RUHR
ECONOMIC PAPERS

Adam Pilny

Mergers and Acquisitions in the German Hospital Market – Who are the Targets?

#518

Imprint

Ruhr Economic Papers

Published by

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI)
Hohenzollernstr. 1-3, 45128 Essen, Germany

Editors

Prof. Dr. Thomas K. Bauer
RUB, Department of Economics, Empirical Economics
Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger
Technische Universität Dortmund, Department of Economic and Social Sciences
Economics – Microeconomics
Phone: +49 (0) 231/7 55-3297, e-mail: W.Leininger@wiso.uni-dortmund.de

Prof. Dr. Volker Clausen
University of Duisburg-Essen, Department of Economics
International Economics
Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Roland Döhrn, Prof. Dr. Manuel Frondel, Prof. Dr. Jochen Kluve
RWI, Phone: +49 (0) 201/81 49-213, e-mail: presse@rwi-essen.de

Editorial Office

Sabine Weiler
RWI, Phone: +49 (0) 201/81 49-213, e-mail: sabine.weiler@rwi-essen.de

Ruhr Economic Papers #518

Responsible Editor: Thomas Bauer

ISSN 1864-4872 (online) – ISBN 978-3-86788-593-5

Ruhr Economic Papers #518

Adam Pilny

Mergers and Acquisitions in the German Hospital Market – Who are the Targets?

Ruhr Graduate School in Economics
RUHR UNIVERSITÄT BOCHUM RUB
RWI

Bibliografische Informationen der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über: *http://dnb.d-nb.de* abrufbar.

http://dx.doi.org/10.4419/86788593
ISSN 1864-4872 (online)
ISBN 978-3-86788-593-5

Adam Pilny[1]

Mergers and Acquisitions in the German Hospital Market – Who are the Targets?

Abstract

Since the introduction of the DRG system in 2004, the German hospital market experienced a stream of consolidations in terms of mergers and acquisitions, resulting in a decreasing number of hospital owners. In this study, I examine the ex ante characteristics of hospitals prior to a merger or an acquisition occurring between 2005 and 2010 in Germany, predominantly focusing on the financial conditions of hospitals. The results reveal that hospitals with a higher probability of default and less liquid resources are more often the targets of acquisitions. On the other hand, hospitals with a lower equity-to-assets ratio exhibit a higher probability of merger. This pattern can be explained by different motives and rationales of hospital chains and potential investors.

JEL Classification: I11, L33

Keywords: Hospital market; mergers; acquisitions; consolidation

November 2014

1 Adam Pilny, RWI, RGS Econ and Ruhr-Universität Bochum. *– The author thanks Thomas K. Bauer, Roman Mennicken, Sandra Schaffner and Ansgar Wübker for helpful comments and suggestions. Financial support by the Ruhr Graduate School in Economics is gratefully acknowledged.* *– All correspondence to: Adam Pilny, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: adam.pilny@rwi-essen.de*

1 Introduction

During the last decade, the German hospital market has been subject of considerable developments, which were constituted by the medical-technical advancement, structural changes in the health care sector and an increasing importance of the financial conditions of hospitals (Schmidt and Möller, 2007). Especially, the introduction of the DRG (Diagnosis Related Groups) system in 2004 and steadily decreasing investment subsidies on the part of the federal states intensified competition among German hospitals. Since then, the hospital market experienced a stream of consolidations in terms of mergers and acquisitions (M&As), resulting in a decreasing number of hospital owners as shown in recent studies: Schmidt (2012) deals with the increasing concentration on the level of hospital ownership, showing a decreasing number of hospital owners. Augurzky et al. (2013) show that 1,399 hospital owners administered all German hospitals in 2003, whereas only 1,121 hospital owners remained in 2011.

In this paper, I analyze the *ex ante* characteristics of hospitals prior to a merger or an acquisition occurring between 2005 and 2010 in Germany. Understanding the factors influencing M&As in the hospital market has relevance for policy makers. Most often concerns regarding antitrust regulation are mentioned in the context of market consolidation. For Germany, Hentschker et al. (2014) and Coenen et al. (2012) highlight that antitrust authorities, although engaged in M&A activities since the early 2000s, seem to have too high antitrust hurdles for the hospital market that do not prevent a higher concentration in the market accurately. They recommend to lower such hurdles for hospital mergers and to improve criteria for a clearer distinction of hospital markets. By avoiding a hospital closure due to a takeover, this transaction might be used as a justification for overlooking concerns with antitrust laws (Sloan et al., 2003). Nevertheless, such a transaction has to be assessed by antitrust regulators with respect to the competition in the regional hospital market. Another argument for the policy relevance of this issue is mentioned by Sloan et al. (2003). They show a trade-off in health policy decisions, insofar that the variety of objectives pursued by policy makers with the aim of increasing competition may come along with concomitant effects of increased risks of hospital closures or other negative impacts to local municipalities. Thus, a change in the environment of hospitals may have an impact on their likelihood to change the ownership or to exit the market. Therefore, it is necessary to understand the factors that are associated with M&As in order to allow the identification of potential targets of an ownership change or a closure. Sloan et al. (2003) recommend assistance programs for poor performing hospitals with the intention of improving their conditions to survive in the market.

So far, the majority of the existing literature is concerned with the effects caused by consolidations.[1] However, the drivers of consolidations have been examined by a few earlier studies for the US hospital market. The most frequently discussed evidence of determinants of consolidations is

[1] A wide range of studies have analyzed the effects on cost savings (see e.g. Kjekshus and Hagen 2007; Dranove and Lindrooth 2003; Shen 2003; Spang et al. 2001; Connor et al. 1998; Dranove 1998) or the impact on profitability (see e.g. Town et al. 2004; Shen 2003) after mergers in health care markets.

documenting the role of financial characteristics of hospitals. Sloan et al. (2003), Feldman et al. (1996) and McCue and Furst (1986) present evidence for a significant influence of the profitability and the capital structure of hospitals on the probability of conversion. Due to this significant role of financial conditions, this paper focuses in particular on its influence on the probability of M&As. Financial difficulties of hospitals may be a reason for the ongoing consolidation in the market (Hentschker et al., 2014). Especially against the background of decreasing investment subsidies by federal states, the question arises whether hospitals that are not able to finance investment gaps are more often the targets of consolidations.

I contribute to the existing literature by presenting first empirical evidence for the determinants of consolidations for the German hospital market, with differentiating between hospitals that were targets of either a merger or an acquisition. Since motives and rationales causing such transactions can differ significantly, it is important to emphasize the difference between the types of consolidation (Bowblis 2011; Harrison 2007).

M&As are still an important subject in the German hospital market. It is likely that consolidations will continue in forthcoming years. Proponents of hospital mergers often refer to the "restructuring" hypothesis, i.e. inefficient management behavior or inefficient structures within a hospital can be abolished after a merger or an acquisition takes place (see e.g. Jarrell et al. 1988). Furthermore, such a transaction can be regarded as an option for hospital survival rather than drop out of the market, i.e. a hospital closure can be avoided due to a takeover (Sloan et al. 2003; Dor and Friedman 1994). In the context of antitrust law this issue has a significant economic relevance. When a takeover of hospitals with weak financial conditions is able to avert a hospital closure, policy makers should balance whether antitrust regulations come into effect and prohibit a transaction, or whether a transaction should be accorded to ensure the regional provision of hospital capacity.

The paper is organized as follows: Section 2 provides a brief outline of the institutional background of the German hospital market. Section 3 describes the data and Section 4 presents the estimation strategy. Result are presented in Section 5. Finally, I conclude in Section 6.

