Düsseldorf Institute
for Competition Economics

DISCUSSION PAPER

No 63

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July 2012

HEINRICH HEINE
UNIVERSITÄT DÜSSELDORF

IMPRINT

DICE DISCUSSION PAPER

Published by
Heinrich-Heine-Universität Düsseldorf, Department of Economics, Düsseldorf Institute for Competition Economics (DICE), Universitätsstraße 1, 40225 Düsseldorf, Germany

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ISSN 2190-9938 (online) – ISBN 978-3-86304-062-8

Hospital Market Concentration and Discrimination of Patients

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Abstract

In this paper we investigate the existence of a two-tier medical system in the German acute care hospital sector using data from a survey of 483 German hospitals. The focus of our analysis lies on the impact of hospital concentration on the probability of discrimination of patients with different health insurances in regard to the access to medical services. Accounting for a possible endogeneity of market structure, we find that hospitals in highly concentrated markets are less likely to pursue any differentiation among prospective patients with different health insurances. We ascribe this finding to competitive pressure in less concentrated markets. Hospitals in competitive markets are more obliged to steal business from rival hospitals by privileging profitable patients than hospitals in highly concentrated markets.

Keywords: Hospital markets, Patients' discrimination, Survey data.

Classification Codes: I1, I11, L1, L19, L22.

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We are grateful to the participants of the 6th DIBOGS 2010 and the 35th Hohenheimer Oberseminar 2010. We also thank Ulrich Heimeshoff, Annika Herr and Hendrik Schmitz for most valuable comments; we are also grateful to Dr. med. Lüder Herzog for medical advisory. The usual disclaimer applies.

1 Introduction

Hospitals are important providers of health care in regional markets. In German hospitals, for instance, in 2009 almost 18 million treatments were administered that ran up a bill of more than 67 billion Euros.[1] Similar to Germany, many highly developed health care systems spend a large part of public health care expenditures for inpatient care. Therefore, in many countries as well as in the scientific literature, ongoing debates on the effects of hospital ownership, size, specialization, mergers, and competition on costs, prices, quality, efficiency, and access exist (see e.g. Horwitz & Nichols, 2009; Mutter, Romano & Wong, 2011 and Lee, Chun & Lee, 2008). At least one reason for the large number of economic literature on the effects of hospital competition and mergers on outcomes is that hospital markets are at least partly characterized by high concentration rates.[2] Besides competition, efficient access to medical services is a major issue in economic literature.[3] Delayed access to medical services often come along with more serious illnesses and higher follow-up treatment costs, so that delayed treatments can cause higher costs than prompt access. In the worst case also costs resulting from disability or from death are possible effects of it. Coherently, economists could fear that long waiting times in general or waiting times longer for some patients than for others, i.e. discrimination of patients could cause high social costs. An often claimed related example for discrimination of patients that can cause high costs is that socially health insured patients have to face longer waiting times or do not receive the optimal treatment quality and quantity in comparison to privately insured patients.

In this paper, we aim to shed light on the relationship between competition in hospital markets and access to inpatient care in regard to patients' insurance type. At least to our knowledge, there is no such existing study. Therefore, in this paper we analyze the impact of hospital market concentration on the probability of discrimination of patients by insurance type in Germany. We use data collected from hospitals by telephone calls from fictitious patients presenting one of three clinical diagnoses belonging to either the department of surgery, cardiology, or gynecology. Since patients can be discriminated according to the insurance status solely if hospitals know it, our key dependent variable is a dummy variable that indi-

[1] The data is drawn from the German Federal Statistical Office Destatis.

[2] For recent economic literature on the effect of hospital competition and mergers on outcomes see for example Courtemanche & Plotzke (2010), Carey, Burgess & Young (2011) or Propper, Burgess & Gossage (2008).

[3] For economic literature concerning the access to medical services see for example Propper et al. (2005) or Norton & Staiger (1994).

cates whether the prospective patient's insurance status has been inquired during the phone call or not. In order to define different relevant markets, we use the fixed-radius technique with varying radiuses to measure the degree of competition in hospital markets.

The paper is organized as follows. Section 2 describes the regulatory policies for hospitals and inpatient care in Germany. In section 3 we give a short review of the related literature, while section 4 includes the empirical analysis and a discussion of our results. Finally, section 5 concludes.

2 Institutional Background

Consumption of inpatient hospital services in Germany is, from patients' point of view, in principle free for any health insured patient. Usually health insurance companies bear the costs for the treatments.[4] Accordingly, there is virtually no price competition between hospitals. The prices that insurance companies have to bear for their customers' inpatient care are regulated by the federal states.[5] Like in many health care systems, also in Germany, medical services are rationed by waiting lists. Due to the absence of any price competition, hospitals rather compete for patients over waiting times than over prices. In times of rationed medical supply, waiting lists are supposed to discriminate between, e.g., urgent and less urgent needs of treatments. When it comes to hospitals' ownership structure, traditionally, the German hospital market is characterized by acute care hospitals of private (for-profit), public, and charitable funding (both not-for-profit). All hospitals are generally obliged to treat all health insured citizens.[6]

Despite the institutional and regulatory specialties in the market,[7] hospitals still are market participants and compete for patients to maximize profits or minimize losses, respectively. Coherently, hospitals can raise profits by discriminating patients with respect to their profitability, for instance, by discrimination with regard to patients' insurance type. Despite the existing price regulation for DRGs, hospitals can still expect higher turnouts from some patients

[4] Hospital consumption is free except for a patients' contribution of ten Euros per day, which is irrespective of the hospital and the diagnosis.

[5] From the beginning of 2009 onwards, they are matched state-wide. Subsequently, since then every hospital of a federal state receives equal payments for a Diagnosis Related Group (DRG).

[6] This is deduced from § 109 IV 2 SGB V.

[7] For instance, hospitals have budgeted individually since 1993 while locations, capacities and specialization are planned for the most part by the states' authorities. These hospitals are called "plan hospitals".

than from others. More precisely, private insurance companies rather accept to bear health care costs for treatments than compulsory health insurance companies do. In any case, approximately 90% and therewith the majority of the German population is compulsory health insured, while only 9% of the population is covered by private health insurance against the financial risks associated with illness (StBA, 2010).[8] Both types of medical insurance cover almost all relevant treatments; however, the services that private insurance companies offer their customers are usually more extensive than services offered by compulsory insurance companies. Often, holders of private health insurance – and also patients who are able to pay out of pocket – pay either more for certain services or have access to more innovative or costly treatments not available to compulsory insured. Patients insured through a private insurance are, as an example, usually entitled to treatments by the chief physician and accommodation in two-bed-rooms or single-bed-rooms. Furthermore, private insurance companies usually accept the costs for additional treatments that compulsory insurances do not accept. Accordingly, in comparison to treatments of compulsory insured patients, hospitals are able to generate additional revenues from treatments of privately insured patients.[9] It is thus important for health service providers like hospitals whether costs for patients' treatments are borne by a compulsory or a private health insurance.

