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Is there a Future for Small Hospitals in Germany?

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Boris Augurzky and Hendrik Schmitz[1]

Is there a Future for Small Hospitals in Germany?

Abstract

We analyse the financial performance of small German hospitals based on balance sheet data of about 1,000 hospitals in 2007. Measures of financial performance are the earnings before interest, tax, depreciation, and amortisation (EBITDA) and the probability of default (PD). We find that, on average, small hospitals have more financial difficulties than large ones. However, there is considerable heterogeneity among small hospitals. While small private-for-profit hospitals tend to perform very well, small public hospitals face considerable financial problems. Apart from ownership, we find that specialisation, less subsidies in absolute terms, and a higher share of lump-sum subsidies are associated with a better financial performance.

JEL Classification: I11, I18

Keywords: Hospital ownership; financial performance

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1 Introduction

Due to demographic change and technical progress in medicine the demand for health care rises faster than social resources to finance the health system. In Germany, until 1993 hospitals had been reimbursed their full costs. Later on, the government has constrained annual rises in hospital expenditures by the growth rate of revenues of the social health insurance. Thus, hospitals' costs usually rise faster than their revenues and hospitals are constantly forced to improve their productivity. Especially since 2004, after the introduction of a prospective payment system based on diagnosis related groups (DRG) hospitals work under given prices and cannot pass higher costs to the health insurances anymore. This reform has strengthened the hospital's own economic responsibility, increased competition between hospitals for patients in order to cover fixed costs, and put strong pressure on costs.

Under this situation many hospitals ran into economic difficulties and had to face the risk of economic default, especially those in public ownership. Some of them were sold to private hospital chains which restructured them. The market share of public hospitals – measured by number of beds – has fallen from 56% in 1997 to 49% in 2008 (Destatis, 2009), while that of private-for-profit hospitals has increased from 6% to 16%. The remaining share belongs to private-not-for-profit hospitals, typically run by churches. Besides, small hospitals, on average, face substantial economic problems. Due to high fixed costs and small market power they are often unable to be profitable or at least to avoid annual losses.

There is some consensus in the economic literature that there might be a minimum efficient scale for hospitals, typically argued to be more than 200 beds (see the discussion in Bays, 1986). Hospitals with less than 100 beds are often found to have a higher probability of closing than larger hospitals (Williams et al., 1992 and Lillie-Blanton et al., 1992). In contrast, Simpson (1995) argues that the majority of hospitals that entered the market in his sample of Californian hospitals between 1989 and 1993 was small implying an efficiency at least similar to the existing larger ones.

While there is an abundant literature on cost and profit efficiency of hospitals (see, e.g., Hollingsworth and Street, 2006, and Hollingsworth, 2008, for reviews), only few studies have analysed profits and credit risks of hospitals. Shen et al. (2005) review 14 studies from the US with data from the 1980s and 1990s that analyse ownership differences in profit-margins. They find some heterogeneity in the quality of the studies and conclude that among the most credible studies there is no strong difference across ownership types. As regards evidence from Europe, Herr et al. (2010) find that German private for-profit hospitals are more profit efficient than public ones. Augurzky et al. (2009) find that private for-profit hospitals have a lower risk of default than public hospitals.

To our knowledge, there is only one study that focuses on small hospitals and analyses their financial performance in detail. Somewhat surprisingly, McCue (1997) finds that among the 783 US hospitals in his sample with less than 100 beds for-profit hospitals have a lower likelihood to have a persistently positive cash flow than not-for-profit hospitals.

This paper describes the financial situation of small German hospitals based on a sample of 719 annual reports of German hospitals or hospital chains of 2007. Furthermore, we analyse the distribution of economic success of small hospitals and have a look on which factors might be behind economic success. We define a hospital to be small if it has less than 200 beds and measure the economic situation by earnings before interest, tax, depreciation, and amortization (EBITDA) and, in addition, by the probability of default (PD) which considers more than one performance figure of the annual report. The next section describes the data and methods. Section 3 presents the estimation strategy and results while Section 4 concludes.