2 Institutional background

The financing of German hospitals is based on a dualistic financing system distinguishing between running costs and investment costs. First, running costs of hospitals are covered by health insurers or privately financed by patients. In 2004, an institutional reform with the introduction of a prospective payment system with DRGs came into effect. Within the DRG system hospitals are remunerated via case-based lump sums.[2] The DRG system sets incentives for hospitals to

[2]For a detailed overview about the development of the reimbursement systems in the German hospital market see Rau et al. (2009).

work more efficiently emphasizing financial sustainability (Augurzky et al., 2012). The second pillar of this dualistic financing system is related to capital expenditures, i.e. expenditures for investments in buildings and equipment. Officially, the German federal states should carry investment costs for hospitals. Augurzky et al. (2010) show that, in fact, only about 50% to 60% of investments are financed by the federal states. The difference in investment expenditures has to be paid by the hospitals themselves. Consequently, investment expenditures are increasingly financed by current receipts or external capital. Heß (2006) shows that access to capital markets is becoming an important issue for hospitals. Therefore, creditworthiness is a relevant factor of sustainability to survive in the market. For the next years the federal states cannot guarantee to disburden hospitals, since they have conditions to consolidate their budgets (Lauterbach et al., 2009).

During the last 20 years, hospitals were subject of two privatization waves. The first wave occurred in the early 1990s after the German reunification, since hospitals in the former German Democratic Republic have been bought by private investors or hospital chains. This first privatization wave explains the large share of private hospitals in East Germany. The second wave of privatizations began in 2000 (Schulten, 2006). Due to high market entry barriers and significant entry costs, entering the hospital market is inhibited to a large extent. Private owned hospital chains avoid these barriers as they enter the market via acquisitions of financially stricken hospitals (Schwierz, 2011). Some authors argue that financially distressed hospitals are preferred targets of acquisitions, e.g. Stumpfögger (2009) notes that such hospitals are more attractive to potential buyers due to their lower price. Thus, acquirers benefit from a relatively low price to which a hospital in a bad financial situation is disposed. In contrast, a hospital chain with expansion efforts can have an interest of incorporating promising hospitals with financial soundness. A hospital owner interested in selling a facility could enhance efficiency reserves in the pre-sale period to improve his bargaining position and to achieve a higher price. However, until now, there is no empirical evidence for cherry picking of lucrative hospitals (Augurzky et al., 2009). Rather, the acquirers have to meet certain agreements. When buying a hospital, agreements for investment expenditures constitute a component in the contract of sale. The aim of such agreements is to improve the infrastructure of the hospital to reach efficiency in the operational processes (Stumpfögger, 2007).

Beyond sales to competitors, some hospital owners transformed their legal form, especially hospitals in public ownership. Formerly included in the budgets of communities, numerous hospitals changed their legal form into public owned limited liability companies, i.e. a status under private law (Schulten, 2006). Compared to other industrialized countries, Public-Private-Partnerships (PPP) do not play an important role in the German hospital market (Rupp, 2007).

During the last decade, mergers, acquisitions and closures caused dynamic changes within the hospital market. Especially the appearance of M&As increased considerably during this period. These consolidations are observable both, on a local and on a supra-regional level (Hentschker

et al., 2014).[3] Hospitals that undergo a merger or an acquisition experience a restructuring in their ownership, while closed hospitals drop out of the market. A precise distinction between merged and acquired hospitals is necessary, because both exhibit different types of change in ownership. A merger among hospitals is defined as a transaction between at least two hospital companies. When the respective hospital companies establish a new common hospital chain, the involved hospitals are denoted as merged hospitals. In contrast, an acquisition is defined as a transaction, in which a particular hospital, or a whole hospital chain, is incorporated into an existing hospital chain. In the case of mergers the former owner is still holding shares of the new established hospital chain, while in the case of an acquisition hospital ownership changes completely. This definition of merged and acquired hospitals corresponds largely to Harrison (2007) and Cuellar and Gertler (2003).[4] They define a merger as a transaction of separate hospitals coming together in a new entity under a shared license. This type of transaction occurs often among adjacent hospitals located in the same region. In contrast, an acquisition is characterized as a transaction in which hospitals are incorporated into a common governing body.

From a management perspective M&As can be used as strategic instruments to reorganize structures within hospitals by relaxing institutional and organizational constraints.[5] Krishnan et al. (2004) show that hospital companies use mergers as a possibility to reconfigure the product-mix after the merger towards more profitable services. Consolidations are often accompanied by reductions in the staff-to-patient ratio (Shen 2003; Mark 1999). By means of internal benchmarking the in-hospital processes can be optimized, e.g. due to the appearance of learning curve effects (Neubauer, 1999). Consolidations may provide a way of financial improvement that ensures a sustainable survival in the hospital market. The listed improvements are manifold: Sloan et al. (2003) and Cutler and Horwitz (2007) regard a merger as an opportunity to achieve a better and cheaper access to equity capital. Neubauer and Beivers (2006) show an easier access to capital by private hospital chains that are listed on the stock exchange. In order to improve the financial situation, a merger builds an occasion for reallocating assets to a more efficient use (Hansmann et al., 2003). Other motives for consolidations are efforts to reduce costs and reputation enhancements (Dranove and Shanley, 1995). From the perspective of multihospital chains other characteristics are crucial: Higher specialized hospitals are more interesting for chains, as they are seeking to diversify their offered services. Accordingly, hospital chains may prefer low-risk and well-managed facilities (Dor and Friedman, 1994).

[3] Consolidation on a local level is characterized by the formation of small hospitals to a hospital system. The formation of a hospital chain that operates across different local hospital markets can be defined as a consolidation on a supra-regional level.

[4] Harrison (2007) adopts the definition of M&As by the American Hospital Association.

[5] For general considerations on organizational restructuring within hospitals see Lee and Alexander (1999).

3 Data

The main data source used for the empirical analysis is the annually published hospital register by the German Statistical Office. The hospital register comprises about 95%-97% of all German hospitals and provides information on ownership status and the number of beds.[6] Data on financial characteristics are obtained from the Dafne database, which provides data on balance sheets and profit and loss statements of German hospitals. Data on regional characteristics are obtained from the Federal Office for Building and Regional Planning (BBSR).

Information on M&As of hospitals were investigated and prepared by the author. I documented establishments of new hospital chains, takeovers of hospitals and transactions of hospital shares when new investors purchased assets of particular hospitals or hospital chains. These comprehensive information allow me to take into account corporate integration in terms of relationships between parent hospital companies and their subsidiary companies. Hence, it enables the identification of actual changes in ownership until 2010. Further, these information on consolidations enable the assignment of each hospital to its *de facto* owner and to determine whether a hospital is a member of a hospital chain.[7] Official data, like the hospital register by the German Statistical Office, assign hospitals to a corresponding owner. However, these assignments do not always allow for correct inference about the *de facto* owner, because often subsidiary companies are displayed and not the parent hospital company that holds the assets. Since official data do not account for the complex corporate integration of hospital chains, these assignments do not reflect the actual ownership adequately. Furthermore, if a takeover of a hospital or a hospital chain occurs, the name of the hospital company sometimes remains unchanged, even though a new owner is holding the assets. This circumstance is also not evident in official data. For this reasons, my documentation of actual ownership and M&As can be regarded as highly superior to publicly available hospital data.