Our main assumption in this paper is that by inquiring a patients' insurance status, hospitals are able to assess a treatment's profitability ex ante. Inquiring hospitals can offer a profitable privately insured patient an incentive in form of a shorter waiting time than in rival hospitals to be treated there and not in a rival hospital. If only some of the hospitals in a market actively inquire the patients' insurance status, of course, only these hospitals can discriminate their patients. The inquiring hospitals are able to offer privately insured patients a shorter waiting time while the others are likely to offer equal waiting times for all patients. Assuming that patients prefer shorter waiting times, privately insured patients are more likely to let themselves treat in insurance inquiring hospitals. According to that, inquiring hospitals can treat more privately insured patients than not-inquiring hospitals. Therefore, we consider the

[8] The leftovers have no health insurance and have to pay their treatments out of pocket.

[9] In 2006 the additional remuneration due to hotel benefits and treatment by the chief physician amounted to 2.5 billion Euros, or 4 % of total hospital revenues. For a one-bed room the additional revenue amounted to 82.61 Euros per day, which is around 2.4 % of average revenues per patient in 2006. Cp. GBE (2008).

insurance inquiry as one method to gain competitive advantages over rival hospitals.[10] If, in contrast to that, there is only one monopolistic hospital in a market, there is no need for this hospital to discriminate patients according to their insurance type since all patients, independent of their health insurance, have no alternative except taking the monopolistic hospital. Although an insurance inquiry can be conducted virtually without any costs, a monopolistic hospital could gain no extra profit by it.

Discrimination of patients by insurance status can be regarded as a problem from a political, regulative or normative perspective. Even though it is not necessarily accompanied with economic efficiency, one of the main issues of reforms in the German health care sector is the non-discriminatory access to medical services. Although it is a major objective to provide direct and identical access to hospital services (SVR, 2007), differences in the access according to the patients' diagnosis, the hospitals' ownership and the patients' insurance status are claimed.[11] We present the empirical analysis and a detailed data description in the next but one section.

3 Related Literature

Economic literature has devoted much attention on analyzing the effect of competition in health care markets on a number of outcomes, focusing especially on hospital markets (Gaynor & Vogt, 2000, 2003). Existing studies analyze the effect of competition on waiting times, both theoretically (e.g. Brekke, Siciliani & Straume, 2008) and empirically (e.g. Siciliani & Martin, 2007, Propper, Burgess & Gossage, 2008). In both cases, competition mostly tends to shorten waiting times. Using a Salop-type model, Brekke, Siciliani & Straume (2008) find that competition in terms of increased hospital density leads to shorter waiting times than in the monopoly case. The empirical results in Siciliani & Martin (2007) confirm this proposition. According to their results, an increased hospital density reduces waiting times; however, their estimates indicate merely modest lower waiting times when the number of hospitals increases.

[10] Not only financial incentives play a role for differences in waiting times. The literature has indentified health status and hospital productivity as important determinants of waiting time. Cp. e.g. Siciliani & Hurst (2005) or Czypionka et al. (2007) for an overview.

[11] For a study analyzing waiting times according to patients' insurance status in the German outpatient sector see Lungen et al. (2008).

Propper, Burgess & Gossage (2008) regard the introduction of payer-driven competition between hospitals in the UK in 1991 as a policy change that may affect several hospital outcomes. Using a panel dataset of all UK acute hospitals from 1991 to 2000 they measure the effect of competition between hospitals on quality employing a difference-in-difference estimator. Quality is here well defined as the mortality rate from acute myocardial infarction (AMI). Their results indicate that hospitals acting in more competitive markets show a higher AMI death rate than hospitals located in less competitive areas. As a rationale for this relationship, they ascribe it on competitive pressure on costs, so that "hospitals cut services that affected AMI mortality rates" (Propper, Burger & Gossage, 2008). Close to our study, they also estimate the effect of competition on waiting times. They have three different measures for waiting time, constructed from hospital level waiting lists. The results show, similar to Siciliani & Martin (2007), that waiting time is significantly shorter in hospitals acting in more competitive markets.

Propper et al. (2005) try to shed light on the relation between self-reported severity of illness as well as socio-economic factors on the probability of having access to UK health resources. Relying on a population survey in two English counties in 1994/1995, they perform a probit estimation with the probability of having any health care expenditure for arthritis as dependent variable and, among others, self assessed health, co-morbidity rate, and socio-economic factors as independent variables. Propper et al. (2005) conclude that household income and education do not affect the probability of having any National Health Service (NHS) treatment significantly. However, an individual's education level does have a significant positive effect on the probability of having any private health care expenditure for arthritis.

Also close to our study are Asplin et al. (2005) and Lungen et al. (2008), since both employ data prior collected by telephone surveys, similar to our data set. Asplin et al. (2005) analyze the effect of the patients' insurance status on access to urgent ambulatory care in hospitals' emergency departments in 9 US cities during 2002 and 2003. Their main objective is to analyze whether the insurance type affects the probability of receiving a prompt urgent follow-up treatment or not. Their results show that patients who claimed to be privately insured were more likely to receive a prompt appointment for a follow-up treatment than Medicaid patients. They also analyze the probability of receiving a prompt follow-up treatment for privately insured patients versus the probability for uninsured patients who could bring up only 20 $ and versus those uninsured patients who claimed to be able to pay the entire treatment costs. While no difference in the probability exists for privately insured and those patients who could pay the entire treatment costs, privately insured patients were more likely to receive a prompt appointment than patients who did not have any health insurance and could bring up only 20 $. The approach used in Asplin et al. is close to Lungen et al. (2008) who called 128 outpatient specialist practices in Western Germany in 2006. Instructed callers requested appointments in the near future for five different diagnoses, while the diagnosis was always chosen according to the physician's specialist field. Descriptive statistics show that for all five diagnoses the mean waiting time was much shorter for holders of private health insurances than for holders of compulsory health insurances, though these results are limited due to a fairly small sample size. However, in their regression with waiting time as dependent variable, the estimated coefficient for private health insurance is significantly negative and hence indicates shorter waiting times for privately insured patients than for compulsory insured.

Existing studies in economic literature show that competition between hospitals has an effect on outcomes. Other studies show that health care providers discriminate their patients according to their insurance type. Although many economists have devoted much attention on both aspects, to our knowledge there is no study in economic literature that combines both and analyzes the effect of competition on the probability of discrimination of patients in the inpatient care sector. With this study we fill this gap in economic literature.

