

Christoph Schwierz

# Expansion in Markets with Decreasing Demand

For-Profits in the German Hospital Industry

#106

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**Christoph Schwierz\***

## **Expansion in Markets with Decreasing Demand – For-Profits in the German Hospital Industry**

Abstract

Over the last 20 years, acute care hospitals in most OECD have built up costly overcapacities. From the perspective of economic policy, it is desirable to know how hospitals of different ownership form respond to changes in demand and are probably best suited to deal with existing overcapacities. This paper examines ownership-specific differences in the responsiveness to changes in demand for hospital services in Germany between 1996 and 2006. With respect to the speed of adaptation to changes in demand, the study finds for-profit ownership to be superior to public and nonprofit ownership. Further, it is shown that declining demand can contribute to the expansion of for-profits through conversions by mainly publicly owned hospitals. Thus, the study finds evidence that to some extent the privatization of the hospital sector may be an adequate answer to reduce excess capacities.

JEL Classification: I11, I12, L31

Keywords: Hospital ownership, privatization, hospital market structure

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## 1. Introduction

Over the last 20 years demand for acute care hospital services in most OECD countries decreased faster than supply. As a consequence, costly overcapacities have been built up (OECD 2008). Hospital care is traditionally provided by nonprofit, publicly owned and for-profit firms. From the perspective of economic policy, it is desirable to know how hospitals of different ownership form respond to changes in demand and are probably best suited to deal with existing overcapacities. This paper examines ownership-specific differences in the responsiveness to changes in demand for acute care hospital services in Germany between 1996 and 2006.<sup>1</sup> The basic model identifies the determinants of changes in regional bed capacity from changes in demand within communities, while controlling for unobservable time-constant heterogeneity across communities and base line market and population characteristics in the year 1996. Further, it decomposes responsiveness in demand into four sources of change: Openings, closures, conversions and changes in hospitals' size. The analysis discerns to which extent these sources are used as adaptation mechanisms to changes in demand in declining versus expanding regions.

This subject has so far received attention solely within the US hospital market, for which Hansmann et al. (2003) offers a similar analysis. Hansmann et al. (2003) find that a relative sluggishness of public hospitals to exit declining markets might have contributed to the built-up of costly excess-capacities. Chakravarty et al. (2005) show that for-profit hospitals are fastest to enter expanding markets. Further, less efficient hospitals exit markets with a higher probability when being privately than publicly owned (Deily et al., 2000). Thus, these studies confirm that private ownership in general, and for-profit ownership specifically, is associated with a higher speed in adaptation to changing market conditions than public ownership.

In the US, hospitals of all ownership forms responded to decreases in demand by decreasing bed capacities. In Germany, the decrease in demand was very unequally felt across ownership types. Public and private nonprofit hospitals heavily lost ground, while for-profit hospitals managed to double their bed capacity, increasing their market share up to 13 percent until 2006. The profound consolidation of the German hospital market as well as the

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<sup>1</sup> There is a long-standing debate on fundamental differences between hospitals of different ownership form on numerous other topics. The literature studying ownership effects on various aspects of socio-economic relevance such as effects on competition, costs, profitability, diffusion of technology or quality of care is abundant. For a useful introduction into the topic consult Sloan (2000) and Kessler and McClellan (2002). For a discussion of popular theories of ownership types see also Villalonga (2000) and Hansmann (1980, 1987). For a seminal overview of the distinguishing features of nonprofit firms see Weisbrod (1988).

pronounced changes in market shares by ownership form are a solid basis to broaden the evidence from the US market in the light of the German experience.

The paper also generates empirical insights concerning the impact of key hospital market characteristics on market consolidation. For instance, I test how market consolidation is driven by past levels of regional bed density, competition and the distribution of market shares by hospital type. These market characteristics are based on predicted patient flows which are modeled on an exogenous source of variation: travel distances between hospitals and patients (Kessler and McClellan 2000). This allows studying an unbiased impact of market shares and competition on changes in bed capacity over time.

The plan of the paper is as follows. Section 2 introduces the data and describes key stylized facts of the evolution of the German hospital industry. Section 3 specifies the model. Results are presented and discussed in section 4. Section 5 concludes.

## 2. Data and Stylized Facts

The main data source is the German hospital statistic in 1996 and 2006. It covers hospital and patient level characteristics from all acute care hospitals in Germany. From this data I have extracted the population of all 16 356 428 patient admissions to 1817 hospitals in 2006 and 14 921 393 admission to 2 040 hospitals in 1996 excluding all purely psychiatric, military and day-/night-specific hospitals.<sup>2</sup> The following hospital characteristics have been retrieved: hospital ownership type (public, for-profit, nonprofit), teaching status, bed capacity and the 8-level-code of the community (*Gemeinde*) of the hospitals' residence.<sup>3</sup> In 2006 there were 12 368 communities in Germany.<sup>4</sup> On patient-level the following variables were recovered: age, sex, 2-digit-diagnosis<sup>5</sup>, the 8-level-code of the community of the patients' area of residence and hospital of admittance. In the models to follow, the areas of residence of patients and hospitals are used to calculate patients' travel dis-

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<sup>2</sup> Data access was provided via data teleprocessing by the Scientific Data Centre of the German Federal States Berlin-Brandenburg.

<sup>3</sup> The data does not contain information about system membership. Thus, mergers are not identified.

<sup>4</sup> Due to regional reforms numerous small communities were merged to bigger communities in the study period. I have constructed and used a transition matrix based on information from the German Statistical Office on changes in community codification to achieve comparability of communities in 1996 and 2006.

<sup>5</sup> Data in 1996 (2006) was codified according to the 9<sup>th</sup> (10<sup>th</sup>) revision of the International Classification of Diseases (ICD).

tances to hospitals. These will be the main predictors of regional market shares and levels of competition.