The unit of observation is the hospital. To ensure a consistent sample, not all hospital types are included. Military hospitals and university hospitals are excluded, because they have also other fields of activity, such as teaching. Furthermore, hospitals without a medical service contract,[8] purely psychiatric hospitals and day hospitals are excluded from the sample. Finally, the sample covers only acute care hospitals and includes information on 567 balance sheets covering 731 hospitals for the period 2005 to 2010. Since some balance sheets are available on the hospital company level, a balance sheet can cover more than only one hospital. In the empirical analysis, standard errors will be clustered on the balance sheet level to ensure accurate standard errors. In total, the sample comprises 54 merged and 76 acquired hospitals. Closed acute care hospitals are

[6] Only hospitals that agreed to the publication of their data are included in the hospital register.

[7] For this analysis, a hospital chain is defined as a hospital owner with at least conducting two hospitals.

[8] To provide medical treatments for patients in the statutory health insurance, a hospital needs a medical service contract. Otherwise, treatments will not be covered by statutory health insurances. Hospitals without a medical service contract are e.g. purely plastic surgery clinics.

not considered, due to missing data.[9] The sample has been compared to the whole population of acute care hospitals to ensure representativeness.[10] Public and private not-for-profit (PNFP) hospitals are somewhat overrepresented in the sample, while private for-profit (PFP) hospitals are underrepresented. Over all types of ownership the sample includes larger hospitals. The included public hospitals operate in a status under private law, i.e. they are obligated to publish their balance sheet as private hospitals are.

I use conventional financial figures as well as a more comprehensive financial indicator to examine the effects of financial conditions on the probability of a merger or an acquisition. The chosen financial variables are according to previous literature: Sloan et al. (2003) use the operating margin to display the profitability and the debt-to-capitalization ratio for displaying the capital structure of hospitals. Similar figures are used by Feldman et al. (1996). In addition to indicators for profitability and the capital structure, McCue and Furst (1986) use ratios of current assets to current liabilities for capturing the liquidity of hospitals. These ratios shall reflect the ability of a hospital to meet current financial obligations.

For the underlying analysis, I use three conventional financial indicators representing the profitability, the capital structure as well as the liquidity of hospitals. First, to depict the profitability of a hospital, the *EBITDA margin* is included to reflect the hospital's operational performance before investment expenses. Next, the *equity-to-assets ratio* is used to display the capital structure of the hospital. A high equity-to-assets ratio constitutes a better financial soundness, due to a higher safety buffer in case of potential losses or the risk of default. Furthermore, the *cash flow* is used as a measure for the liquidity of a hospital. The higher liquid resources of a hospital are, the more a hospital should be able to fill potential gaps in investment expenditures, which should be associated with a lower probability of consolidation. Finally, I include a more comprehensive indicator, the *probability of default* (PD), that is used as an all-encompassing measure indicating the financial sustainability of a hospital and its ability to survive in the market in the long run. The PD displays the probability which a hospital is predicted to default within one year. It is a preferred indicator by institutional creditors to rate companies and it is an accredited measure of financial performance, since it has been already used in the literature (Augurzky et al., 2012).

The PD is calculated from 11 financial figures that are reported in the balance sheet.[11] A simultaneous inclusion of all financial variables can lead to multicollinearity, because the calculation of the PD covers the other three financial variables. For this reason the model will be estimated in two specifications, each including another set of financial variables: *Model I* includes only the PD, while *Model II* comprises the other three financial variables.

[9] Balance sheet data on closed acute care hospitals prior to the closure were not available for the period 2005 to 2010.

[10] A comparison of sample and population statistics is provided in Table A1 in the Appendix.

[11] A detailed overview of the calculation of the PD is provided in the Appendix.

Table 1: Descriptive statistics

	Unconsolidated		Merger		Acquisition	
Variable	Mean	St. D.	Mean	St. D.	Mean	St. D.
PD_{t-1}	0.010	(0.020)	0.008	(0.015)	0.021	(0.037)
EBITDA $margin_{t-1}$	0.041	(0.048)	0.025	(0.022)	0.030	(0.064)
Equity-to-assets $ratio_{t-1}$	0.239	(0.153)	0.187	(0.110)	0.219	(0.138)
Cash $flow_{t-1}$	0.033	(0.046)	0.021	(0.028)	0.012	(0.053)
$Public_{t-1}$	0.397	(0.489)	0.630	(0.487)	0.382	(0.489)
$PNFP_{t-1}$	0.409	(0.492)	0.370	(0.487)	0.474	(0.503)
PFP_{t-1}	0.191	(0.393)	0.000	(0.000)	0.145	(0.354)
$Beds_{t-1}$	317.9	(252.9)	302.2	(181.7)	237.4	(161.9)
Chain $member_{t-1}$	0.574	(0.495)	0.611	(0.492)	0.500	(0.503)
$Rural_{t-1}$	0.199	(0.246)	0.225	(0.264)	0.265	(0.265)
East $Germany_{t-1}$	0.227	(0.419)	0.389	(0.492)	0.184	(0.390)
Share $65+_{t-1}$	0.203	(0.022)	0.206	(0.026)	0.205	(0.019)
Household $income_{t-1}$	1,532	(226.2)	1,412	(181.0)	1,516	(177.8)
2005	0.087	(0.282)	0.185	(0.392)	0.039	(0.196)
2006	0.138	(0.345)	0.185	(0.392)	0.145	(0.354)
2007	0.191	(0.393)	0.111	(0.317)	0.237	(0.428)
2008	0.186	(0.389)	0.241	(0.432)	0.211	(0.410)
2009	0.200	(0.400)	0.185	(0.392)	0.092	(0.291)
2010	0.197	(0.398)	0.093	(0.293)	0.276	(0.450)
Number of hospitals	696		54		76	
Number of balance sheets	544		39		53	

Notes: Based on 3,098 observations.

Sample means are presented in Table 1.[12] Hospitals with a good financial soundness are characterized by a low PD. On average, all unconsolidated hospitals in the sample exhibit a PD of 1.0%. Merged hospitals do not differ significantly from unconsolidated hospitals, while acquired entities are associated with a significantly higher PD of 2.1%. The EBITDA margin of unconsolidated hospitals has a value of 4.1%. Both, merged as well as acquired hospitals, have a lower EBITDA margin compared to unconsolidated hospitals with 2.5% and 3.0%, respectively. Though, only the difference between unconsolidated and merged hospitals is statistically significant. Unconsolidated hospitals have a share of equity assets of 23.9%. A slightly lower share is attributed to acquired hospitals with 21.9%, while merged hospitals exhibit a significantly lower equity-to-assets ratio of 18.7%. Furthermore, consolidated hospitals are afflicted with less liquidity in terms of cash flow. To ensure comparability, the cash flow is presented in relative relation to the balance sheet total. Merged (2.1%) as well as acquired hospitals (1.2%) possess a significantly lower cash flow compared to unconsolidated ones with about 3.3%. However, on average merged hospitals have a rough twice higher share of liquid resources compared to acquired hospitals. At

[12] Variable definitions and significance levels of a two group mean comparison test between the means of the alternatives are provided in Tables A2 and A3 in the Appendix.

first glance, hospitals that are targets of acquisitions exhibit a worse financial situation due to a higher PD and less liquid resources. In contrast, hospitals that are involved in mergers exhibit better financial conditions than acquired hospitals.

An interesting finding is that PFP hospitals are not targets of mergers in the sample. About two-thirds of all merged hospitals were publicly owned before the merger took place; the remaining one-third can be referred to formerly PNFP owned hospitals. However, among acquired hospitals formerly PNFP owned represent the majority with about 47%, followed by formerly public hospitals with 38%. At last, 15% of all acquired hospitals were formerly in PFP ownership. Hospitals becoming a target of acquisition are considerably smaller in size, while the number of beds does not differ significantly between merged and unconsolidated hospitals. Differences in chain membership are not statistically significant, but the share of chain members among merged hospitals is higher than of unconsolidated and being smaller among acquired hospitals.