4 Empirical Analysis

4.1 Data

In the following, we analyze our research question empirically. For this purpose, we combine two datasets: The first one consists of a variable that indicates whether hospitals ask for prospective patients' insurance status or not and other variables related to this collected through a telephone survey.[12] The second dataset contains information about each hospital's characteristics, market shares, and market concentration. The first dataset was generated in a nationwide

[12] The data were presented in Kuchinke, Sauerland & Wübker (2009). The design of this study is very close to Asplin et al. (2005). With the same dataset, Schwierz et al. (2011) test if hospitals discriminate patients by insurance type and if these hospitals are more "successful" than others.

telephone survey among 483, out of 1,659 total, German hospitals.[13] The survey was conducted in order to observe the hospitals' behavior against privately insured patients on the one hand and compulsory insured patients on the other hand. To assess differences in hospitals' behavior, instructed telephoners, who pretended to suffer from diseases that require a hospital treatment, called 483 hospitals and asked for appointments for a treatment. For this purpose, the callers chose one of three different clinical indications which, from a medical point of view, require a treatment within a couple of days, but are not life-threatening. The indications are deliberately chosen from different departments to prevent a systematical bias: the surgical department ("ankle fracture"), the cardiological department ("stenosis"), and the gynecological department ("conisation"), respectively. Telephone calls were placed between April 2006 and January 2007. The callers claimed that a general medical practitioner had already confirmed the diagnosis, so that all preoperative consultation had been performed before. Moreover, the interviewers remained passive and so revealed their insurance status only if they were asked for it. The hospitals' inquiry whether the patients are privately or compulsory insured is crucial in our analysis since only hospitals that inquire patients' insurance status are able to discriminate them according to the insurance type. Only these hospitals are able to distinguish and favor (c.p. more profitable) privately insured patients in the form of shorter waiting times, while non-inquiring hospitals are not able to do so.

Interestingly, only 120 out of 483 answering hospital employees asked for the patient's insurance status. Hence more than 75% of the hospitals did not actively differentiate between privately and compulsory insured in the waiting time. Apparently, there is only little evidence for the existence of a so called two-tier medicine – at least with respect to our dataset. However, in contrast to Kuchinke, Sauerland & Wübker (2009), who analyzed whether hospitals discriminate patients in waiting times by their insurance status, we aim at a more competition policy related issue. That is, we analyze the impact of the degree of competition between hospitals on the probability that a hospital inquires a patients' insurance status. To assess this, we regress a variable that indicates whether a hospital inquired the insurance status or not on a competition measure – using different concentration measures – and several controls.

[13] Even though some of the hospitals were called twice under certain circumstances, we use only information on an initial call to each hospital in this paper. Therefore we observe only one period per unit, leaving us a cross-section dataset.

Figure 1: Hospitals in the dataset

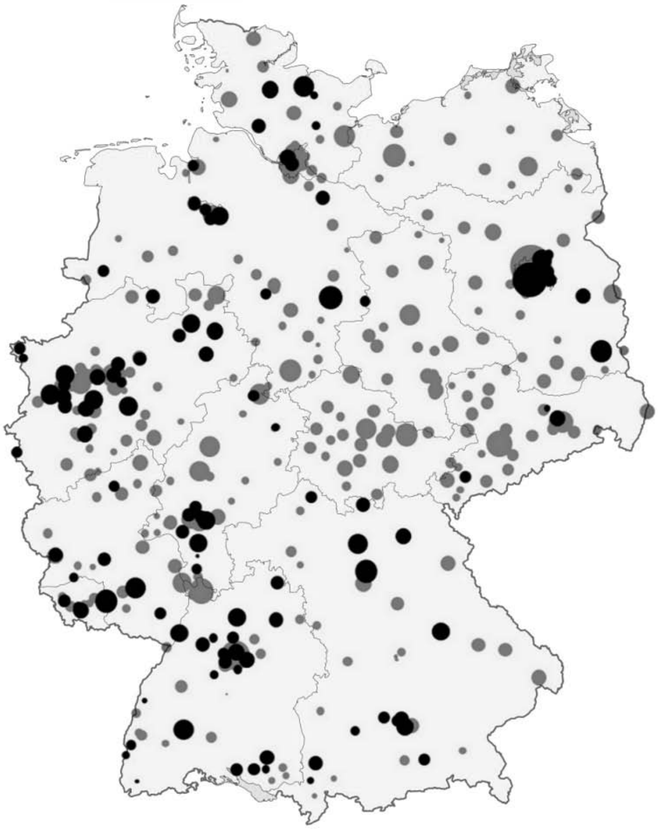

Figure 1 shows the geographical distribution of the 483 hospitals in our sample across the German territory. While 363 grey bubbles represent the hospitals which did not ask for the patient's insurance status, 120 black bubbles represent the hospitals that actively asked for the status. The size of each bubble coincides with the number of beds, i.e. with the size of the respective hospital. Interestingly, many of the black bubbles are located in large cities and regions with a relatively high population density, such as Berlin, Hamburg, Munich, Stuttgart, the Ruhr area and the Frankfurt/Rhine-Main Metropolitan Region.

Market definition

Market definition is clearly central to any competition related analysis; so it is for analyzing hospital markets. Calculating a supplier's market share and market concentration measures requires a clear definition of the relevant market. The definition of the relevant product market and the relevant geographic market is therefore one of the most important issues (Motta, 2004). While the definition of the relevant product market aims at the identification of all relevant products that consumers regard as substitutes, defining the relevant geographic market means to define a geographic region in which consumers still regard the before identified relevant products as substitutes. After defining both, the relevant product and the relevant geographic market, we are able to calculate market shares and so draw conclusions on market concentration.

When it comes to the product market definition in our analysis, we follow the market definition approach of the German Federal Cartel Office (Bundeskartellamt) in hospital merger cases (see e.g. Federal Cartel Office, 2005, 2006), that is we apply the standard product market definition of "general acute care hospital services" (Gaynor & Vogt, 2000; Gaynor et al., 2007).[14] According to interviews with health professionals, a treatment for each diagnosis can neither be conducted by general practitioners nor in rehabilitation centers, so that we consider them being outside the relevant product market. However, we assume that treatments for each of the three diagnoses can be conducted in each German acute care hospital, since hospitals are generally able to administer therapies they are not specialized in. More precisely, due to hospitals' supply flexibility we assume that a patient with, for instance, a cervix-surgery like a conisation can be treated in each German acute care hospital, even in hospitals with no explicit gynecological department. Hence, in our case all suppliers of hospital services belong to the relevant product market, since patients with one of the three diagnoses could frequent them for a treatment. Anyway, due to limitations in the supply flexibility, we eliminate hospitals specialized on very special therapies from our analysis so that we do not treat them as competitors. Besides day hospitals, eliminated hospitals are specialized in ophthalmology, oral and maxillofacial surgery, plastic surgery, neurology, psychiatry, and pediatrics. In summary, we consider all hospitals, apart from very specialized ones, within a hospital's catchment area as potential competitors.