The second data source comprises population data on the level of communities from the German Statistical Office, which is used as a proxy for demand for hospital services. Applying the community identifier, the population data and the hospital data are merged. Descriptive statistics are presented in the Appendix in Table A1.

Table 1 shows changes in inpatient days, hospital capacity and capacity utilization over the period 1996-2006. Total inpatient days fell by 19.4 percent, strongly driven by a decrease in the average length of stay by 21 percent (Statistisches Bundesamt 2008). Both public and nonprofit hospitals heavily lost ground while for-profits increased the number of inpatient days by 75 percent. Thus, the overall decrease in market size was very unequally felt across ownership types. To some extent this is also mirrored in the change of the number of facilities and beds by ownership type. Still, the overall drop in inpatient days exceeds the build-down of hospital capacity, such that the overall rate of capacity utilization in the industry fell to 75 percent. The drop in capacity utilization was experienced by all hospitals irrespective of the ownership type.

It is noteworthy to consider the specific evolution of the East German relative to the West German hospital market after German reunification. In 1990, the differences in the supply of hospital services between East and West Germany were huge. For example, capacity utilization was around 73 percent in East and 87 percent in West Germany (Statistisches Bundesamt 2008). Moreover, 92.2 percent of the market was controlled by public, 7.0 percent by nonprofit and only 0.2 percent by for-profit hospitals. After reunification a massive influx of public and private capital was used to modernize and consolidate the East German hospital sector. The progress was fast. Already in 1996, capacity utilization in East Germany was close to 80 percent equalling West German levels (Table 2). Moreover, in 1996 already 10 percent of the market in terms of beds was controlled by for-profit hospitals, a share larger than in West Germany. This share more than doubled further in the ten coming years nearly exclusively at the expense of public hospitals. Between 1996 and 2006, the increase in the market share of for-profits was also experienced in West Germany, although from a lower starting level as compared to East Germany. Still, the expansion of for-profit capacity was driven to 64 percent by increases in capacity in West Germany and to 46 percent in East Germany (own calculations not in the tables), because the West German hospital market is roughly five times bigger than the East German hospital market. Evidently, market consolidation and privatization in both West and East Germany contributed to the growing significance of for-profit orientation in the hospital sector.



Table 1  
**Changes in inpatient days, hospital capacity and capacity utilization, 1996-2006**

	Inpatient days (in Mill.)					
	Total	Public	Nonprofit	For-profit	East Germany	West Germany
<b>1996</b>	161.3	90.1	61.3	9.9	26.9	134.3
<b>2006</b>	130.0	67.8	44.8	17.3	23.5	106.5
<b>Change in % of 1996 total</b>	-19.4	-24.79	-26.9	75.9	-12.9	-20.7
<b>Facilities</b>						
	Total	Public	Nonprofit	For-profit	East Germany	West Germany
<b>1996</b>	2,040	831	835	374	295	1 745
<b>2006</b>	1,817	617	696	504	240	1 577
<b>Change in % of 1996 total</b>	-10.9	-25.8	-16.6	34.8	-18.6	-9.6
<b>Beds</b>						
	Total	Public	Nonprofit	For-profit	East Germany	West Germany
<b>1996</b>	552,149	306,957	211,647	33,545	94,949	457,200
<b>2006</b>	473,595	238,272	171,615	63,708	82,282	391,313
<b>Change in % of 1996 level</b>	-14.2	-22.4	-18.9	89.9	-13.3	-14.4
<b>Capacity Utilization</b>						
	Total	Public	Nonprofit	For-profit	East Germany	West Germany
<b>1996</b>	79.8	80.2	79.1	80.3	79.6	79.9
<b>2006</b>	75.2	76.8	73.7	73.2	78.1	74.6
<b>Change in %-points of 1996 total</b>	-4.6	-3.4	-5.4	-7.1	-1.4	-5.3

Notes: Statistisches Bundesamt (2008), own calculations; Including all acute care general medical hospitals in Germany excluding purely psychiatric, military and day-/night-specific hospitals.

Table 2

**Market shares by ownership type, 1996-2006**

	<b>Market Shares in Beds</b>			
	<b>Total</b>	<b>Public</b>	<b>Nonprofit</b>	<b>For-profit</b>
<b>1996</b>	100	55.2	37.1	5.7
<b>2006</b>	100	49.6	36.3	13.1
<b>Change in %-points of 1996 level</b>	0.0	-5.6	-0.8	6.4

	<b>Market Shares in Beds in East Germany</b>			
	<b>Total</b>	<b>Public</b>	<b>Nonprofit</b>	<b>For-profit</b>
<b>1996</b>	100	73.0	17.1	9.9
<b>2006</b>	100	55.7	17.6	26.7
<b>Change in %-points of 1996 level</b>	0.0	-17.3	0.5	16.8

	<b>Market Shares in Beds in West Germany</b>			
	<b>Total</b>	<b>Public</b>	<b>Nonprofit</b>	<b>For-profit</b>
<b>1996</b>	100	52.8	42.1	5.1
<b>2006</b>	100	50.2	38.8	11.0
<b>Change in %-points of 1996 level</b>	0.0	-2.6	-3.3	5.9

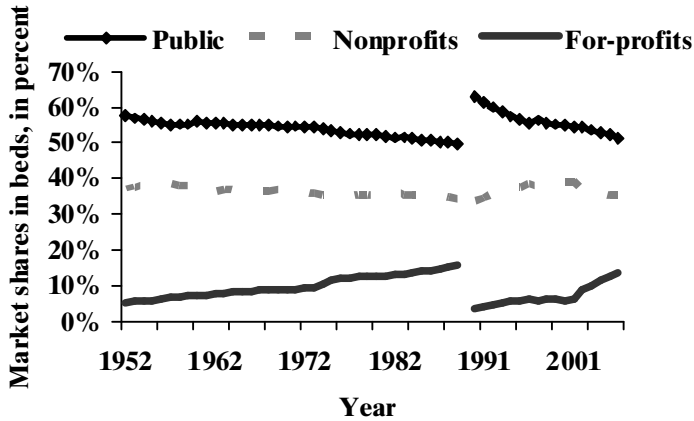
*Notes:* See notes to Table 1.

