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The Impact of Competition on Management Quality: Evidence from Public Hospitals

Nicholas Bloom, Carol Propper, Stephan Seiler and John Van Reenen

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Abstract

We analyze the causal impact of competition on managerial quality (and hospital performance). To address the endogeneity of market structure 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 is expecting a tight election race ("marginals") is rare due to the fear of electoral defeat, we can use political marginality as an instrumental variable for the number of hospitals in a geographical area. We find that higher competition is positively correlated with management quality, measured using a new survey tool. Adding a rival hospital increases management quality by 0.4 standard deviations and increases survival rates from emergency heart attacks by 8.8%. We confirm the validity of our IV strategy by conditioning on marginality in the hospital's own catchment area, thus identifying purely off the marginality of rival hospitals. This controls for "hidden policies" that could be used in marginal districts to improve hospital management. We also run placebo tests of marginality on schools, a public service where the central government has no formal influence on market structure.

JEL Classifications: J45, F12, I18, J31
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Nicholas Bloom is an Associate at the Centre for Economic Performance, London School of Economics. He is also a Professor of Economics, Stanford University. Carol Propper is Chair of Economics at Imperial College and a Senior Researcher at the Centre for Market and Public Organisation (CMPO), University of Bristol. Stephan Seiler is an Associate of the Centre for Economic Performance, London School of Economics and Political Science. He is also Assistant Professor of Marketing, Stanford Graduate School of Business. John Van Reenen is Director of CEP and Professor of Economics, LSE.

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In the EU, US and almost every other nation, healthcare costs have been rapidly rising as a proportion of GDP. 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. One possible lever to increase efficiency is through competition which will put pressure on hospitals to improve management and therefore productivity. Adam Smith remarked "monopoly .... is a great enemy to good management" (*Wealth of Nations*, Chapter XI Part 1, p.148). Given the large differences in hospital performance across a wide range of indicators, it is quite likely that there is scope for improving management practices.[2] In this paper analyze the causal impact of competition on management quality using the UK public healthcare sector as a test bed.

Analyzing the relationship between management and competition has been hampered by two factors; first, the endogeneity of market structure and second, credibly measuring management practices. In this paper we seek to address both of these problems. Using a novel identification strategy and new survey data on management practices we find a significant and positive impact of greater local hospital competition on management quality. Adding a rival hospital increases management quality by 0.4 standard deviations and increases heart attack survival rates by 8.8%.

We use an identification strategy that leverages the institutional context of the UK healthcare sector to our advantage. Closing a hospital in any healthcare system tends to be deeply unpopular. In the case of the UK National Health Service (NHS), the governing party is deemed to be responsible for the NHS and voters therefore tend to punish this party at the next election if their local hospital closes down.[3] The notion that the UK government responded to this incentive is supported by anecdotal evidence. 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 jeopardizing key marginal seats*".

[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] 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).

More specifically, hospital openings and closures in the NHS are centrally determined by the Department of Health.[4] If hospitals are less likely to be closed in areas because these are politically 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. Therefore, in equilibrium politically marginal areas will be characterized by 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 won or lagged behind by a small margin (under 5 percentage points) there were over 20% more hospitals than when it or the opposition Conservative and Liberal Democratic parties enjoyed a large majority. To exploit this variation we use the share of "marginal" constituencies in a hospital's market as an instrumental variable for the numbers of competitors a hospital faces. Furthermore, because hospital markets do not overlap completely we can implement a tough test of our identification strategy by conditioning on marginality around a hospital's own market. This controls for any other "hidden policies" that might improve management quality and identifies the competition effect purely from political marginality around the *rival* hospitals' markets.

The 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, Genakos, Sadun and Van Reenen, 2012). The measures, covering incentives, monitoring, target-setting and lean operations are strongly correlated with firm performance in the private manufacturing and retail sectors. 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 clinicians and managers in two specialties: cardiology and orthopedics. We cover 61% of all National Health Service providers of acute care in England, a sample that appears random based on observable characteristics.

[4] Closures occur in the NHS because there has been a concentration of services in a smaller number of public hospitals since the early 1990s. One factor driving this rationalization has been change in population location and another the increasing demand for larger hospitals due to the benefits from grouping multiple specialties on one site (Hensher and Edwards, 1999), a process that has also led to extensive hospital closures in the US (Gaynor, 2004).

Our paper contributes to the literature on competition in healthcare. Competition is being introduced in many countries such as The Netherlands, Belgium, the UK, Germany, Norway and Australia as a means of improving the productivity of the health care sector. Yet, despite the appeal to policy makers, there is no consensus on the effects of such pro-competitive interventions and little evidence from outside the US.[5] And while markets have long been used for the delivery of health care in the US, massive consolidation among hospitals has led to concerns about the functioning of these markets.[6] The concern for quality in health care means that most countries seeking to introduce competitive forces adopt a regulated approach where prices (reimbursement rates) are fixed across hospitals (essentially adopting the US Medicare system). In such a system, where there is competition to attract patients, this has to be in non-price dimensions such as quality. The central issue is whether this does improve quality where providers (as in the US) are heavily dominated by public and private non-profits. Our finding of a positive role for competitive forces in such a set-up is thus very relevant to this world-wide debate.

More generally, our results tie in with the large literature in industrial organization examining whether competition has a positive effect on productivity.[7] We leverage the institutional features of English hospitals to provide a credible identification strategy for these effects. 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), empirically support that politicians do target policies at a geographical level in order to attract undecided voters.[8] We exploit this relationship to implement our IV-approach.

The structure of the paper is as follows. The next section presents a simple model of the effect of competition on managerial effort. Section II discusses the data, Section III describes the

[5] Positive assessments are also Kessler and McClellan (2000) for the US and Gaynor et al (forthcoming) and Cooper et al (2011) for England. Overall, the evidence on competition in healthcare is mixed –see Dranove and Satherthwaite (2000), Gaynor and Haas-Wilson (1999) and Gaynor (2004).
[6] For example, Federal Trade Commission and US Department of Justice (2004) and Vogt and Town (2006).
[7] 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 survey by Holmes and Schmitz (2010).
[8] 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 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.

relationship between hospital performance and management quality, Section IV analyzes the effect of competition on hospital management and Section V discusses our placebo test on schools. Section VI discusses the possible mechanism through which competition can affect management and Section VI concludes.

I. A SIMPLE MODEL OF MANAGERIAL EFFORT AND COMPETITION

The vast majority of hospital care in the UK is provided in public hospitals. The private sector remains very small and accounted for only around one percent of elective care over our sample period.[9] Public hospitals compete for patients who are fully covered for the costs of their healthcare and make choices about which hospital to use in conjunction with their family doctors ("General Practitioners"). NHS hospitals, as in many healthcare systems, are non-profit making. The bulk of their income comes from a prospective per case (patient) national payment system, which is very similar to and modeled on the DRG (diagnostic related group) system used in the US. Hospitals have to break even annually and CEOs are penalized heavily for poor financial performance. In this system, to obtain revenues hospitals must attract patients.

We explore a simple model which reflects key features of this type of hospital market. 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. For simplicity we assume that revenues and costs enter in an additive way. Note that the CEO's utility is not equal to the hospital's profit function due to the presence of effort costs. Therefore our formulation does not require that hospitals are profit maximizing.

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 $q(e)$. 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.

[9] Private hospitals operate in niche markets, particularly the provision of elective services for which there are long waiting lists in the NHS. Most of this is paid for by private health insurance.

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:

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

The first order condition can be written:

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

This can be re-arranged as:

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

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 change 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. 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.

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: the “stakes” are higher but mark-ups are lower (a “Schumpeterian” effect).[10]

[10] For example, Raith (2003), Schmidt (1997) or Vives (2008).

The model here sketches the most obvious mechanism by which competition could improve hospital quality. In the UK when a General Practitioner (the local "gatekeeper physician" for patients) refers a patient to a hospital for treatment 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 strengthened these incentives by tightening hospital budgets and increasing the information available to choosers of care. Gaynor et al. (2012b) estimate a model of patient choice for hospitals and find that referrals are indeed sensitivity to the hospital's quality of service.[11] This suggests that the mechanism we identify is operating through greater demand sensitivity in less concentrated markets 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).

II. DATA

Our data 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 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

[11] In a similar vein, Gaynor et al. (forthcoming) 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, suggesting that demand is responsive to quality.

The core of this dataset is made up of 18 questions which can be grouped in the following four subcategories: operations and monitoring (6 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.[13] 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 ran 46 interviews on average we can also remove interviewer fixed effects in the regression analysis.

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

[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.