4 Model

To analyze the determinants of M&As a multinomial model framework is appropriate, since a hospital faces different types of consolidation. Previous studies examining the determinants of consolidations in hospital markets use a multinomial logit model (Sloan et al. 2003; Feldman et al. 1996). To obtain a multinomial logit model the error terms are assumed to be identically and independently distributed as a log Weibull distribution. In this setting the choice probabilities are denoted as

$$P(y_{it} = m) = \frac{exp(\boldsymbol{x}_{it-1} \cdot \beta_m)}{\sum_{j=1}^{J} exp(\boldsymbol{x}_{it-1} \cdot \beta_j)} \tag{1}$$

with y_{it} representing the type of consolidation of hospital i in year t. The choice set of each hospital covers three alternatives, i.e. *Merger*, *Acquisition* and *Unconsolidated*, with the latter one used as the base group. The covariates in the vector x_{it-1} include hospital-specific characteristics and regional control variables. The hospital-specific covariates include general information on the hospital, such as its ownership type or its size as well as financial performance measures based on balance sheet data. Covariates will be included with a lag of one year, since it is assumed that a consolidation in a particular year is influenced by factors from the previous year. Furthermore, the lagged structure of covariates ensures that potential endogeneity problems are diminished, especially with respect to financial covariates. Otherwise, a consolidation that takes place may have an influence on the financial situation of a hospital in the corresponding year.

However, applying a multinomial logit model is associated with some limitations. The first shortcoming is the independence of irrelevant alternatives (IIA) assumption (McFadden, 1973). The IIA assumes the odds between two alternatives j and k to be equal to the odds of a binary

choice between j and k. Thus, it is assumed that the existence of other alternatives has no influence on the ratio of choice probabilities between the alternatives j and k. In econometric terms this means that the off-diagonal elements of the covariance matrix Σ are restricted to be zero, i.e. the error terms ϵ are not allowed to be correlated. One solution to overcome the IIA assumption is the estimation of a multinomial probit model assuming the error terms ϵ to be joint normally distributed with $\epsilon \sim \mathcal{N}[0, \Sigma]$. In this setting correlation across the error terms is allowed. Unfortunately, it was not possible to apply a multinomial probit model for this analysis due to convergence problems with the data. According to Long and Freese (2006), the application of a multinomial logit model is appropriate when the alternatives in the choice set are not substitutes among each other and they are clearly distinct. It can acceptably be said that this condition applies in the case of the consolidation alternatives in the choice set of hospitals. The alternatives *Merger*, *Acquisition* and *Unconsolidated* are too distinct in terms of the change in the ownership of a hospital that is associated with each alternative. After a merger of hospitals the former owners are still holding a part of the assets, whereas an acquired hospital faces a completely new owner. Unconsolidated hospitals do not experience a change in their ownership at all. Hence, it can be ruled out that these alternatives are substitutes for one another, because motives and efforts that are associated with each type of consolidation differ substantially.

The second limitation is related to the interpretation of the estimated coefficients due to the nonlinearity of the model. Only sign and statistical significance of the estimated coefficients can be interpreted, i.e. statements can be made about a positive or negative influence of the covariates. To assess the quantitative impact of the covariates on the hospitals' probability of being merged or acquired, average marginal effects are calculated. For calculating the average marginal effects of the continuous variables, I follow Long and Freese (2006) by taking the partial derivative of Equation 1 with respect to the variable of interest:

$$\frac{\partial P(y_{it} = m \mid \boldsymbol{x}_{it-1})}{\partial x_{ikt-1}} = P(y_{it} = m \mid \boldsymbol{x}_{it-1}) \Big[\beta_{k,m|J} - \sum_{j=1}^{J} \beta_{k,j|J} \cdot P(y_{it} = j \mid \boldsymbol{x}_{it-1}) \Big]. \tag{2}$$

As Equation 2 shows, the magnitude of the marginal effects depends on the level of all included covariates, since their coefficients $\beta_{k,j|J}$ are included in the partial derivative. Similarly, the marginal effect for dummy variables, defined as a discrete change, also depends on the level and the size of all included covariates:

$$\frac{\Delta P(y_{it} = m \mid \boldsymbol{x}_{it-1})}{\Delta x_{ikt-1}} = P(y_{it} = m \mid \boldsymbol{x}_{it-1}, x_{ikt-1} = 1) - P(y_{it} = m \mid \boldsymbol{x}_{it-1}, x_{ikt-1} = 0). \tag{3}$$

For the analysis the used panel data are treated as pooled observations. Applications for multinomial logit models using panel data are quite limited. Haan and Uhlendorff (2006) provide an application for multinomial logit models with random effects for considering unobserved hetero-

geneity. They show that for maximizing the likelihood function an integral over the distribution of unobserved heterogeneity must be solved. The maximization of the likelihood function is only possible with an approximation of the integral. Thus, unobserved heterogeneity in the model does not allow for an analytical solution making simulation methods necessary. For taking fixed effects into account, I estimate binary choice models with fixed effects as a robustness check for testing the sensitivity of the results.

5 Results

Regression coefficients of the multinomial logit model are presented in Table 2. The columns comprise the estimated coefficients for the consolidation alternatives *Merger* and *Acquisition*, while they also differentiate between the two model specifications, each including a different set of financial variables. The coefficients of the two alternatives have to be interpreted with respect to the reference group of unconsolidated hospitals. *Model I* includes the PD as financial indicator. The coefficients of the PD for both alternatives are simultaneously statistically significant at the 1% level ($p = 0.0047$), indicating that a higher PD prohibits mergers, while hospitals with a higher PD have a higher probability of acquisition. Viewed separately, only the coefficient for acquisition is statistically significant with a positive sign. *Model II* comprises the remaining three financial variables with the coefficients for the equity-to-assets ratio ($p = 0.0715$) and the cash flow ($p = 0.0026$) being simultaneously statistically significant for both consolidation alternatives. However, viewed separately, a higher equity-to-assets ratio lowers the likelihood of a merger, while having no influence on the probability of acquisition. A higher cash flow has an influence on both the probability of merger and acquisition. On the one hand, more liquidity of a hospital makes mergers more likely; while, on the other hand, a higher share of liquid resources prohibits acquisitions. The EBITDA margin has no statistically significant effects on both mergers and acquisitions.

Considering the remaining hospital characteristics, hospitals in public and PNFP ownership have a significantly higher probability of merger compared to PFP owned hospitals. This result is not surprising due to the fact that PFP hospitals are not included in the group of merged hospitals. Throughout all model specifications, larger hospitals are less likely to be the target of a consolidation. The coefficients for the chain membership dummy variable are not statistically significant, though they are indicating a higher probability of merger and a lower probability of acquisition for chain members.