In a historical perspective, the growing share of for-profit orientation in the hospital industry just follows a long-term trend. Figure 1 shows changes in market shares by ownership type from 1952 to 2006.<sup>6</sup> There is a slow but steady decline of the market share of publicly owned hospitals, which is basically taken over by for-profit hospitals. Thus, interestingly, for-profit hospitals gained shares both in times of market expansion – total bed capacity increased from 1952 to 1975 by 36.7 percent – and in times of market shrinkage, which is basically ongoing from then on.

A general explanation of the early preponderance of public and nonprofit hospitals may be the underdevelopment of the hospital market as an industry back in the 1950s. It is a common characteristic of new markets – such as telecommunication, transport or education – that in their beginning they are in the hands of public and nonprofit investors, because this spreads the high investment needs (and the risk of default) over the society. Later, the responsibility to manage the market is handed over to private firms. In this view, the decline of public firms in the hospital sector may be a sign of a developed and well-functioning market (Sloan 2000).

<sup>6</sup> Because of a change in the statistical definition of hospitals, there is a break in the comparability of the data in 1990. Up to 1989 the shares are based on the bed capacity from the long-term rehabilitative and the acute care hospital sector in West-Germany. From 1990 onwards bed capacity from the acute care market from East- and West-Germany is included to calculate the displayed market shares.

Figure 1

**Market shares in bed capacity by ownership type, 1952-2006**

Notes: DKG, Statistisches Bundesamt (2008), own calculations.

A more specific explanation for the declining significance of public hospitals during the last 15 years is the growing effort of containment of public expenditures in the hospital sector. Chronic underinvestment by public authorities led to a continued ageing of public facilities, creating a huge need for reinvestment (Augurzky et al. 2009). Consequently, the for-profit status with its broader access to private capital presents a natural basis for modernization. Further, before 2004 acute care hospitals in Germany acted under a cost-plus reimbursement system. This changed in 2004 after the introduction of the Prospective Payment System (PPS), creating strong incentives for economic discipline in the hospital sector. Under PPS hospitals get a fixed payment for the treatment of each patient in a diagnosis-related group (DRG), regardless of the actual costs incurred by the care of the patient. The introduction of the prospective payment system in 2004 increased cost saving incentives punishing high-cost hospitals. Augurzky et al. (2009) shows that from 2001 onwards the financial standing of the sector has improved. However, due to high costs and low profitability public hospitals had a significantly higher probability of default than nonprofit and for-profit hospitals. Thus, economic defaults of public hospitals are nurturing the process of privatization. As an alternative to privatization many public owners have changed the legal status of their hospitals from being part of the community's balance sheets to independent limited liability corporations owned by the community. In 2003, 30% out of 796 publicly owned hospitals were run as an independent limited liability corporation; in 2006 this was

already the case for 51% (Destatis 2008).<sup>7</sup> This may have freed public hospitals from potentially restrictive political concerns and may have enhanced their ability to adapt to the economic environment.

Unlike the US, insurance did not favour the expansion of for-profit hospital in the hospital sector. In the US, private insurance schemes often offer preferential treatment schemes in for-profit hospitals, such that market shares by ownership type of hospitals may depend on the number of private insurees in the population. This is, however, not the case in Germany. There is universal obligatory insurance coverage in Germany and nearly 99 percent of the population was insured already in 1996. Around 10 percent of the population are privately insured, the rest being covered by statutory health insurance. All patients irrespective of insurance type have the right to be treated in hospitals of all ownership types, except in some few specialized private hospitals for private insurees, which are quantitatively not important. Most importantly, there are no insurance plans, which favour admission of patients to hospitals of a specific ownership type.

Table 3 decomposes changes in capacity over the period 1996-2006, by ownership type as well as by the sources of change: openings, closures, conversions and changes in bed capacity.<sup>8</sup> The decomposition by the sources of change is based on Hansmann's et al. (2003) method. Consider an example using closings of hospitals. A hospital's capacity in 1996 is defined as its actual capacity in 1996. If the hospital was closed, its capacity in 2006 is defined by its actual capacity in 2006, i.e. in this case zero. This implies a decrease in this hospital's capacity due to its closing by the number of beds it had in 1996. However, if it did not close this implies a zero change in capacity for the hospital in this category. In the case of conversions, bed capacity is subtracted from the converting and added to the converted ownership type, such that it enters both as a gain and a loss in bed capacity throughout 1996 to 2006.

In terms of total contraction in bed capacity, closures played the most important role, but also downsizing of hospitals was substantial. Public and nonprofit hospitals made a similar experience as to the sources of change, although nonprofits seem to have decreased bed capacity through downsizing rather than closing of whole entities. Both ownership types lost heavily through conversions, but also registered some gains. The main source of expansion of for-profits was the conversion of ownership type.

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<sup>7</sup> The distinctions in legal forms of public hospitals are not available before 2003.

<sup>8</sup> Due to a lack of information on mergers, it is not directly possible to study the effect of mergers on changes in bed capacity. Mergers will be, most probably, implicit in conversions.

Conversions contributed 66 percentage points of the total 90 percent gain in for-profit bed capacity. This is to be expected in a market with overall excess capacities. However, expansion by means of openings of new hospitals was also considerable.