Similar to other markets with an important regional dimension, such as many service and retail markets, an important issue in hospital competition analysis is the geographic market definition. The simplest method for defining the relevant geographic market is to presume geopolitical boundaries like zip code areas or counties as a hospital's catchment area. However, this method has the important shortcoming that nearby hospitals that lie in different counties are not considered to belong to the same geographic market, while distant hospitals in the resident county do (Basu & Friedman, 2007). Moreover, since market definition has to be carried out from a patients' point of view there are series of overlapping markets which can be identified. In merger analyses the German Cartel Office therefore applies a more feasible me-

14 See also Sacher & Silva (1998) and Guerin-Calvert (2003).

thod proposed by Elzinga & Hogarty (1973). It measures hospitals' patient inflow from other areas and the outflow of patients living in a hospital's area to hospitals located in other areas. Since Elzinga and Hogarty's method of geographic market definition is very data demanding as it requires detailed patient data for each hospital considered, we are not able to apply it.

A more feasible and plausible way for geographic market definition is to define a radius of a distance measure – like travel time, travel distance in km or linear distance in km – round each hospital (Siciliani & Martin, 2007, and Robinson & Luft (1985) for similar approaches). Then, each hospital's catchment area is defined as an area of certain kilometers or minutes of travel time around it. Hospitals lying within this radius of travel time or kilometers are considered as belonging to the same market while hospitals to which it takes a longer travel time or more kilometers are considered as not belonging to the market. Therefore by finding an adequate radius a relevant market can be easily defined.

In this paper we use linear distances instead of travel time or travel kilometers. Hence, each hospital's relevant geographic market is defined as a circular area with an ascertained linear kilometer radius. Our approach, also known as 'fixed-radius technique' (Gaynor & Vogt, 2000), suffers from the shortcoming that each hospital has an equal sized catchment area. By patients observed quality differences and other characteristics like the number of beds or socio-economic characteristics of the people living in its catchment area are not accounted for. Hence, in our approach, well-known high quality hospitals' catchment areas are assumed to be as large as less-known low quality hospitals' catchment areas. This might be unreal to the extent that in reality a high quality well-known hospital's catchment area will certainly be larger than a low-quality less-known hospital's catchment area. In contrast to that, allowing for a larger geographic market for high-quality hospitals would coincide with a larger number of competitors for them. This would result in a smaller market power measure, while in reality they might have more market power than neighboring hospitals (Tay, 2003).

Overall, although the 'fixed-radius technique' has some above mentioned shortcomings, we are confident that this method is an applicable and feasible approach for geographical market definition. Moreover, note that the goal of this technique is not to define an exact size of a hospital's catchment area, but to analyze whether our results are robust against variations in the size of geographical markets. However, by means of the defined product market and different radiuses for the 'fixed-radius technique', we derive several measures of market concentration in the following section.

Market Concentration

In 2006 the total number of hospitals in Germany has been 2,061. Altogether, they controlled 509,134 hospital beds (StBA, 2008). According to our product market definition, we had to eliminate 402 hospitals from our sample and hence consider 1,659 hospitals that control 463,201 beds. The geographic distribution of the hospitals and of hospital beds considered in the analysis is shown in Figure 2 and Figure 3..

Figure 2: German hospital distribution

Figure 3: German hospital bed distribution

In order to measure market concentration, we computed a matrix of linear distances from each hospital under consideration to all other relevant hospitals, so that we are able to derive several measures of market concentration. Since our above defined relevant product market consists of all German acute care hospitals except for certain specialized hospitals, our market definition depends on the geographic dimension exclusively. In accordance with the German Federal Cartel Office we expect a hospital's catchment area to be well defined by a radius of 15 to 25 kilometers, meaning that most patients with one of the considered diagnoses probably would accept travelling 15 to 25 kilometers for a hospital treatment. For the purpose of robustness checks we additionally use extremely small and extremely large catchment areas. We therefore consider radiuses of 5, 10, 15, 20, 25, 30, 35 and 40 kilometers. Concentration is then measured by the number of competing hospitals, the hospitals' market share and the Herfindahl-Index (HHI) for different radiuses (Siciliani & Martin, 2007). According to the geographic market definition the Herfindahl-Index (HHI_j) as well as market shares ($share_j$) have been calculated based on the number of hospital beds.[15] Descriptive statistics of the chosen competition measures with respect to radius size for the 483 hospitals under consideration are presented in Table 1. By these means we are able to overcome the problem of overlapping markets to some degree.

Not surprisingly, the average number of rival hospitals increases with increasing radiuses and market shares as well as Herfindahl indexes decrease. Thus a wider geographical market definition is watering down the impact of market concentration on market behavior considerably. An adequate market definition is therefore expected to be essential for calculating adequate concentration numbers.

Table 1: Descriptive statistics, concentration measures (n = 483)

Variable	Definition	Mean	Std. dev.	Min	Max
hosp5	Number of hospitals within 5km	1.95	3.09	0	15
hosp10	Number of hospitals within 10km	4.44	6.63	0	37
hosp15	Number of hospitals within 15km	7.93	9.75	0	43
hosp20	Number of hospitals within 20km	12.19	13.21	0	57
hosp25	Number of hospitals within 25km	16.66	16.80	0	79
hosp30	Number of hospitals within 30km	22.10	21.23	1	101
hosp35	Number of hospitals within 35km	27.73	25.89	1	123
hosp40	Number of hospitals within 40km	33.96	30.64	1	150
share5	Market share for radius of 5km	0.7098	0.3379	0.0046	1
share10	Market share for radius of 10km	0.5688	0.3737	0.0046	1
share15	Market share for radius of 15km	0.4182	0.3589	0.0043	1
share20	Market share for radius of 20km	0.2899	0.2991	0.0035	1
share25	Market share for radius of 25km	0.2120	0.2473	0.0030	1
share30	Market share for radius of 30km	0.1488	0.1743	0.0022	0.9341
share35	Market share for radius of 35km	0.1111	0.1318	0.0012	0.8524
share40	Market share for radius of 40km	0.0877	0.1075	0.0009	0.8524
HHI5	HHI for radius 5km	7.134	3.098	1.317	10
HHI10	HHI for radius 10km	5.776	3.442	0.596	10
HHI15	HHI for radius 15km	4.334	3.247	0.331	10
HHI20	HHI for radius 20km	3.067	2.672	0.221	10
HHI25	HHI for radius 25km	2.285	2.178	0.164	10
HHI30	HHI for radius 30km	1.666	1.486	0.133	8.770
HHI35	HHI for radius 35km	1.301	1.176	0.116	7.484
HHI40	HHI for radius 40km	1.042	0.965	0.099	7.484

[15] The subscript j represents different radiuses in km with j = 5, 10, 15, 20, 25, 30, 35, 40.

Variables

Our dependent variable (*Ask*) is a binary variable that indicates whether a hospital actively inquired a patient's insurance status during the phone call or not. *Ask* equals 1 if the answering hospital employee asked for the patient's insurance status and 0 if not.