To assess the influence of financial variables on the probability of merger and acquisition in quantitative terms, average marginal effects are presented in Table 3. The signs of all marginal effects of the financial characteristics correspond to the signs of the estimated coefficients. According to *Model I*, an increase in the PD of 0.1% increases the probability of acquisition of about

Table 2: Regression coefficients

	Model I		*Model II*	
	Merger	Acquisition	Merger	Acquisition
PD_{t-1}	−6.950	13.112***	-	-
	(9.683)	(4.103)	-	-
EBITDA $margin_{t-1}$	-	-	−3.765	0.902
	-	-	(4.120)	(4.880)
Equity-to-assets $ratio_{t-1}$	-	-	−3.454**	0.141
	-	-	(1.506)	(0.900)
Cash $flow_{t-1}$	-	-	5.874*	−10.142***
	-	-	(3.194)	(3.542)
$Public_{t-1}$	15.957***	0.323	15.940***	0.094
	(0.407)	(0.584)	(0.586)	(0.687)
$PNFP_{t-1}$	15.128***	0.608	15.196***	0.429
	(0.370)	(0.422)	(0.466)	(0.479)
$Beds_{t-1} \times 10^{-3}$	−1.891***	−1.787**	−1.838***	−1.968**
	(0.667)	(0.733)	(0.680)	(0.772)
Chain $member_{t-1}$	0.238	−0.318	0.269	−0.342
	(0.311)	(0.262)	(0.332)	(0.264)
$Rural_{t-1}$	−1.113	0.633	−1.313	0.807
	(0.934)	(0.622)	(0.827)	(0.627)
East $Germany_{t-1}$	0.038	−0.455	0.216	−0.503
	(0.609)	(0.432)	(0.563)	(0.416)
Share $65+_{t-1}$	4.552	6.142	3.740	6.779
	(9.019)	(6.378)	(8.851)	(6.362)
Household $income_{t-1}$	−2.721*	−0.723	−2.802*	−0.618
	(1.498)	(0.700)	(1.433)	(0.687)
2006	−0.314	0.789	−0.288	0.805
	(0.783)	(0.661)	(0.797)	(0.673)
2007	−1.022	0.950	−0.959	0.988
	(0.737)	(0.663)	(0.752)	(0.652)
2008	−0.102	0.820	−0.011	0.912
	(0.688)	(0.645)	(0.705)	(0.638)
2009	−0.270	−0.096	−0.166	0.000
	(0.763)	(0.825)	(0.765)	(0.822)
2010	−0.923	1.045	−0.765	1.157*
	(0.918)	(0.703)	(0.917)	(0.698)
Constant	−15.154***	−4.509**	−14.378***	−4.306**
	(2.665)	(2.047)	(2.537)	(2.142)
Pseudo-R^2	0.0807		0.0913	
Log-Pseudolikelihood	-577.046		-570.410	
Wald-χ^2 test	5,417.68***		4,134.78***	
Observations	3,098		3,098	
Hospitals	731		731	
Balance sheets	567		567	

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. The alternative *Unconsolidated* is the base group. *p<0.1 **p<0.05 ***p<0.01.

Table 3: Average marginal effects

	Model I		*Model II*	
	Merger	Acquisition	Merger	Acquisition
PD_{t-1}	-0.122	0.310^{***}	-	-
	(0.165)	(0.103)	-	-
EBITDA $margin_{t-1}$	-	-	-0.063	0.023
	-	-	(0.066)	(0.115)
Equity-to-assets $ratio_{t-1}$	-	-	-0.058^{**}	0.005
	-	-	(0.027)	(0.021)
Cash $flow_{t-1}$	-	-	0.102^{*}	-0.239^{***}
	-	-	(0.054)	(0.093)
$Public_{t-1}$	0.267^{***}	0.001	0.266^{***}	-0.004
	(0.043)	(0.013)	(0.051)	(0.015)
$PNFP_{t-1}$	0.253^{***}	0.008	0.253^{***}	0.004
	(0.040)	(0.010)	(0.047)	(0.011)
$Beds_{t-1} \times 10^{-3}$	-0.031^{**}	-0.041^{**}	-0.030^{**}	-0.045^{**}
	(0.012)	(0.018)	(0.012)	(0.019)
Chain $member_{t-1}$	0.004	-0.008	0.005	-0.008
	(0.005)	(0.006)	(0.006)	(0.006)
$Rural_{t-1}$	-0.019	0.015	-0.022	0.019
	(0.015)	(0.015)	(0.014)	(0.015)
East $Germany_{t-1}$	0.001	-0.011	0.004	-0.012
	(0.010)	(0.010)	(0.009)	(0.009)
Share $65+_{t-1}$	0.074	0.142	0.060	0.157
	(0.152)	(0.155)	(0.148)	(0.155)
Household $income_{t-1}$	-0.045^{*}	-0.016	-0.046^{*}	-0.013
	(0.025)	(0.016)	(0.024)	(0.016)
2006	-0.006	0.019	-0.005	0.019
	(0.013)	(0.016)	(0.013)	(0.016)
2007	-0.017	0.023	-0.016	0.023
	(0.013)	(0.016)	(0.014)	(0.016)
2008	-0.002	0.019	-0.001	0.021
	(0.012)	(0.016)	(0.012)	(0.015)
2009	-0.004	-0.002	-0.003	0.000
	(0.013)	(0.019)	(0.013)	(0.019)
2010	-0.016	0.025	-0.013	0.027
	(0.016)	(0.017)	(0.016)	(0.017)
Observations	3,098		3,098	
Hospitals	731		731	
Balance sheets	567		567	

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. *p<0.1 **p<0.05 ***p<0.01.

3.1%-points at a significance level of 1%. Further, an increase in the PD by about 0.1% would lower the probability of merger of about 1.2%-points, even though this effect is not statistically significant. However, it does not mean *per se* that this effect cannot be significant in economic terms, as pointed out by Krämer (2011). Hence, an increase in the PD also has substantial effects on mergers among hospitals. Thus, hospitals that are confronted with a high probability of default are, on average, less likely to merge.

The column for *Model II* presents the marginal effects for the set of the other three financial variables: The EBITDA margin has neither a statistically significant effect on the probability of merger nor on the probability of acquisition. Compared to the equity-to-assets ratio or the cash flow, the management board of a hospital has some scope to "adjust" the EBITDA margin within accounting policies, e.g. by applying different amortization rules. The EBITDA margin cannot be regarded as the essential fundament of financial sustainability, but rather as a snap-shot of the financial standing of a hospital. Hence, a potential competitor or investor seeking to buy a particular hospital would lay his focus on a wide range of financial indicators that display the financial sustainability of a hospital more suitably. For that, the EBITDA margin may be not a relevant factor in the context of consolidations.

Instead, the capital structure plays a significant role. A 1% higher equity-to-assets ratio is associated with a 5.8%-points lower likelihood for a merger, holding the other covariates constant. One may assume that hospitals with a higher share of equity assets would be attractive to potential investors, due to a lower debt. Surprisingly, the equity-to-assets ratio has no significant influence on the probability of acquisition. However, more equity assets seem to decrease the probability of merger.

A higher cash flow is associated with a reduced probability of acquisition, i.e. a 0.1% higher cash flow diminishes the probability of acquisition by about 2.4%-points, all else equal. The cash flow is an important indicator for hospitals since it represents the liquid resources of a hospital. Due to the lack of subsidy payments by the federal states, most hospitals have to finance investment gaps by their own. Consequently, those hospitals that have the availability of liquid resources are more able to fill such investment gaps. The results reveal that hospitals with a lower cash flow have, on average, a higher probability of acquisition. Hence, hospitals that are potentially unable to finance investment expenditures have a higher likelihood of being sold to a competitor. A higher cash flow also tends to increase the probability of merger. Less liquid resources for filling potential investment gaps may force a hospital chain to incorporate its facilities into a new hospital chain.

Former public and PNFP owned hospitals are more often the targets of mergers. Furthermore, the probability of merger and acquisition decreases for larger hospitals. This confirms the hypothesis of a preference towards low-risk entities, since small-sized hospitals may represent low-risk facilities due to lower costs for restructuring.

5.1 Robustness check

Robustness checks are performed to test for the sensitivity of the results. First, the multinomial logit model is re-estimated with the EBITDA margin, the equity-to-assets ratio and the cash flow inserted separately in the equation, because these financial variables are to some extend correlated.[13] The results show that a higher equity-to-assets ratio has a negative influence on the probability of merger and a higher cash flow lowers the probability of acquisition. The marginal effects of both variables are close to the main results. However, the estimated coefficient and marginal effect of cash flow for the alternative *Merger* is no longer statistically significant. Thus, the result that a higher cash flow decreases the probability of a merger cannot be regarded as robust.