2 Data

The data consist of 719 annual reports of hospitals or hospital chains of 2007.[1] Altogether the reports comprise 1,014 single hospitals. Some chains provide one report for a group of hospitals. The given annual reports consist of the balance sheet and the profit-and-loss statement. In addition, we have information on the ownership type distinguishing between public (hospitals owned by public authorities), private not-for-profit (secular and religious) and private for-profit hospitals, the number of beds, the number of hospitals in a hospital chain, the address, the degree of rurality, and per-capita-income in the region of the hospital. Additionally, we know the amount of annual and cumulated subsidies for each hospital or hospital chain and the share of lump-sum subsidies as part of all subsidies between 2000 and 2007 on the level of the federal state.

The unit of observation in our analyses is the single hospital, not the annual report. Since the annual reports are consolidated for the chains, i.e. we do not have the reports of the single hospitals, we assign the financial measures of a chain to all its single hospitals. Thus, we assume that all hospitals in a chain have the same financial performance.[2] This implies that chains with n hospitals get an n-fold weight in the regression compared to a stand-alone hospital which is reasonable. Since the potential measurement error in the dependent variable is not related to the explanatory variables this does not affect the consistency of parameter estimates. We cluster the standard errors by chains.

For some statistics we fall back on data of the German Statistical Office (Destatis) containing the full population of all 1,791 general acute care hospitals in 2007.[3] Defining small hospitals by number of beds less than 200, 53% of all German hospitals in 2007

[1] The data are extracted from the Dafne database and partly collected by own research. Dafne is a product of the largest German credit rating agency (Creditreform) distributed by the leading company in electronic publishing of business information (Bureau van Dijk). In 2010 it contained accounting data for over 105,000 German firms. Accounting data is collected centrally at Creditreform headquarters and the quality of the data should be high.

[2] This is sensible. A hospital chain is responsible for all its hospitals. There are internal cash flows between single hospitals that are also due to strategic decisions of the chain, not only due to the performance of the single hospital.

[3] In contrast to our data set, this does not include purely psychiatric hospitals. Due to data constraints we cannot calculate Tables 1 and 2 using the full population of all hospitals. However, the sample of general hospitals covers about 90 per cent of all hospitals.

are small (Table 1). However, their market share measured in beds only amounts to 18% (Destatis, 2009). 79% of all private for-profit hospitals are small while this is the case for only 38% of all public and 46% of all private not-for-profit hospitals. Table 2 compares our sample with the full population. Our sample slightly overrepresents hospitals of private not-for-profit and underrepresents hospitals of private for-profit ownership. On average, the sample includes larger hospitals.

Table 1: Characteristics of small hospitals (full population)

	Small Hospitals (1)	All Hospitals (2)	Column (1) as share of (2) (3)
Hospitals			
All ownership types	958	1,791	53%
Public	225	587	38%
Private not-for-profit	315	678	46%
Private for-profit	418	526	79%
Beds			
All ownership types	85,915	468,169	18%
Public	26,143	229,971	11%
Private not-for-profit	36,006	167,739	21%
Private for-profit	23,766	70,459	34%
Cases			
All ownership types	2,854,193	16,670,545	17%
Public	933,688	8,416,378	11%
Private not-for-profit	1,164,911	5,846,393	20%
Private for-profit	755,595	2,407,774	31%

Source: Destatis (2009). Small hospitals: 1-199 beds.

Table 2: Number of hospitals in the sample and the population in 2007

Sample	All sizes		Small		Medium		Large	
Public	329	(32.4%)	125	(27.6%)	118	(29.2%)	86	(54.8%)
Private not-for-profit	424	(41.8%)	171	(37.7%)	213	(52.7%)	40	(25.5%)
Private for-profit	261	(25.7%)	157	(34.7%)	73	(18.1%)	31	(19.7%)
All ownership types	1,014	(100.0%)	453	(100.0%)	404	(100.0%)	157	(100.0%)
Population								
Public	587	(32.8%)	225	(23.5%)	211	(35.6%)	151	(62.9%)
Private not-for-profit	678	(37.9%)	315	(32.9%)	301	(50.8%)	62	(25.8%)
Private for-profit	526	(29.4%)	418	(43.6%)	81	(13.7%)	27	(11.3%)
All ownership types	1,791	(100.0%)	958	(100.0%)	593	(100.0%)	240	(100.0%)