Our explanatory variable of main interest is a market concentration measure, the Herfindahl-Index (HHI_j), which has been generated by means of a matrix of linear distances from each German hospital to all its potential competitors. We add a vector of control variables in order to control for the hospitals' heterogeneity and to account for a proper specification (see Table 2). We include the total number of the corresponding hospital's beds (*Beds*) as a cost shifter because hospitals with a large number of beds are likely to obtain economies of scale due to decreasing average costs. As an additional cost shifter we include each hospital's base rate (*BFW*). *BFW* is a hospital specific monetary amount that is taken as a basis for the calculation of the payments from health insurances to hospitals, i.e. hospitals' turnout. Hospitals negotiate individually with health insurances on a budget for the expected prospective expenses. Hospitals with the same expected Case-Mix negotiate on different budgets if the cost structures are different. *BFW* is then calculated as the ratio of the hospitals' budget and the expected Case-Mix. Hence, *BFW* approximately describes the expected average costs per patient and so reflects the hospitals' cost level. To calculate the hospitals' reimbursement, *BFW* is multiplied with a diagnosis specific, but not hospital specific, cost weight whose amount depends on the economic severity of the treatment.[16] We further expect that hospitals whose capacity is almost completely utilized are especially aware of the marginal patient's profitability. Hence, they are presumably more likely to ask for a patient's insurance status. This makes controlling for capacity utilization crucial in our setup. Since we are not able to observe each hospital's capacity utilization directly, we add a proxy for it by using the patient's waiting time, which is the number of days from the initial call to the appointment made for the treatment. Waiting time should be highly correlated with unobserved capacity utilization, since, all else equal, the higher capacity utilization the longer patients have to wait for a treatment. In addition we also add dummy variables indicating the three diagnoses (*Koni*, *Stenosis*, *Weber*), dummy variables indicating the hospital's ownership type, and dummies for the hospital's institutional form. Private (i.e. for-profit) hospitals should have strong incentives to discriminate patients in order to maximize profits. Non-profit hospitals should be less

[16] In practice, hospitals at this time decided on the BFW on their own, so that they had an incentive to overstate the BFW. Thus, BFW is likely to be biased to a too high number.

likely to distinguish between private and compulsory insured patients. However, though being not-for-profit, public and charitable hospitals are at least supposed to aim for self-preservation and the achievement of certain minimum objectives.

Table 2: Descriptive statistics, other variables (n = 483)

Variable	Definition	Mean	Std.Dev.	Min	Max
Ask	Dummy = 1 if insurance inquiry	0.248	0.432	0	1
Koni	Dummy = 1 if conisation	0.374	0.484	0	1
Stenosis	Dummy = 1 if stenosis	0.213	0.410	0	1
Weber	Dummy = 1 if ankle fracture	0.412	0.492	0	1
Beds	Number of hospital's beds	469.22	379.79	10	4,474
BFW	Basisfallwert	2,756	300	1,411	4,245
Public hospital	Dummy = 1 if public hospital	0.443	0.497	0	1
Non-profit hospital	Dummy = 1 if non-profit hospital	0.354	0.478	0	1
Private hospital	Dummy = 1 if private hospital	0.202	0.402	0	1
University hospital	Dummy = 1 if university hospital	0.041	0.199	0	1
Plan hospital	Dummy = 1 if plan hospital	0.946	0.225	0	1
Hosp. with service contract	Dummy = 1 if hospital with service contract	0.012	0.110	0	1

To account for seasonality and temporary differences among months (e.g. the soccer world championship in summer 2006), we include dummies for the month in which the telephone interview has been conducted. Moreover, to account for health political differences between federal states (Bundesländer), we include 16 dummies for the state a hospital is located in.[17]

Apart from the dummies for the patients' diagnoses, the control variables have been mostly collected from the German Clinic Guide 2006 (Krankenhausverzeichnis 2006, see StBA, 2008). The German Clinical Guide is published yearly by the German Federal Statistical Office (StBA) and contains information about all German hospitals, i.e. the address, ownership type (public, private or charitable), the hospitals' number of beds, and whether the hospitals is a university hospital, a plan hospital or a hospital with a service contract. Table 2

[17] Apart from the dummies for the patients' diagnoses the control variables have been mostly collected from the German Clinic Guide 2006 (Krankenhausverzeichnis 2006, see StBA, 2008). Table 2 presents descriptive statistics of the dependent variable and control variables. For descriptive statistics of market concentration measures, see Table 1.

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4.2 Identification

Endogenous concentration

The standard industrial economic Structure-Conduct-Performance-Paradigm (SCP-Paradigm) provides a simple explication on how market structure influences the market conduct which in turn influences market performance (Bain, 1956). A fundamental criticism of the SCP-Paradigm lies in the endogeneity of the market structure. In contrast to a uni-directional relationship from market structure to market conduct and market conduct to market performance, a bi-directional connection seems to be more feasible. Feedback effects occur, so that market performance affects market conduct and in turn market conduct affects market structure. Numerous studies for others than hospital markets, in which firms unlike hospitals compete on prices, analyze the influence of market concentration (i.e. structure) on price levels (i.e. performance) (Evans, Froeb & Werden, 1993). It is commonly expected that high market concentration has a positive impact on prices. Reversely, tough (soft) price competition is expected to result in high (low) concentration ratios due to market exit (entry). Ignoring the bi-directional connection/feedback effects between market structure and market conduct and market performance in econometric estimations can lead to considerably biased results. Therefore, the effect of concentration on market conduct or performance cannot be identified without a further consideration of this simultaneity.

Although in case of hospitals there is virtually no price competition and therefore no risk of simultaneity between price setting and concentration, endogeneity of market structure might persist, since hospitals compete on waiting times. As it is the main question of our study, market concentration might affect the probability of an insurance inquiry. Reversely, there is also a relatively high probability that insurance inquiries also affect market concentration, as we expect an insurance inquiry to be a possibility to gain competitive advantages over the competitors. Insurance inquiring hospitals can gain competitive advantages over non-inquiring competitors, if treating a larger number of privately insured patients increases profits which in turn can be invested in innovation and quality. Hospitals that invest much in quality and innovation are able to offer their patients a high degree of quality of the personnel, the equipment, the furnishings etc. and can also purchase new and innovative medical equipment.

All else equal, higher quality and higher innovation rates lead to higher demand for treatments in investing hospital. Higher demand for treatments in turn increases a hospital's number of beds or at least decreases its downsizing relative to its competitors. As this leads to higher market shares for inquiring hospitals, a positive relation between insurance inquiries and market concentration exists. Therefore we assume a two-way relation between insurance inquiries and market concentration: as we expect, market concentration might negatively affect the probability of an insurance inquiry. However, the coefficient might be understated because of a positive impact of insurance inquiries on market concentration. This implies that the coefficient of market concentration would suffer from inconsistency due to a simultaneity bias when estimated by OLS so that an IV approach is more likely to obtain consistent results.

Instrumental Variables

A major challenge of the application of instrument variables techniques is to find adequate instruments. A good instrumental variable is expected to be relevant, or, to put differently, to be strongly enough correlated with the potentially endogenous explanatory variable. Moreover, a good instrument should be uncorrelated with the error term. That is, instruments should not suffer from the same problem of endogeneity as the endogenous explanatory variable itself.