Second, all model specifications are further re-estimated with a sample only covering hospitals with single balance sheets, since in the main sample a balance sheet can cover more than only one hospital due to its availability on the hospital company level. On the whole, the effects for the PD and the cash flow do not change. However, in this setting the effect for the EBITDA margin for merged hospitals becomes statistically significant with a quite large influence.

Furthermore, binary models were estimated for the pairs *Merger vs. Unconsolidated* and *Acquisition vs. Unconsolidated*. For this purpose the binary choice models are estimated via OSL and fixed effects. The marginal effects of all specifications confirm that a higher equity-to-assets ratio tends to prohibit mergers. Furthermore, the effects of the PD and the cash flow on the probability of acquisition are quite similar to the main results, except for the fixed effects estimation results.[14]

6 Conclusion

In this study, the *ex ante* characteristics of German hospitals prior to a merger or an acquisition are examined. An often mentioned problem for German hospitals is the gap in investment capital, because the federal states are not able to carry all investment costs. This increases the financial pressure on hospitals, since they are forced to fill this gap on their own. The question of interest is, if hospitals with poor financial conditions are more often the targets of consolidations. Following previous studies, I focus predominantly on financial indicators representing the profitability, the capital structure and the liquidity of hospitals.

To analyze the determinants of M&As, I apply a multinomial logit model allowing for a clear distinction between both types of consolidation. The results indicate that hospitals with a higher probability of default have a higher probability of acquisition. In contrast, a higher share of liquid

[13] Correlation coefficients of the financial variables are provided in Table A4 in the Appendix.
[14] The results from the robustness checks are provided in Tables A5 to A12 in the Appendix.

resources in terms of cash flow lowers the probability of acquisition. Thus, hospitals with a higher potential to fill gaps in investment capital reveal a lower likelihood of acquisition. Furthermore, the analysis shows that mergers are more likely among hospitals with less equity assets.

M&As can be regarded as different strategies that are mainly driven by diverse motives of hospital owners and potential investors. Acquisitions are preferably used by hospital chains to expand in the hospital market due to high market entry barriers and high sunk costs. With buying and incorporating a hospital in its network, a hospital chain can enter new regional markets or diversify its medical services. Acquirers are disposed to buy less risky hospitals. Hospitals associated with mergers exhibit another pattern. When a hospital chain is willing to merge it considers mainly hospitals with reasonable financial conditions, while entities with financial troubles tend to be sold to competitors. Mergers can be regarded as a strategy to establish local or regional networks, e.g. to provide an adequate provision of health care services in the region. Hence, two not-for-profit companies are more willing to merge and establish a new common hospital chain than for-profit companies are. The shareholders of profit-maximizing hospital chains (PFP) may have no incentives to establish a new chain, but to grow by acquisitions of new entities.[15]

M&As are a current issue in the hospital market. Most likely this concentration process will continue in the future with the formation of local or regional hospital networks. In this context, antitrust authorities have to assess such transactions more clearly and should define antitrust hurdles accurately, since these issues have been criticized in former studies (Hentschker et al. 2014; Coenen et al. 2012). For improving the performance of a hospital in order to avoid the hospital to get in trouble Sloan et al. (2003) recommend assistance programs. Using the example of North Carolina, where the state introduced a program of technical assistance for hospitals to ensure their surviving, it is shown that such programs present alternatives to closures. Such an intervention could be a way to ensure the provision of health care services, especially in rural regions.

[15] Actually, not-for-profit hospital companies are allowed to make profits, but they are not allowed to distribute them among shareholders. Profits can ensure a long-term survival in the hospital market, e.g. by financing investments (Herr et al., 2011).

References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance 23*(4), 589–609.

Augurzky, B., A. Beivers, G. Neubauer, and C. Schwierz (2009). Bedeutung der Krankenhäuser in privater Trägerschaft. RWI Materialien 52, Rheinisch-Westfälisches Institut für Wirtschaftsforschung.

Augurzky, B., D. Engel, C. M. Schmidt, and C. Schwierz (2012). Ownership and financial sustainability of German acute care hospitals. *Health Economics 21*(7), 811–824.

Augurzky, B., R. Gülker, S. Krolop, C. M. Schmidt, H. Schmidt, H. Schmitz, and S. Terkatz (2010). Krankenhaus Rating Report 2010 – Licht und Schatten. RWI Materialien 59, Rheinisch-Westfälisches Institut für Wirtschaftsforschung.

Augurzky, B., S. Krolop, C. Hentschker, A. Pilny, and C. M. Schmidt (2013). *Krankenhaus Rating Report 2013 – Krankenhausversorgung zwischen Euro-Krise und Schuldenbremse*. Heidelberg: medhochzwei.

Augurzky, B., S. Krolop, C. Hentschker, A. Pilny, and C. M. Schmidt (2014). *Krankenhaus Rating Report 2014 – Mangelware Kapital: Wege aus der Investitionsfalle*. Heidelberg: medhochzwei.

Bowblis, J. R. (2011). Ownership conversion and closure in the nursing home industry. *Health Economics 20*(6), 631–644.

Coenen, M., J. Haucap, and A. Herr (2012). Regionalität: Wettbewerbliche Überlegungen zum Krankenhausmarkt. In J. Klauber, M. Geraedts, F. Friedrich, and J. Wasem (Eds.), *Krankenhaus-Report 2012 – Schwerpunkt: Regionalität*, pp. 149–163. Stuttgart: Schattauer.

Connor, R. A., R. D. Feldman, and B. E. Dowd (1998). The effects of market concentration and horizontal mergers on hospital costs and prices. *International Journal of the Economics of Business 5*(2), 159–180.

Cuellar, A. E. and P. J. Gertler (2003). Trends in hospital consolidation: The formation of local systems. *Health Affairs 22*(6), 77–87.

Cutler, D. M. and J. Horwitz (2007). Converting hospitals from not-for-profit to for-profit status: Why and what effects? In D. M. Cutler (Ed.), *The changing hospital industry: Comparing not-for-profit and for-profit institutions*, pp. 45–90. University of Chicago Press.

Dor, A. and B. Friedman (1994). Mergers of not-for-profit hospitals in the 1980s: Who were the most likely targets? *Review of Industrial Organization 9*(4), 393–407.

Dranove, D. (1998). Economies of scale in non-revenue producing cost centers: Implications for hospital mergers. *Journal of Health Economics 17*(1), 69–83.

Dranove, D. and R. Lindrooth (2003). Hospital consolidation and costs: Another look at the evidence. *Journal of Health Economics 22*(6), 983–997.

Dranove, D. and M. Shanley (1995). Cost reductions or reputation enhancement as motives for mergers: The logic of multihospital systems. *Strategic Management Journal 16*(1), 55–74.

Engelmann, B., E. Hayden, and D. Tasche (2003). Exit and inefficiency: The effects of ownership type. *RISK 16*, 82–86.

Feldman, R., D. Wholey, and J. Christianson (1996). Economic and organizational determinants of HMO mergers and failures. *Inquiry 33*(2), 118–132.

Haan, P. and A. Uhlendorff (2006). Estimation of multinomial logit models with unobserved heterogeneity using maximum simulated likelihood. *The Stata Journal 6*(2), 229–245.

Hansmann, H., D. Kessler, and M. B. McClellan (2003, Jan-Jun). Ownership form and trapped capital in the hospital industry. In *The Governance of Not-for-Profit Organizations*, NBER Chapters, pp. 45–70. National Bureau of Economic Research, Inc.