Table 3

**Changes in hospitals' bed capacity by ownership type and the sources of change, 1996-2006**

		<b>Total</b>	<b>Openings</b>	<b>Closures</b>	<b>Conversions<sup>1</sup></b>	<b>Changes in # Beds</b>
<b>Total</b>						
	<b>Gain</b>	74,686	26,958	-	41,048	6,680
	<b>Loss</b>	153,240	-	56,587	51,081	45,572
	<b>Net change</b>	-78,554	26,958	-56,587	-10,033	-38,892
	<b>Net change in % of 1996 level</b>	-14.2	4.9	-10.3	-1.8	-7.0
<b>Public</b>						
	<b>Gain</b>	22,872	9,540	-	9,912	3,420
	<b>Loss</b>	91,557	-	36,444	30,947	24,166
	<b>Net change</b>	-68,685	9,540	-36,444	-21,035	-20,746
	<b>Net change in % of 1996 level</b>	-22.4	3.1	-11.9	-6.9	-6.8
<b>Nonprofit</b>						
	<b>Gain</b>	11,585	5,783	-	4,402	1,400
	<b>Loss</b>	51,617	-	16,305	15,539	19,773
	<b>Net change</b>	-40,032	5,783	-16,305	-11,137	-18,373
	<b>Net change in % of 1996 level</b>	-18.9	2.7	-7.7	-5.3	-8.7
<b>For-profit</b>						
	<b>Gain</b>	40,229	11,635	-	26,734	1,860
	<b>Loss</b>	10,066	-	3,838	4,595	1,633
	<b>Net change</b>	30,163	11,635	-3,838	22,139	227
	<b>Net change in % of 1996 level</b>	89.9	34.7	-11.4	66.0	0.7

*Notes:* FDZ (2008), own calculations; Including all acute care general medical hospitals in Germany excluding purely psychiatric, military and day-/night-specific hospitals; <sup>1</sup> Net change in conversions can differ from zero, because converting hospitals also change bed capacity over time.

Due to the importance of conversions for the evolution of market shares by ownership type, Table 4 presents the number and direction of conversions. Around 48 percent of the 145 conversions are aimed at for-profit ownership, out of which 85 percent are conversions of public hospitals. Another considerable amount of 32 percent of all conversions is to nonprofit ownership. The remaining 20 percent of from for-profit and nonprofit to public ownership. Hansmann et al. (2003) found similar evidence for the US market.

Table 4

**Ownership conversions between 1996 and 2006**

<b>Ownership form in 1996</b>	<b>Ownership form in 2006</b>			<b>Total</b>
	<b>Public</b>	<b>Nonprofit</b>	<b>For-profit</b>	
<b>Public</b>	-	19	59	78
<b>Nonprofit</b>	20	-	10	30
<b>For-profit</b>	10	27	-	37
<b>Total</b>	30	46	69	145

Notes: FDZ (2008), own calculations.

### 3. Models and estimation methods

The aim of this study is to identify the impact of changes in demand for hospital services on changes in hospital bed capacity. For the econometric analysis it is desirable to use as much variation in changes in local demand for as well as supply of hospital services as possible in order to identify the effects as accurately as possible. The community level was the lowest geographic level for which data was available, such that changes in bed capacity are modeled on the community level in this study. To capture unobserved heterogeneity, long-difference regressions for the period 1996-2006 are estimated. As in fixed-effect models based on a year-to-year panel, a long-difference model eliminates time-constant unobservable variable bias. Moreover, it is intuitive that any effects of changes in demand (as proxied by population levels) on changes in bed capacity will materialize only in longer time periods. Therefore, with regard to the aim of this study the modeling strategy of using long-difference equations seems preferable to fixed-effects regressions with annual data.

Local bed capacity in 1996 and 2006 is defined as follows. By assumption every community is served by every general medical hospital within a distance of 50 km from the centre of the community. The distance is meant to be nonrestrictive.<sup>9</sup> Each hospital's total bed capacity is allocated to a com-

<sup>9</sup> The average linear travel distance in Germany between patients and hospitals is 23.21 km and 90 percent of all patients reach their hospital within a distance of 43.96 km.

munity in inverse proportion to the distance between the hospital and the centre of a community.<sup>10</sup> The distributed beds across communities add up to the original capacity of the hospitals, i.e. each bed can be distributed only once. For each hospital  $j$  this yields a measure of bed capacity serving community  $i$  in 1996 ( $C_{ij,1996}$ ), in 2006 ( $C_{ij,2006}$ ) and the log change in capacity  $\Delta \ln C_{ij} = \ln(C_{ij,2006}) - \ln(C_{ij,1996})$ . Then, each hospital's capacity is added up to the communities' capacities into several samples. First, capacities are summed by ownership types. For instance, the for-profit capacity of a community is defined as the sum of beds of for-profit hospitals serving a community in 1996 ( $C_i^{FP,1996}$ ) and in 2006 ( $C_i^{FP,2006}$ ). The capacities of nonprofit and public hospitals are defined analogously. University hospitals are excluded from the sample of public hospitals.<sup>11</sup> Second, subsamples are based on the different sources of change, which are openings, closings, conversions and changes in bed size as described above. For this purpose each hospital's capacity is decomposed by the sources of change. Then, each community's capacity is recalculated based on these counterfactual hospital capacities.

The basic model specifies the log change in bed capacity of a community  $i$  as:<sup>12</sup>

$$\Delta \ln C_i = \beta_1 \Delta \ln P_i^+ + \beta_2 \Delta \ln P_i^- + \Theta M_{i,1996} + \Phi X_{i,1996} + \Delta \varepsilon_i, \quad (1)$$

where  $\Delta$  denotes changes in value between 2006 and 1996,  $\ln P_i^+$  is the log change in  $i$ 's population if it increased, 0 otherwise;  $\ln P_i^-$  is the log change in  $i$ 's population if it decreased, 0 otherwise; the vector  $M_i$  comprises five variables denoting the log of beds per capita, the log of the level of market concentration as measured by the Herfindahl-Hirschman-Index, which is defined as the squared market shares in terms of beds of all hospitals serving a community, and the shares of for-profit, nonprofit and university hospitals

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<sup>10</sup> In order not to divide through zero, we assume that each hospital is situated at one kilometer's distance from the centre of the community it is situated in.

