al, 2007). We are careful to show that our results are robust to reasonable changes in the 15km radius definition. Given this 15km catchment area, any competing hospital that is less than 30km away will have a catchment area that overlaps to some extent with the catchment area of the hospital in question. We therefore use the number of competing hospitals within a 30km radius, i.e. twice the catchment area, as our main measure of competition.[13] Figure 2 illustrates graphically the relationship between the catchment area radius and the area over which the competition measure is defined.

[13] We use the number of public hospitals, as British private hospitals generally offer a very limited range of services (e.g. they do not have Emergency Rooms). Including the number of private hospitals as an additional control does not change our main results.

We also present estimates based on alternative measures of competition based on the Herfindahl index (HHI) that takes into account the patient flows across hospitals. Such a measure has two attractive features: first, we take asymmetries of market shares in to account and second, we can construct measures which do not rely on assuming a fixed radius for market definition. From hospital discharge data (Health Episodes Data, HES) we know both where a patient lives and which hospital she uses, so we can construct an HHI for every area and weight a hospital's aggregate HHI by its share of patients from every area. The serious disadvantage of an HHI, however, is that market shares are endogenous as more patients will be attracted to hospitals of higher quality. We try to address this problem following Kessler and McClellan (2000) by using only *predicted* market shares based on exogenous characteristics of the hospitals and patients (such as distance and demographics). Appendix B details this approach which implements a multinomial logit choice model using 6.5 million records 2005-2006. Using predicted market shares is an improvement but the choice specification does rely on some strong functional form assumptions. Furthermore, it does nothing to deal with the deeper problem that the number of hospitals may itself be endogenous. So although we present experiments with the HHI measure, we focus on our simpler and more transparent count-based measures of competition.

II.C Political marginality

We use data on outcomes of the national elections at the constituency level from the British Election Study. We observe the vote shares for all parties and use these to compute the winning margin. We define a constituency to be marginal if the winning margin is below 5% (we also show robustness to other thresholds). Based on our definition of the catchment area, we construct our measure of marginality. All constituencies within the 30km area over which our competition measure is constructed could be relevant their voters are potentially affected. Therefore a constituency that lies up to 45km away from the hospital matters, as it lies within the catchment area (15km) of a potential competitor hospital that lies up to 30km away. Our baseline measure of political contestability is therefore defined to be the share of marginal constituencies within a 45km radius of the hospital. Figure 3 illustrates graphically the relationship between the catchment area (15km radius), the area used for the competition measure (30km radius) and our marginality measure (45km radius).

There are three main parties in the UK (Labour, Conservative and Liberal Democrat). We distinguish between marginal constituencies which were controlled by the governing party and opposition parties. We test and confirm that the strongest effects are in the Labour controlled marginal seats.[14] Our key instrumental variable is therefore the lagged (1997) share of Labour marginal constituencies, defined as constituencies where Labour won but by less than 5 percentage points. We use lagged marginality to reduce the problem of closures leading to marginality though similar results occur if we use a definition of marginality from later elections. [15]

II.D. Hospital Performance Data

Productivity is difficult to measure in hospitals, so regulators and researchers typically use a wide range of measures.[16] We use measures of clinical quality, access, staff satisfaction and financial performance. The clinical outcomes we use are the in-hospital mortality rates following emergency admissions for (i) AMI (acute myocardial infarction) and (ii) surgery.[17] We choose these for four reasons. First, regulators in both the US and the UK use selected death rates as part of a broader set of measures of hospital quality. Second, using emergency admissions helps to reduce selection bias because elective cases may be non-randomly sorted among hospitals. Third, death rates are well recorded and cannot be easily "gamed" by administrators trying to hit government-set targets. Fourth, heart attacks and overall emergency surgery are the two most common reasons for admissions that lead to deaths.

As another quality marker we use MRSA infection rates.[18] As a measure of access to care we use the size of the waiting list for all operations (long waits have been an endemic problem of the UK NHS and of considerable concern to the general public, Propper et al, 2010). We use the hospitals' operating margin as a measure for their financial efficiency and the average intention of staff intending to leave in the next year as an indication of worker job satisfaction. Finally, we use the UK Government's Health Care Commission ratings which represent a composite performance measure

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[14] There are two reasons for this. First, Labour was the party in power so hospital closures were politically more associated with their Members of Parliament. Second, this period coincided with Tony Blair's honeymoon period in power in which Labour's popularity was at an all time high, so its marginals were more at risk than opposition marginals as Labour's vote share trended downwards as its early popularity eroded.

[15] The reason is Labour's polling rating were relatively constant from the mid-1990s after Tony Blair took over as leader in 1994, through the 1997 and 2001 elections (majorities of 167 and 179 seats respectively), until the mid-2000s after the electorally unpopular invasion of Iraq.

[16] See for example http://2008ratings.cqc.org.uk/findcareservices/informationabouthealthcareservices.cfm

[17] Examples of the use of AMI death rates to proxy hospital quality include Kessler and McClellan (2000), Gaynor (2004) and, for the UK, Propper et al (2008) and Gaynor et al (2010). Death rates following emergency admission were used by the UK regulator responsible for health quality in 2001/2.
http://www.performance.doh.gov.uk/performanceratings/2002/tech_index_trusts.html

[18] MRSA is Methicillin-Resistant Staphylococcus Aureus (commonly known as a hospital "superbug"). This is often used as a measure of hospital hygiene.

across a wide number of indicators. The Health Care Commission rates hospitals along two dimensions of "resource use" and "quality of service" (measured on a scale from 1 to 4).

II.E. Other Controls

We experiment with different sets of controls. Throughout the regressions we include patient case-mix by using the age/gender profile of total admissions at the hospital level (22 groups)[19]; and to control for demand we proxy the health of the local population by the age-sex distribution (11 groups) and population density. We also condition on hospital size, "Foundation Trust" status (these have greater autonomy), and "noise" controls (interviewer dummies and interviewee tenure). We also present regressions with more general controls such as a teaching-hospital dummy, a London dummy, skills (proxied by the proportion of managers with clinical degrees) and political variables (see below).

II.F Preliminary Data Analysis

The management questions are all highly correlated (see Bloom and Van Reenen, 2007) so we usually aggregate the questions together either by taking the simple average (as in the figures) or by z-scoring each individual question and then taking the z-score of the average across all questions (in the regressions).[20]

Figure 4 divides the Health Care Commission (HCC) hospital performance score into quintiles and shows the average management score in each bin. There is a clear upward sloping relationship with hospitals that have higher management scores also enjoying higher HCC rankings. Figure 5 plots the entire distribution of management scores for our respondents. There is a large variance with some well managed firms, and other very poorly managed firms[21].

[19] Specifically we have 11 age categories for each gender (0-15, 16-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80, 81-85, >85), so up to 22 controls. These are specific to the condition in the case of AMI and general surgery. For all other performance indicators we use the same variables at the hospital level. Propper and Van Reenen (2010) show that in the English context the age-gender profile of patients does a good job of controlling for case-mix.

[20] z-scores are normalized to have a mean of zero and a standard deviation of one. Factor analysis confirms that there is one dominant factor that loads heavily and positively on all questions. As with earlier work (Bloom and Van Reenen 2007), there is a second factor that loads positively on the incentives management questions, but negatively on the monitoring/operations questions. This suggests that there is some specialization across hospitals in different forms of management.

[21] Using the 16 common questions with the manufacturing survey we found that the average public sector UK hospital was significantly worse managed than the average private sector UK manufacturing firm.

III. HOSPITAL PERFORMANCE AND MANAGEMENT PRACTICES

Before examining the impact of competition on management practices we undertake two types of data validation test. The first involves running a second independent interview, with a different interviewer speaking to a different manager (or physician) at the same hospital. We find that these independently run first and second interviews have a correlation in their average management scores across the 18 questions of 0.530 (p-value 0.001), as plotted in Appendix Figure A1. While this correlation is less than unity, implying some variation in management practices across managers and/or measurement error in the survey instrument, it is also significantly greater than zero suggesting our survey is picking up consistent differences in practices across hospitals.

The second data validation test is to investigate if the management score is robustly correlated with external performance measures. This is not supposed to imply any kind of causality. Instead, it merely serves as another data validation check to see whether a higher management score is correlated with a better performance. We estimate regressions of the form:

$$y_j^P = \alpha_1 M_{jg} + \alpha_2' x_{jg} + u_{jg}$$

where y_j^P is performance outcome *P* (e.g. AMI mortality) in hospital *j*, M_{jg} is the average management score of respondent *g* in hospital *j*, x_{jg} is a vector of controls and u_{jg} the error term. Since errors are correlated across respondents within hospitals we cluster our standard errors at the hospital level.[22] We present some results disaggregating the 18 questions, but our standard results simply z-score each individual question, average these into a composite and then z-score this average. In terms of timing, we use the 2005/6 (average) outcomes to be consistent with the management survey.

Table 2 shows results for regressions of each of the performance measures on the standardized management score. The management score in the top row (A) is calculated over the 18 survey questions. The other rows show results based on the four different categories of questions. Looking across the first row higher management scores are associated with better hospital outcomes across all the measures, and this relationship is significant at the 10% level or greater in 6 out of 8 cases. This immediately suggests our measure of management has informational content.

[22] We weight the observations with the inverse of the number of interviews conducted at each hospital. This gives equal weight to each hospital in the regressions.

Looking in more detail, in the first column of Table 2 we present the AMI mortality rate regressed on the management score controlling for a wide number of confounding influences.[23] High management scores are associated with significantly lower mortality rates from AMI - a one standard deviation increase in the management score is associated with a reduction of 0.76 percentage points in the rate of AMI mortality (or a fall in 4.5% over the mean AMI mortality of 17.08%). Since there are 58,500 emergency AMI admissions in aggregate this corresponds to 445 less deaths a year. Column (2) examines death rates from all emergency surgery (excluding AMI) and again shows a significant correlation with management quality.[24] Columns (3) and (4) show that better managed hospitals tend to have lower waiting lists and lower MRSA infection rates, although the results are not statistically significant. The financial performance measured by the hospital's operating margin is significantly higher when hospitals have higher management scores in column (5).[25] Column (6) indicates that higher management scores are also associated with job satisfaction (a lower probability of the average employee wanting to leave the hospital). In the final two columns we use composite measures from the Health Care Commission (HCC) and compute a "pseudo HCC rating" by attempting to reverse engineer the process by which the original rating was calculated (see Appendix B). The management practice score is significantly and positively correlated with both of these measures.

Panels B-E of Table 2 repeats the exercise using the different categories of management practice questions, where each row is an individual regression. The results are very similar although the coefficients are less precisely estimated.[26] Different categories are more strongly correlated with different performance measures in an intuitive way. For example "Lean Operations" is the category that has the most explanatory power for the operating margin. "Incentives Management" has a stronger association than any other category on the staff's intention to leave the job.

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[23] As is standard we drop observations where the number of cases admitted for AMI is low because this leads to large swings in observed mortality rates. Following Propper and Van Reenen (2010) we drop hospitals with under 150 cases of AMI per year, but the results are not sensitive to the exact threshold used.

[24] We exclude two specialist hospitals from this regression as they are difficult to compare to the rest in terms of all emergency admissions.

[25] The operating margin is influenced by both revenue and costs per spell. As the revenue side is fixed (hospitals receive a fixed national payment per type of case, known as Payment by Results and similar to the US fixed payment per DRG system), the operating margin is effectively a measure of (lower) costs.

[26] This suggests that averaging over different questions helps to reduce noise. We also examined decomposing the management score even further. When regressing the scores for individual questions on the HCC rating, 5 out of 18 questions are significant at the 10% level and of these 4 are significant at the 5% level.

Overall, Table 2 is reassuring as our measure of management practices is positively associated with superior hospital outcomes across a wide range of performance indicators.

IV. MANAGEMENT PRACTICES AND HOSPITAL COMPETITION

In order to analyze the impact of competition on the quality of management, we estimate:

$$M_{jg} = \beta_1 COMP_j + \beta_2 ' x_{jg} + \varepsilon_{jg}$$

where M_{jg} is the average management score in hospital *j* of respondent *g* (recall that we have a mean of 1.65 respondents per hospital), *COMP* is a measure of competition, x_{jg} is a vector of controls (most of which are *j*-specific not *jg*-specific) and u_{jg} is the error term. Although entry and exit is governed by the political process rather than by individual firms, hospital numbers are still potentially endogenous as the government may choose to locate more hospitals in an area based on unobservable characteristics, which might be correlated with management quality. For example, assume there are more hospitals in "sicker" areas (e.g. with older, poorer populations). If these neighborhoods are less attractive to good quality managers *and* we do not fully capture this health demand with our (extensive) controls, this will generate a spuriously negative relationship between $COMP_j$ and management quality, biasing the coefficient β_1 downwards. Another reason for downward bias is reverse causality. Closure is economically and politically easier to justify if patients have a good substitute due to the presence of a neighbouring well managed hospital. Because of this, a higher management score would generate a lower number of competing hospitals, just as in the standard model in industrial organization where a very efficient firm will tend to drive weaker firms from the market (e.g. Demsetz, 1973). Some biases could also work in the opposite direction – for example if there are more hospitals in areas where the population are "health freaks" (e.g. San Francisco) then this will cause an upwards bias on β_1.