[13] Strictly speaking they knew the name of the hospital and might have made inference about quality from this. As the interviewers had not lived in the UK for an extended period of time, it is unlikely that this was a major issue.

cardiology service and a manager and physician in the orthopedic service (note that some managers may have a clinical background and we control for this). There were 164 acute hospital trusts with orthopedics 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 specialty. 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. An NHS hospital consists of a set of facilities located on one site or within a small area run by a single CEO responsible for strategic decision making with regard to quality control.[14] The number and location of hospitals in the NHS are planned by the Department of Health. When it believes that there is excess capacity in a local area (due, for example, to population change), the Department consolidates separate hospitals under a single CEO (i.e. replacing at least one CEO) and rationalizing the number and distribution of facilities.[15]

In our baseline regression we define a hospital's catchment area as 15km, the standard definition in England (Propper et al, 2007). We show that our results are robust to reasonable changes in this definition. Given a 15km catchment area, any 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 public hospitals within a 30km radius, i.e. twice the catchment area, as our main measure of competition. We use the number of public hospitals, as British private hospitals offer a very limited range of services (e.g. they do not have Emergency

[14] There are no hospital chains in the NHS.
[15] In the period we examine, the government has sought to reduce, rather than increase, hospital capacity.

Rooms). We show that including the number of private hospitals as an additional control does not change our main results. Figure 2 illustrates graphically the relationship between the catchment area radius and the area over which the competition measure is defined.

We also present estimates using 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 into 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 the local neighborhood where a patient lives and which hospital she uses, so we can construct an HHI for every neighborhood and weight a hospital's aggregate HHI by its share of patients from every neighborhood.[16] 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 for 2005-2006. Using predicted market shares is an improvement but 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). There are three main parties in the UK (Labour, Conservative and Liberal Democrat). We define marginal constituencies with respect to the governing party because the government decides about hospital closures. For this reason we measure political pressure for Labour, the governing party during the relevant time period, by looking at constituencies the Labour party marginally won or lost. Our key instrumental variable is the lagged (1997) share of Labour marginal constituencies, defined as constituencies where

[16] Defined here as the Middle Super Output Area, an administratively defined area containing around 7,000 persons.

Labour won or lagged behind by less than 5 percentage points.[17] We use this definition of marginality, together with the 15km definition of each hospital's catchment area, to construct a measure of marginality of the *rivals* of each hospital and use this as our key instrumental variable. We discuss this in detail in Section IV.B.

II.D. Hospital Performance Data

Productivity is difficult to measure in hospitals, so regulators and researchers typically use a wide range of measures.[18] 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.[19] 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.[20] 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' expenditure per patient 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 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. Controls

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[17] We use lagged marginality for reasons we detail in Section IV. Results are similar if we use a definition of marginality from later elections as Labour's polling ratings were relatively constant for the decade from 1994 after Tony Blair took over as leader, through the 1997 and 2001 elections (majorities of 167 and 179 seats respectively), until the mid-2000s after the electorally unpopular 2003 invasion of Iraq.

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

[19] 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 (forthcoming). 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

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

We show robustness to the inclusion of different sets of controls. In all regressions we include patient case-mix by using the age/gender profile of total admissions at the hospital level (four groups in the "minimal control" specification and eleven groups in our baseline for each gender).[21] To control for demand we measure the health status of the local population by its age-gender distribution (9 groups) and population density. We condition on characteristics of the hospital: these are size (as measured by admissions), "Foundation Trust" status (such hospitals have greater autonomy) and management survey "noise" controls (interviewer dummies, interviewee occupation and tenure). We also present regressions with more general controls which include teaching-hospital status, a larger set of patient case-mix controls and the political variables as they may be correlated with health status and the demand for health care. These variables are the share of Labour votes and the identity of the winning party in the 1997 election.[22]

II.F Preliminary Data Analysis

The management questions are all highly correlated 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).[23] Figure 3 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 4 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[24].

III. HOSPITAL PERFORMANCE AND MANAGEMENT PRACTICES

Before examining the impact of competition we validate the data by investigating if the management score is robustly correlated with external performance measures. This is *not*

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[21] We split admissions into 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), giving 21 controls (22 minus one omitted category). These are specific to the condition in the case of AMI and general surgery. For the minimal control specification we use more aggregate categories for each gender (0-55, 56-65, 66-75,>75). 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.

[22] The share of Labour votes is defined over the same geographic area as our marginality instrument (see later discussion for more details). The identity of the winning party refers to the constituency the hospital actually lies in.

[23] z-scores are normalized to have a mean of zero and a standard deviation of one.

[24] 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.

supposed to imply any kind of causality. Instead, it merely serves as a 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.

Table 2 shows results for regressions of each of the performance measures on the standardized management score. Looking across the results we see that 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 7 cases. This immediately suggests our measure of management has informational content.

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.[25] 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 0.97 percentage points in the rate of AMI mortality (or a fall in 5.7% over the mean AMI mortality of 17.08%). Since there are 58,500 emergency AMI admissions in aggregate this corresponds to 570 less deaths a year. Column (2) examines death rates from all emergency surgery (excluding AMI) and again shows a significant correlation with management quality.[26] Columns (3) and (4) show that better managed hospitals tend to have lower waiting lists and lower MRSA infection rates, although the MRSA result is not statistically significant. The financial performance measured by the hospital's expenditure per patient is significantly better when hospitals have higher management scores in column (5). Column (6) indicates that higher management scores are also associated with job satisfaction (a lower probability of the average employee wanting to leave the

[25] 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.
[26] We exclude two specialist hospitals from this regression as they are difficult to compare to the rest in terms of all emergency admissions.

hospital). In the final column we use composite measures from the Health Care Commission (HCC) and find that the management practice score is significantly and positively correlated with this measure.

IV. POLITICAL PRESSURE AND MARKET STRUCTURE

IV.A. Definition of the Instrumental Variable

In order to quantify the degree of political pressure we leverage the institutional features of the British electoral system. There is a first-post-the-post system similar to the election of the US president through the Electoral College. For the purpose of the National Elections, votes are counted in each of about 500 political constituencies. Whichever party obtains the majority of votes within a particular constituency wins the constituency and the party's representative will become a Member of Parliament. The party that wins the majority of constituencies will form the government. One implication of this type of electoral system is the incentive of politicians to cater to constituencies in which they predict a tight race with another party in the next election. They will therefore avoid implementing policies that are very unpopular with voters in those constituencies, such as hospital closures. In the context of the UK such constituencies are referred to as "marginal", in reference to a small winning margin ("swing" states in the US). As constituencies are fairly small geographical units, we use the share of marginal constituencies in all the constituencies that lie within a certain radius of the hospital to construct our instrument.[27]

For any given hospital, any other rival hospital within a 30 km radius will have an overlap in its catchment area (defined as a 15km radius). Following a similar logic, political pressure within the catchment area of every possible competitor (who might be up to 30km away) will matter for determining the absolute number of competitors nearby. 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 5 illustrates graphically the relationship between the catchment area (15km radius), the area used for the competition measure (30km radius) and our marginality measure (45km

[27] To be precise we draw a radius around each hospital location and then find all constituencies whose centroid lies within this radius. The percentage of those constituencies that are marginals is defined as our instrument.

radius).[28] In the empirical work we show the robustness of the results to different assumptions over catchment areas.

Finally, we need to define the dating of the instrument relative to our measure of competition. One challenge is the fact that marginality influences the closures and openings of hospitals i.e. the *change* in the number of hospitals. However, we only have access to cross sectional measures of management quality so the appropriate measure of market structure is the current number *stock* of hospitals. The stock of course is a function of the change in numbers. Fortunately, we are able to exploit the fact that between 1997 and 2005 there was a large wave of hospital closures, which substantially reduced the number of hospitals in the UK (see Figure A1). The political environment was stable over this period – there were two elections and the governing Labour party achieved very similar election outcomes in 2001 and 1997. Out of a total of 526 constituencies in 2001, Labour only won one constituency they did not previously win and only lost six that they had won in 1997. We therefore think of the distribution of marginal constituencies in 1997 as reflecting the geographical variation in political pressure during the period leading up to 2005. This leads us to use marginality in 1997 as an instrument for the number of hospitals in 2005 (we show that the results are robust to using 2001 instead). In this way, our IV-strategy leverages the combination of a stable political environment with a large change in hospital numbers from 1997 to 2005. In principle, we could use marginality from earlier elections as well because previous governments should have had similar incentives. However, there was a relatively small amount of change in the number of hospitals prior to 1997 and therefore there was less scope for the government to influence the geographical distribution of hospital density.