Major determinants of hospital market concentration are most probably demographic and socio-economic factors indicating the structure of a specific district.[18] For example, the share of senior citizens living in a district will have an impact on the decisions made in the state plan for hospital requirements (*Krankenhausbedarfsplan*). Since senior citizens are more likely to require hospital treatments than younger people, a higher share of older citizens will lead to higher demand of hospital capacity and so determines hospital market concentration. However, we assume that the influence of hospital market concentration on a region's demographic and socio-economic structure should be insignificant. Additionally, population density is an important factor for hospital market concentration. In general, rural areas are more often characterized by a monopolistic hospital market structure, while in urban areas stronger competition is observed (see Figure 2 and Figure 3 for a graphical illustration of the hospital distribution). Thus, we expect population density to have an impact on hospital market concentration.

[18] Of course, information on administrative districts can only serve as approximation of hospital markets defined by linear distances. A possible alternative would be to calculate average numbers from all areas affected by defined hospital markets.

Information on the average gross income is a good predictor for hospital market concentration since it indicates market size. Since rates of private and compulsory insurances are not available on regional levels, average gross income is also able to serve as a hospital's revenue shifter as it indicates the number or the share of privately insured patients in a district.

Accordingly, we use the following variables as instruments: population density (*Popdens*), the share of people older than 65 years relative to the share of people younger than 65 years (*Oldshare*) and average gross wages per inhabitant (*Grosswage*), each for the corresponding county the hospitals are located in. As presented in the correlation matrix (see Table 8 in the appendix), correlations between the endogenous variable and the instruments are quite high and statistically significant ($p < 0.05$). In Table 3 we show the relation between the Herfindahl-Index, illustrated through the HHI quartiles, and the means of our instruments *Popdens*, *Oldshare* and *Grosswage* for hospitals acting in more or less competitive markets. The table shows that more competitive markets are rather marked with a higher population density, a lower share of older inhabitants and higher gross wages.

Table 3: LPM and Probit estimations with and without instrumentation

HHI quartile	# hospitals	HHI range		Popdens	Oldshare	Grosswage
		Min.	Max.			
1	120	.1643115	.8231874	1.793857	29.46562	29.18867
2	121	.8347355	1.599954	.9197341	30.4211	25.96688
3	121	1.610446	2.744401	.4258359	31.22178	24.17368
4	121	2.759951	10	.2984734	30.95975	22.40502

Additionally, adequacy of instruments is tested by both, weak identification tests and overidentification tests. Neither of them lets us doubt relevance or exogeneity of the chosen instruments.[19]

4.3 Results

Estimates

To analyze the impact of concentration on market conduct we now turn to instrumental variable regressions accounting for the endogeneity of market structure. Table 4 reports both, the

[19] First stage regression results are presented in Table 6.

estimation results of a least squares regression and the results from an instrumental variable linear probability model (LPM) as well as from probit and from instrumental variable probit estimates.

The coefficient for market concentration *HHI25* is not significantly different from zero, neither in the not instrumented LPM nor in the not instrumented probit estimation. This indicates that concentration seems to have no impact on the probability that hospitals inquire the insurance type. However, this result changes once the endogeneity of market concentration is accounted for. In both, the IV-LPM and IV-Probit estimations, *HHI25* has a negative and statistically significant influence on the dependent variable. Hence, market concentration is found to have a negative and statistically significant impact on the probability of an insurance inquiry. To put differently, higher market concentration lowers the probability of identifying patients' health insurance type. According to that, tougher competition is likely to change the hospitals' conduct towards a more profit-oriented behavior.[20]

[20] Interestingly, assuming a market radius of 25 kilometers none of the eight resulting monopolistic hospitals in our sample has inquired the insurance status.

Table 4: LPM and Probit estimations with and without instrumentation

	Without instrumentation		With instrumentation	
	LPM	Probit	LPM	Probit
Dependent Variable	Ask, Dummy = 1 if insurance inquiry			
HHI25	-.012 (.011)	-.061 (.057)	-.067** (.033)	-.240** (.107)
Koni	.168*** (.047)	.818*** (.212)	.154*** (.050)	.738*** (.230)
Stenosis	.476*** (.063)	1.786*** (.258)	.464*** (.065)	1.680*** (.263)
Beds	.075 (.066)	.327 (.231)	.075 (.068)	.335 (.243)
Waiting time	.002 (.003)	.008 (.009)	.003 (.003)	.010 (.0089)
BFW	.058 (.070)	.239 (.300)	.041 (.069)	.160 (.284)
Public hospital	.059 (.044)	.274 (.250)	.076* (.046)	.288 (.259)
Non-profit hospital	.024 (.044)	.142 (.244)	.024 (.045)	.109 (.236)
University hospital	-.269* (.161)	-1.269* (.691)	-.256 (.158)	-1.191* (.659)
Plan hospital	.002 (.128)	-.018 (.539)	.024 (.124)	.060 (.495)
State dummies	YES	YES	YES	YES
Month dummies	YES	YES	YES	YES
R^2 / Pseudo R^2	0.33	0.30	0.29	-
Wu-Hausman F test	-	-	3.108 (0.078)	-
Underidentification test (Kleibergen-Paap LM-statistic) Chi-sq(3) P-val	-	-	24.633 0.000	-
Cragg-Donald Wald F statistic Stock-Yogo Weak ID Test val. 5% maximal IV relative bias 10% maximal IV size	-	-	19.495 13.91 22.30	-
First stage F-statistic	-	-	19.53 (0.000)	-
Sargan statistic (Hansen J-test of over-identifying restrictions) Chi-sq(2) P-val	-	-	1.433 0.4885	-
Wald test of exogeneity	-	-	-	3.14 (0.076)

Notes: Heteroskedasticity robust standard errors are given in parentheses. Standard errors are also robust against Moulton (1990) bias. Significance levels: *: 10%; **: 5%; ***: 1%.

In order to show the impact of the market concentration measure *HHI25* more precise, we compute marginal effects for an increase in *HHI25* of 1.[21] Results for marginal effects calcu-

[21] The Herfindahl-Index in our setup ranges from 0 to 10, so that an increase of 1 in our setup equals an increase of 1,000 in the traditional interpretation of the Herfindahl-Index ranging from 0 to 10,000.

lations are presented in Table 5. According to our calculations, an increase of market concentration *HHI25* from, say, 2 to 3 implies a decrease of the probability of an insurance status inquiry of about 6.9 percent. Marginal effects decrease with an increasing value of *HHI25*, so that an increase of market concentration *HHI25* from, say, 8 to 9 implies a decrease of the probability of an insurance inquiry of only 0.7 percent.