So, ultimately the direction of bias is an empirical issue. To address endogeneity we use the political instrumental variable described above - the degree to which the hospitals' competitors are located in politically marginal constituencies held by the governing Labour party.

IV.A Basic Results

To investigate whether competition improves management practices, column (1) of Table 3 presents an OLS regression (with very few controls) of management on the number of rivals that could serve a hospital's geographical catchment area. There is a positive and significant coefficient on this competition measure. Adding one rival hospital is associated with an increase in management quality of 0.118 of a standard deviation. The key set of controls is the case-mix of inpatients treated at the hospital and population density, as areas with greater demographic needs (e.g. more older people) tend to have more hospitals.[27] Dropping hospital size as measured by the number of patients made little difference to the results.[28]

These baseline estimates use a very simple measure of competition, the number of competing hospitals within a fixed radius of 30km. We experiment with alternatives based on the (predicted as discussed above) Herfindahl Index (HHI). Columns (1) and (2) of Table B3 repeat the baseline specification with and without a large set of controls. Column (3) and (4) show that the fixed radius Herfindahl index is negatively and significantly related to management quality. Columns (5) and (6) repeat these specifications for an HHI based on predicted patient flows and also show a negative correlation of market concentration with management scores.[29]

Having shown that there is a robust positive correlation between management quality and various measures of competition we return to Table 3 to examine whether this is a causal relationship. Column (2) reports the first stage indicating that the share of Labour-controlled local marginal constituencies (within a 45km radius) is highly significant in explaining increased total number of hospitals. Consistent with Figure 1, a one standard deviation increase in political marginality (0.109) leads to almost 1.8 additional hospitals (1.762 = 0.109*16.172). Column (3) shows the IV results where there is still a positive effect of the number of local hospitals on management quality that is significant at the 10% level.

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[27] Without the 22 case mix controls the coefficient on competition drops to 0.063 with a standard error of 0.059, which is consistent with the idea of a downward bias resulting from failing to control for demographic demands.

[28] Dropping the number of patients caused the coefficient on competition to change from 0.118 to 0.117 (standard error= 0.057). Similarly, dropping the number of sites left the coefficient and standard error unaltered. The theoretical model of Section 1 delivered the result that competition should increase managerial effort and quality conditional on size which is why we include size as a basic control, but one could worry about size being endogenous. It is therefore reassuring that we can drop the size variables with no change to the results.

[29] The impact of the predicted patient flow HHI is significant only in the case of few control variables (column (5)).

The specification in columns (1) to (3) contains only basic controls (population density and area age/gender-profile, patient case-mix and hospital size/type), so a concern is that the relationship is driven by omitted variables. In columns (4) to (6) we include a richer set of covariates including dummies for teaching hospital, location in London, the share of Labour votes and the identity of the winning party and other variables as discussed in section I.D.[30] The full set of coefficients is presented in column (1) of Table B4. The coefficients on our key variables are little changed by these additional covariates and, in fact, the second stage coefficient on competition in column (6) is 0.443, a bit stronger than in column (3). We also examined adding higher order controls for Labour's vote share or dropping Labour's vote share completely with robust results.[31]

The IV estimate of competition is considerably larger than the OLS estimate. Some of this might be due to attenuation bias or a LATE interpretation. More obviously, there may be omitted variables (some unobserved factors that increase demand for health that make an area less attractive to high quality managers) or reverse causality as discussed in the previous sub-section.

Although our focus here is on the impact of competition on management quality, we also consider the impact on more direct measures of hospital performance. One key indicator of hospital quality is the mortality rate from emergency AMIs. We present OLS results in column (7) which indicates that hospitals facing more competition have significantly fewer deaths.[32] Columns (8) and (9) use our IV strategy and indicate that there appears to be a causal effect whereby adding one extra hospital in the neighborhood reduces death rates in rival hospitals by 1.63 percentage points (or 9.5%).

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[30] The set of control variables used in this specification is identical to the ones used in Table 2, except for the additional controls for area demographics and population density. We experimented with including a set of further regional dummies, but these were jointly insignificant at the 5% level. Including the total mortality rate in the hospital's catchment area was also insignificant with a coefficient (standard error) of 0.004 (0.004) in column (6) with a coefficient (standard error) of competition of 0.47 (0.188). This implies our case mix controls do a good job at controlling for co-morbidity.

[31] Using a squared and a cubic term for Labour's vote share in addition to the linear one leads to a coefficient (standard error) on competition of 0.444 (0.166). Dropping the Labour vote share completely yields a coefficient of 0.432 (0.167). We also run the first stage of our IV specification using the number of private hospitals as dependent variable. We find that marginality is insignificant in this case. This constitutes another piece of evidence that our marginality measure is not picking up unobserved area health status.

[32] Running the same OLS regressions, but using each of the other seven performance outcomes in Table 2 as a dependent variable, reveals that competition is associated with better performance in every case. However, competition is only significant for AMI mortality rates.

IV.B Validity of the marginality instrument

A threat to our political instrument for competition is that it is correlated with some factors that could lead directly to better management. This might be due to omitted variables, or it might be because politicians find other routes to improve management practices directly other than via market structure.

First, Table B5 shows the correlation of marginal constituencies with other demographic features of the area. Each cell in column (1) is from a bivariate regression where the dependent variable is an area characteristic (as noted in the first column) and the right hand side variable is the Labour marginality instrument. It is clear from the reported coefficient on Labour marginality that these areas are more likely to have higher rates of employment and fewer people with long-term illness. However, our management regressions control for population density so column (2) reports the coefficients on Labour marginality after conditioning on the age profile and population density controls. We can see from this that only one variable of the twenty considered ("fraction of population that does not work") remains significant. However, when we re-ran the management regressions including fraction non-working, the fraction non-working is not significant in OLS, first stage or IV and the competition variable remains significant.[33]

Secondly, it is possible that marginality is associated with higher funding for healthcare. This should not be the case as health funding (all from general taxation) is allocated on a per capita basis and is a separate process from hospital exit and entry, so there is no automatic association between funding and marginality. The public purchasers of health care cover a defined geographical area and are allocated resources on the basis of a formula that measures need for healthcare (essentially, the demographics and the deprivation of the area the hospital is located in). The purchasers use these resources to buy healthcare from hospitals, at fixed national prices, for their local population. Purchasers do not own hospitals and are not vertically integrated with hospitals. This system is intended to ensure resources are neither used to prop up poorly performing local hospitals nor are subject to local political influence. However, it is possible that lobbying by politicians could distort the formal system.

[33] We also estimated specifications which include further control variables (results are not reported but available on request): total mortality rate in the area, a dummy for whether a hospital is a specialist hospital, total hospital employment, the number of acute beds, the number of medical staff and doctor vacancy rates. These variables were insignificant and the competition results are not sensitive to including them.

To test any possible impact of marginality on hospital funding, we report in Table 4 column (2) a regression of expenditure per patient on marginality and find no significant effect.[34] We also add expenditure per patient into our main IV regressions. The coefficient for this variable is insignificant in both first and second stages and does not alter the coefficient on competition – see column (3). We also control for the age of the hospitals' buildings to test whether marginal constituencies receive more resources in terms of newer capital equipment. In fact we find the contrary to be true: in marginal constituencies hospital buildings tend if anything to be older, presumably because hospital closures are rarer. [35]

A third approach to the problem is more direct. Although one might worry that the political environment in the *hospital's own catchment area* influences its management score, the political environment in the hospital's *competitors' catchment areas* instead should not have any direct impact on the quality of management. Our baseline definition of a 15km catchment area leads us to use fraction of Labour marginals within a 45km radius.[36] We are therefore able to control for the political contestability in the hospital's own catchment area, while simultaneously using the political contestability in the area that affect its competitors as an instrument. In other words, we use the fraction of Labour marginals both within a 15km radius (own catchment area) and a 45km radius (competitors' catchment areas) in the first stage, but only exclude the latter from the second stage. By controlling for political marginality in the hospital's own catchment area we effectively rule out the problem that our instrument is invalid because it is correlated with an unobservable factor within the hospital's catchment area (such as omitted demographic variables) correlated with management quality. Figure 6 illustrates the approach graphically. Essentially, we only use marginality in constituencies that are far enough away not to influence the hospital itself, but near enough to still have an impact on its competitors.

Column (4) of Table 4 presents the alternative first stage where we include both political marginality around rivals (the standard IV) and also the political marginality around the hospital (the new variable). As expected, marginality around rivals significantly increases their numbers, whereas political marginality around the hospital itself has no effect. Column (5) presents the second stage.

[34] Note that column (1) contains our baseline results from column (6) of Table 3.
[35] Including building age, the coefficient (standard error) on the number of hospitals is 0.423 (0.170) and the first stage coefficient on the marginality variable 19.170 (4.157).
[36] The logic of how the 45km radius for marginality follows from the 15km radius of the catchment area was presented in Section II.C and Figures 2 and 3.

Competition still has a positive and significant impact on management quality although the coefficient falls from 0.44 to 0.30. The coefficient on marginality around the hospital itself is positive but insignificant in this second stage.

In Section V we present a final test of the validity of our instrumentation strategy by examining an alternative public service – schools – that national politicians would presumably like to influence if they could, but institutionally should not be able to. If we obtain an effect of marginality on schools this placebo test would indicate a problem with our identification strategy.

IV.C. Robustness tests of the positive effect of competition on hospital performance

In this sub-section we look at several alternative explanations for our results and argue that none of them can fully account for the previous findings. Rather than proxying product market competition, larger numbers of hospitals may reflect a more attractive labor market for medical staff. It is not *a priori* clear why this should be the case, in particular because we control for population density in our main specification. Nevertheless, as a test of this hypothesis, we include as a control the proportion of teaching hospitals. A high share of teaching hospitals serves as a proxy for a local labour market with better employment opportunities for high quality medical staff. In column (6) of Table 4 we show results for the IV regression of management quality on the number of competing hospitals when also controlling for the fraction of teaching hospitals. The coefficient on our measure of competition is unchanged and the fraction of teaching hospitals has no significant impact.

Having multiple hospitals in the same area may reduce the pressure on managers and physicians so that they can improve management practices. In this case, it is capacity rather than competition causing improvements in management. We investigate this empirically by using two types of capacity controls: the number of physicians per patient in the area and the number of beds per patient in the area. When we include physicians in the IV-regression in column (7), we find that our results are robust to the inclusion of this additional control variable, and capacity constraints have no significant impact on management.[37] We find very similar results when using the number of beds per patient as control for capacity.[38]

[37] Weakening time pressure has ambiguous effects on management practices as it could lead to slack (Bloom and Van Reenen, 2010).
[38] In the second stage of the IV, the coefficient (standard error) on the number of beds per patient is 17.239 (11.699). The coefficient (standard error) on the competition measure is 0.481 (0.180).

A related concern is that areas which experience more hospital closures suffer from disruption because incumbent hospitals face unexpected patient inflows. Hospitals with a high number of marginal constituencies nearby might therefore be able to improve their management quality as they operate in a more stable environment. We test this by including the growth in admissions from 2001 through 2005 into the regression in column (8) of Table 4. We find no evidence for an impact of the change in admission rates on the quality of management. The coefficient on competition remains significant, with a very similar magnitude.[39]

A further concern with the instrument might be that the lower risk of a hospital being closed down in a marginal constituency may *decrease* managerial effort because the CEO is less afraid of losing his job (e.g. the "bankruptcy risk" model of Schmidt, 1997). This mechanism is unlikely to be material in the NHS because hospital closure is relatively rare compared to a high level of managerial turnover. In the context of our set-up, the bankruptcy risk model still implies that marginality would cause a greater number of hospitals, but this would be associated with a *decrease* in management quality. In fact, we find the opposite: managerial quality increases with the number of hospitals. Furthermore, looking at the reduced form, management quality is higher in areas where there is greater political competition, implying that the bankruptcy risk model is unlikely to be empirically important in our data.[40]

Finally, as noted earlier, none of the qualitative results depend on the precise thresholds used for the definition of political marginal. Figure 7 shows the results from varying the baseline 15km catchment area in 1km bands from 10km to 25km. The coefficient on the marginality variable in the first stage is robustly positive and significant with a maximum at around 24km. In terms of the second stage we show that using a 10km catchment area instead of the baseline 15km shows slightly stronger results in column (9) of Table 4: a coefficient (standard error) on competition of 0.538 (0.188). Using a 20km catchment area generates a coefficient (standard error) on competition of 0.516 (0.207) in column (10).

[39] We repeated the same exercise using the variance in yearly admissions over the same time period as an alternative measure of shocks originating from fluctuations in admissions. Again the variable was insignificant and the competition coefficient remained positive and significant.

[40] There is a coefficient (standard error) on political marginality of 7.661 (2.796) in the reduced form regression with management as the dependent variable – see Table B4 column (2).