<sup>11</sup> Up to 2006 all university hospitals were publicly owned. University hospitals are financed to do research, which made up around 1/5 of their total revenues in 2006 (Statistisches Bundesamt 2008). This makes them more independent of market forces than other hospital types. Including them within the public hospitals would unfairly downgrade the ability of public hospitals to adapt to changes in demand relatively to the other ownership types.

<sup>12</sup> A simpler model in the form of  $\Delta \ln C_i = \beta_1 \Delta \ln P_i^+ + \beta_2 \Delta \ln P_i^- + \Delta \varepsilon_i$  was also estimated, but estimation results for the demand variables did not differ significantly from the model as in equation (1). Therefore, this model is omitted.

in 1996; the vector  $X_{i,1996}$  denotes the proportion of the male population aged 20-39, 40-64, 65-74 and 75 or more in 1996 (male, because morbidity is sex specific);  $\mathcal{E}_i$  is the iid error term. The controls for base line market characteristics  $M_{i,1996}$  and population characteristics  $X_{i,1996}$  test whether the impact of demand on changes in bed capacity is sensitive to these base line characteristics.

In a second model, the impact of demand on changes in bed capacity is allowed to differ by base line bed capacity per capita in 1996 ( $B_{i,1996}$ ). This model tests whether changes in bed capacity differ depending on whether regional bed capacity was high or low in 1996. For this purpose, interaction variables between the demand variables and bed capacity in 1996 are introduced:

$$\begin{aligned} \Delta \ln C_i = & \tilde{\beta}_1 \Delta \ln P_i^+ + \tilde{\beta}_2 \Delta \ln P_i^- + \gamma_1 \Delta \ln P_i^+ * \ln B_{i,1996} + \\ & + \gamma_2 \Delta \ln P_i^- * \ln B_{i,1996} + \tilde{\Theta} M_{i,1996} + \tilde{\Phi} X_{i,1996} + \Delta \tilde{\mathcal{E}}_i. \end{aligned} \quad (2)$$

Equations (1) and (2) are estimated separately for regional changes in total bed capacity, as well as by ownership type and the sources of change.

Ideally, explanatory variables should be exogenous to the dependent variable to identify their true effect on the outcome of interest. Typically, however, market characteristics such as those in equations (1) and (2) may depend on unobserved characteristics of patients and hospital quality, and can therefore be endogenous. As one possible solution, Kessler and McClellan (2000) propose an identification strategy which instruments the measures of hospital market structure on an exogenous source of variation: travel distances between hospitals and patients. In short, Kessler and McClellan specify patient-level hospital choice models and predict the number of patients admitted to each hospital based solely on exogenous characteristics of patients and hospitals. In the models, patients are allowed to choose probabilistically all hospitals within a limited distance from their point of residence, where the key determinant of their choice is the travel distance to the hospitals. The predicted numbers of patients to each hospital are then used to calculate measures of hospital market shares and market concentration in each geographic region. The effects of these measures on the dependent variable are unbiased, because they do not depend on unobserved patient and hospital characteristics, such as hospital quality and differences in the



severity of illness of patients. For a detailed description of the model see Kessler and McClellan (2000).<sup>13</sup>

#### 4. Results

In the following Tables 5 to 9, the upper part is reserved to display the results from equation (1), while the lower part displays results from equation (2).<sup>14</sup> In Table 5, the impact of demand and base line market and population characteristics in 1996 on total changes in bed capacity as well as changes by ownership type is presented. The responsiveness of hospitals to increases in demand is highest for for-profits (upper part of the table). It is lower but equally high for nonprofits and public hospitals. Overall, a one percent increase in demand leads to a 0.27 percent increase in capacity. Interestingly, and in contrast to Hansmann's results, for-profits also tend to expand vehemently in markets with decreasing demand. A one percent decrease in demand is associated with a 1.26 percent increase in for-profit bed capacity. The expansion of for-profits is balanced by the decrease of capacity of public and nonprofit hospitals in declining markets.

Further, public hospitals are as fast to reduce capacity in declining markets as nonprofit hospitals. Concerning the impact of market characteristics in 1996 on changes in bed capacity, I find the plausible result that capacity decreases were stronger in communities with a formerly high bed density per capita. These communities probably already had high levels of excess capacity in the past and felt more pressure to adapt. Further, higher levels of market concentration are associated with higher decreases in bed capacity. Overall, capacities are increased in regions with a higher market share of university hospitals compared to regions with a higher market share of public hospitals. The effects are more variegated for variation in market shares of other hospital types.

The lower part of Table 5 presents the results from equation (2), where demand is interacted with base line bed capacity per capita in 1996. Because the estimation results of the other market characteristics are very similar to those in the upper part of Table 5, they are omitted from presentation.

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<sup>13</sup> In the adaptation of the model to the data used here, I estimate the patient-hospital choice models separately for 1996 and 2006 and for different clusters of the communities of the country, in order to allow for flexible functional forms of the model across regions and over years. Maximum travel distances of 50 km to every general hospital are assumed. Clusters used are the 97 German regional planning areas, as defined by the German Federal Office for Building and Regional Planning. Regional planning areas with a high density of hospitals are subdivided, in order to enable the estimation of the patient hospital-choice models.

<sup>14</sup> For the sake of brevity, I omit the presentation of estimation results for the population characteristics. Overall, higher shares of the older population are associated with smaller decreases in bed capacity. Results are obtainable on request.

High-capacity areas with population increases record higher decreases in bed capacity relative to low capacity areas, as would be expected. Similarly, in high-capacity areas with population decreases total bed capacity is reduced relatively strongly. This effect is statistically significant for for-profits and public hospitals. It reveals that the expansion of for-profits in areas with decreasing demand was more prevalent, when past levels of capacity were relatively high.