IV.B. Analysis of the first stage: the effect of political marginality on hospital numbers

In Table 3 we report regressions of the number of hospitals in 2005 on the degree of political marginality in 1997. We use the sample of all hospitals which existed in 1997 and define a radius of 30km around every hospital and count the number of hospitals still operating within this radius in 2005.[29] To address potential geographic overlap we cluster at the county level (there are 42 of

[28] In our sample there are 38 constituencies on average in this radius (see Table 1).
[29] The number will include the hospital around which the radius is drawn. If the hospital is closed this is still used as an observation and the number of hospitals within its 30km market is reduced by one.

these in England). We also present results using spatially corrected standard errors as in Conley (1999) in Table B3 which produce slightly smaller standard-errors. The regressions are the form:

$$COMP_j = \gamma_1 MARGINALITY_j + \gamma_2' z_j + v_j$$

where *COMP* is our measure of competition for hospital j, $MARGINALITY_j$ denotes our instrumental variable based on political contestability, z_j is a vector of controls referring to hospital j, and v_j is an error term.

Column (1) of Table 3 shows that marginality in 1997 has a significant positive impact on the number of hospitals that exist in 2005. Consistent with Figure 1, a one standard deviation increase in political marginality (0.098) leads to almost half an additional hospital (0.405 = 0.098*4.127). In column (2) we regress changes in the number of hospitals between 1997 and 2005 on the change in marginality between 1992 and 1997. These fixed effects / first difference estimates have a similar coefficient on marginality without population controls in column (2), or with population controls on column (3). In column (4) we look directly at closures which constitute the mechanism through which marginality affects the change in the number of hospitals. We regress whether a hospital was closed or consolidated with another hospital on our marginality measure and find that marginality significantly lowers the likelihood of being part of a closure/consolidation. Column (5) shows that even after adding further controls the effect of marginality on hospital closures continues to be robustly negative.[30]

The first stage of our main IV specification has to be run on a smaller sample than the results in Table 3 because management score is only available for the sub-sample of hospitals who responded to our 2006 management survey. We therefore have a smaller sample relative to the full set of 1997 hospital locations. Column (6) reports an identical specification to column (1) on this sub- sample, which shows a very similar coefficient (4.96 compared to 4.13). A fixed effect estimator for the second stage is infeasible as we observe management quality at only one point in

[30] One advantage of using the closure dummy for a specific hospital rather than the number of hospitals in a given market is the fact that hospital-specific control variables are more meaningful in this context (i.e. the regression uses a hospital rather than a market as the unit of observation). This allows us, for example, to control for the impact of teaching and specialist status on the probability of closure.

time but the similarity of the coefficients in columns (1) and (2) is reassuring, as it suggests little bias (at least in the first stage) from omitting fixed effects.

V. MANAGEMENT PRACTICES AND HOSPITAL COMPETITION

V.A Empirical Model of Management and Competition

Our main regression of interest is:

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

where M_{jg} is the average management score of respondent *g* in hospital *j* (we have a mean of 1.65 respondents per hospital), z_{jg} is a vector of controls (most of which are *j*-specific not *jg*-specific) and ε_{jg} is the error term. The direction of the OLS bias on β_1 is ambiguous. 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 that 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 sickness-related health demand with our 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 neighboring 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 desirable areas where the population are high income "health freaks" then this may cause an upwards bias on β_1. To address endogeneity we use the political marginality instrumental variable described above.

V.B Basic Results

To investigate whether competition improves management practices, column (1) of Table 4 presents an OLS regression (with minimal controls) of management on the number of rivals that could serve a hospital's geographical catchment area. The controls are population density and demographics in the hospital's catchment area, a limited set of hospital-specific patient case-mix and hospital type. There is a positive and significant coefficient on the competition measure. Adding one rival hospital is associated with an increase in management quality of 0.161 of a standard deviation. The key set of controls is the patient case-mix and population density, as areas with greater demographic needs (e.g. more old people) tend to have more hospitals.[31] Dropping hospital size, as measured by the number of admissions, made little difference to the results.[32]

These baseline estimates use a very simple measure of competition, the number of competing hospitals within a fixed radius of 30km. Table B4 presents robustness checks with alternatives based on the Herfindahl Index (HHI). Columns (1) and (2) of Table B4 repeat the baseline specification from columns (1) and (4) of Table 4 (without and with the larger set of controls). Columns (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 the HHI based on predicted patient flows (as discussed above) and also show a negative correlation of market concentration with management scores.[33]

Is the positive correlation between management quality and various measures of competition causal? Column (2) of Table 4 reports the first stage (column (6) of Table 3) showing that marginality strongly predicts hospital numbers. Column (3) presents the IV second-stage results and shows a positive effect of the number of competing hospitals on management quality that is significant at the 10% level. In columns (4) to (6) we include a richer set of covariates including dummies for teaching hospital status, the share of Labour votes and the identity of the winning party.[34] The full set of coefficients is presented in column (1) of Table B5. The coefficients on our

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[31] Without the case mix controls (8 age/gender groups in this specification) the coefficient on competition drops to 0.138 (standard error 0.052), which is consistent with a downward bias resulting from failing to control for demographic demands.

[32] Dropping the number of patients caused the coefficient on competition to change from 0.161 to 0.133 (standard error 0.046). 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.

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

[34] 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, population density and political controls. Including the total mortality rate in the hospital's catchment area was also insignificant with a coefficient (standard error) of 0.001 (0.004) in column (6) with a coefficient (standard error) of competition of 0.389 (0.202). This implies our case mix controls do a good job at controlling for co-morbidity.

key variables are little changed by these additional covariates and, in fact, the first stage coefficient on marginality in column (5) is 7.228, a bit stronger than in column (2).[35]

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, i.e. 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.[36] 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 by 1.5 percentage points (or 8.8%) per year. One worry might be that a higher density of hospitals implies that patients are closer to the nearest hospital, which will decrease mortality due to faster treatment (this is not an issue when using management as an outcome). In order to address this concern, we include a measure of ambulance response times as additional control and find that our results are robust.[37]

V.C Validity of the marginality instrument

A threat to our IV strategy is the political marginality may be correlated with some unobserved factors that could lead directly to better management. This might be due to omitted variables, or it might be because politicians find other routes via "hidden policies" to improve management practices directly other than via market structure. To examine this we carry out three tests.

[35] We also examined adding higher order controls for Labour's vote share or dropping Labour's vote share completely with robust results. 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 0.366 (0.168). Dropping the Labour vote share completely yields a coefficient of 0.389 (0.175).

[36] 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.

[37] Specifically, we include the percentage of ambulance call-outs that took longer than 8 minutes to arrive (the national target). In the equivalent specification of column (9) the coefficient (standard error) on the number of hospitals was -1.486 (0.672) after including the response time variables in first and second stages. The response time measure was insignificant suggesting that population density and the other covariates adequately controlled for this factor.

First, we look directly at whether there is a relationship between marginality and the potential demand for healthcare in the area. Table B6 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 marginality that these areas (among other things) are more likely to have higher rates of employment and fewer people with long-term illness. However, our management regressions control for population density and demographics, so column (2) reports the coefficients on Labour marginality after conditioning on population density, the fraction of households owning a car (which captures both income and the degree of urbanization) and a London dummy, all of which are variables used in our main regression. Using these controls, none of the observables reported in B6 are significantly correlated with marginality.

Our second approach is perhaps the most direct and compelling: 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 hospital catchment area leads us to use the fraction of Labour marginals within a 45km radius as our instrument.[38] 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. Specifically, 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.

[38] The logic of how the 45km radius for marginality follows from the 15km radius of the catchment area was presented in Section IV.B and Figures 2 and 5.

Table 5 reports the baseline IV estimate in column (1) which is the same as Table 4 column (6). Column (2) of Table 5 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 (3) presents the second stage. Competition still has a positive and significant impact on management quality (the coefficient falls slightly from 0.366 to 0.336). The coefficient on marginality around the hospital itself is positive but insignificant in this second stage.

The validity of the test above depends crucially on the correct definition of the own and rival geographic areas. We therefore also test directly for the most obvious channel through which politicians might influence hospital performance: better funding. This should in principle not be an issue 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. To test for any possible impact of marginality on hospital funding we report, in Table 5 column (4), a regression of expenditure per patient on marginality and find no significant effect. Similarly, when we include expenditure as an additional control in our IV in column (5), our main result remains unchanged. Finally, in column (6) we also control for the age of the hospital's buildings in the second stage to test whether marginal constituencies receive more resources in terms of newer capital equipment. This seems not to be the case.