Figure 8 shows how the first stage changes when we vary the precise value of the threshold that defines marginality from 1 percentage point to 10 percentage points (instead of our baseline 5 percentage points). Unsurprisingly, the point estimate is strongest when we choose a value of 1%, but we still obtain a (weakly) significant effect even at 7%. Looking at the second stage in Table 4, if we use a 3% threshold for marginality (column (11)) the coefficient (standard error) on competition is 0.303 (0.143). Increasing it to 7% (column (12)) raises the coefficient (standard error) on competition to 0.760 (0.327).

V. A PLACEBO TEST USING SECONDARY SCHOOLS

As a final test of our identification strategy we compare the impact of political marginality on secondary (combined middle and high) schools to hospitals. The public schools sector has many institutional features that are similar to hospitals as they are free at the point of use, CEOs (principals) receive more resources depending on the number of students they attract and the funding formula is transparent and (in theory) not open to manipulation depending on political marginality status. Unlike hospitals, however, school closure decisions are left to the Local Education Authority (LEA), which decides primarily on financial grounds given per capita pupil funding. Other things equal, the Government would like better public schools in marginal political districts, so if they were able to exert influence in other ways we should also expect to see better school outcomes in marginal districts. Therefore, by comparing the impact of political marginality on outcomes in schools we can evaluate whether marginality is generating some other positive effect on public services (presumably through political pressure on managers or channelling some other unobserved resource). We find that political marginality does *not* matter for school on any dimension – numbers, expenditure or pupil outcomes. This suggests that it is political marginality that is driving our hospital results, rather than some other channel.

We do not have managerial quality measures in schools but do have school outcome indicators: test scores at the school level both in levels and value added. Pupils in England take nationally set and assessed exams at 5 different ages. A key measure of school performance is the performance of pupils in the exams (known as GCSEs or Key Stage 4) taken at the minimum school leaving age of 16. These are "high stakes" exams, as performance in these exams determines the progression of pupils into the final two years of high school and into university level education, and is used to assess school performance by regulators and parents. Our measures are the proportion of pupils that achieved 5 GCSE results with a high grade (grades A* to C) and school value-added: the improvement between the Key Stage 2 exams (which are taken just before entering secondary school at age 11), and the GCSE exams.[41]

As control variables at the school-level we use the proportion of students eligible for a free-school meal to proxy for the income of the parents (eligibility is determined by parental income). We also control for proportion of male, non-white pupils, pupils with special educational needs (severe and less severe), school and cohort size. At the level of the local authority we control for the share of pupils in private schools and selective schools, population density and total population. In contrast to patient flows to hospitals, catchment areas for schools are delineated by local authority boundaries. When calculating the number of competing schools and the proportion of marginal constituencies we therefore use the local authority as the geographical catchment area, rather than the fixed radius we use for hospitals.[42]

In Table 5 columns (1) and (2) we see that the number of schools at the local authority level is unaffected by the proportion of marginal constituencies within the LEA. Column (1) only includes basic control variables, whereas column (2) controls for total population, population density, the proportion of private school and special school pupils. Marginality is insignificant in both columns. The magnitude of the point estimate of the marginality coefficient is also very small - a one standard deviation increase in marginality is associated with 9% of a new school (0.086 = 0.176 *0.489), compared to the significant effect of about 50% of an additional hospital for a similar change in political conditions.

In the absence of an indirect effect of political marginality on performance via the impact on the number of schools, there could still be a *direct* effect of marginality on school performance. For example, politicians might try to influence school performance by providing more funding or by putting pressure on the school management to improve their performance. Contrary to the entry/exit decision, the incentives to improve performance in schools and hospitals will be very similar in this

[41] At GCSE/Key Stage 4 students can choose to take additional exams on top of the compulsory ones. Because of this variation in the number of exams taken, we use a capped score that only takes the best 8 exams into account.

[42] The main results presented later do not change when a fixed radius is used. We tried using a radius of 10km and obtained qualitatively similar results (we use a smaller radius than in the case of hospitals as schools have a smaller catchment area).

respect. The impact of political contestability on school performance is therefore likely to carry over to hospitals as well. This arguably provides us with a placebo test of the validity of our IV strategy.

We start by looking at the impact of the proportion of marginal constituencies within the local authority on school funding. In columns (3) and (4) of Table 5 we regress expenditure per pupil on the proportion of Labour marginals. The specification in column (4) exactly mirrors the regression in column (2) of Table 4. As in the case of hospitals we do not find any effect of marginality on public funding for secondary schools in both specifications. We then look directly at the impact of the political environment on school performance, using the proportion of pupils with at least 5 GCSE exams with a grade between A* and C as the dependent variable in columns (5) and (6). The coefficient on marginality is negative with basic controls and full sets of controls, but not significantly different from zero. Column (7) includes an additional variable of interest, the number of competing schools in the local area. The coefficient on this competition variable is positive and significant. Although we cannot claim causality in these OLS regressions, it does provide some suggestive evidence that competition may also matter for performance in public schools, just as it does for public hospitals.

Columns (8) to (10) of Table 5 use the school's value-added and find similar results, with a small and insignificant coefficient of political marginality on school outcomes. To put it another way, if a constituency becomes a Labour marginal, value added is predicted to increase by a (statistically insignificant) 0.055 of a standard deviation according to column (9). By comparison, if a constituency becomes a Labour marginal AMI death rates are predicted to fall by a (statistically significant) -0.390 of a standard deviation.

In summary, we have provided evidence that political marginality has no impact on school numbers or school performance, but does raise hospital numbers and improve hospital management and healthcare outcomes. This suggests that political marginality influences hospital outcomes through increasing the number of rival hospitals.

VI. CONCLUSIONS

In this paper we have examined whether competition can increase management quality. We use a new methodology for quantifying the quality of management practices in the hospital sector, and implemented this survey tool in almost two thirds of acute hospitals in England. We found that our measure of management quality is robustly associated with better hospital outcomes across mortality rates and other indicators of hospital performance. We then exploit the UK's centralized public hospital system to provide an instrumental variable for hospital competition. We use the share of marginal political constituencies around each hospital as an instrument for the number of nearby competing hospitals. This works well because in the UK politicians rarely allow hospitals in politically marginal constituencies to close down, leading to higher levels of hospital competition in areas with more marginal constituencies. We find in both OLS and 2SLS (using our political instrument) that more hospital competition leads to improved hospital management. Our results suggest competition is useful for improving management practices in the public sector.

We examined a variety of reasons that would invalidate our IV strategy. We found that marginality appeared essentially random conditional on our controls for demographics. Secondly, we also conditioned in the second stage on marginality around the hospital and still identified an effect of competition using marginality around only *rival* hospitals as the instrument. Thirdly, we could not find evidence that marginality increased health expenditure or affected outcomes in our "placebo" group of public schools where entry/exit is not controlled by central Government, but where national politicians would seek to improve outcomes in marginal districts if they were able to.

In general, our paper provides positive evidence for competition in health care markets and so provides support for policies which aim to increase health care productivity by promoting competition (including those of the governments of the US, the Netherlands, Germany, the UK, and Norway). A caveat is that although we have shown evidence of a positive effect of competition on welfare, this does not answer the normative question of whether welfare would unambiguously increase. There are resource costs of building new hospitals, especially if there are economies of scale and it is quite possible to have models that generate an inefficiently high level of quality. A full cost benefit would take these into account as well as the reduced transport costs for patients being able to access more local hospitals. In any event, although most governments (including the UK) do recognise the trade-off between access and costs of entry, they generally ignore the quality enhancing effects of competition. The estimates presented here suggest that these benefits should also enter the cost-benefit analysis. Furthermore, there can be efforts to expand patient choice through information, incentives and other reforms (such as those in England in the 2000s) which do not require the building of extra hospitals and are, therefore, likely to have large effects on quality at very low cost.

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Table 1: Means and Standard Deviations of Variables

Variable	Mean	Standard Dev.	Obs
Management Quality (non-z-scored, regressions use z-scored version)			
Average Management Score	2.57	0.66	161
Average Operations Score	2.83	0.95	161
Average Monitoring Score	3.00	0.75	161
Average Targets Score	2.47	0.78	161
Average Incentives Management Score	2.35	0.70	161
Performance Measures			
Mortality rate from emergency AMI after 28 days (quarterly av., %)	17.08	7.56	156
Mortality rate from emergency surgery after 30 days (quarterly av., %)	2.21	0.84	160
Numbers on waiting list	4,893	2,667	160
Infection rate of MRSA per 10,000 bed days (half yearly av.)	1.61	0.64	160
Operating margin (%)	1.27	2.81	161
Staff likelihood of leaving within 12 months (1=very unlikely, 5=very likely)	2.70	0.13	160
Average Health Care Commission rating (1-4 scale)	2.25	0.68	161
Pseudo HCC rating (standardized)	0.00	0.98	161
Competition Measures			
Number of competing hospitals (in 30km radius)	6.89	9.68	161
Number equivalent of Herfindahl index	6.92	8.49	161
Herfindahl index based on patient flows (0-1 scale)	0.59	0.15	161
Herfindahl index based on predicted patient flows (0-1 scale)	0.49	0.19	161
Political Variables			
Proportion of marginal Labour constituencies (in 45km radius, %)	3.42	5.03	161
Proportion of marginal Labour constituencies (in 15km radius, %)	3.49	13.16	161
Labour share of votes (average of constituencies in 45km radius, %)	45.97	11.71	161
Noise Controls			
Respondent's tenure in the post (years)	3.50	3.79	161
Covariates			
Density: Total Population (millions) in 30km radius	2.12	2.26	161
Foundation Trust hospital	34.16	47.57	161
Teaching hospital (%)	11.80	32.36	161
Specialist hospital (%)	1.86	13.56	161
Managers with a clinical degree (%)	50.38	31.7	120
Building age (years)	25.98	8.37	152
Expenditure per patient (£ 1000)	9.69	4.51	152
Mortality rate in catchment area Deaths per 100,000 in 30km radius	930	137	161
Size Variables			
Number of total admissions (quarterly)	18,137	9,525	161
Number of emergency AMI admissions (quarterly)	90.18	52.26	161
Number of emergency surgery admissions (quarterly)	1,498	800	161
Number of sites	2.65	2.01	161

Hospital Case-Mix (Percentage of Admission in Age-/Gender Bins)			
Male 16-45 years old	8.88	2.08	161
Male 46-50 years old	2.13	0.50	161
Male 51-55 years old	2.31	0.53	161
Male 56-60 years old	3.14	0.84	161
Male 61-65 years old	3.34	0.89	161
Male 66-70 years old	3.60	0.90	161
Male 71-75 years old	3.80	0.90	161
Male 76-80 years old	3.66	0.85	161
Male 81-85 years old	2.90	0.75	161
Male 86 years or older	2.29	0.69	161
Female 0-15 years old	5.76	3.17	161
Female 16-45 years old	22.09	5.22	161
Female 46-50 years old	2.57	0.43	161
Female 51-55 years old	2.60	0.48	161
Female 56-60 years old	3.17	0.63	161
Female 61-65 years old	3.10	0.75	161
Female 66-70 years old	3.19	0.66	161
Female 71-75 years old	3.36	0.63	161
Female 76-80 years old	3.59	0.69	161
Female 81-85 years old	3.40	0.78	161
Female 86 years or older	4.20	1.30	161
School Variables			
Number of schools (at the LA-level)	9.29	6.60	299
Proportion of marginal Labour constituencies (at the LA-level)	0.04	0.17	299
Proportion of pupils in private schools (at the LA-level)	0.11	0.08	299
Proportion of pupils in selective schools (at the LA-level)	0.10	0.22	299
Expenditure per pupil	4.50	0.91	2778
Number of pupils in cohort	178.90	61.17	2778
Number of pupils in school	1034.27	345.82	2778
Proportion of pupils with free school meal	0.16	0.14	2778
Proportion of pupil of white ethnicity	0.82	0.23	2778
Proportion of male pupils	0.51	0.19	2778
Proportion of pupils with special needs (severe)	0.02	0.02	2778
Proportion of pupils with special needs (less severe)	0.15	0.09	2778
Proportion of pupils achieving 5 GCSEs grade A* - C	0.56	0.19	2778
Value-Added between Keystage 2 and Keystage 4 (capped and normalized)	-1.50	4.03	2778

Notes: See Appendix B for more details, especially Table B1 for data sources and more description. Due to space constraints we have not shown the means for the demographics of the local area which are included in the regressions.