Table 5:Marginal effects for HHI25

at HHI25 =	*Marginal effect HHI25*	*Std. Err.*
0	-.091*	.047
1	-.082*	.042
2	-.069**	.032
3	-.056***	.020
4	-.042***	.009
5	-.030***	.004
6	-.020***	.006
7	-.013	.008
8	-.007	.007
9	-.004	.006

Significance levels: *: 10%; **: 5%; ***: 1%.

In Table 8 in the Appendix we present estimations with a concentration measure HHIad which is based on geopolitical market boundaries. HHIad indicates market concentration when each hospital's market size is defined as the entire administrative district it is located in. Accordingly, our competition measure HHIad is defined using the same geographic areas as we use for measuring our instrumental variables. Results change slightly; however, the main implication stays the same.

Focusing on the control variables our analysis reveals additional results: First, the probability of an inquiry is higher for *Koni* and *Stenosis* in comparison to the excluded dummy (*Weber*). There are various possible reasons for this outcome. It is, e.g., imaginable that average profits from the latter diagnosis are lower in comparison to the others. However, it is also possible that other factors such as the load factor are responsible for this outcome. Both coefficients, the total number of beds and *BFW*, seem to have no influence on the dependent variable in neither of the regressions.

Finally, including dummies for the ownership structure and the hospital type reveals (to some extent) surprising results. According to the estimated coefficients, the probability of an insurance inquiry is higher for public hospitals ($p < 0.10$) in comparison to private hospitals in the IV-LPM. A significant difference between private and charitable non-profit hospitals does not exist. Additionally, a significant lower probability of an insurance inquiry for university hospitals in comparison to hospitals with service contract is identifiable in the IV-Probit estimation, while no difference between plan hospitals and hospitals with service contract exists. This result is somewhat surprising since we expected private hospitals to conduct a more intensive inquiry.

Analyzing the endogeneity of concentration measures and the validity of the instruments leads to results as expected before: Using a Hausman-Wu test the null of exogeneity can be rejected at a common level of significance ($p < 0.10$). Instrumenting HHI_j is therefore an adequate strategy. Moreover, tests for instrument relevance are performed by means of the linear probability model because, to our knowledge, weak instrument tests for probit models with endogenous regressors do not exist. Instrument relevance is supported by the first stage regression results. Excluded instruments are individually significant as well as jointly significant.[22] Additionally and more important, the Stock-Yogo weak identification test (Stock & Yogo, 2005) indicates an IV relative bias of 5% maximum. That means that a bias due to possible instrument weakness is at most 5% as high as the bias induced by endogeneity. We find this an acceptable degree. The Hansen-J overidentification test supports economic intuition as the null of instrument validity cannot be rejected on reasonable significance levels. Summing up, the relevance condition as well as identification matters appear to be met and the bias of the 2SLS estimation should be small, so that our approach proves to be well chosen.

Robustness

Having controlled for the validity of the instruments we now turn to a robustness check of different concentration measures. We therefore repeat IV-Probit regressions as reported in table 4 using different HHI_j, j = 5, 10, 15, 20, 25, 30, 35, 40. Table 6 presents the respective coefficients of concentration measures for various market definitions in IV-Probit estimations.

[22] See first stage F-statistic cp. Stock & Watson (2007).

Independent from the assumed market size we found a negative and mostly statistically significant influence of market concentration on *Ask*.[23] Moreover, the magnitude of the coefficients is increasing with the assumed market size (see Figure 4). This is not very surprising as market concentration decreases continuously with larger geographical markets. Market concentration has a statistical significant influence which is robust against variations in market size and concentration measures. However, this robustness of the concentration measures is of course partly founded in the use of instrumental variables which are related to administrative districts but not to defined markets.

Table 6: Coefficients of different radiuses of market definitions

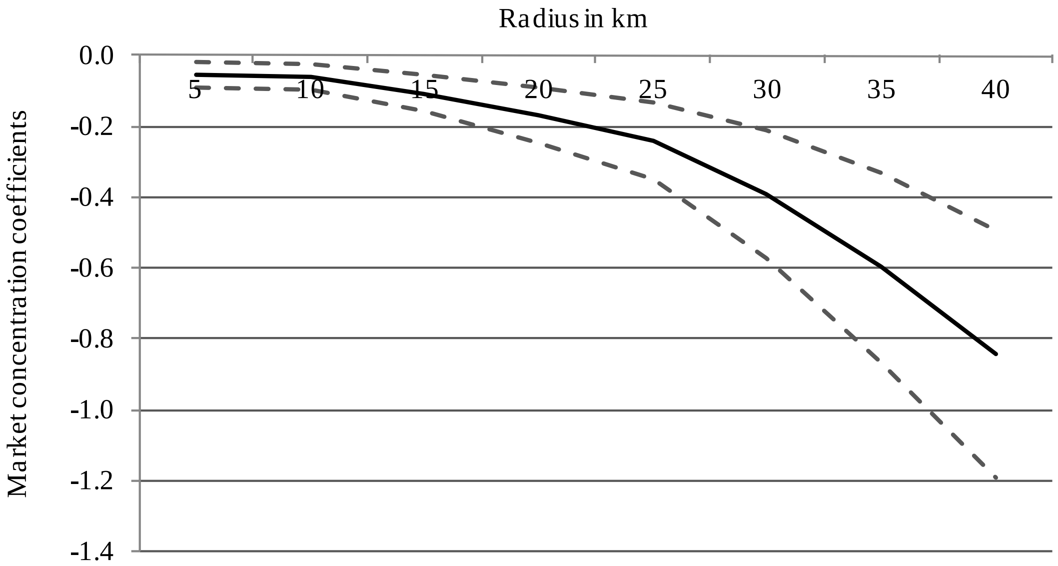
HHI_j	Coefficient IV-Probit regressions	Standard Errors
HHI5	-.056	.037
HHI10	-.061*	.036
HHI15	-.106**	.052
HHI20	-.170**	.079
HHI25	-.240**	.107
HHI30	-.392**	.182
HHI35	-.598**	.266
HHI40	-.842**	.347

Reported standard errors are heteroskedasticity robust and are also robust against Moulton (1990) bias. Significance levels: *: 10%; **: 5%; ***: 1%.

Summing up, we find a negative impact of concentration on the probability of the inquiry of patients' insurance statuses. The tougher the competition in regional hospital markets, the more likely profit-oriented behavior of hospitals occurs. Monopolistic hospitals in contrast do, at least in our sample, not inquire health insurance status at all.

[23] The same holds when we use different measures of concentration and market structure such as the number of hospitals, market shares or concentration ratios (not reported). Estimation results for other concentration measures than HHI_j are submitted upon request.

Figure 4: Market concentration coefficients and radiuses of markets



Absolute values, 95% confidence intervall indicated by dashed lines

5 Conclusions

This paper aims at analyzing the impact of hospitals' market structure on the probability of discrimination against patients by insurance type. Put differently, we analyze to what extent hospitals are likely to discriminate private insured and compulsory insured patients when markets are more or less concentrated. We do this by regressing a dummy variable that indicates hospitals' inquiry of prospective patients' health insurance status on market concentration measures. Using data generated by surveying 483 hospitals by telephone we find only little evidence for a so called two-tier medical system. Not more than a quarter of all hospitals in our sample raised the issue of insurance status meaning that about 75% are not interested in discriminating patients by insurance status to a larger extent.