V.D. Robustness and Extensions

Capacity rather than Competition? 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 in the area* rather than competition causing improvements in management. We investigate this empirically by using two types of capacity controls at the level of the local area: the number of physicians per patient and the number of beds per patient (we also implement a check where we control for these at the hospital level). 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.[39] We find very similar results when using the number of beds per patient as control for capacity.[40]

A related concern is that areas which experience more hospital closures suffer from disruption because incumbent hospitals face unexpected patient inflows.[41] 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 hospital's 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 admissions on the quality of management. The coefficient on competition remains significant with a very similar magnitude to that in column (1).[42] Note also, that there were almost no closures after 2001 (see Figure (A1)). We would therefore not expect to still see the disruptive effects of closures that happened at least 4 years prior to our survey.

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

[39] Weakening time pressure has ambiguous effects on management practices as it could lead to slack (Bloom and Van Reenen, 2010).
[40] In the second stage of the IV, the coefficient (standard error) on the number of beds per patient is 8.033 (8.893). The coefficient (standard error) on the competition measure is 0.367 (0.171).
[41] Closures/consolidations led to increases in waiting times in nearby hospitals (Gaynor et al., 2012a).
[42] We repeated the same exercise using the variance in yearly admissions over the same time period as an alternative measure of shocks. The variable was insignificant and the competition coefficient remained positive and significant.

in areas where there is greater political competition, implying that the bankruptcy risk model is unlikely to be empirically important in our data.[43]

Alternative thresholds for catchment areas and marginality. 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 changing the catchment area in columns (9) and (10) makes little difference. 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 5, using a 3% or 7% threshold for marginality in column (11) and (12) makes little difference to the main results.

Local labor markets? 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 as 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. When this proxy is added to the specification the coefficient (standard error) on the competition measure is 0.351(0.167) and the coefficient on number of teaching hospitals in the local area is actually negative (clinical skills may be better, but managerial skills are not). This would also suggest it is not learning through local knowledge spillover which is driving the effect of the number of rival hospitals on performance. We return to this issue in the conclusion.

VI. 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

[43] 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 B6 column (2).

(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 the formal responsibility of the Local Education Authority (LEA), which decides primarily on financial grounds given per capita pupil funding. Other things equal, the national 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 (through political pressure on managers or channeling 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 the effect of political marginality on market structure 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.[44]

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

[44] 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.

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.[45]

In Table 6 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 controls for the political color of the constituencies, whereas column (2) controls for total school and area characteristics. Marginality is insignificant in both columns. The magnitude of the point estimate of the marginality coefficient is also small. A one standard deviation increase in marginality is associated with 15% of a new school (0.153 = 0.255 *0.599), 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 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 6 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 5. As in the case of hospitals we do not find any effect of marginality on public funding for secondary schools. 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

[45] 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).

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.[46] Columns (8) to (10) of Table 6 use the school's value-added and finds similar results: a small and insignificant coefficient of political marginality on school outcomes. To put it another way, for a one standard deviation increase in the fraction of marginal constituencies, value added is predicted to increase by a (statistically insignificant) 0.014 of a standard deviation according to column (9). By comparison, a one standard deviation increase in the fraction of marginal constituencies will lead AMI death rates to fall by a (statistically significant) 0.15 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. Of course, schools and hospitals differ in many ways from one another. However, we think the main ways in which the government could influence the performance of each of these public services through funding or political pressure is quite similar. The placebo test therefore provides some additional evidence for the validity of our IV-strategy.

VII. 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 implement this survey in two thirds of acute hospitals in England. We found that 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, 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

[46] This provides some suggestive evidence that competition may matter for performance in public schools as it does for public hospitals.

more hospital competition leads to improved hospital management. Our results suggest competition is useful for improving management practices in the healthcare.

We examined a variety of reasons that would invalidate our IV strategy. Importantly, we are able to control for marginality around the hospital and still identified an effect of competition using marginality around only *rival* hospitals as the instrument. This suggests that "hidden policies" to improve management in marginal districts is not driving our results. Further, 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). The setting we examine – non-profit hospitals reimbursed using ex-ante regulated prices - is common in many healthcare systems. Non-profits are important providers in many health care markets and governments (and other third party payers) seek to limit the growth in health care costs, frequently by setting regulated prices. The incentives facing CEOs of hospitals in many healthcare systems are similar to those in the NHS: these not necessarily to maximise profits but to earn revenues subject to convex effort costs.

One caveat to our conclusions is that the increase in the number of hospitals could have an effect on managerial quality through learning instead of competition, as it may be easier to imitate best practice by examining one's neighbors. We think the most likely route for this would be from clinical learning as proxied by the density of local teaching hospitals and empirically we found no evidence for this mechanism. More likely learning operates more on a national (or international) level. Furthermore, the evidence from increasing patient choice in the NHS (conditional on the number of hospitals) also shows improvements in hospital performance, which implies competition effects rather than knowledge spillovers (Gaynor et al, forthcoming, and Cooper et al, 2011). Nevertheless, it is possible that there may be geographically local knowledge spillovers specifically for managers that we are missing, and this would be an interesting area for future research.

Another caveat to our results is that although we have shown evidence of a positive effect of competition on quality of care, 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 a larger number of hospitals could lead to 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, the estimates presented here suggest that the benefits generated from competitive pressure should also enter the cost-benefit analysis. Furthermore, there can be efforts to increase the demand elasticity through information, incentives and other reforms (such as the patient choice reforms in England in the 2000s, see Gaynor et al 2012b) 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	Median	Standard Dev.	Obs
Average Management Score (not z-scored)	2.46	2.44	0.59	161
Competition Measures				
Number of competing hospitals (in 30km radius)	7.11	3	9.83	161
Herfindahl index based on patient flows (0-1 scale)	0.49	0.46	0.19	161
Performance Measures				
Mortality rate from emergency AMI after 28 days (quarterly av., %)	15.55	14.54	4.46	140
Mortality rate from emergency surgery after 30 days (quarterly av., %)	2.18	2.01	0.79	157
Numbers on waiting list	4,893	4,609	2,667	160
Infection rate of MRSA per 10,000 bed days (half yearly av.)	1.61	1.53	0.64	160
Expenditure per Patient (£ 1000)	9.69	8.85	4.51	152
Staff likelihood of leaving within 12 months (1=v. unlikely, 5=v. likely)	2.70	2.69	0.13	160
Average Health Care Commission rating (1-4 scale)	2.25	2	0.68	161
Political Variables				
Proportion of marginal constituencies (in 45km radius, %)	8.41	5.88	9.78	161
Number of Marginals (in 45km radius)	2.646	2	2.430	161
Number of Constituencies (in 45km radius)	37.795	25	32.38	161
Proportion of marginal constituencies (in 15km radius, %)	10.10	0	23.51	161
Labour share of votes (average of constituencies in 45km radius, %)	42.08	43.01	13.43	161
Covariates				
Density: Total Population (millions) in 30km radius	2.12	1.23	2.26	161
Foundation Trust hospital	34.16	0	47.57	161
Teaching hospital (%)	11.80	0	32.36	161
Specialist hospital (%)	1.86	0	13.56	161
Managers with a clinical degree (%)	50.38	50.0	31.7	120
Building age (years)	25.98	27.06	8.37	152
Mortality rate in catchment area:Deaths per 100,000 in 30km radius	930	969	137	161
Size Variables				
Number of total admissions (quarterly)	18,137	15,810	9,525	161
Number of emergency AMI admissions (quarterly)	90.18	82	52.26	161
Number of emergency surgery admissions (quarterly)	1,498	1,335	800	161
Number of sites	2.65	2	2.01	161

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable:	Mortality rate from emergency AMI	Mortality rate from all emergency surgery	Waiting list (1000 patients)	MRSA infection rate	Expenditure per patient	Intention of staff to leave in next 12 months	Health Care Commission (HCC) overall rating
Mean	17.08	2.21	4.90	1.61	9.69	2.70	2.25
Standard Deviation	7.56	0.84	2.70	0.64	4.51	0.13	0.68
Management Practice Score	-0.968**	-0.099**	-0.207*	-0.081	-0.681**	-0.031**	0.108***
	(0.481)	(0.044)	(0.121)	(0.062)	(0.260)	(0.013)	(0.041)
Observations	140	157	160	160	152	160	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 (6) are generally considered to be "bad" whereas (7) is "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 the county level (there are 42 clusters). All columns include controls for whether the hospital was a Foundation Trust, a teaching hospital dummy, number of total admissions, the fraction of households owning a car, a London 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, whether the respondent was a clinician, share of managers with clinical degree and a joint decision making dummy. In column (1) we drop hospitals with less than 150 AMI cases per year; in column (2) specialist hospitals that do not perform standard surgery are dropped. There is minor variation in the number of observations for the other columns due to the fact that not all performances measures were available for all hospitals. Column (7) uses the average of HCC's rating on resource use and quality of service as dependent variable

Table 3: The Effect of Political Pressure ("Marginality") on the Number of Hospitals