Table 2: Hospital Performance and Management Practices

Dependent Variable:	(1) Mortality rate from emergency AMI	(2) Mortality rate from all emergency surgery	(3) Waiting list (1000 patients)	(4) MRSA infection rate	(5) Operating Margin	(6) Intention of staff to leave in next 12 months	(7) Health Care Commission (HCC) overall rating	(8) "Pseudo" HCC rating
Mean	17.08	2.21	4.90	1.61	1.27	2.70	2.25	0
Standard Deviation	7.56	0.84	2.70	0.64	2.81	0.13	0.68	0.98
A. Overall Management Practices Score	-0.761*	-0.094**	-0.152	-0.074	0.691**	-0.027*	0.089**	0.247***
	(0.434)	(0.038)	(0.118)	(0.061)	(0.304)	(0.014)	(0.041)	(0.082)
B. Lean Operations	-0.193	-0.044	-0.034	-0.082	0.710**	-0.014	-0.027	0.180**
	(0.387)	(0.034)	(0.095)	(0.055)	(0.348)	(0.012)	(0.044)	(0.088)
C. Monitoring	-0.397	-0.086**	-0.107	-0.018	0.228	-0.006	0.063	0.147*
	(0.381)	(0.035)	(0.110)	(0.069)	(0.307)	(0.011)	(0.045)	(0.083)
D. Targets	-0.698*	-0.079*	-0.229**	-0.067	0.508*	-0.027*	0.081*	0.186**
	(0.360)	(0.040)	(0.110)	(0.057)	(0.283)	(0.015)	(0.043)	(0.079)
E. Incentives Management	-0.877**	-0.069	-0.093	-0.048	0.503*	-0.032**	0.147***	0.223***
	(0.433)	(0.042)	(0.122)	(0.068)	(0.285)	(0.015)	(0.041)	(0.082)
Observations	140	157	160	160	161	160	161	161

Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. Every cell constitutes a separate regression. The dependent variables in columns (1) to (4) and (6) are generally considered to be "bad" whereas those in (5), (7) and (8) are "good" – see text for more details. Management scores are standardized across the questions in Appendix A. These are OLS regressions with standard errors that are clustered at a hospital level (the unit of observation is a management interview with a service line in cardiology or orthopaedics across 100 public acute hospitals). All columns include controls for the number of sites, a London dummy, foundation trust status and a teaching hospital dummy. Controls for case mix and total admissions are also included, but vary across columns (see Table B1). Column (1) uses 22 AMI-specific patient controls (11 age groups by both genders) and column (2) does the same for general surgery. The other columns use these across all admissions. All columns also include "noise controls" comprising interviewer dummies and tenure of the interviewee, share of managers with clinical degree and joint decision making dummy. The observations are weighted by the inverse of the number of interviews with the same hospital. In column (1) we drop hospitals with less than 150 AMI cases per year. Column (7) is average of HCC's rating on resource use and quality of service. Column (8) is our self-constructed HCC rating based on several indicators (see Appendix B for details).

Table 3: The Effect of Competition on Management Practices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Type of Regression	OLS	IV: First Stage	IV: Second Stage	OLS	IV: First Stage	IV: Second Stage	OLS	IV: First Stage	IV: Second Stage
Dependent variable	Mgmt	Number of Competing Hospitals	Mgmt	Mgmt	Number of Comp. Hospitals	Mgmt	Mortality emergency AMI	Number of Comp. Hospitals	Mortality emergency AMI
Number of Competing Public Hospitals	0.118** (0.057)		0.280* (0.150)	0.172*** (0.060)		0.443*** (0.167)	-1.103*** (0.350)		-1.626*** (0.575)
Proportion of Labour Marginal Constituencies (around the rivals)		16.172*** (3.555)			17.284*** (3.752)			16.213*** (3.341)	
Proportion of Labour Marginal Constituencies (around the Hospital)									
F-statistic of excluded instrument in corresponding first stage		20.69			21.23			23.56	
General Controls	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
AMI-specific controls	No	No	No	No	No	No	Yes	Yes	Yes
Observations	161	161	161	161	161	161	140	140	140

Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. Competition is measured as the number of hospitals in a 30km radius around the hospital (based on a "catchment area" of 15km for the individual hospital, see text for more details). A political constituency is defined as marginal if it was won by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on a 45km radius). Standard errors are clustered at a hospital level (the unit of observations is a service line in cardiology or orthopaedics). All columns include controls for the total population and age profile (11 categories) in the catchment area, whether the hospital was a Foundation Trust, the number of sites, number of total admissions and the "case-mix" (22 age/gender bins of patient admissions), the tenure of the respondent and interviewer dummies. "General controls" include share of Labour votes, the number of political constituencies, a set of dummies for the winning party in the hospital's own constituency, a London dummy, teaching hospital status, share of managers with a clinical degree and a dummy for whether there was joint decision making at the hospital level. Labour share of votes is defined as the absolute share obtained by the Governing party in the 1997 UK General Election averaged over all constituencies in the catchment area. "AMI specific controls" are those in Table 2 column (1). Regressions are weighted by the inverse of the number of interviews within the same hospital.

Table 4: Robustness Tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Type of Regression	IV	OLS	IV	1st Stage	IV	IV	IV	IV	IV	IV	IV	IV
Dependent Variable	Mgmt	Expenditure Per Patient	Mgmt	Number of rival Hospitals	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt
Marginality: Radius	45km	45km	45km	45km	45km	45km	45km	45km	40km	50km	45km	45km
Marginality % Threshold	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	3%	7%
Number of Competing	0.443***		0.422**		0.296**	0.444**	0.410**	0.470**	0.538***	0.516**	0.303**	0.760**
Public Hospitals	(0.167)		(0.167)		(0.144)	(0.170)	(0.164)	(0.195)	(0.188)	(0.207)	(0.143)	(0.327)
Proportion of Labour Marginal Constituencies		-7.750		21.118***								
(around the rivals)		(7.214)		(5.297)								
Expenditure per Patient			-0.068									
			(0.045)									
Proportion of Labour Marginal Constituencies				-1.669	1.111							
(around the hospital)				(1.298)	(0.671)							
Fraction of Teaching						-0.477						
Hospitals in area						(0.521)						
Physicians per Patient							-0.092					
in area							(0.060)					
Growth Total Admissions								-0.130				
2001-2005 (10,000s)								(0.185)				
Observations	161	161	161	161	161	161	161	161	161	161	161	161

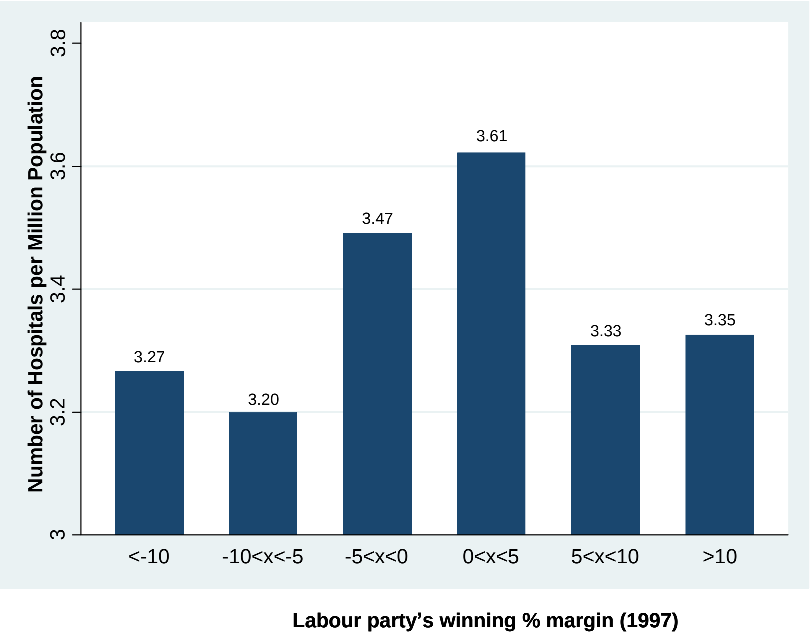
Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. Competition is measured as the number of hospitals in a 30km radius around the hospital (based on a “catchment area” of 15km for the individual hospital, see text for more details). A political constituency is defined as marginal if it was won by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on a 45km radius, unless stated otherwise). Standard errors are clustered at a hospital level (the unit of observations is a service line in cardiology or orthopaedics). All columns include controls for the total population and age profile (11 categories) in the catchment area, whether the hospital was a Foundation Trust, the number of sites, number of total admissions and the “case-mix” (age/gender profile of admissions), the tenure of the respondent and interviewer dummies. “General controls” include share of Labour votes, the number of political constituencies, a set of dummies for the winning party in the hospital’s own constituency, a London dummy, teaching hospital status, share of managers with a clinical degree and a dummy for whether there was joint decision making at the hospital level. Labour share of votes is defined as the absolute share obtained by the Governing party in the 1997 UK General Election averaged over all constituencies in the catchment area. Regressions are weighted by the inverse of the number of interviews within the same hospital.

Table 5: The (absence of an) Effect of Political Marginality on Performance in the Schools Sector

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable	Number Of Schools		Expenditure Per Pupil		Exams results: Proportion With 5 GCSE (A*-C)			Value Added: Key Stage 2 to 4 (improvement between ages 11 and 16)		
Unit of Observation	Local Education Authority (LEA)		School		School			School		
Proportion of Labour Marginal Constituencies	-1.035 (1.014)	-0.488 (0.472)	-0.117 (0.079)	0.005 (0.063)	-0.022 (0.025)	-0.023 (0.017)	-0.016 (0.017)	0.365 (0.464)	0.215 (0.368)	0.327 (0.370)
Labour Share of Votes	13.923*** (1.901)	0.671 (0.937)	1.165*** (0.089)	-0.109 (0.155)	-0.250*** (0.021)	-0.023 (0.020)	-0.008 (0.019)	-5.554*** (0.442)	-2.576*** (0.475)	-2.304*** (0.470)
Cohort Size (Unit: 10 pupils)				0.007 (0.006)		-0.009*** (0.001)	-0.008*** (0.001)		-0.141*** (0.021)	-0.132*** (0.021)
School Size (Unit: 100 Pupils)				-0.067*** (0.014)		0.012*** (0.002)	0.013*** (0.002)		0.178*** (0.036)	0.192*** (0.036)
Number of Schools in the LEA							0.007*** (0.001)			0.136*** (0.023)
School-Level Controls	No	No	No	Yes	No	Yes	Yes	No	Yes	Yes
LEA-Level Controls	No	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes
Observations	298	298	2772	2772	2772	2772	2772	2772	2772	2772

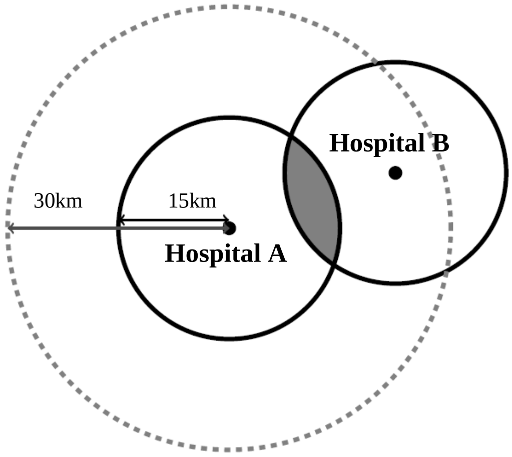
Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. A political constituency is defined as marginal if it was won by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on the catchment area, in this case a local authority). The Labour share of votes is the absolute share obtained by the Governing party in the 1997 UK General Election averaged over all constituencies in the catchment area. All columns include controls for the Labour share of votes. "School-level controls" include the fraction of pupils with a free school meal, male pupils, non-white pupils, and pupils with special education needs (severe and less severe). "LEA-level controls" include the proportion of pupils in private and selective schools, total population and population density.

Figure 1: Governing Party's (Labour) Winning Margin and the Number of Hospitals in a Political Constituency



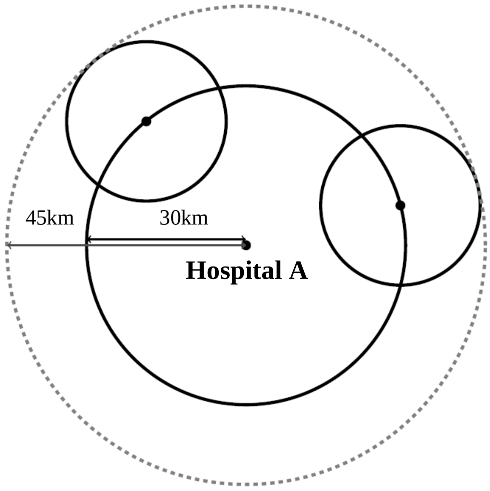
Notes: This figure plots the mean number of hospitals per 1 million people within a 30km radius of the centroid of a political constituency against the "winning margin" in 1997 of the governing party (Labour). When Labour is not the winning party, the margin is the negative of the difference between the winning party (usually Conservative) and the next closest party. The margin is denoted "x". There are 528 political constituencies in England.