Table 6 decomposes changes in bed capacity by the sources of change. The upper part of the table shows that openings and changes in bed size have been equally strong means to increase bed capacity. Capacity reductions were to the largest extent driven by closures and the downsizing of hospitals. As expected, reductions in total bed capacity were stronger in areas with decreases in demand. In the aggregate, conversions did not affect overall bed capacity. The lower part of the table discerns that market consolidation in high-capacity regions in areas with increasing demand took place through downsizing, whereas in areas with decreasing demand closures were of stronger importance.

Tables 7 to 9 present a further decomposition of the changes in bed capacity by the sources of change and the ownership types. Table 7 indicates that for public hospitals closures and downsizing have been the most effective tools of capacity reduction. Moreover, closures had been undertaken to a greater extent in areas with decreasing demand. This is also true for conversions, while changes in bed size responded on average equally strongly to changes in both demand regimes. Furthermore, capacity decreases due to closures, conversions and downsizing were stronger in high-capacity areas facing a shrinking population than in areas with population increases, as expected (lower part of Table 6). Similarly to public hospitals, the main vehicles of changes in bed capacity of nonprofit hospitals had been closures and downsizing (Table 8). Also, nonprofits reduced capacity foremost in high-capacity areas with a decreasing population.

Table 5

**Impact of changes in demand and market characteristics in 1996 on changes in ln(bed capacity), 1996-2006**

	All		Public		Nonprofits		For-profits	
	Coeff.	SE. <sup>1</sup>	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.
<b>Effect of demand independent of bed capacity in 1996 (Equation 1)<sup>2</sup></b>								
$\Delta \ln(\text{pop. increases})$	0.270***	(0.086)	0.139***	(0.025)	0.136**	(0.054)	0.664***	(0.105)
$\Delta \ln(\text{pop. decreases})$	0.328***	(0.025)	0.456**	(0.181)	0.426***	(0.116)	-1.260***	(0.265)
<b>Market characteristics in 1996</b>								
ln(beds per capita)	-0.327***	(0.011)	-0.333***	(0.009)	-0.321***	(0.011)	-0.365***	(0.012)
Market concentration	-0.227***	(0.017)	-0.311***	(0.021)	-0.234***	(0.022)	-0.170***	(0.022)
Market shares in beds								
For-profits	-0.416***	(0.089)	-1.854***	(0.111)	0.305**	(0.119)	-2.184***	(0.103)
University hospitals	0.563***	(0.067)	0.377**	(0.149)	1.436***	(0.092)	0.830***	(0.092)
Nonprofits	-0.126*	(0.071)	-0.455**	(0.181)	0.038	(0.033)	-0.030	(0.039)
<b>Effects of demand and interactions of demand with bed capacity per capita in 1996 (Equation 2)<sup>3</sup></b>								
$\Delta \ln(\text{pop. increases})$	0.308***	(0.085)	0.555***	(0.088)	0.626***	(0.095)	0.820***	(0.099)
$\Delta \ln(\text{pop. decreases})$	0.156***	(0.033)	-0.175	(0.232)	0.272	(0.295)	-2.702***	(0.191)
$\Delta \ln(\text{pop. increases}^*)$	-0.305***	(0.068)	-0.365***	(0.07)	-0.425*	(0.240)	-0.276	(0.191)
ln(beds per capita) 1996								
ln(beds per capita) 1996	0.529***	(0.146)	0.760***	(0.059)	0.378	(0.415)	0.665***	(0.196)

Notes: Total number of communities for all ownership types without missing changes in capacity is 11,765, 9,218 for nonprofits, 7,062 for for-profits, and 10,191 for public hospitals; Huber-White robust standard errors;<sup>2</sup> Controlling for base line population characteristics in 1996, results available upon request;<sup>3</sup> Controlling for base line market and population characteristics in 1996, results available upon request; \*\*\*,\*\*,\* indicates significance at 1% level, \*\* at 5% level; \* at 10% level.

Table 6  
**Impact of changes in demand on changes in total ln(bed capacity) by the sources of change, 1996-2006**

	Openings		Closures		Conversions		Changes in bed size	
	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.
<b>Effect of demand independent of bed capacity per capita in 1996 (Equation 1)</b>								
$\Delta \ln(\text{pop. increases})$	0.112**	(0.044)	-0.104*	(0.060)	0.122	(0.139)	0.101**	(0.043)
$\Delta \ln(\text{pop. decreases})$	-0.056	(0.183)	0.624***	(0.135)	-0.102	(0.191)	0.575***	(0.171)
<b>Market characteristics in 1996</b>								
$\Delta \ln(\text{beds per capita})$	-0.112***	(0.038)	-0.121***	(0.036)	-0.076	(0.142)	-0.165***	(0.050)
Market concentration	-0.029	(0.136)	0.078	(0.095)	-0.165***	(0.056)	-0.060*	(0.037)
Market shares in beds								
For-profits	-0.125***	(0.044)	-0.159***	(0.053)	0.103	(0.105)	-0.240***	(0.027)
University hospitals	1.108***	(0.123)	0.015	(0.029)	1.107*	(0.650)	0.779*	(0.444)
Nonprofits	-0.104***	(0.008)	-0.054***	(0.013)	-0.114*	(0.068)	-0.029***	(0.011)
<b>Effects of demand and interactions of demand with bed capacity per capita in 1996 (Equation 2)</b>								
$\Delta \ln(\text{pop. increases})$	0.057***	(0.019)	-0.159**	(0.063)	0.110	(0.123)	0.073**	(0.030)
$\Delta \ln(\text{pop. decreases})$	-0.041**	(0.016)	0.484***	(0.039)	0.113*	(0.064)	-0.077	(0.192)
$\Delta \ln(\text{pop. increases})^*$								
$\ln(\text{beds per capita})$ 1996	0.108	(0.143)	-0.050	(0.154)	-0.151	(0.243)	-0.186***	(0.018)
$\Delta \ln(\text{pop. decreases})^*$								
$\ln(\text{beds per capita})$ 1996	-0.153	(0.256)	0.150***	(0.032)	-0.507	(0.768)	0.249	(1.496)

Notes: See notes to table 4.