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All Hospitals In 1997	All Hospitals In 1997	All Hospitals In 1997	All Hospitals In 1997	All Hospitals In 1997	Interviewed Hospitals
Dependent Variable:	# Hospitals 2005	Change in # Hospitals 1997-2005	Change in # Hospitals 1997-2005	Closure Dummy	Closure Dummy	# Hospitals 2005
Political Marginality in 1997	4.127***			-0.894**	-1.308***	4.955***
	(1.279)			(0.359)	(0.376)	(1.382)
Change in Marginality 1992 – 1997		4.708**	2.919**			
		(2.026)	(1.256)			
# Hospitals per Capita in 30km radius (in 1997)					0.309***	
					(0.092)	
Teaching Hospital Dummy					-0.083	
					(0.097)	
Specialist Hospital Dummy					-0.344*	
					(0.181)	
Population Controls	Yes	No	Yes	No	Yes	Yes
Further Controls (see Table 4)	No	No	No	No	No	Yes
Observations	212	212	212	212	212	161

Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. The number of hospitals is measured within 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 Labour won/was lagging behind by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on a 45km radius). Standard errors are clustered at the county level (there are 48 clusters in all columns except column (6) where there are 42). "Population controls" include total population and age profile (9 categories) in the catchment area as well as a London dummy. In column (3) population controls refer to the change in population between 1997 and 2005. "Further controls" are whether the hospital was a Foundation Trust, number of total admissions and basic case-mix controls (6 age/gender bins of patient admissions), the tenure of the respondent, whether the respondent was a clinician, the share of managers with a clinical degree and interviewer dummies .

Table 4: 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	0.161*** (0.042)		0.325* (0.178)	0.181*** (0.049)		0.366** (0.168)	-1.022*** (0.285)		-1.502** (0.654)
Proportion of Marginal Constituencies		4.955*** (1.382)			7.228*** (2.115)			7.613*** (1.851)	
F-statistic of excluded instrument in corresponding first stage		12.85			11.68			16.91	
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 Labour won/was lagging behind by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on a 45km radius). Standard errors are clustered at the county level (there are 42 clusters). All columns include controls for the total population and age profile (9 categories) in the catchment area, whether the hospital was a Foundation Trust, number of total admissions and basic case-mix controls (8 age/gender bins of patient admissions), the tenure of the respondent, whether the respondent was a clinician and interviewer dummies as well as the share of managers with a clinical degree. "General controls" include Labour share of votes, the fraction of households owning a car, the number of political constituencies in the catchment area, a set of dummies for the winning party in the hospital's own constituency, a London dummy, teaching hospital status and a dummy for whether there was joint decision making at the hospital level as well as detailed "case-mix" controls (22 age/gender bins of patient admissions). 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).

Table 5: Instrument Validity and Robustness Tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Type of Regression	IV	1st Stage	IV	OLS	IV	IV	IV	IV	IV	IV	IV	IV
Dependent Variable	Mgmt	Number of rival Hospitals	Mgmt	Expenditure Per Patient	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt	Mgmt
Catchment Radius	15km	15km	15km	15km	15km	15km	15km	15km	13km	17km	15km	15km
Marginality Threshold	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	3%	7%
Number of Competing Public Hospitals	0.366**		0.336**		0.432*	0.343*	0.359**	0.361**	0.484**	0.395*	0.227*	0.485*
	(0.168)		(0.144)		(0.224)	(0.175)	(0.169)	(0.160)	(0.225)	(0.219)	(0.126)	(0.279)
Proportion of Marginal Constituencies within 45km		9.001***		3.596								
		(2.722)		(3.478)								
Expenditure Per Patient					-0.059							
					(0.036)							
Average age of hospital Buildings						0.009						
						(0.010)						
Proportion of Marginal Constituencies within 15km		-1.092	0.135									
		(0.916)	(0.371)									
Physicians per Patient in Local Area							-0.057					
							(0.052)					
Growth in Total Admissions 2001-2005 (10,000s)								-0.124				
								(0.175)				
Observations	161	161	161	152		161	161	161	161	161	161	161

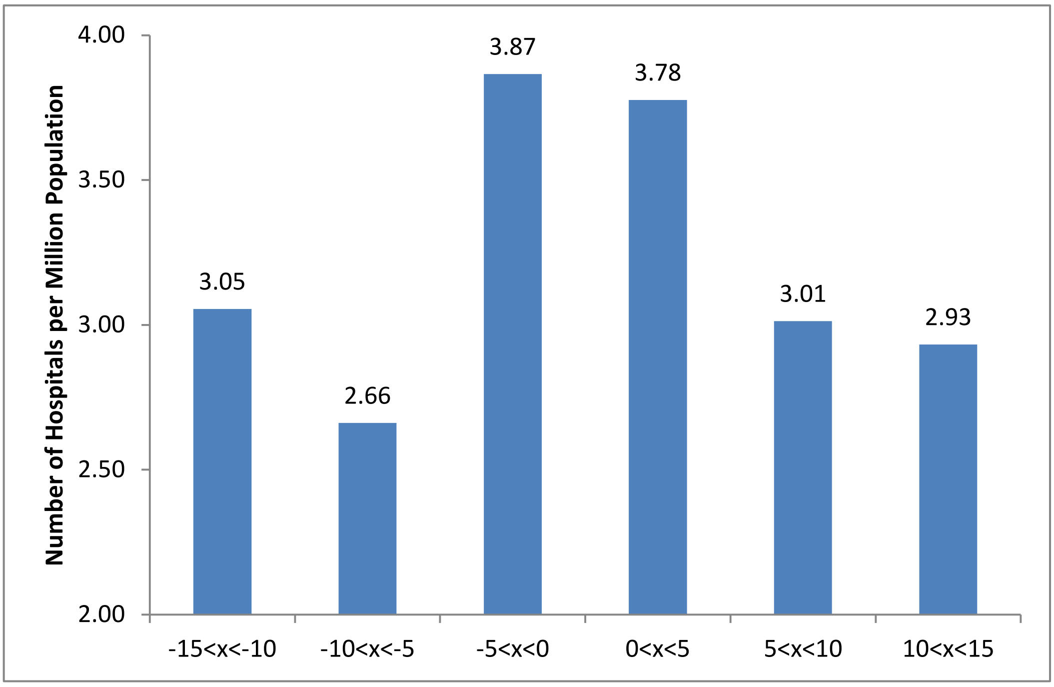
Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. Competition is measured as the number of hospitals in a 30km radius around the hospital (based on a "catchment area" of 15km for the individual hospital, see text for more details). A political constituency is defined as marginal if Labour won/was lagging behind by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on a 45km radius). Standard errors are clustered at the county level (there are 42 clusters). All columns include controls for the total population and age profile (9 categories) in the catchment area, whether the hospital was a Foundation Trust, number of total admissions, the tenure of the respondent, whether the respondent was a clinician and interviewer dummies as well as the share of managers with a clinical degree. "General controls" include Labour share of votes, the fraction of households owning a car, the number of political constituencies in the catchment area, a set of dummies for the winning party in the hospital's own constituency, a London dummy, teaching hospital status and a dummy for whether there was joint decision making at the hospital level as well as detailed "case-mix" controls (22 age/gender bins of patient admissions). 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).

Table 6: 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 Marginal Constituencies	-0.863 (0.922)	-0.599 (0.394)	-0.043 (0.057)	0.032 (0.047)	0.001 (0.017)	-0.011 (0.011)	-0.006 (0.011)	0.529 (0.323)	0.216 (0.260)	0.314 (0.262)
Labour Share of Votes	13.770*** (1.892)	0.617 (0.922)	1.155*** (0.089)	-0.117 (0.153)	-0.251*** (0.021)	-0.026 (0.020)	-0.010 (0.019)	-5.505*** (0.442)	-2.577*** (0.475)	-2.276*** (0.469)
Cohort Size (Unit: 10 pupils)				0.006 (0.006)		-0.009*** (0.001)	-0.008*** (0.001)		-0.142*** (0.021)	-0.133*** (0.021)
School Size (Unit: 100 Pupils)				-0.066*** (0.014)		0.012*** (0.002)	0.013*** (0.002)		0.181*** (0.036)	0.196*** (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	300	300	2782	2782	2782	2782	2782	2782	2782	2782