Figure 2: Graphical Representation of the Competition Measure



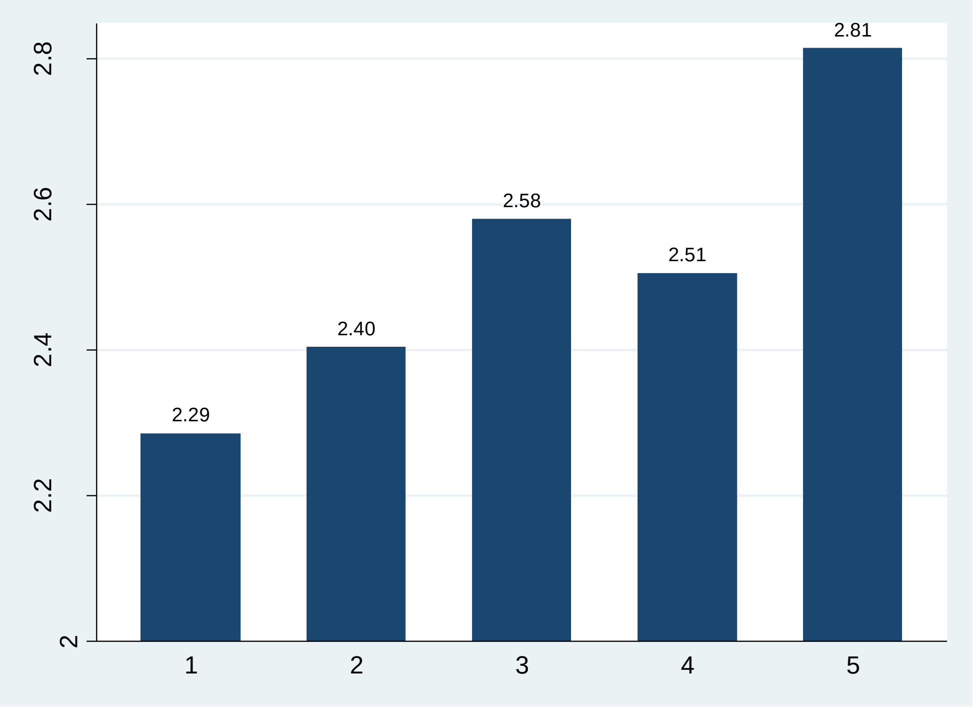
Notes: The figure shows the 15km catchment area for hospital A. Any hospital within a 30km radius of hospital A will have a catchment area that overlaps (at least to some extent) with hospital A's catchment area. The overlap is illustrated in the graph for hospital B. Our competition measure based on a 15km catchment area therefore includes all hospitals within a 30km radius. This is represented by the dashed grey circle in the figure.

Figure 3: Graphical Representation of the Marginality Measure



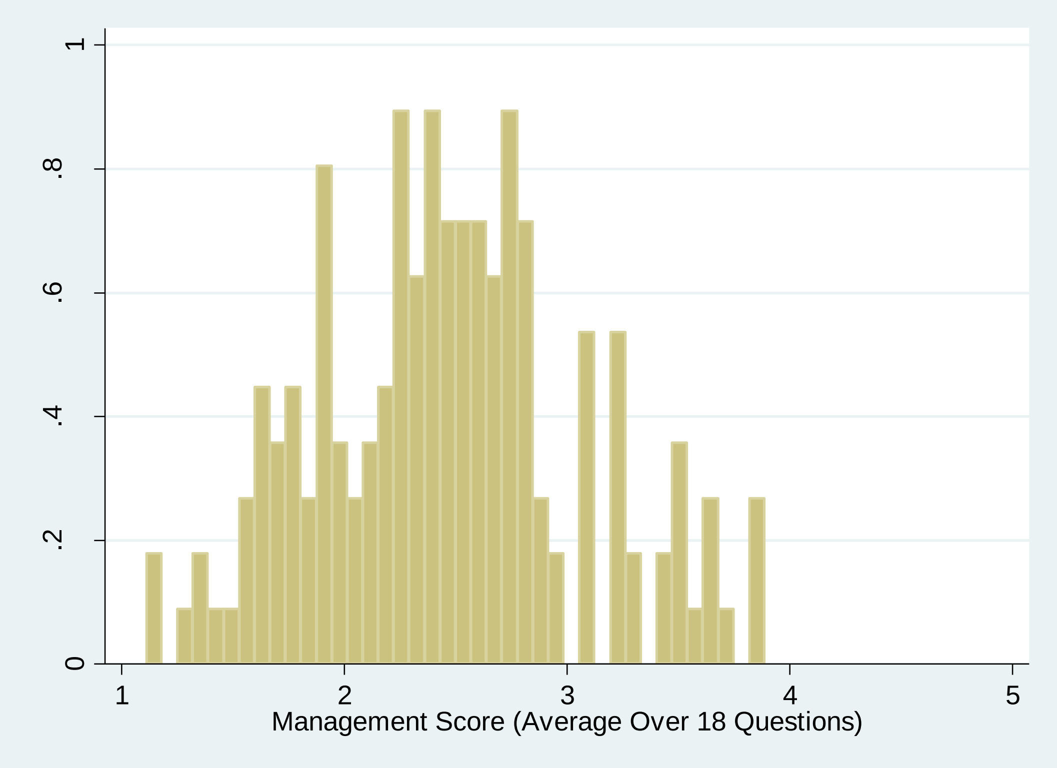
Notes: The figure illustrates the definition of our main marginality measure. Any hospital within a 30km radius of hospital A is considered to be a competitor (see Figure 2). We care about the political environment in the catchment area of any possible competitor. Therefore we draw a 15km radius (our definition of the catchment area) around each possible location for a competitor (as illustrated by the two smaller solid circles). The intersection of all these areas is given by the area within the grey dashed circle. In other words, we compute our marginality measure for hospital A based on all constituencies within a 45km radius of the hospital.

Figure 4: Management Score by Quintiles of Average HCC Rating



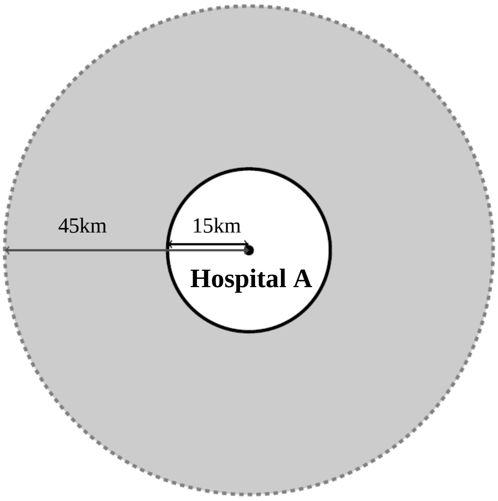
Notes: The Health Care Commission (HCC) is an NHS regulator who gives every hospital in England an aggregate performance score across seven domains (see Appendix B). We divide the HCC average score into quintiles from lowest score (first) to highest score (fifth) along the x-axis. We show the average management score (over all 18 questions) in each of the quintiles on the y-axis. The better performing hospitals have higher management scores.

Figure 5: Management Scores in Hospitals



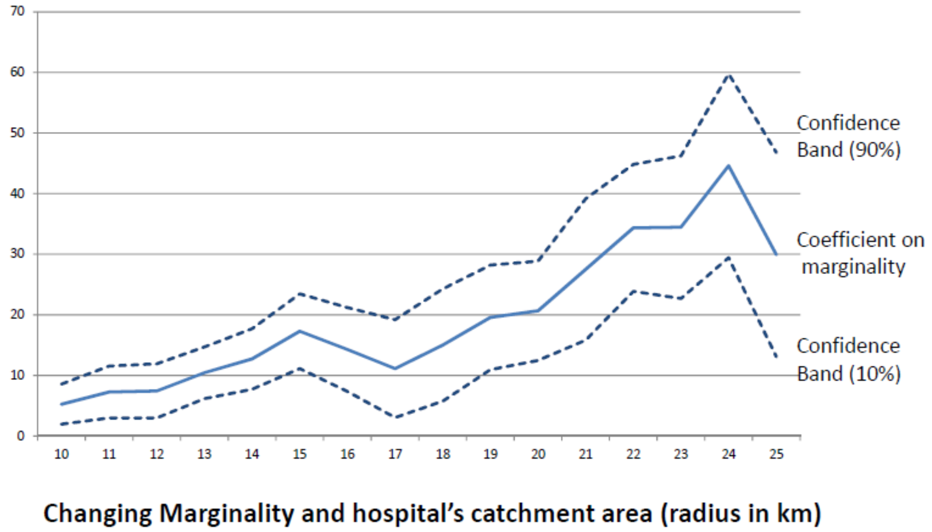
Notes: This is the distribution of the management score (simple average across all 18 questions)

Figure 6: Using Two Marginality Measures



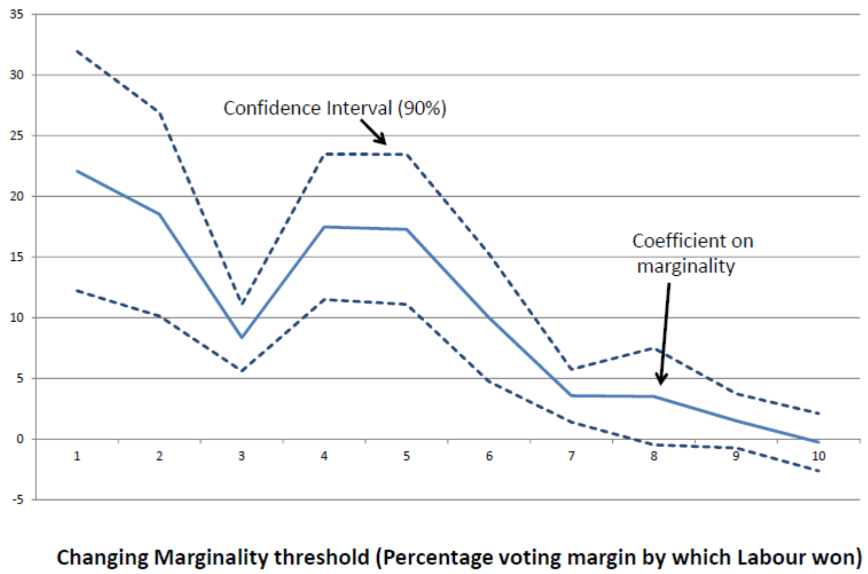
Notes: The graph illustrates the idea behind the sensitivity check conducted in columns (4) and (5) of Table 4. We include the marginality measure defined over a 45km radius and the one defined over a 15km radius in the first stage. But only the 45km measure is excluded from the second stage, i.e. serves as an instrument. We therefore effectively only use marginality within the grey-shaded area of the graph to instrument the number of competitors.

Figure 7: Robustness of Results to Changing the Definition of the Size of Hospital Catchment Area



Notes: These are the results from 15 separate first stage regressions of the number of hospitals on the Labour marginality instrument (identical in specification to those of column (6) in Table 3). We vary (on the x-axis), the size of the catchment area around the hospital in an interval from 10km to 25km (our baseline results use a 15km catchment area). Note that this increases the effective political catchment area (relevant for number of rival hospitals from 30kn to 75km). The y-axis plots out the coefficient on marginality (and confidence intervals) in each of these separate regressions.

Figure 8: Robustness of Results to Changes in the Threshold for Marginality



Notes: These are the results from 10 separate first stage regressions of the number of hospitals on the Labour marginality instrument (identical in specification to those of column (6) in Table 3). We vary (on the x-axis), the percentage margin by which the constituency was won from 1 percentage point to 10 percentage points (our baseline results use a 5 percentage point definition of marginality). The y-axis plots out the coefficient on marginality (and confidence intervals) in each of these separate regressions.

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APPENDIX A: MANAGEMENT PRACTICE INTERVIEW GUIDE FOR THE HEALTHCARE SECTOR

Any score from 1 to 5 can be given, but the scoring guide and examples are only provided for scores of 1, 3 and 5. Multiple questions are used for each dimension to improve scoring accuracy.

(1) Lay out of patient flow

Tests how well the patient pathway is configured at the infrastructure level and whether staff pro-actively improve their own work-place organization

a) Can you briefly describe the patient journey or flow for a typical episode?
b) How closely located are wards, theatres, diagnostics centres and consumables?
c) Has the patient flow and the layout of the hospital changed in recent years? How frequently do these changes occur and what are they driven by?

	Score 1	Score 3	Score 5
Scoring grid:	Lay out of hospital and organization of workplace is not conducive to patient flow, e.g., ward is on different level from theatre, or consumables are often not available in the right place at the right time	Lay out of hospital has been thought-through and optimised as far as possible; work place organization is not regularly challenged/changed (or vice versa)	Hospital layout has been configured to optimize patient flow; workplace organization is challenged regularly and changed whenever needed

(2) Rationale for introducing standardization/ pathway management

Test the motivation and impetus behind changes to operations and what change story was communicated

a) Can you take me through the rationale for making operational improvements to the management of patient pathway? Can you describe a recent example?
b) What factors led to the adoption of these practices?
c) Who typically drives these changes?

	Score 1	Score 3	Score 5
Scoring grid:	Changes were imposed top down or because other departments were making (similar) changes, rationale was not communicated or understood	Changes were made because of financial pressure and the need to save money or as a (short-term) measure to achieve government targets	Changes were made to improve overall performance, both clinical and financial, with buy-in from all affected staff groups. The changes were communicated in a coherent ‘change story’

(3) Continuous improvement

Tests process for and attitudes to continuous improvement and whether things learned are captured/documented

a) How do problems typically get exposed and fixed?
b) Talk me through the process for a recent problem that you faced
c) How do the different staff groups get involved in this process? Can you give examples?