Source: Destatis (2009), RWI hospital data base, own calculations.
Small = 1-199 beds; medium = 200-499 beds, large = 500+ beds

As a first measure of financial performance we refer to earnings before interest, taxes, depreciation and amortization (EBITDA) divided by revenues. EBITDA measure prof-

its from the core business before taking into account financial and investment issues. Note that we do not add subsidies hospitals receive for the purpose of investment to the EBITDA.[4] A second measure is the probability with which an enterprise is predicted to default within one year (probability of default, PD). The PD is a comprehensive indicator of financial soundness and often asked for by institutional creditors. The PD depends not only on profitability but also on liquidity and capital structure.

When calculating the PD we do not take into account explicit or implicit guarantees, e.g. given by public owners such as municipalities. From the perspective of a creditor a guarantee would reduce the risk of default. However, we want to measure how financially sound is a hospital without resort to external aid. In particular, we intend to measure the risk to the tax payer who usually has to pay for public guarantees.

Building a model to predict the PD is difficult in a small sample comprising only few defaults. In our case its direct estimation is impossible because there have been only very few real hospital defaults in the past. For political reasons, many hospitals at high risk of default or already at default often obtain public aid or are privatised and, thus, are able to survive. Given this restriction, instead of constructing an own hospital rating based on our data we rely on an existing quantitative rating tool. The details are explained in the Appendix.

The average PD over all annual reports in the sample amounts to 1.2%. The average EBITDA is 3.6% of revenues. Note that we exclude 12 hospitals from the analysis that have implausible values of EBITDA-margins of more than 30% or less then -10%. The average PD of small hospitals is 1.5%, that of large hospitals 1.1%. Obviously, small hospitals face more serious economic problems than large ones. However, there are notable differences among ownership types. Table 3 shows PD and EBITDA by size and ownership types. Small hospitals of all ownership types have a higher PD than their medium or large counterparts, but the PD of small public hospitals is exceptionally high.

The average EBITDA-margin does not differ strongly between small hospitals (3.8%)

[4] In Germany, officially, investment costs should be carried by the federal states. In fact, only roughly 50 to 60% are paid by the states, the rest is paid for by the hospital's revenues (Augurzky et al., 2010).

and large ones (3.9%). However, there are notable differences across ownership types. Small public hospitals perform significantly worse (0.59%) than both small private and medium or large public hospitals. Small private not-for-profit hospitals also have a slightly (but insignificantly) lower EBITDA-margin than medium or large private not-for-profit hospitals. Small private for-profit hospitals perform better than medium size and almost as good as large private for-profit hospitals (both differences not significant).

Table 3: Financial performance by size and ownership of hospitals

PD	Size	All ownerships	Public	Private not-for-profit	Private for-profit
	Small	1.46	2.06	1.18	1.27
	Medium	0.84	1.16	0.65	0.86
	Large	1.05	1.18	0.90	0.90
EBITDA	Size	All ownerships	Public	Private not-for-profit	Private for-profit
	Small	3.77	0.59	2.62	7.55
	Medium	3.51	2.28	3.17	6.49
	Large	3.90	2.61	3.02	8.61

Own calculations.

3 Estimation Strategy and Results

3.1 Estimation Strategy

We restrict our analysis to the small hospitals in our sample which are 453 hospitals and 320 reports and carry out regressions with PD and EBITDA-margin as dependent variables. Explanatory variables are the ownership type, a dummy for rural regions, being part of a chain, and the mean per-capita-income in the local area of the hospital. Moreover, we proxy the degree of specialisation of hospital i by

$$\text{specialisation}_i = \sum_{k=1}^{20} \left(\frac{\text{beds in department}_{ik}}{\text{total number of beds}_i} \right)^2 \quad \in (0, 1]$$

where $k = 1, ..., 20$ are the possible different departments.[5] This indicator increases when the hospital focuses on few activities. That is, given a number of departments, this index increases when a hospital puts more weight on one department. Likewise, given a certain number of beds, a lower number of departments results in a higher value of the specialisation-index. The importance of specialisation might differ for urban and rural hospitals. There might be more competition in urban areas than in rural areas where less hospitals cover a larger area. To allow for different effects of specialisation we interact the index with indicators for rural and urban areas.