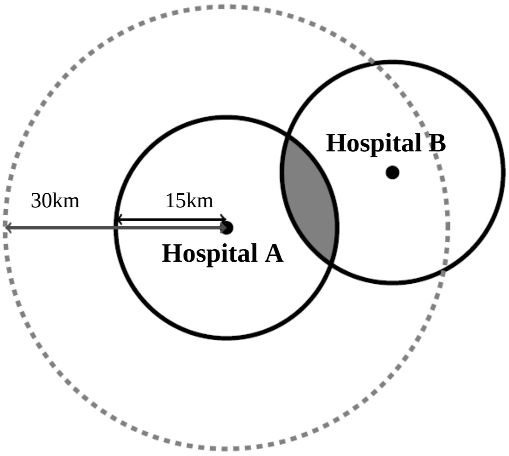
Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. A political constituency is defined as marginal if Labour won/was lagging behind by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on all constituencies within in the catchment area, i.e. within the 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



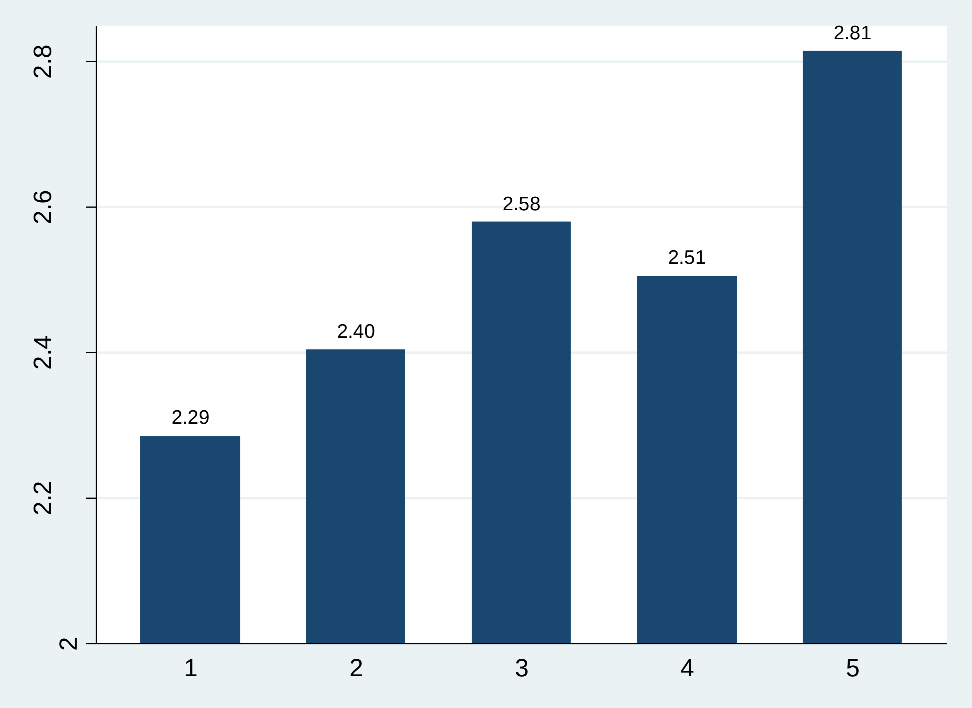
Notes: This figure plots the mean number of hospitals per 1 million people within a 15km radius of the centroid of a political constituency against the "winning margin" in 1997 of the governing party (Labour). When Labour is not the winning party, the margin is the negative of the difference between the winning party (usually Conservative) andLabour. The margin is denoted "x". There are 529 political constituencies in England.

Figure 2: Graphical Representation of the Competition Measure



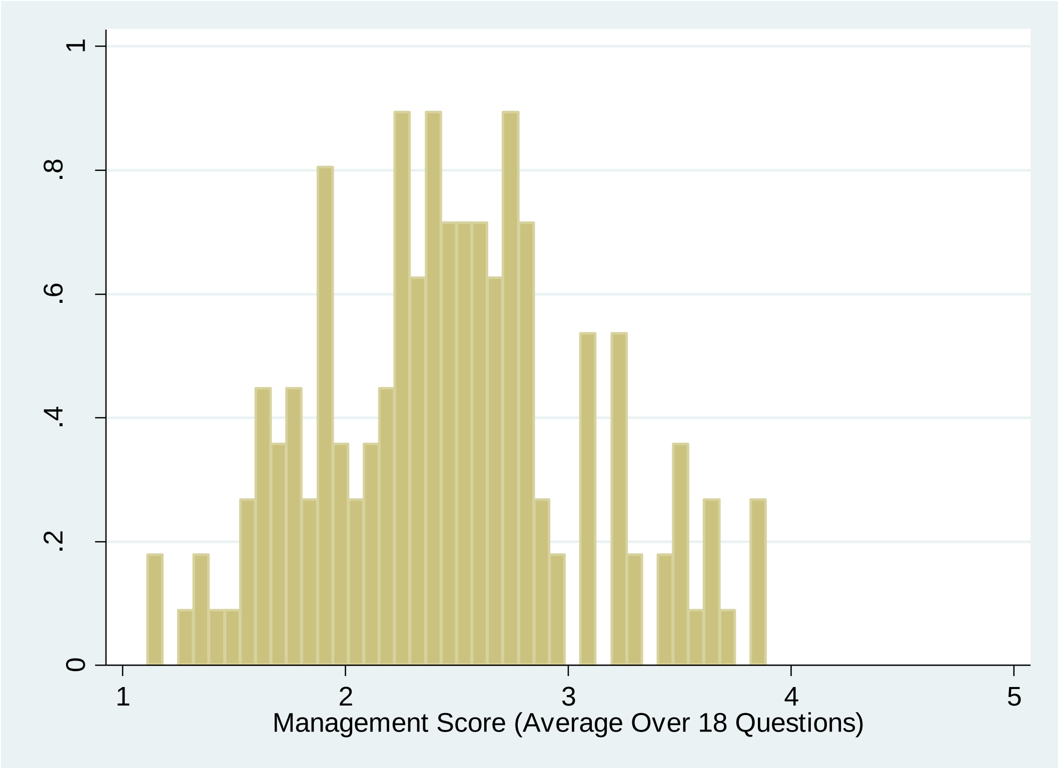
Notes: The figure shows the 15km catchment area for hospital A. Any hospital within a 30km radius of hospital A will have a catchment area that overlaps (at least to some extent) with hospital A's catchment area. The overlap is illustrated in the graph for hospital B. Our competition measure based on 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: Management Score by Quintiles of Average HCC Rating



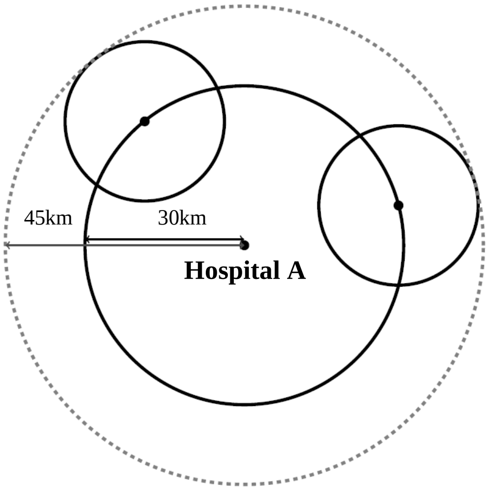
Notes: The Health Care Commission (HCC) is an NHS regulator who gives every hospital in England an aggregate performance score across seven domains (see Appendix B). We divide the HCC average score into quintiles from lowest score (first) to highest score (fifth) along the x-axis. We show the average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

Figure 4: Management Scores in Hospitals



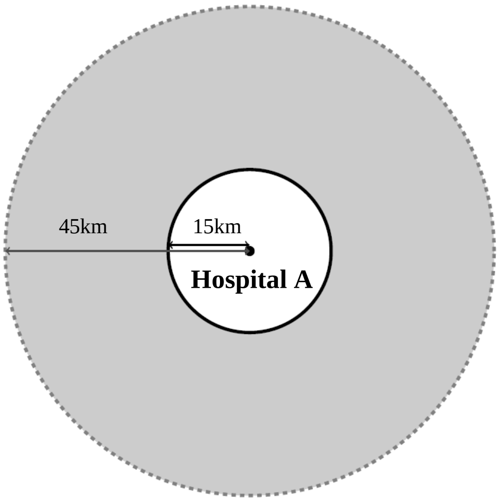
Notes: This is the distribution of the management score (simple average across all 18 questions). 1 = Worst Score, 5 = Best Score.