	Score 1	Score 3	Score 5
Scoring grid:	No, process improvements are made when problems occur, or only involve one staff group	Improvements are made irregular meetings involving all staff groups, to improve performance in their area of work (e.g., ward or theatre)	Exposing problems in a structured way is integral to individuals' responsibilities and resolution involves all staff groups, along the entire patient pathway as a part of regular business processes rather than by extraordinary effort/teams

(4) Performance tracking

Tests whether performance is tracked using meaningful metrics and with appropriate regularity

a) What kind of performance indicators would you use for performance tracking?
b) How frequently are these measured? Who gets to see these data?
c) If I were to walk through your hospital wards and theatres, could I tell how you were doing against your performance goals?

	Score 1	Score 3	Score 5
Scoring grid:	Measures tracked do not indicate directly if overall objectives are being met, e.g., only government targets tracked. Tracking is an ad-hoc process (certain processes aren't tracked at all).	Most important performance indicators are tracked formally; tracking is overseen by senior staff.	Performance is continuously tracked and communicated against most critical measures, both formally and informally, to all staff using a range of visual management tools

(5) Performance review

Tests whether performance is reviewed with appropriate frequency and communicated with staff

a) How do you review your KPI's?
b) Tell me about a recent meeting
c) Who is involved in these meetings? Who gets to see the results of this review?
d) What is the follow-up plan?

	Score 1	Score 3	Score 5
Scoring grid:	Performance is reviewed infrequently or in an un-meaningful way e.g. only success or failure is noted	Performance is reviewed periodically with both successes and failures identified. Results are communicated to senior staff. No clear follow up plan is adopted.	Performance is continually reviewed, based on the indicators tracked. All aspects are followed up to ensure continuous improvement. Results are communicated to all staff.

(6) Performance dialogue

Tests the **quality** of review conversations

a) How are these meetings structured?
b) During these meetings do you find that you generally have enough data?
c) What type of feedback occurs in these meetings?

	Score 1	Score 3	Score 5
Scoring grid:	The right information for a constructive discussion is often not present or the quality is too low; conversations focus overly on data that is not meaningful. Clear agenda is not known and purpose is not explicitly. Next steps are not clearly defined	Review conversations are held with the appropriate data present. Objectives of meetings are clear to all participating and a clear agenda is present. Conversations do not, drive to the root causes of the problems, next steps are not well defined	Regular review/performance conversations focus on problem solving and addressing root causes. Purpose, agenda and follow-up steps are clear to all. Meetings are an opportunity for constructive feedback and coaching

(7) Consequence management

Tests whether differing levels of (personal) performance lead to different consequences (good or bad)

a) Let's say you've agreed to a follow up plan at one of your meetings, what would happen if the plan weren't enacted?
b) How long is it between when a problem is identified to when it is solved? Can you give me a recent example?
c) How do you deal with repeated failures in a specific sub-specialty or cost area?

	Score 1	Score 3	Score 5
Scoring grid:	Failure to achieve agreed objectives does not carry any consequences	Failure to achieve agreed results is tolerated for a period before action is taken	A failure to achieve agreed targets drives retraining in identified areas of weakness or moving individuals to where their skills are appropriate

(8) Target balance

Test whether targets cover a sufficiently broad set of metrics

a) What types of targets are set for the hospital? What are the goals for your specialty?
b) Tell me about goals that are not set externally (e.g. by the government, regulators).

	Score 1	Score 3	Score 5
Scoring grid:	Goals focussed only on government targets and achieving the budget	Goals are balanced set of targets (including quality, waiting times, operational efficiency, and financial balance). Goals form part of the appraisal for senior staff only or do not extend to all staff groups. Real interdependency is not well understood	Goals are a balanced set of targets covering all four dimensions (see left). Interplay of all four dimensions is understood by senior and junior staff (clinicians as well as nurses and managers)

(9) Target inter-connection

Tests whether targets are tied to hospital/Trust objectives and how well they cascade down the organization

a) What is the motivation behind your goals?
b) How are these goals cascaded down to the different staff groups or to individual staff members?
c) How are your targets linked to hospital performance and its goals?

	Score 1	Score 3	Score 5
Scoring grid:	Goals do not cascade down the organization	Goals do cascade, but only to some staff groups, e.g., nurses only	Goals increase in specificity as they cascade, ultimately defining individual expectations, for all staff groups

(10) Time horizon of targets

Tests whether hospital/Trust has a '3 horizons' approach to planning and targets

a) What kind of time scale are you looking at with your targets?
b) Which goals receive the most emphasis?
c) Are the long term and short term goals set independently?
d) Could you meet all your short-run goals but miss your long-run goals?

	Score 1	Score 3	Score 5
Scoring grid:	Top staff's main focus is on short term targets	There are short and long term goals for all levels of the organization. As they are set independently, they are not necessarily linked to each other	Long term goals are translated into specific short term targets so that short term targets become a 'staircase' to reach long term goals

(11) Target stretch

Tests whether targets are appropriately difficult to achieve

a) How tough are your targets? Do you feel pushed by them?
b) On average, how often would you say that you meet your targets?
c) Do you feel that on targets all specialties, departments or staff groups receive the same degree of difficulty? Do some groups get easy targets?
d) How are the targets set? Who is involved?

	Score 1	Score 3	Score 5
Scoring grid:	Goals are either too easy or impossible to achieve, at least in part because they are set with little clinician involvement, e.g., simply off historical performance	In most areas, senior staff push for aggressive goals based, e.g., on external benchmarks, but with little buy-in from clinical staff. There are a few sacred cows that are not held to the same standard	Goals are genuinely demanding for all parts of the organization and developed in consultation with senior staff, e.g., to adjust external benchmarks appropriately

(12) Clarity and comparability of targets

Tests how easily understandable performance measures are and whether performance is openly communicated

a) If I asked your staff directly about individual targets, what would they tell me?
b) Does anyone complain that the targets are too complex?
c) How do people know about their own performance compared to other people's performance?

	Score 1	Score 3	Score 5
Scoring grid:	Performance measures are complex and not clearly understood, or only relate to government targets. Individual performance is not made public	Performance measures are well defined and communicated; performance is public at all levels but comparisons are discouraged	Performance measures are well defined, strongly communicated and reinforced at all reviews; performance and rankings are made public to induce competition

(13) Managing talent

Tests what emphasis is put on talent management

a) How do senior staff show that attracting and developing talent is a top priority?
b) Do senior managers, clinicians or nurses get any rewards for bringing in and keeping talented people in the hospital?

	Score 1	Score 3	Score 5
Scoring grid:	Senior staff do not communicate that attracting, retaining and developing talent throughout the organization is a top priority	Senior management believe and communicate that having top talent throughout the organization is key to good performance	Senior staff are evaluated and held accountable on the strength of the talent pool they actively build

(14) Rewarding high performers

Tests whether good performance is rewarded proportionately

a) How does your appraisal system work? Tell me about your most recent round.
b) Are there any non-financial or financial (bonuses) rewards for the best performers across all staff groups?
c) How does the bonus system work?
d) How does your reward system compare to that at other comparable hospitals?

	Score 1	Score 3	Score 5
Scoring grid:	People are rewarded equally irrespective of performance level	There is an evaluation system for the awarding of performance related rewards that are non-financial (beyond progression through nursing grades or clinical excellence awards for doctors) at the individual level (but rewards are always or never achieved)	There is an evaluation system for the awarding of performance related rewards, including personal financial rewards

(15) Removing poor performers

Tests whether hospital is able to deal with underperformers

a) If you had a clinician or a nurse who could not do his job, what would you do? Could you give me a recent example?
b) How long would underperformance be tolerated?
c) Do you find staff members who lead a sort of charmed life? Do some individuals always just manage to avoid being fixed/fired?

	Score 1	Score 3	Score 5
Scoring grid:	Poor performers are rarely removed from their positions	Suspected poor performers stay in a position for a few years before action is taken	We move poor performers out of the hospital/department or to less critical roles as soon as a weakness is identified

(16) Promoting high performers

Tests whether promotion is performance based

a) Tell me about your promotion system?
b) What about poor performers? What happens with them? Are there any examples you can think of?
c) How would you identify and develop your star performers?
d) Are better performers likely to promote fasters or are promotions given on the basis of tenure/seniority?

	Score 1	Score 3	Score 5
Scoring grid:	People are promoted primarily on the basis of tenure	People are promoted upon the basis of performance (across more than one dimension, e.g., isn't related only to research or clinical excellence)	We actively identify, develop and promote our top performers

(17) Attracting talent

Tests how strong the employee value proposition is

a) What makes it distinctive to work at your hospital, as opposed to your other similar hospitals?
b) If I were a top nurse or clinician and you wanted to persuade me to work at your hospital, how would you do this?
c) What don't people like about working at your hospital?

	Score 1	Score 3	Score 5
Scoring grid:	Our competitors offer stronger reasons for talented people to join their hospitals	Our value proposition to those joining our department is comparable to those offered by others hospitals	We provide a unique value proposition to encourage talented people join our department above our competitors

(18) Retaining talent

Tests whether hospital/Trust will go out of its way to keep its top talent

a) If you had a top performing manager, nurse or clinician that wanted to leave, what would the hospital do?
b) Could you give me an example of a star performer being persuaded to stay after wanting to leave?
c) Could you give me an example of a star performer who left the hospital without anyone trying to keep them?

	Score 1	Score 3	Score 5
Scoring grid:	We do little to try and keep our top talent	We usually work hard to keep our top talent	We do whatever it takes to retain our top talent across all three staff groups

APPENDIX B: DATA

B.1 Sample

The main sampling frame was all acute public sector hospitals (NHS "trusts") in England.[43] There were 174 such units in 2006, but we dropped hospitals without orthopaedics or cardiology departments (e.g. specialist eye hospitals) so this left us with a sample of 164 possible hospital trusts. We obtained 161 usable responses from 100 hospital trusts which represented 61% of the frame. We sought responses from up to four senior employees in each hospital: a manager and a clinician from two service lines (cardiology and orthopaedics). Table 1 shows the data is evenly split between the specialities (52% cardiology and 48% orthopaedics), but that it was harder to obtain interviews with the physicians than managers (80% of the respondents were managers). We interviewed one respondent in 53 hospitals, two respondents in 34 hospitals, three respondents in 12 hospitals and four respondents in one hospital. The correlation of the average management score across responders within the same hospital was high (0.53) as shown in Figure A1.

We examined evidence for selection bias by estimating probit models of whether a trust responded on the observable characteristics used in our analysis. Table B2 contains the results of this exercise. There is no significant correlation at the 5% level between sample response and any of the performance measures or covariates and only one (from 16) of the indicators are significant at the 10% level. This suggests that there was little systematic response bias.

In the regressions all interviews with many unanswered questions (three or more) are excluded as the information obtained is unlikely to be reliable. This excludes 3 interviews out of 164. We weight regressions by the inverse of the number of interviews so that hospitals with multiple responses are weighted less (we also cluster standard errors at the hospital level).

B.2 Construction of the Pseudo HCC Rating

In column (8) of Table 2 we reported our best effort to reconstruct the HCC's rating. Although the exact method of creating the HCC ratings is not publicly known, the Appendix of the HCC's "Annual Health Check 2006/2007" brochure mentions seven "domains" in which the hospitals need to achieve certain standards in order to achieve a high score.

These domains are: safety, clinical and cost effectiveness, governance, patient focus, accessible and responsive care, public health, and care environment and amenities. From the datasets described above we choose eight variables which capture the requirements of these different domains. Infection rates and re-admission risk are chosen to represent the "safety" aspect; operational margin and income per medical full time equivalent capture the financial side; patient satisfaction covers the "patient focus" domain. Waiting times and average length of stay fall into the category "accessible and responsive care" and information on job satisfaction from the NHS staff survey is used to represent the "care environment and amenities" domain.

B.3 Construction of predicted HHIs

Assigning hospital market competitiveness based on which hospital patients *actually* attended - rather than, for example, their area of residence - can induce a correlation between competitiveness and unobservable determinants of outcomes, because patients' hospital of admission may depend on unobserved determinants of their hospital's quality and their own health status. We therefore follow Kessler and McClellan (2000) and Gowrisankaran and Town (2003) in assigning a level of market competition to a hospital based on predicted patient flows from neighborhoods to hospitals. Hospitals are assigned the predicted level of market competition based on the neighborhoods from which they draw their patients. Our construction of HHIs follows Gaynor et al (2010) and the reader is referred to their Appendix B for more details.

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[43] A trust can consist of more than one site (as a firm can consist of more than one plant). The median number of sites was 2 with a range from 1 to 10.

For the predicted flows which underlie these HHIs, we estimate a logit model for patient choice. Having estimated these models, *predicted HHIs* at the hospital level are then computed as functions of the patient level predicted probabilities. First, neighborhood level predicted HHIs are computed as the sum of squared (predicted) shares of patients from the neighborhood attending each hospital and second, the hospital level predicted HHI is calculated as a weighted average across these neighborhood HHIs, where the weights are the predicted proportions of the hospital's patients from each neighborhood. The neighborhood is defined as an MSOA (middle layer super output area).[44]

The details are as follows.