Table 7  
**Impact of changes in demand on changes in ln(bed capacity) of public hospitals by the sources of change, 1996-2006**

	Openings		Closures		Conversions		Changes in bed size	
	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.
<b>Effect of demand independent of bed capacity per capita in 1996 (Equation 1)</b>								
$\Delta \ln(\text{pop. increases})$	0.130***	(0.003)	-0.174***	(0.087)	0.083***	(0.032)	0.205**	(0.081)
$\Delta \ln(\text{pop. decreases})$	-0.228	(0.246)	0.303***	(0.121)	0.207**	(0.089)	0.210***	(0.109)
<b>Market characteristics in 1996</b>								
$\ln(\text{beds per capita})$	-0.125***	(0.028)	-0.085*	(0.049)	-0.125***	(0.017)	-0.091***	(0.025)
Market concentration	-0.086**	(0.034)	-0.038**	(0.015)	-0.087**	(0.037)	-0.029**	(0.012)
Market shares in beds								
For-profits	-0.346***	(0.110)	-0.397*	(0.225)	-0.128**	(0.051)	-0.189***	(0.085)
University hospitals	-0.036	(0.073)	-0.084	(0.078)	0.099**	(0.041)	-0.097	(0.074)
Nonprofits	-0.216**	(0.089)	-0.697***	(0.032)	-0.035	(0.044)	-0.568**	(0.225)
<b>Effects of demand and interactions of demand with bed capacity per capita in 1996 (Equation 2)</b>								
$\Delta \ln(\text{pop. increases})$	0.050***	(0.004)	-0.134*	(0.076)	0.053	(0.132)	0.135**	(0.054)
$\Delta \ln(\text{pop. decreases})$	-0.209	(0.236)	0.333*	(0.189)	0.176***	(0.014)	0.219***	(0.141)
$\Delta \ln(\text{pop. increases})^*$								
$\ln(\text{beds per capita})$ 1996	0.162	(0.937)	0.373	(0.996)	0.218	(0.291)	0.936	(0.697)
$\Delta \ln(\text{pop. decreases})^*$								
$\ln(\text{beds per capita})$ 1996	-0.096**	(0.168)	0.563**	(0.223)	0.147***	(0.021)	0.551***	(0.076)

Notes: See notes to table 4.

Table 8  
**Impact of changes in demand on changes in ln(bed capacity) of nonprofit hospitals by the sources of change, 1996-2006**

	Openings		Closures		Conversions		Changes in bed size	
	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.
<b>Effect of demand independent of bed capacity in 1996 (Equation 1)</b>								
$\Delta \ln(\text{pop. increases})$	0.091***	(0.035)	-0.132***	(0.021)	0.101	(0.176)	0.237***	(0.101)
$\Delta \ln(\text{pop. decreases})$	-0.102	(0.159)	0.150**	(0.047)	0.198	(0.247)	0.239**	(0.165)
<b>Market characteristics in 1996</b>								
ln(beds per capita)	-0.091***	(0.024)	-0.056***	(0.021)	-0.159***	(0.041)	-0.171***	(0.024)
Market concentration	-0.111***	(0.023)	-0.078***	(0.018)	-0.118***	(0.002)	-0.067***	(0.017)
Market shares in beds								
For-profits	-0.409***	(0.117)	-0.895***	(0.127)	-0.295***	(0.022)	-0.163***	(0.143)
University hospitals	0.244***	(0.102)	0.281***	(0.088)	0.202	(0.218)	0.288***	(0.094)
Nonprofits	-0.033	(0.039)	0.316***	(0.027)	0.312	(0.427)	0.305***	(0.029)
<b>Effects of demand and interactions of demand with bed capacity per capita in 1996 (Equation 2)</b>								
$\Delta \ln(\text{pop. increases})$	0.266	(0.375)	-0.032***	(0.014)	0.133	(0.278)	0.266***	(0.082)
$\Delta \ln(\text{pop. decreases})$	0.263	(0.161)	0.325*	(0.172)	-0.261	(0.391)	0.306*	(0.172)
$\Delta \ln(\text{pop. increases})^*$								
ln(beds per capita) 1996	0.111	(0.348)	-0.152	(0.43)	-0.043	(0.163)	0.288	(0.07)
$\Delta \ln(\text{pop. decreases})^*$								
ln(beds per capita) 1996	-0.039	(0.131)	0.294***	(0.189)	-0.118	(0.286)	0.504***	(0.067)

Notes: See notes to table 4.

Table 9  
**Impact of changes in demand on changes in ln(bed capacity) of for-profit hospitals by the sources of change, 1996-2006**