Harrison, T. D. (2007). Consolidations and closures: An empirical analysis of exits from the hospital industry. *Health Economics 16*(5), 457–474.

Hentschker, C., A. Schmid, and R. Mennicken (2014). Defining hospital markets: An application to the German hospital sector. Ruhr Economic Papers 469.

Herr, A., H. Schmitz, and B. Augurzky (2011). Profit efficiency and ownership of German hospitals. *Health Economics 20*(6), 660–674.

Heß, W. (2006). Krankenhäuser im Spannungsfeld zwischen Reformdruck und Finanznot. Working Paper 49, Economic Research Allianz Group Dresdner Bank.

Jarrell, G. A., J. A. Brickley, and J. M. Netter (1988). The market for corporate control: The empirical evidence since 1980. *The Journal of Economic Perspectives 2*(1), 49–68.

Kjekshus, L. and T. Hagen (2007). Do hospital mergers increase hospital efficiency? Evidence from a national health service country. *Health Services Research 12*(4), 230–235.

Krämer, W. (2011). The cult of statistical significance – What economists should and should not do to make their data talk. *Schmollers Jahrbuch 131*, 455–468.

Krishnan, R. A., S. Joshi, and H. Krishnan (2004). The influence of mergers on firms' product-mix strategies. *Strategic Management Journal 25*(6), 587–611.

Lauterbach, K. W., S. Stock, and H. Brunner (2009). *Gesundheitsökonomie*. Bern: Verlag Hans Huber.

Lee, S.-Y. and J. A. Alexander (1999). Consequences of organizational change in U.S. hospitals. *Medical Care Research and Review 56*(3), 227–276.

Long, J. S. and J. Freese (2006). *Regression models for categorical dependent variables using Stata* (2nd. ed.). Stata Press.

Mark, T. L. (1999). Analysis of the rationale for, and consequences of, nonprofit and for-profit ownership conversions. *Health Services Research 34*(1), 83–101.

McCue, M. J. and R. W. Furst (1986). Financial characteristics of hospitals purchased by investor-owned chains. *Health Services Research 21*(4), 515–527.

McFadden, D. (1973). Conditional logit analysis of qualitative choice behavior. In P. Zarembka (Ed.), *Frontiers of Econometrics*, pp. 105–142. New York: Academic Press.

Neubauer, G. (1999). Private im Vormarsch! Umstrukturierung des deutschen Krankenhausmarktes. *Krankenhaus Umschau 3*, 175–178.

Neubauer, G. and A. Beivers (2006). Privatisierung der Krankenhäuser - Modischer Trend oder ökonomische Notwendigkeit? *Orientierungen zur Wirtschafts- und Gesellschaftspolitik 109*(3), 48–52.

Rau, F., N. Roeder, and P. Hensen (2009). Zum Stand der deutschen DRG-Einführung: Erkenntnisse, Erfahrungen und Meinungen. In F. Rau, N. Roeder, and P. Hensen (Eds.), *Auswirkungen der DRG-Einführung in Deutschland, Standortbestimmung und Perspektiven*, pp. 9–22. Stuttgart: Kohlhammer Krankenhaus.

Rupp, B. (2007). Public Private Partnerships im Gesundheitswesen: Ist der "dritte Weg" ein Holzweg oder ein Königsweg? In H. Ivansits and U. Filipic (Eds.), *Privatisierung von Gesundheit - Blick über die Grenzen*, Volume 5 of *Sozialpolitik in Diskussion*, pp. 91–96. Wien: Kammer für Arbeiter und Angestellte.

Schmidt, A. (2012). Konsolidierung und Konzentration im Krankenhaussektor – Eine empirische Analyse der Marktstruktur unter Berücksichtigung des Krankenhausträgers. Volume 36 of *Beiträge zum Gesundheitsmanagement*, pp. 1405–1487. Baden-Baden: Nomos.

Schmidt, C. and J. Möller (2007). Katalysatoren des Wandels. In J. Klauber, B. Robra, and H. Schellschmidt (Eds.), *Krankenhaus-Report 2006 – Schwerpunkt: Krankenhausmarkt im Umbruch*, pp. 3–18. Bonn and Magdeburg: Schattauer.

Schulten, T. (2006). Liberalisation, privatisation and regulation in the German healthcare sector/hospitals. *Country report on liberalisation and privatisation processes and forms of regulation for the project "Privatisation of Public Services and the Impact on Quality, Employment and Productivity (PIQUE)", Düsseldorf: WSI/Hans-Böckler Stiftung.*. Accessed: 2010-09-11.

Schwierz, C. (2011). Expansion in markets with decreasing demand-for-profits in the German hospital industry. *Health Economics 20*(6), 675–687.

Shen, Y.-C. (2003). Changes in hospital performance after ownership conversions. *Inquiry 40*(3), 217–234.

Sloan, F. A., J. Ostermann, and C. J. Conover (2003). Antecedents of hospital ownership conversions, mergers, and closures. *Inquiry 40*(1), 39–56.

Spang, H. R., G. J. Bazzoli, and R. J. Arnould (2001). Hospital mergers and savings for consumers: Exploring new evidence. *Health Affairs 20*(4), 150–158.

Stumpfögger, N. (2007). Privatisierung von Krankenhäusern in Deutschland und ihre Auswirkungen auf die Beschäftigten. In H. Ivansits and U. Filipic (Eds.), *Privatisierung von Gesundheit– Blick über die Grenzen*, Volume 5 of *Sozialpolitik in Diskussion*, pp. 75–84. Wien: Kammer für Arbeiter und Angestellte.

Stumpfögger, N. (2009). Wenn die Gründerzeit zu Ende geht. In N. Böhlke, T. Gerlinger, K. Mosebach, R. Schmucker, and T. Schulten (Eds.), *Privatisierung von Krankenhäusern*, pp. 199–219. Düsseldorf and Frankfurt a. M.: VSA Verlag.

Town, R., R. Feldman, and D. Wholey (2004). The impact of ownership conversions on HMO performance. *International Journal of Health Care Finance and Economics 4*(4), 327–342.

7 Appendix

Calculating the probability of default

As an all-encompassing measure indicating the financial sustainability of a hospital and its ability to survive in the market in the long run, the probability of default (PD) is calculated from 11 financial figures of a hospital's balance sheet. The PD displays the probability which a hospital is predicted to default within one year. To predict the PD for each hospital a logit score by Engelmann et al. (2003) is applied. The formula to calculate the logit score reads as follows:

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

The conventional benchmark model to predict the probability of default is the Z-Score by Altman (1968). Engelmann et al. (2003) have shown that their logit score does outperform Altman's Z-Score. The PD is an accredited measure to display the financial performance of hospitals, since it has been used in the literature (Augurzky et al., 2012) and is still employed in the annually published German Hospital Rating Report (*Krankenhaus Rating Report*) examining the financial conditions of the German hospital market (Augurzky et al., 2013, 2014).