Estimated HHIs

The probability π_{ij} that patient i chooses hospital j is given by:

$$\pi_{ij} = \Pr\left(y_{ij} = 1\right) = \frac{\exp\left(\beta_1 d_{ij}\right)}{\sum_{j=1}^{J_i} \exp\left(\beta_1 d_{ij}\right)}$$

The log-likelihood function is:

$$\log L = \sum_{i=1}^{n} \sum_{j=1}^{J} \log\left(\pi_{ij}\right)$$

The predicted HHI for patient i is the sum of their squared probabilities:

$$H\hat{H}I_i = \sum_{j=1}^{J} \hat{\pi}_{ij}^2$$

Following Kessler and McClellan (2000) we compute the predicted HHI for hospital j as the weighted average across neighborhood level predicted HHIs where the weights equal the predicted proportions of patients from hospital j that live in neighborhood k.

$$H\hat{H}I_j = \sum_{k=1}^{K} \left(\frac{\hat{n}_{kj}}{\hat{n}_j} \right) H\hat{H}I_k, \qquad H\hat{H}I_k = \sum_{j=1}^{J} \left(\frac{\hat{n}_{jk}}{\hat{n}_k} \right)^2$$

$$\hat{n}_j = \sum_{i=1}^{n} \hat{\pi}_{ij}, \qquad \hat{n}_k = \sum_{i=1}^{n_k} \sum_{j=1}^{J} \hat{\pi}_{ij} = \sum_{i=1}^{n_k} 1 = n_k, \qquad \hat{n}_{kj} = \hat{n}_{jk} = \sum_{i=1}^{n_k} \hat{\pi}_{ij}$$

The predicted HHI for neighborhood k is the sum of the squared shares of patients from neighborhood k who attend each hospital j.[45]

Specification of the utility function

We estimate alternative specific conditional logit models using the following specification of the patient utility function:

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[44] There are approximately 7,000 MSOAs in England each containing approximately 7,200 people, so they are similar in size if not a little smaller than a US zipcode. MSOAs are constructed to have maximum within MSOA homogeneity of population characteristics.

[45] The predicted HHI for hospital *j* can be calculated in different ways. Gowrisankaran and Town (2003) compute the predicted HHI for hospital *j* as the weighted average across patient level predicted HHIs where the weights are equal to the predicted probability that they attend hospital *j*,

$$H\hat{H}I_j = \frac{1}{\hat{n}_j} \sum_{i=1}^{n} \hat{\pi}_{ij} H\hat{H}I_i; \qquad \hat{n}_j = \sum_{i=1}^{n} \hat{\pi}_{ij}.$$

When each patient lives in their own neighborhood, our approach will give the same predicted hospital level HHIs as Gowrisankaran and Town (2003). However, the larger the geographic scale of the neighborhoods, the more the HHIs based on this approach will differ from those based on the Gowrisankaran and Town (2003) approach.

$$
\begin{aligned}
U_{ij} = & \sum_{h=1}^{2}\left\{\beta_1^h\left(d_{ij}-d_{ij^+}^h\right)\times z_j^h+\beta_2^h\left(d_{ij}-d_{ij^+}^h\right)\times\left(1-z_j^h\right)\right\} \\
& +\sum_{h=1}^{2}\left\{\beta_3^h\left(d_{ij}-d_{ij^-}^h\right)\times z_j^h+\beta_4^h\left(d_{ij}-d_{ij^-}^h\right)\times\left(1-z_j^h\right)\right\} \\
& +\sum_{h=1}^{2}\left\{\begin{array}{l}\beta_5^h female_i\times z_j^h \\ +\beta_6^h young_i\times z_j^h+\beta_7^h old_i\times z_j^h \\ +\beta_8^h lowseverity_i\times z_j^h+\beta_9^h highseverity_i\times z_j^h\end{array}\right\}+e_{ij}
\end{aligned}
$$

where z_j^1 is a binary indicator of whether hospital j is a teaching hospital, z_j^2 is a binary indicator of whether hospital j is a big hospital (defined as being in the top 50% of the distribution of admissions), d_{ij} is the distance from the geographic centre of the neighborhood (the MSOA) for patient i to the geographic centre of the neighborhood (the MSOA) for hospital j, $d_{ij}-d_{ij^+}^h$ is the additional distance from patient i to the alternative under examination j over and above the distance to the nearest alternative j^+ which is a good substitute in terms of hospital characteristic h, $female_i$ indicates gender, $young_i$ and old_i are binary indicators of whether patient i is below 60 years old or above 75 years old respectively, and $lowseverity_i$ and $highseverity_i$ are binary indicators of whether patient i has one ICD diagnosis or three or more ICD diagnosis respectively. All patient level variables are interacted with the variables z_j^1 and z_j^2.[46]

Following Kessler and McClellan (2000), no individual or hospital level variables are entered as main effects and as Kessler and McClellan (2000) and Gowrisankaran and Town (2003), we explicitly omit hospital level fixed effects to prevent predicted choice being based on unobserved attributes of quality. The error term, e_{ij}, is assumed i.i.d, Type I extreme value and captures the effects of unobservable attributes on patient choice.

The model is estimated for the years 2005/6 and undertaken separately for each of the nine Government Office Regions of England, thus allowing parameter estimates to be region-specific.[47]

The sample of admissions is all elective admissions and we restrict our analysis to those hospitals which have 50 or more elective admissions. Hospitals with fewer admissions are dropped from the sample as are the patients who attend these hospitals.[48]

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46 For example, consider the teaching hospital dimension $h=1$ and suppose that the hospital under examination is a non-teaching hospital $z_j^1=0$, then the differential distance $d_{ij}-d_{ij^+}^1$ is the distance to the hospital under examination over and above the distance to the nearest hospital which is also a non-teaching hospital.

47 To make the model computation more efficient, we collapse patients who are identical in terms of model characteristics (i.e. who live in the same MSOA and go to the same hospital and have the same patient level characteristics) into groups. All patients within the group have the same choice set. Similarly, all patients within the group also have the same distances to each hospital within the choice set as distances are measured from MSOA centroids to hospital locations. Frequency weights are used in the estimation to reflect the number of patients within each group.

48 It is possible for some alternatives within patients' choice sets to be never chosen. This is likely to happen since hospitals located outside the region under investigation will be included in the choice set of those patients living close to the boundary, even if no patients from the region under investigation go to that hospital. These faraway hospitals should not cause any problems with the statistical

Travel distance

We restrict the distance travelled to be 100km, subject to ensuring that each patient's choice set includes the hospital actually attended and the first and second nearest hospital with each binary characteristic switched on and off. To see why choice of both the first and second hospital is included, the following alternatives are included in all patients' choice sets, irrespective of distance: the hospital actually chosen, the nearest non-teaching hospital ($z^1 = 0$), the nearest teaching hospital ($z^1 = 1$), the nearest small hospital ($z^2 = 0$) and the nearest big hospital ($z^2 = 1$). If the hospital under examination is, for example, the nearest hospital for which $z^1 = 0$, then the nearest alternative which is a good substitute will actually be the second nearest hospital where $z^1 = 0$ and so the differential distance is negative. To compute the value of this differential distance, we must also ensure that we include the second nearest hospital for which $z^1 = 0$ in patient's choice sets. The same argument can be made when the hospital under examination is the nearest hospital that has each of the other hospital characteristics (i.e. $z^1 = 1$, $z^2 = 0$, $z^2 = 1$). Thus, the following alternatives must also be included in all patients' choice sets, even if they are beyond the cut-off distance: the second nearest non-teaching hospital ($z^1 = 0$), the second nearest teaching hospital ($z^1 = 1$), the second nearest small hospital ($z^2 = 0$), the second nearest big hospital ($z^2 = 1$). Where patients actually travel further than 100km, we extend their choice set to additionally include the actual hospital attended. Each patient will thus always have at least four to nine alternatives within their choice set.

Model fit

The proportion of correct predictions is around 75%.[49] The results are robust to a range of model specifications including: (1) whether we allow model parameters to be region-specific; (2) the extent to which we expand patients' choice sets beyond the minimum set of hospitals required to estimate the model; and (3) whether we enter distance variables as linear or non-linear variables. Hospital HHIs based on predicted data are lower in value than HHIs based on actual data. The most important coefficient estimates are for distance, so that if patients were allocated to hospitals solely on a distance basis then hospitals would appear more competitive than they actually are. Actual choice of hospital is therefore based on additional factors that we have excluded from the model, and these additional factors lead hospitals to become less competitive than they would otherwise be given geographical location.

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identification of the model parameters. This is because, unlike standard alternative-specific conditional logit models, our model does not include any hospital-specific intercepts.

[49] Parameter estimates available from the authors.

Table B1: Data Sources

Variable	Notes	Source
Mortality within 28 days of emergency admission for AMI (in hospital and out of hospital)	During financial quarter Defined according to NHS mortality rate performance indicators (PIs)	Hospital Episode Statistics (HES) (The NHS Information Centre for health and social care) [a]
Mortality within 30 days of surgery for selected emergency procedures (excludes AMI).	During financial quarter Defined according to NHS mortality rate PIs	Hospital Episode Statistics (HES) (The NHS Information Centre for health and social care).[a]
Waiting list size	At start of quarter (as proxied by end of previous quarter)	Department of Health: Provider based waiting times/list statistics[b]
MRSA (Methicillin-Resistant Staphylococcus Aureus) rates	Recorded 6-month period	Health Protection Agency: Half-yearly reporting results for clostridium difficile infections and MRSA bacteraemia
Operating Margin	Recorded annually	Trust Financial Returns (The NHS Information Centre for health and social care)
Probability of leaving in next 12 months	Respondents are asked to rate chances of leaving on a 1 to 5 scale.	NHS Staff Survey[c] (2006). 128,328 NHS staff responded and results are reported as average of scale by each trust
Healthcare Commission rating[d] (Healthcare Commission, 2006)	All trusts are scored on a scale of 1 to 4 on "resource use" and quality of "care"	Our main indicator averages over the two measures and standardizes. We also construct our own "pseudo" HCC rating from the underlying indicators (see Appendix B for full description)
Local authority all-cause mortality rates	Calendar year; standardised	Office of National Statistics
Casemix of admissions: For the general performance indicators (e.g. management regressions and HCC rating) we use case mix for all admitted patients. For the specific outcomes of AMI and general surgery death rates we use condition-specific casemix.	Proportion of admitted patients in each sex-specific age band. 11 age categories: 0-15, 16-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80, 81-85, >85 and two genders, so up to 22 controls.	Hospital Episode Statistics (HES) (The NHS Information Centre for health and social care).

Notes: All data is pooled between 2005/06

[a] http://www.performance.doh.gov.uk/nhsperformanceindicators/2002/trdca_t.doc.

[b] http://www.performance.doh.gov.uk/waitingtimes/index.htm

[c] http://www.cqc.org.uk/usingcareservices/healthcare/nhsstaffsurveys.cfm

[d] http://www.cqc.org.uk/_db/_documents/0607_annual_health_check_performance_rating_scoring_rules_200702284632.pdf

Variable	Notes	Source
Total admissions, Admissions for AMI, Admission for Emergency Surgery (excludes AMI)	During financial quarter	Hospital Episode Statistics (HES) (The NHS Information Centre for health and social care)
Area Demographics: Population Density, Age- / Gender Mix in the Population		LA statistics from Office of National Statistics
Number of Sites		Hospital Estates and Facilities Statistics[a] (The NHS Information Centre for health and social care).
Foundation Trust Status		Monitor (Foundation Trust Regulator)[b]
Specialist Hospital	Self-coded from individual hospital web pages (2 in the sample: one specialist cardiology centre and a children hospital	Self-coded
Building Age	Data is provided at the site level and aggregated up to hospital level using the surface area as weights	Hospital Estates and Facilities Statistics[a] (The NHS Information Centre for health and social care).
Expenditure per patient	Cost divided by the number of total admissions	Cost data from Trusts' Annual Reports and Accounts from Trusts' webpages or Monitor[b] (in the case of Foundation Trusts)
Political Variables: Marginal Constituencies, Labour Vote Share and identity of Winning Party	4 elections from 1992 until 2005	British Election Study
School Variables: Pupil Performance Measures, School Size and Characteristics of the Pupils and School Location		National Pupil Data Base Dataset

[a] http://www.hefs.ic.nhs.uk/ReportFilter.asp

[b] http://www.monitor-nhsft.gov.uk/

Table B2: Tests of Sample Selection for Public Hospitals

Variable	Marginal effect(Standard error)	Observations
Performance Measures		
Mortality rate from emergency AMI after 28 days (quarterly average)	0.129 (0.161)	133
Mortality rate from emergency surgery after 30 days (quarterly average)	0.313 (0.365)	163
Numbers on waiting list	0.025 (0.0454)	163
Infection rate of MRSA per 10,000 bed days (half yearly)	-0.025 (0.041)	163
Operating margin (percent)	0.040 (0.032)	164
Likelihood of leaving in next 12 months (1=very unlikely, 5=very likely)	-0.063 (0.04)	161
Average Health Care Commission rating (1-4 scale)	-0.011 (0.043)	164
Pseudo HCC rating (standardized)	0.027 (0.038)	164
Size Variables		
Number of total admissions (per 100,000 population)	0.213 (0.417)	164
Number of emergency AMI admissions (per 100,000 population)	53.896 (70.863)	164
Number of emergency surgery admissions (per 100,000 population)	0.612 (4.739)	164
Number of sites	0.016 (0.196)	164
Covariates		
Foundation Trust (hospitals with greater autonomy)	0.091 (0.082)	164
Building age	-0.013 (0.013)	154
Expenditure per patient (£ 1000)	-0.015 (0.008)*	156
Area mortality (average of local authorities in 30km radius, per 100,000,000 population)	0.275 (0.277)	163

Notes: These are the results from separate probit ML regression of whether a public hospital had any response to the survey on the relevant variable (e.g. AMI mortality rate in the first row). There is a population of 164 potential acute hospitals in England and we had 100 hospitals with at least one respondent. For the first 2 rows we use the same restrictions as in table 2: we use only hospitals with more than 150 yearly cases in the AMI regression and exclude specialist hospitals from the regression in the second row. *** indicates significance at 1% level; ** significance at 5%, * for significance at 10%.