Furthermore, we control for the cumulated amount of subsidies as of 2007 for each hospital or hospital chain and the share of lump-sum subsidies of all subsidies at the federal state level.[6] The latter is a proxy for the degree of political influence on hospitals in a federal state. If the share of lump-sum subsidies of all subsidies is high the federal state delegates responsibility to hospitals. If it is low the federal state has a strong influence on investment decisions of hospitals. The cumulated total amount of subsidies is a special item in the balance sheet and reflects the subsidies of previous years until 2007. We prefer this measure to the subsidies of the single year 2007 because, first, subsidies are paid irregularly and, second, hospitals benefit not only from recent subsidies but also from those of previous years. Finally, we include regional dummies for the federal states as appearing in Table 4 (Saarland and the city states Berlin, Hamburg, and Bremen being the reference group).

3.2 Results

Table 5 reports the results of ordinary least squares regressions for small hospitals. We find that private ownership is associated with a lower PD than public ownership with only private not-for-profit ownership being significant at the 10 per cent level, however.

[5] The classification of departments follows the definition of Destatis (2009) that distinguishes 20 different types. In our sample of small hospitals, the maximum number of departments is 8.

[6] In Germany, hospitals get subsidies for purposes of investments independently of the type of ownership. These are singular subsidies for large investments and annual lump-sum subsidies for ongoing small investments. Singular subsidies have to be applied for. Lump-sum subsidies are paid without request to all hospitals according to their size.

Table 4: Variable description and sample means

Variable	Description	Sample means		
		Small	Medium	Large
Private for-profit	Dummy for private for-profit ownership	0.35	0.18	0.20
Private not-for-profit	Dummy for private not-for-profit ownership	0.38	0.53	0.25
Specialisation x Rural	Defined as explained in the text	0.33	0.12	0.10
Specialisation x Urban	Defined as explained in the text	0.24	0.19	0.10
Rural	Dummy for rural region	0.41	0.60	0.52
Share lump sum	Share of lump-sum subsidies	0.42	0.44	0.40
Total investment subsidies	Cumulated total investment subsidies/Assets	0.37	0.37	0.38
Mean income district/1000	Mean income in € in district	17.01	16.74	16.71
Chain	Dummy for being part of a chain	0.49	0.37	0.34
Regional dummies				
Bavaria		0.19	0.10	0.08
Baden-Wuerttemberg		0.16	0.08	0.13
North Rhine-Westphalia		0.18	0.34	0.23
Saxony		0.06	0.06	0.05
Saxony-Anhalt		0.02	0.03	0.04
Brandenburg		0.02	0.04	0.05
Mecklenburg-Vorpommern		0.02	0.01	0.03
Thuringia		0.02	0.03	0.06
Lower Saxony		0.10	0.09	0.07
Hesse		0.12	0.07	0.08
Schleswig-Holstein		0.03	0.03	0.03
Rhineland-Palatinate		0.05	0.04	0.05
Observations		453	404	157

Small = 1-199 beds; medium = 200-499 beds, large = 500+ beds

Moreover, more specialised hospitals in urban areas have a significantly lower PD. In rural areas specialisation does not seem to have a positive effect on the PD. This difference can be explained by more competition in urban areas and, thus, more pressure to sharpen the hospital's portfolio. The remaining coefficients are not significant.

As regards to the EBITDA-margin private-for-profit hospitals perform significantly better than public ones. Note that the interpretation in the two columns is reversed. A low PD and a high EBITDA-margin reflect a good financial performance. As expected from the raw means in Table 3, private-for-profit ownership is associated with a 6 percentage points higher EBITDA-margin as compared to public. Moreover, a higher degree of specialisation significantly increases profits both in rural and in urban areas. In contrast to the PD equation, this effect is even stronger for rural hospitals. However, the difference in the

effects between rural and urban is not significant.