	Openings		Closures		Conversions		Changes in bed size	
	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.	Coeff.	SE.
<b>Effect of demand independent of bed capacity per capita in 1996 (Equation 1)</b>								
$\Delta \ln(\text{pop. increases})$	0.253**	(0.120)	0.049	(0.114)	0.333***	(0.076)	0.048**	(0.019)
$\Delta \ln(\text{pop. decreases})$	-0.128***	(0.038)	-0.090	(0.168)	-0.435***	(0.051)	-0.063**	(0.025)
<b>Market characteristics in 1996</b>								
$\ln(\text{beds per capita})$	-0.448***	(0.012)	-0.161***	(0.025)	-0.061	(0.132)	-0.296***	(0.015)
Market concentration	-0.119*	(0.069)	-0.062**	(0.025)	-0.067	(0.202)	-0.126***	(0.021)
Market shares in beds								
For-profits	-0.200**	(0.081)	-0.077**	(0.031)	-0.144**	(0.060)	-0.035**	(0.015)
University hospitals	0.205**	(0.087)	0.169*	(0.137)	0.437	(0.583)	0.499	(0.585)
Nonprofits	-0.171***	(0.033)	-0.125**	(0.052)	0.132	(0.256)	-0.362**	(0.144)
<b>Effects of demand and interactions of demand with bed capacity per capita in 1996 (Equation 2)</b>								
$\Delta \ln(\text{pop. increases})$	0.269***	(0.101)	0.075	(0.100)	0.442***	(0.139)	0.075***	(0.014)
$\Delta \ln(\text{pop. decreases})$	-0.143***	(0.015)	0.016	(0.156)	-1.243***	(0.276)	-0.085**	(0.036)
$\Delta \ln(\text{pop. increases})^*$								
$\ln(\text{beds per capita})$ 1996	0.078	(0.081)	0.065**	(0.026)	-0.042	(0.211)	-0.134*	(0.076)
$\ln(\text{pop. decreases})^*$								
$\ln(\text{beds per capita})$ 1996	0.017**	(0.007)	0.387**	(0.153)	-0.218***	(0.075)	0.378***	(0.097)

Notes: See notes to table 4.

Finally, Table 9 suggests that conversions were the most important source of increases in bed capacity of for-profit hospitals. More specifically, conversions have contributed to growth of for-profits more in areas with population decreases than in areas with population increases (upper part of the table). This growth was to some extent triggered by conversions in high-capacity areas with decreasing demand (lower part of the table). In contrast to this, it was shown that public hospitals decreased capacity in these areas via conversions in Table 7. These two findings indicate that conversions of public to for-profit status mainly took place in regions with a high-capacity and a relative decline in demand. This is not surprising, as it may have been particularly difficult for public hospitals to maintain capacity in these areas and conversions may have offered a way of restructuring. The second most important means of expansion were openings of new hospitals. Openings seem to have taken place predominantly in areas with increasing demand, while growth is also significant in areas with decreasing demand in the sample of for-profit hospitals.

## **5. Conclusions**

The objective of this paper has been to examine the evolution of the German hospital industry over the period 1996-2006. More specifically, the focus has been on the magnitude and the sources of ownership-specific changes in regional bed capacity. The first result of the paper is that for-profits are most responsive to increases and decreases in demand, as proxied by changes in population size. Thus, with respect to the speed of adaptation to changes in demand the study finds for-profit ownership to be superior to public and nonprofit ownership. This result has been formerly shown to hold within the US hospital market.

The reasons behind this finding are, at least in the German context, manifold and may in general also hold for other countries. The ease of access to new capital to expand existing capacities combined with a lack of public investments in the hospital sector and the incentives to minimize costs by optimizing capacity make for-profit firms in general more apt to fast adaptations to changing market environments.

The second result of the paper is the growing market share of for-profit hospitals. On the one hand, during the period 1996-2006 public and nonprofit hospitals were primarily concerned with a reduction of excess capacities. They did so by closures, downsizing of existing capacity and – predominantly in the case of public hospitals - conversions. These had been under-



taken to a greater extent in high-capacity areas with decreasing demand, which shows in general a sound functioning of the market dealing with excess capacities. On the other hand, the main sources of expansion of for-profits have been conversions of mainly public, and to a lesser extent, non-profit hospitals to for-profit ownership. To a large extent, these conversions have taken place in markets with declining demand.

This finding is not surprising, as public owners will be most willing to get rid of their hospitals in regions with falling demand, the alternative being costly subsidies. Moreover, taking over these hospitals may be a relatively easy entry option for for-profit owners as compared to the opening of completely new hospitals. The latter is often more time consuming or even impossible in a heavily regulated market such as the hospital industry.

From the economic policy perspective, it is not obvious whether the expansion of for-profit ownership in a market with an overall decline in demand is good or bad. The expansion of for-profits has been shown to relieve debt-ridden public hospitals, to increase the cost-efficiency of the sector and to some extent the quality of medical care in the US (Gaynor and Haas-Wilson (1999), Cutler and Horwitz (1998)). However, there is some evidence that for-profits are less cost efficient and less technically efficient than public hospitals in retrospective payment systems due to long average lengths of stay (Herr 2008). Moreover, the expansion of for-profits may also slow down the process of reduction of excess capacities and can thus be socially wasteful (Wicks, Meyer and Carlyn, 1996). If in the long-term for-profits succeed to restructure those hospitals, which they have acquired through conversions (or mergers), then efficiency-gains should exceed potential costs of slowing down the process of reducing excess-capacities.

Further research should therefore focus on the long-term welfare implications of changes in the ownership-structure and market consolidation. Welfare effects largely depend on competition and the quality of medical care. These have been already partially dealt with in studies using US hospital data, but remain largely unanswered for the European hospital markets.

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## Appendix

Table A1

### Descriptive statistics of market characteristics on community level, 1996 and 2006

Variables	Obs.	1996		2006	
		Mean	St. Dev.	Mean	St. Dev.
Bed capacity					
Total	11765	44.68	33.74	40.25	34.23
Public	11765	20.38	17.42	17.35	15.22
Nonprofit	11765	18.37	16.94	13.32	10.52
For-profit	11765	2.40	3.45	6.25	7.43
University	11765	3.53	4.21	3.32	4.01
Population	11765	6862.04	7032.24	6875.27	6943.62
Beds per capita * 1000	11765	7.01	4.09	6.32	4.35
Market concentration (HHI)	11765	3119.65	2749.48	3038.00	2525.84
Market shares in beds					
Public	11765	0.54	0.42	0.43	0.38
Nonprofits	11765	0.33	0.21	0.32	0.26
For-profits	11765	0.08	0.12	0.19	0.18
University	11765	0.05	0.07	0.06	0.08

Notes: FDZ (2008), own calculations.