Table B3: OLS-regression Using Alternative Measures of Competition

	(1)	(2)	(3)	(4)	(5)	(6)
Type of Regression	OLS	OLS	OLS	OLS	OLS	OLS
Dependent Variable	Mgmt score	Mgmt score	Mgmt score	Mgmt score	Mgmt score	Mgmt score
Number of Public Hospitals	0.118**	0.172***				
(Based on a Fixed Radius of 30km)	(0.057)	(0.060)				
Herfindahl-Index (Based on			-0.791*	-0.867**		
Fixed Radius of 30km)			(0.458)	(0.427)		
Herfindahl-Index (Based on					-2.558*	-1.808
Predicted Patient Flows)					(1.332)	(1.289)
General Controls	No	Yes	No	Yes	No	Yes
Observations	161	161	161	161	161	161

Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. Competition is measured as the number of hospitals in a 30km radius around the hospital (based on a "catchment area" of 15km for the individual hospital, see text for more details) in columns (1) and (2). The competition measure in columns (3) and (4) is a Herfindahl-Index (normalized between 0 and 1) of competition based on admissions of all hospitals within a 30km radius. In columns (5) and (6) we use a Herfindahl-Index (normalized between 0 and 1) of competition based on predicted patient flows. Predicted patient flows are estimated using a model of hospital choice in a first stage (see text and Appendix B for more discussion). Standard errors are clustered at a hospital level (the unit of observations is a service line in cardiology or orthopaedics). All columns include controls for the total population and age profile (11 categories) in the catchment area, whether the hospital was a Foundation Trust, the number of sites, number of total admissions and the "case-mix" (age/gender profile of admissions), the tenure of the respondent and interviewer dummies. "General controls" include share of Labour votes, the number of political constituencies, a set of dummies for the winning party in the hospital's own constituency, a London dummy, teaching hospital status, share of managers with a clinical degree and a dummy for whether there was joint decision making at the hospital level. Labour share of votes is defined as the absolute share obtained by the Governing party in the 1997 UK General Election averaged over all constituencies in the catchment area. Regressions are weighted by the inverse of the number of interviews within the same hospital.

Table B4: Full Results for Baseline Regressions

Type of Regression	OLS	Reduced Form	IV, 1st Stage	IV, 2nd St.
Dependent Variable	Mgmt	Mgmt	# Hospitals	Mgmt
Number of Competing	0.172***			0.443***
Hospitals	(0.060)			(0.167)
Proportion of Labour Marginal		7.661***	17.284***	
Constituencies		(2.796)	(3.752)	
General Controls				
Number of Constituencies	0.066	0.140**	0.285***	0.013
	(0.049)	(0.056)	(0.070)	(0.056)
Winning Party was Labour	0.070	-0.130	-0.226	-0.030
	(0.238)	(0.253)	(0.469)	(0.285)
Winning Party was Liberal Democrats	0.139	0.297	0.645	0.011
	(0.283)	(0.287)	(0.465)	(0.350)
Labour Share of Votes	0.011	0.004	-0.053*	0.027
	(0.017)	(0.018)	(0.030)	(0.019)
Size (Total patient admissions)	0.155	0.242*	0.122	0.188
In 10,000s	(0.128)	(0.137)	(0.187)	(0.129)
Number of Sites	-0.038	-0.058	-0.118*	-0.005
	(0.052)	(0.047)	(0.068)	(0.061)
Foundation Trust	0.639***	0.782***	0.282	0.657***
	(0.166)	(0.156)	(0.387)	(0.223)
Proportion of Managers with	0.762*	0.755**	-0.421	0.942**
Clinical Degree	(0.400)	(0.373)	(0.462)	(0.458)
Clinicians and Managers	0.293*	0.267	-0.135	0.327**
take decision jointly	(0.157)	(0.166)	(0.236)	(0.165)
Teaching Hospital	0.599**	0.485*	0.253	0.373
	(0.266)	(0.258)	(0.473)	(0.295)
London	-1.047	-0.989	2.875*	-2.263*
	(0.875)	(0.822)	(1.665)	(1.297)
Interviewer 1	0.315	0.361	0.421	0.174
	(0.595)	(0.565)	(0.540)	(0.582)
Interviewer 2	-0.368	-0.324	0.414	-0.507
	(0.567)	(0.557)	(0.504)	(0.531)
Interviewer 3	0.284	0.496	0.805	0.139
	(0.553)	(0.547)	(0.582)	(0.531)
Interviewee Tenure	-0.081***	-0.077***	0.010	-0.082***
	(0.017)	(0.017)	(0.023)	(0.018)
Area Demographics				
Total Population in 15kn Catchment Area	-1.132**	-1.212**	0.364	-1.373**
(1,000,000s)	(0.520)	(0.527)	(0.745)	(0.647)
Age-/ Gender-Controls	1.84*	2.59***	5.79***	1.44
(F-stat for 11 Variables)				
Case-Mix Controls				
Age-/ Gender Controls	2.23***	1.51*	1.69**	1.93**
(F-stat for 21 Variables)				

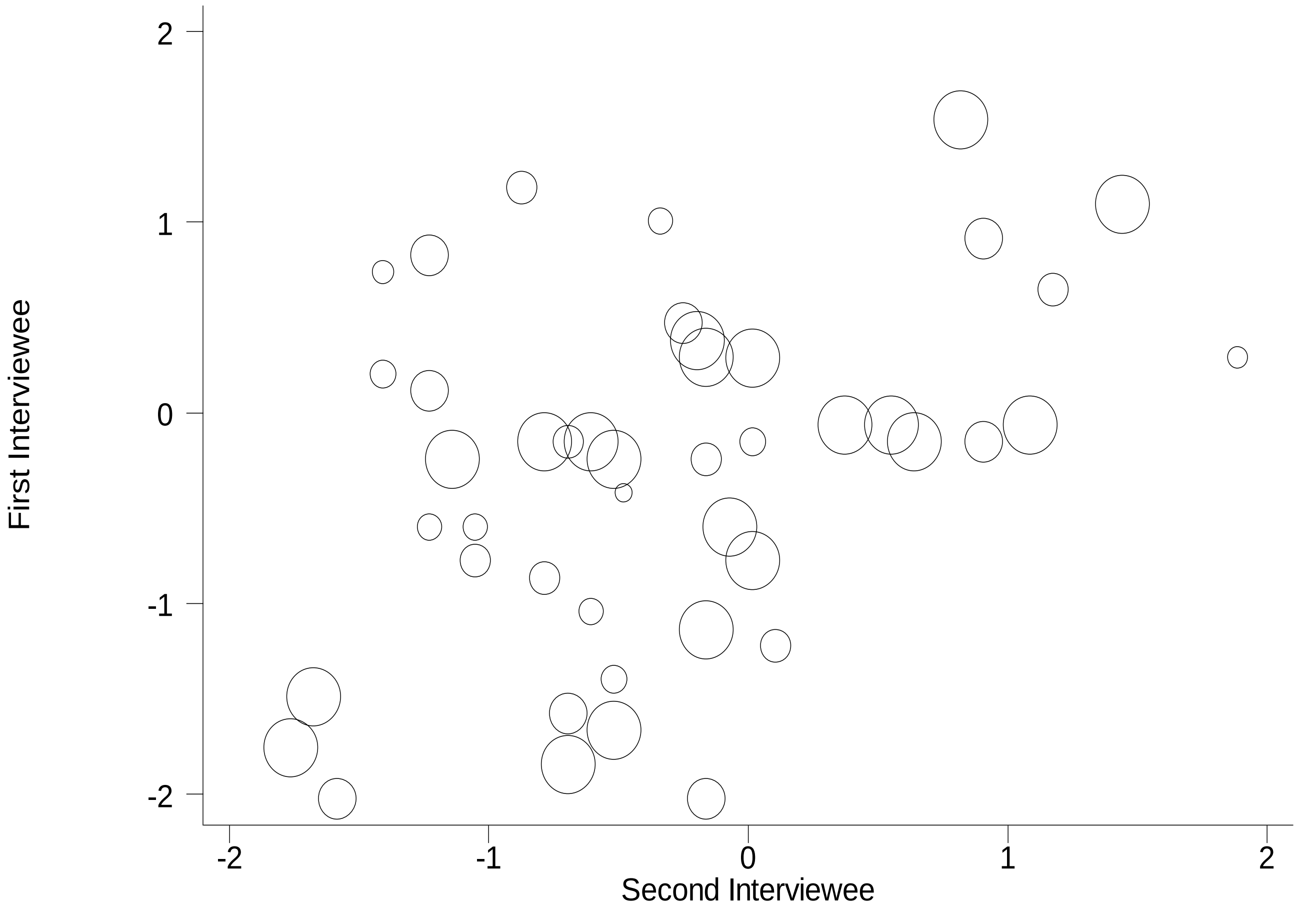
Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. Competition is measured as the number of hospitals in a 30km radius around the hospital (based on a "catchment area" of 15km for the individual hospital, see text for more details). A political constituency is defined as marginal if it was won by less than 5% in the 1997 General Election (% marginal constituencies based on a 45km radius). Standard errors are clustered at a hospital level (the unit of observations is a service line in cardiology or orthopaedics). Labour share of votes is defined as the absolute share obtained by the Governing party in the 1997 UK General Election averaged over all constituencies in the catchment area. All variables in the regressions are reported in the table. The observations are weighted by the inverse of the number of interviews within the same hospital.

Table B5: Correlations of Marginality with other Area Covariates

Method Dependent Variable	(1) Unconditional	(2) Conditional
1. % Voter Turnout 1997	0.028** (0.013)	-0.013 (0.008)
2. Number of Households (10,000s)	0.217** (0.098)	0.027 (0.032)
3. Fraction of Retired Population	0.001 (0.008)	0.001 (0.002)
4. Fraction of Population with Long-term Illness	-0.014* (0.008)	-0.003 (0.004)
5. Fraction of Unemployed	-0.006* (0.003)	-0.001 (0.002)
6. Fraction that Own a House	0.072*** (0.026)	0.022 (0.016)
7. Fraction of Higher Social Class (Managerial and Professional)	0.012 (0.017)	-0.001 (0.009)
8. Fraction Male	0.002 (0.002)	0.002 (0.001)
9. Fraction that do not Work	-0.008* (0.004)	-0.006** (0.003)
10. Fraction Long-term Unemployed	-0.002** (0.001)	-0.001 (0.001)
11. Fraction Students	0.002 (0.008)	-0.001 (0.007)
12. Fraction that Own a Car	0.058** (0.026)	0.018 (0.013)
13. Fraction Without Qualification	-0.023 (0.017)	0.001 (0.009)
14. Fraction Migrants	-0.001 (0.006)	0.001 (0.004)
15. Fraction Working Age Pop.	0.027* (0.014)	0.008 (0.009)
16. Fraction that Work in Manufacturing	-0.002 (0.013)	-0.007 (0.011)
17. Fraction Using Public Transport\ to Work	-0.029 (0.030)	0.005 (0.021)
18. Fraction Single Households	-0.013 (0.011)	-0.003 (0.007)
19. Fraction Lone Parents	-0.013** (0.006)	-0.003 (0.003)
20. Fraction not in Employment	-0.022* (0.011)	-0.006 (0.007)

Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. Each cell reports the coefficient (and standard errors) of a *separate* regression where the dependent variable is the variable named in the first column. The sample is composed of 529 constituencies. Each of the 20 variables is regressed on a dummy variable equal to unity if the constituency is a Labour marginal and zero otherwise. The regressions in the first column are bivariate correlations of a variety of an area characteristic with this Labour marginality variable. The regressions in column (2) condition on some of the basic controls in the main regression analysis: vote share of Labour, population density, the identity of the winning party (dummy for Conservative, Labour or Liberal Democrat) as well as age-controls (4 age-bins are used: under 16, 16-24, 25-39, 40-65, above 65 is the omitted category).

Figure A1: Correlation in Management Scores Between Independent First and Second Interviews on Different Managers or Doctors in the Same Hospital



Notes: Plots the standardized management scores for hospitals where two (or more) independently run interviews have taken place on different managers and/or doctors in different departments. Weight is the inverse of the number of different hospital sites (correlation is 0.53).