Table 5: Regression results small hospitals

	PD	EBITDA
Private for-profit	-0.632	5.773***
	(0.397)	(1.178)
Private not-for-profit	-0.585*	0.952
	(0.348)	(0.633)
Specialisation x Rural	-0.092	2.826**
	(0.684)	(1.134)
Specialisation x Urban	-0.933**	2.407**
	(0.418)	(1.158)
Urban	0.571	0.406
	(0.530)	(1.097)
Share lump sum	2.862	30.089**
	(2.526)	(12.404)
Total investment subsidies	0.442	-4.898***
	(0.889)	(1.554)
Mean income district/1000	-0.092	0.195
	(0.069)	(0.150)
Chain	-0.335	-1.388
	(0.273)	(0.863)
Constant	1.307	-11.195***
	(1.454)	(4.216)
Observations	453	453

* p<0.1, ** p<0.05, *** p<0.01, standard errors in parentheses, clustered by chains; Regional dummies included

A higher share of lump-sum subsidies increases the EBITDA-margin. 1 percentage point more lump-sum subsidies – as opposed to singular subsidies –, that is, an increase in the dependent variable by 0.01, is associated with an increase in the EBITDA-margin by about 0.30 percentage points. This result can be interpreted as evidence for a positive effect in case of less political influence on hospitals. Note that a higher cumulated total amount of subsidies (per assets) seems to have a negative impact on EBITDA and no significant one on the PD. On average, cumulated subsidies of the hospitals in the sample amount to 3.7% of their assets. One more percent (that is, 0.01 more of the variable *total investment subsidies*) decreases the EBITDA-margin by about 0.049. On average, subsidies by the federal state might not have been used to invest in measures that increase profitability.

Thus, although small hospitals are, on average, in a worse financial situation than larger ones, there is remarkable heterogeneity and there are several factors that improve the

financial situation. Especially private ownership, specialisation, and a high degree of lump-sum subsidies are associated with a good performance.

3.3 Robustness Check

Due to our data structure there might be a concern that the results are somewhat contaminated by the existence of chains. Chains as such would not pose a major problem if they consisted only of hospitals of the same size. Typically, however, chains do have both smaller and larger hospitals in their portfolio. The difference in the economic situation between smaller and larger hospitals introduces a problem because we implicitly assume that all hospitals within a chain have the same financial performance. According to Table 3, larger hospitals, on average, perform better than smaller hospitals. If this is also true within a chain (which we cannot test) small hospitals that are part of a chain are assigned financial measures which are too good.

As a robustness check we drop all hospitals from the sample that belong to a chain. This almost halves the sample size to 229 hospitals. Repeating Table 3 for all stand-alone hospitals results in Table 6. The differences between the two tables are small. On average, small stand-alone hospitals have a slightly higher PD than the full sample of small hospitals. This holds especially for small private-for-profit hospitals. An exception, however, are small public hospitals that have a lower PD than those in the full sample. As regards to the EBITDA-margin, stand-alone hospitals even have higher profits throughout all subgroups (except for medium-sized private not-for-profit hospitals). This holds especially for private for-profit hospitals.

Table 7 reports the respective regression results. Basically, the results are comparable to the ones above. The major difference is that in the PD equation there are no significant coefficients anymore. The effects of specialisation and subsidies on the EBITDA-margin, however, are even stronger in this subgroup. Altogether, the main findings also hold for the special subgroup of stand-alone hospitals.

Table 6: Financial performance by size and ownership of stand-alone hospitals

PD	Size	All ownerships	Public	Private not-for-profit	Private for-profit
	Small	1.51	1.74	1.31	1.70
	Medium	0.87	1.11	0.73	1.03
	Large	1.15	1.30	0.92	0.74
EBITDA	Size	All ownerships	Public	Private not-for-profit	Private for-profit
	Small	4.53	2.20	2.71	8.79
	Medium	3.81	3.08	3.10	9.62
	Large	3.77	3.08	3.44	11.70

Own calculations.