Examining the role of concentration we find a negative and statistically significant impact on the probability of the inquiry of patients' insurance statuses when accounting for the endogeneity of market concentration. To prevent a possible simultaneity bias, we instrument concentration variables with (socio-)economic information on the administrative districts level. Hospitals facing tougher competition are then more likely to behave profit-oriented and to discriminate between compulsory and private insurances. Monopolists in contrast do not raise this issue at all. Following this rationing hospitals in high concentrated markets seem to have lower incentives to discriminate patients by their insurance status.

Overall we conclude that if discrimination occurs, it is much more likely to occur in highly competitive markets. Hospitals seem to compete for profitable patients to a much higher degree than in markets with lower concentration measures. Our results are extremely robust against variations of different concentration measures. However, this robustness is also due to the use of instruments on district levels. Therefore, further research should strive for a more adequate calculation of (socio-)economic variables on basis of the defined markets.

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Appendix

Table 7: First Stage Regression (HHI25 as endogenous variable)

Included and excluded instruments	Coefficient
Koni	-.301* (.179)
Stenosis	-.252 (.223)
Beds	.365 (.234)
Waiting time	.017* (.009)
BFW	-.081 (.259)
Public hospital	.323 (.247)
Non-profit hospital	.176 (.255)
University hospital	.248 (.546)
Plan hospital	.453 (.414)
Popdens	-.344*** (.108)
Oldshare	-.016 (.065)
Grosswage	-.134*** (.040)
State dummies	YES
Month dummies	YES
R^2	0.58
Partial R-squared of excluded instruments	0.11
F(3, 202) Prob > F	19.53 0.000

Notes: Heteroskedasticity robust standard errors are given in parentheses.
Standard errors are also robust against Moulton (1990) bias.
Significance levels: *: 10%; **: 5%; ***: 1%.

Table 8: LPM and Probit estimations with and without instrumentation with geopolitical market definition based on administrative districts

	Without instrumentation		With instrumentation	
	LPM	Probit	LPM	Probit
Dependent Variable	Ask, Dummy = 1 if insurance inquiry			
HHIad	.002 (.007)	.005 (.036)	-.050* (.027)	-.164* (.092)
Koni	.171*** (.046)	.821*** (.210)	.172*** (.046)	.765*** (.213)
Stenosis	.480*** (.063)	1.788*** (.257)	.452*** (.068)	1.586*** (.309)
Beds	.074 (.065)	.320 (.228)	.107 (.074)	.399 (.258)
Waiting time	.001 (.003)	.007 (.009)	.002 (.003)	.008 (.009)
BFW	.062 (.071)	.260 (.299)	.048 (.072)	.150 (.297)
Public hospital	.055 (.043)	.259 (.244)	.094** (.046)	.376 (.235)
Non-profit hospital	-.024 (.044)	.147 (.241)	.025 (.043)	.118 (.227)
University hospital	-.271* (.161)	-1.260* (.694)	-.294* (.172)	-1.359** (.664)
Plan hospital	-.002 (.129)	-.014 (.549)	-.009 (.128)	-.078 (.470)
State dummies	YES	YES	YES	YES
Month dummies	YES	YES	YES	YES
R^2 / Pseudo R^2	0.33	0.30	0.26	-
Wu-Hausman F test	-	-	3.290 (0.070)	-
Underidentification test (Kleibergen-Paap LM-statistic) Chi-sq(3) P-val	-	-	5.803 0.122	-
Cragg-Donald Wald F statistic Stock-Yogo Weak ID Test val. 5% maximal IV relative bias 10% maximal IV size	-	-	3.965 13.91 22.30	-
First stage F-statistic	-	-	4.02 (0.008)	-
Sargan statistic (Hansen J-test of over-identifying restrictions) Chi-sq(2) P-val	-	-	2.437 0.2957	-

Notes: Heteroskedasticity robust standard errors are given in parentheses. Standard errors are also robust against Moulton (1990) bias. Significance levels: *: 10%; **: 5%; ***: 1%.

Table 9: Correlations between variables

	Ask	*HHI25*	*Popdens*	*Oldshare*	*Gross wage*	*Koni*	*Stenosis*	*Weber*	*BFW*	*Waiting Time*	*Beds*	*Public hosp.*	*Nonprofit hosp.*	*Private hosp.*	*University hosp.*	*Plan Hosp.*	*Hosp. with service contract*
Ask	1																
HHI25	-0.18*	1															
Popdens	0.20*	-0.42*	1														
Oldshare	-0.20*	0.13*	-0.38*	1													
Gross wage	0.33*	-0.52*	0.60*	-0.54*	1												
Koni	-0.01	0.12*	-0.08	0.07	-0.16*	1											
Stenosis	0.36*	-0.12*	0.16*	-0.10*	0.17*	-0.40*	1										
Weber	-0.29*	-0.02	-0.05	0.01	0.015	-0.64*	-0.43*	1									
BFW	0.12*	-0.17*	0.19*	-0.13*	0.24*	-0.05	0.08	-0.01	1								
Waiting Time	0.23*	-0.01	0.12*	-0.04	0.07	0.17*	0.43*	-0.53*	0.06	1							
Beds	0.10*	-0.04	0.31*	-0.08	0.13*	-0.04	0.22*	-0.14*	0.19*	0.15*	1						
Public hosp.	0.06	0.07	-0.06	-0.05	0.02	-0.01	0.08	-0.07	0.07	0.03	0.29*	1					
Nonprofit hosp.	0.04	-0.20*	0.15*	-0.02	0.13*	0.02	-0.01	-0.02	-0.09*	0.01	-0.18*	-0.66*	1				
Private hosp.	-0.13*	0.14*	-0.11*	0.09*	-0.19*	-0.03	-0.09*	0.11*	0.01	-0.06	-0.14*	-0.45*	-0.37*	1			
University hosp.	-0.02	-0.05	0.11*	-0.00	0.09*	-0.03	0.14*	-0.09*	0.14*	0.11*	0.46*	0.19*	-0.15*	-0.05	1		
Plan Hosp.	0.01	0.06	-0.08	0.03	-0.10*	0.05	-0.12*	0.05	-0.17*	-0.13*	-0.37*	-0.15*	0.17*	-0.01	-0.87*	1	
Hosp. with service contract	0.02	-0.02	-0.03	-0.05	0.04	-0.04	-0.01	0.05	0.10*	0.05	-0.08	-0.02	-0.08	0.12*	-0.02	-0.47*	1

Significance level: *: 5%

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ISSN 2190-9938 (online)
ISBN 978-3-86304-062-8