Figure 5: Graphical Representation of the Marginality Measure



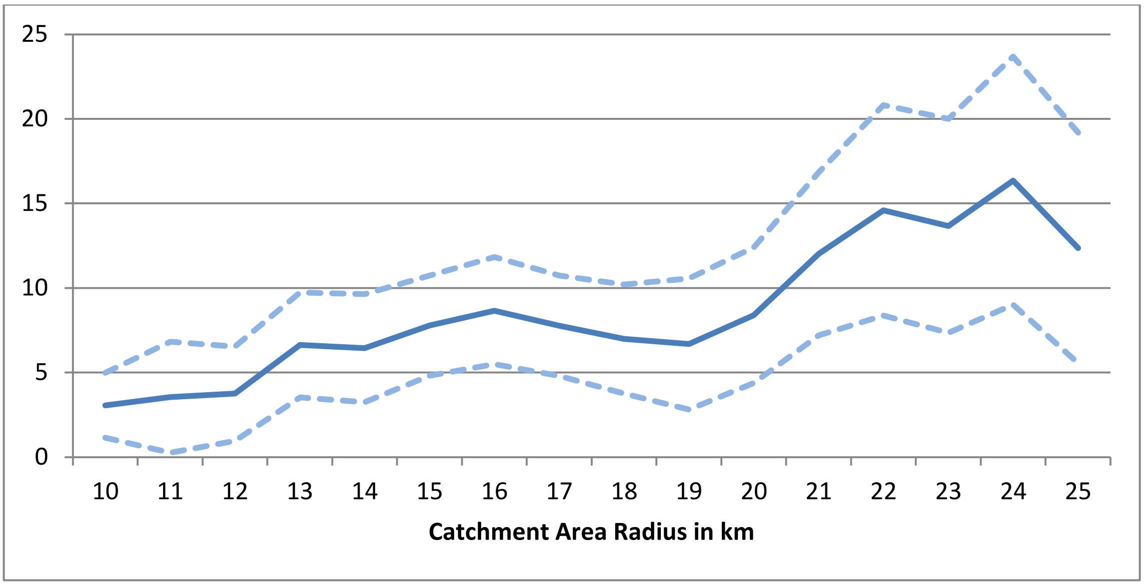
Notes: The figure illustrates the definition of our main marginality measure. Any hospital within a 30km radius of hospital A is considered to be a competitor (see Figure 2). We care about the political environment in the catchment area of any possible competitor. Therefore we draw a 15km radius (our 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 6: Using Two Marginality Measures



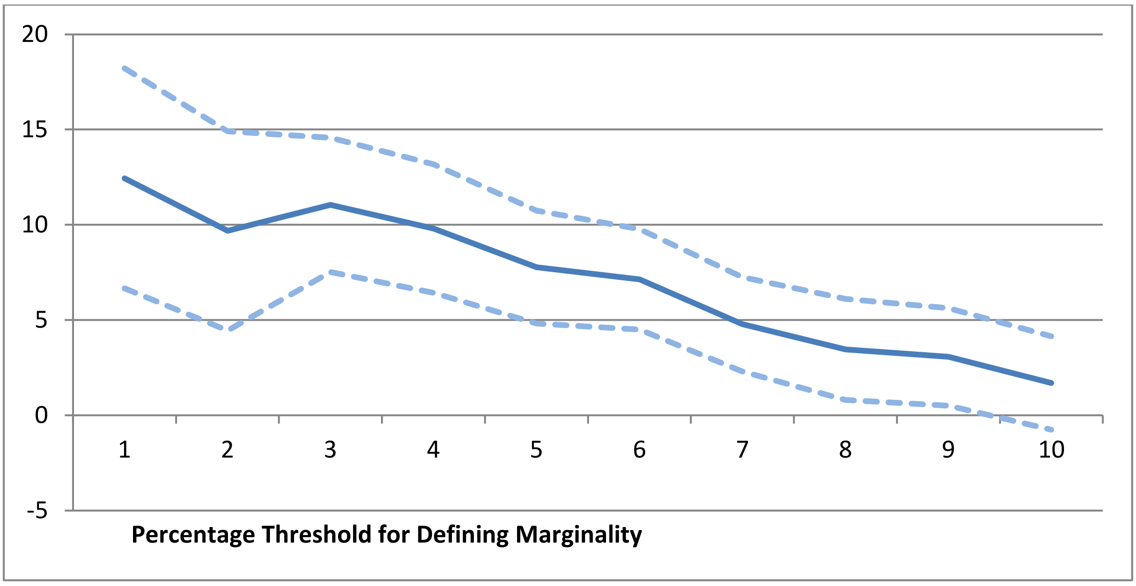
Notes: The graph illustrates the idea behind the sensitivity check conducted in columns (2) and (3) of Table 5. We include the marginality measure defined over a 45km radius and the one defined over a 15km radius in the first stage. But only the 45km measure is excluded from the second stage, i.e. serves 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 marginality instrument (identical in specification to those of column (5) in Table 4). The solid line is the OLS coefficient and the dashed lines show the 90% confidence bands. 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 implies that the area over which we define competition varies from 20km to 50km. The effective political catchment area (relevant for number of rival hospitals) varies from 30km 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 marginality instrument (identical in specification to those of column (5) in Table 4). The solid line is the OLS coefficient and the dashed lines show the 90% confidence bands. We vary (on the x-axis), the percentage margin by which Labour won / was lagging behind 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.

APPENDICES ARE NOT INTENDED FOR PUBLICATION (UNLESS REQUESTED)

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 optimized 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 focused 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.[47] There were 174 such units in 2006, but we dropped hospitals without orthopedics 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 orthopedics). Table 1 shows the data is evenly split between the specialties (52% cardiology and 48% orthopedics), 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.

B.2 Construction of predicted HHIs (used in Table B4)

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 (forthcoming) and the reader is referred to their Appendix B for more details.

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).[48] 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:

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

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

[48] 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.

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.[49]

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

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

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

[49] 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.

diagnosis or three or more ICD diagnosis respectively. All patient level variables are interacted with the variables z_j^1 and z_j^2.[50]

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.[51]

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.[52]

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%. (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). The results are robust to a range of model specifications including: (1) whether we allow model parameters to be region-

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50 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.

51 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.

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

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.

Appendix 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
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.
Local authority all-cause mortality rates	Calendar year; standardized	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/

Appendix 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
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%.

Appendix Table B3: The Effect of Political Pressure on the Number of Hospitals: Conley (1999) spatially-corrected standard errors

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All Hospitals In 1997	All Hospitals In 1997	All Hospitals In 1997	All Hospitals In 1997	All Hospitals In 1997	Interviewed Hospitals In 2005
Dependent Variable:	# Hospitals 2005	Change # Hospitals 1997-2005	Change # Hospitals 1997-2005	Closure Dummy	Closure Dummy	# Hospitals 2005
Political Marginality in 1997	4.127***			-0.894***	-1.308***	4.955***
	(1.154)			(0.327)	(0.356)	(1.260)
Change in Marginality 1992 - 1997		4.708***	2.919***			
		(1.738)	(1.040)			
# Hospitals per Capita in 30km radius (in 1997)					0.309***	
					(0.088)	
Teaching Hospital Dummy					-0.083	
					(0.102)	
Specialist Hospital Dummy					-0.344*	
					(0.142)	
Population Controls	Yes	No	Yes (Changes)	No	Yes	Yes
Further Controls (see also Table 4)	No	No	No	No	No	Yes
Observations	212	212	212	212	212	161

Notes: *** Indicates significance at the 1% level; ** significance at 5%, * significance at 10%. The number of hospitals is measured within 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 Labour won/was lagging behind by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on a 45km radius). Standard errors are corrected using Conley (1999) spatially correlated standard errors on a 45 km radius. Where indicated controls are included for the total population and age profile (9 categories) in the catchment area as well as a London dummy.

Appendix Table B4: 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	0.161***	0.181***				
(Based on a Fixed Radius of 30km)	(0.042)	(0.049)				
Herfindahl-Index (Based on			-0.784**	-0.701*		
Fixed Radius of 30km)			(0.335)	(0.387)		
Herfindahl-Index (Based on					-1.960**	-1.174
Predicted Patient Flows)					(0.958)	(1.147)
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 the county level (there are 42 clusters). All columns include controls for the total population and age profile (9 categories) in the catchment area, whether the hospital was a Foundation Trust, number of total admissions and basic case-mix controls (8 age/gender bins of patient admissions), the tenure of the respondent, whether the respondent was a clinician and interviewer dummies as well as the share of managers with a clinical degree. "General controls" include Labour share of votes, the fraction of households owning a car, the number of political constituencies in the catchment area, a set of dummies for the winning party in the hospital's own constituency, a London dummy, teaching hospital status and a dummy for whether there was joint decision making at the hospital level as well as detailed "case-mix" controls (22 age/gender bins of patient admissions).