Table 7: Regression results small stand-alone hospitals

	PD	EBITDA
Private for-profit	0.175	5.363***
	(0.526)	(1.066)
Private not-for-profit	-0.139	0.770
	(0.460)	(0.767)
Specialisation x Rural	0.466	5.542***
	(1.301)	(1.866)
Specialisation x Urban	-0.466	4.258**
	(0.623)	(1.648)
Urban	0.321	0.768
	(0.904)	(1.601)
Share lump sum	2.392	43.709***
	(2.859)	(15.500)
Total investment subsidies	0.470	-5.216***
	(0.953)	(1.643)
Mean income district/1000	-0.029	0.263
	(0.093)	(0.176)
Constant	-0.076	-16.698***
	(1.748)	(5.296)
Observations	229	229

* p<0.1, ** p<0.05, *** p<0.01, standard errors in parentheses, clustered by chains; Regional dummies included

4 Conclusion

We analyse the financial performance of small German hospitals based on 719 annual reports in 2007 covering 453 small hospitals. We find that, on average, small hospitals have a higher one-year probability of default. Moreover, especially small public but also small private not-for-profit hospitals have a lower EBITDA-margin than the average medium size and large hospital. Small private hospitals perform significantly better with respect to the EBITDA-margin. Apart from ownership we find that specialisation, less subsidies

in absolute terms, and a higher share of lump-sum subsidies are associated with a better financial performance. On the other hand, small hospitals in rural areas do not perform worse than those in urban areas. Nevertheless, defaults of small hospitals in rural areas might pose other problems than in urban centers where there are many other hospitals that offer medical services as well.

In order to increase the financial stability of small hospitals, especially in rural areas, politics should delegate more responsibility to the hospital management and the management, in turn, should focus the hospital's portfolio. In Germany, even in rural areas there is a relatively high density of hospital locations (Augurzky et al., 2010) such that specialisation of rural hospitals does not necessarily worsen the supply with medical services in all rural areas.

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Appendix: Modelling the probability of default

Its limited sample size precludes the direct estimation of PDs from our hospital data base. Instead, we apply the logit score of Engelmann and Tasche (2003) to predict the

PD associated with each hospital. The formula is as follows:

$$
\begin{aligned}
\text{Logit score} \;=\; & 5.65 - 0.98 \times \text{liabilities/assets} - 1.37 \times \text{bank debt/assets} + \\
& 2.42 \times \text{cash/current liabilities} + 2.08 \times \text{cashflow/(liabilities-advances)} - \\
& 0.81 \times \text{current assets/net sales} - 1.49 \times \text{current liabilities/assets} - \\
& 5.26 \times \text{accounts payable/net assets} + 0.19 \times \text{net sales/assets} + \\
& 0.28 \times \text{(net sales - material cost)/personnel costs} + \\
& 8.21 \times \text{ordinary business income/assets} - 0.17 \times \text{net sales one year ago}
\end{aligned}
$$

This rating tool has been developed for German medium-sized companies on the basis of 325,000 balance sheets spanning the years 1987 to 1999. About 3,000 of the units were identified as legal insolvencies. The quality of a rating system mainly depends on the fit to predict default accurately. Engelmann and Tasche (2003) show that their logit score outperforms the Altman's Z-score (Altman, 1968), the conventional benchmark model in the financial literature to predict a default. We further checked the efficiency of the model against Moody's KMV RiskCalcTM, a leading credit rating model for corporations. In the first step, we create a broad sample of medium-sized firms (of all sectors, not only hospitals) with full information in those accounting data which are needed to produce both rating scores. About 15,972 balance sheet data, mainly from the years 2002 and 2003 are considered to test for the accuracy, with 81 firms identified as legal insolvencies. In the second step, we apply the concept of a receiver operating characteristic (ROC) curve to prepare the test on differences between two rating models. The ROC-curve is a binary classification model that is frequently used to compare the efficiency of rating models (Engelmann and Tasche, 2003). The chi(2) test on differences of the areas below the ROC curves shows a p-value of 0.1232 and thus, the null hypothesis of similar areas below the ROC curves is not be rejected at the significance level of 1%.