Appendix Table B5: 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	0.181***			0.366**
Hospitals	(0.049)			(0.168)
Proportion of Marginal		2.644**	7.228***	
Constituencies		(1.013)	(2.115)	
General Controls				
Number of Constituencies	0.077	0.117*	0.178***	0.051
	(0.060)	(0.062)	(0.060)	(0.058)
Winning Party was Labour	0.006	-0.018	0.167	-0.079
	(0.235)	(0.227)	(0.565)	(0.295)
Winning Party was Liberal Democrats	0.012	0.320	1.193***	-0.117
	(0.276)	(0.304)	(0.406)	(0.322)
Labour Share of Votes	0.016	0.009	-0.028	0.019
	(0.013)	(0.014)	(0.030)	(0.013)
Size (Total patient admissions)	0.111	0.129	-0.125	0.175
In 10,000s	(0.090)	(0.106)	(0.194)	(0.107)
Foundation Trust	0.562***	0.576***	-0.138	0.627**
	(0.192)	(0.192)	(0.491)	(0.248)
Proportion of Managers with	0.519	0.479	-0.397	0.624
Clinical Degree	(0.374)	(0.361)	(0.396)	(0.416)
Clinicians and Managers	0.264**	0.266*	0.006	0.264*
take decision jointly	(0.128)	(0.135)	(0.229)	(0.135)
Teaching Hospital	0.228	0.245	0.600	0.026
	(0.358)	(0.345)	(0.384)	(0.340)
London	-0.590	-0.162	3.929**	-1.599
	(0.833)	(0.663)	(1.571)	(1.165)
Interviewer 1	0.371	0.390	0.201	0.316
	(0.516)	(0.488)	(0.348)	(0.526)
Interviewer 2	-0.402	-0.318	0.479	-0.494
	(0.497)	(0.488)	(0.318)	(0.498)
Interviewer 3	0.398	0.494	0.473	0.321
	(0.503)	(0.476)	(0.346)	(0.519)
Interviewee Tenure	-0.056***	-0.056**	0.000	-0.056***
	(0.020)	(0.022)	(0.024)	(0.019)
Interviewee is a Clinician	-0.594***	-0.611***	-0.107	-0.572***
	(0.150)	(0.158)	(0.159)	(0.144)
Area Demographics				
Total Population in 15km Catchment Area	-1.354**	-1.111*	1.487*	-1.655**
(1,000,000s)	(0.604)	(0.596)	(0.761)	(0.762)
8 Age-Gender-Controls (F-stat)	1.90*	2.29**	7.32***	2.47**
Fraction of Households that own a car	-0.009	-0.006	0.040	-0.020
	(0.017)	(0.017)	(0.028)	(0.020)
Case-Mix Controls				
22 Age-/ Gender Controls (F-stat)	3.94***	4.36***	4.54***	4.23***

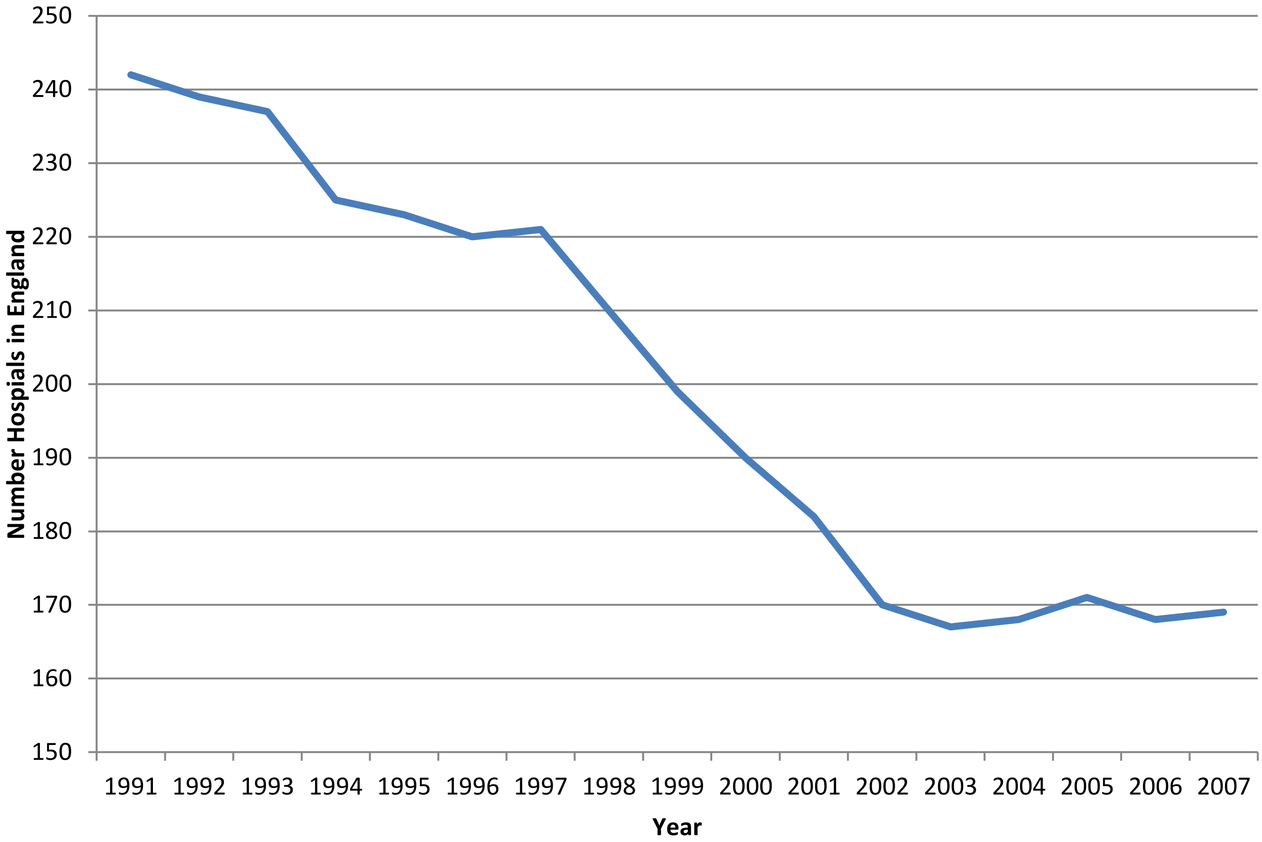
Notes: *** Significance at the 1% level; ** significance at 5%, * significance at 10%. Competition is measured as the number of hospitals in a 30km radius around the hospital (based on a "catchment area" of 15km for the individual hospital). A political constituency is defined as marginal if Labour won/was lagging behind by less than 5% in the 1997 General Election (proportion of marginal constituencies is based on a 45km radius). Standard errors clustered at county level. Labour share of votes is the absolute share obtained by in the 1997 Election averaged over all constituencies in the catchment area. Observations are weighted by the inverse of the number of interviews within the same hospital.

Appendix Table B6: Correlations of Marginality with other Area Covariates

Method Dependent Variable	(1) Unconditional	(2) Conditional
1. Number of Households (100,000)	-1.363* (0.758)	n/a
2. Fraction of Retired Population	0.211 (0.571)	-0.690 (0.479)
3. Fraction of Population with Long-term Illness	-1.431*** (0.547)	-0.356 (0.380)
4. Fraction of Unemployed	-0.680*** (0.216)	0.077 (0.096)
5. Fraction that Own a House	5.976*** (1.829)	-0.480 (0.815)
6. Fraction of Higher Social Class (Managerial and Professional)	1.172 (1.194)	-0.174 (0.764)
7. Fraction that do not Work	-0.806*** (0.298)	0.006 (0.181)
8. Fraction Long-term Unemployed	-0.252*** (0.084)	0.002 (0.041)
9. Fraction Students	-0.637 (0.569)	0.269 (0.511)
10. Fraction Without Qualification	-1.446 (1.162)	0.697 (0.858)
11. Fraction Migrants	-0.337 (0.443)	0.247 (0.380)
12. Fraction Working Age Pop.	3.272*** (0.982)	0.243 (0.543)
13. Fraction that Work in Manufacturing	0.407 (0.883)	0.550 (0.744)
14. Fraction Using Public Transport\ to Work	-4.802** (2.088)	-0.486 (0.689)
15. Fraction Single Households	-2.233*** (0.728)	0.046 (0.443)
16. Fraction Lone Parents	-1.319*** (0.413)	-0.073 (0.249)

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 marginal (a political constituency is defined as marginal if Labour won/was lagging behind by less than 5% in the 1997 General Election) and zero otherwise. The regressions in the first column are bivariate correlations of a variety of an area characteristic with this marginality variable. The regressions in column (2) condition on some of the basic controls in the main regression analysis: population density, a London dummy, the fraction of households that own a car.

Appendix Figure A1: The Evolution of the Total Number of Hospitals in England between 1991 and 2007



Notes: Plots the total number of hospitals for each year between 1991 and 2007. The dataset used for our main analysis begins in 1997 so we use a different data source for this graph. For the years in which both datasets overlap, they are extremely close together.

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