Table A1: Representativeness of the sample

	2005	2006	2007	2008	2009	2010	Total
Share of ownership types according to number of hospitals							
Sample							
Public	52.6%	45.2%	37.8%	37.2%	36.2%	36.5%	39.5%
Private not-for-profit	37.5%	42.7%	42.4%	42.6%	40.0%	38.9%	40.9%
Private for-profit	9.9%	12.1%	19.8%	20.2%	23.7%	24.6%	19.6%
Population							
Public	35.9%	34.9%	33.6%	33.3%	32.9%	32.5%	36.3%
Private not-for-profit	41.9%	41.2%	41.7%	41.4%	41.2%	40.9%	41.8%
Private for-profit	22.2%	23.8%	24.7%	25.3%	26.0%	26.6%	21.9%
Share of ownership types according to number of beds							
Sample							
Public	61.5%	55.3%	50.0%	50.6%	49.2%	49.6%	51.7%
Private not-for-profit	32.6%	38.7%	38.2%	38.6%	36.8%	36.3%	37.2%
Private for-profit	6.0%	6.0%	11.7%	10.9%	14.1%	14.1%	11.1%
Population							
Public	46.9%	45.3%	44.4%	44.4%	44.1%	44.0%	44.9%
Private not-for-profit	39.3%	39.1%	39.2%	39.2%	38.8%	38.7%	39.0%
Private for-profit	13.7%	15.6%	16.3%	16.4%	17.1%	17.4%	16.1%
Average number of beds per hospital[a]							
Sample							
Public	397.2	409.0	408.9	416.8	422.5	428.4	414.9
	(304.2)	(305.0)	(293.1)	(303.1)	(312.0)	(313.2)	(304.7)
Private not-for-profit	295.3	302.8	278.6	277.8	286.1	293.2	287.5
	(169.7)	(174.0)	(176.4)	(181.9)	(187.2)	(200.9)	(183.4)
Private for-profit	203.8	167.0	182.5	165.4	184.7	180.8	178.9
	(156.2)	(129.7)	(184.0)	(165.2)	(164.3)	(161.6)	(164.5)
All	339.8	334.5	307.7	306.4	309.4	312.3	315.3
	(256.6)	(251.4)	(244.3)	(250.2)	(253.6)	(259.4)	(252.4)
Population							
Public	341.5	335.3	342.8	346.7	351.0	357.3	340.2
	(323.8)	(330.4)	(334.1)	(336.9)	(342.8)	(352.1)	(320.9)
Private not-for-profit	245.3	245.0	244.2	245.8	246.3	249.7	247.0
	(164.6)	(164.3)	(167.4)	(172.4)	(173.7)	(179.4)	(166.3)
Private for-profit	161.3	168.7	171.1	169.0	172.6	171.9	154.9
	(183.6)	(196.4)	(198.6)	(193.7)	(195.1)	(193.5)	(181.1)
All	255.6	252.4	254.6	254.4	252.2	253.8	256.0
	(247.3)	(250.0)	(251.6)	(253.4)	(256.2)	(261.6)	(247.1)

Notes: [a]Standard deviations in parentheses.

Table A2: Definition of variables

Variable	Definition
PD_{t-1}	Predicted 1-year probability of default, based on logit scores in period $t-1$
EBITDA $margin_{t-1}$	Ratio of earnings before interest, taxes, depreciation and amortization to total revenues in period $t-1$
Equity-to-assets $ratio_{t-1}$	Ratio of equity assets to balance sheet total in period $t-1$
Cash $flow_{t-1}$	Ratio of cash flow to balance sheet total in period $t-1$
$Public_{t-1}$	1, if public hospital in period $t-1$, 0 otherwise
$PNFP_{t-1}$	1, if private not-for-profit hospital in period $t-1$, 0 otherwise
PFP_{t-1}	1, if private for-profit hospital in period $t-1$, 0 otherwise
$Beds_{t-1}$	Number of hospital beds in period $t-1$
Chain $member_{t-1}$	1, if the hospital is a member of a hospital chain in period $t-1$, 0 otherwise
$Rural_{t-1}$	Continuous indicator for degree of rurality in period $t-1$
East $Germany_{t-1}$	1, if the hospital is situated in East Germany in period $t-1$, 0 otherwise
Share $65+_{t-1}$	Share of population aged above 65 years in a county in period $t-1$
Household $income_{t-1}$	Mean income of households in thousand EUR in a county in period $t-1$
2005	1, if year 2005, 0 otherwise
2006	1, if year 2006, 0 otherwise
2007	1, if year 2007, 0 otherwise
2008	1, if year 2008, 0 otherwise
2009	1, if year 2009, 0 otherwise
2010	1, if year 2010, 0 otherwise

Table A3: Two group mean comparison t test

	Unconsolidated		Merger		Acquisition		t test[a]		
	(1)		(2)		(3)		(1-2)	(1-3)	(2-3)
Variable	Mean	St. D.	Mean	St. D.	Mean	St. D.	P-Value	P-Value	P-Value
PD_{t-1}	0.010	(0.020)	0.008	(0.015)	0.021	(0.037)	0.2971	0.0147	0.0076
EBITDA $margin_{t-1}$	0.041	(0.048)	0.025	(0.022)	0.030	(0.064)	0.0000	0.1382	0.5078
Equity-to-assets $ratio_{t-1}$	0.239	(0.153)	0.187	(0.110)	0.219	(0.138)	0.0010	0.2110	0.1400
Cash $flow_{t-1}$	0.033	(0.046)	0.021	(0.028)	0.012	(0.053)	0.0056	0.0010	0.1782
$Public_{t-1}$	0.397	(0.489)	0.630	(0.487)	0.382	(0.489)	0.0010	0.7881	0.0051
$PNFP_{t-1}$	0.409	(0.492)	0.370	(0.487)	0.474	(0.503)	0.5660	0.2713	0.2422
PFP_{t-1}	0.191	(0.393)	0.000	(0.000)	0.145	(0.354)	0.0000	0.2618	0.0006
$Beds_{t-1}$	317.9	(252.9)	302.2	(181.7)	237.4	(161.9)	0.5357	0.0001	0.0386
Chain $member_{t-1}$	0.574	(0.495)	0.611	(0.492)	0.500	(0.503)	0.5864	0.2084	0.2114
$Rural_{t-1}$	0.199	(0.246)	0.225	(0.264)	0.265	(0.265)	0.4666	0.0356	0.4054
East $Germany_{t-1}$	0.227	(0.419)	0.389	(0.492)	0.184	(0.390)	0.0201	0.3442	0.0126
Share $65+_{t-1}$	0.203	(0.022)	0.206	(0.026)	0.205	(0.019)	0.2762	0.3192	0.6989
Household $income_{t-1}$	1,532	(226.2)	1,412	(181.0)	1,516	(177.8)	0.0000	0.4516	0.0015
2005	0.087	(0.282)	0.185	(0.392)	0.039	(0.196)	0.0733	0.0414	0.0141
2006	0.138	(0.345)	0.185	(0.392)	0.145	(0.354)	0.3851	0.8729	0.5477
2007	0.191	(0.393)	0.111	(0.317)	0.237	(0.428)	0.0720	0.3623	0.0567
2008	0.186	(0.389)	0.241	(0.432)	0.211	(0.410)	0.3587	0.6077	0.6889
2009	0.200	(0.400)	0.185	(0.392)	0.092	(0.291)	0.7824	0.0022	0.1426
2010	0.197	(0.398)	0.093	(0.293)	0.276	(0.450)	0.0124	0.1328	0.0056
Number of hospitals	696		54		76				
Number of balance sheets	544		39		53				

Notes: Based on 3,098 observations. [a]Two group mean comparison t test, to test whether the differences in means are significantly different from zero.

Table A4: Correlation matrix of financial variables

	PD	EBITDA margin	Equity-to-assets ratio	Cash flow
PD				
EBITDA margin	-0.2839***			
Equity-to-assets ratio	-0.3898***	0.2121***		
Cash flow	-0.3759***	0.6626***	0.3172***	

Notes: *p<0.1 **p<0.05 ***p<0.01.

Table A5: Regression coefficients for single financial variables

	Model III		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.
EBITDA margin$_{t-1}$	−3.219	−6.156	-	-	-	-
	(3.653)	(5.139)	-	-	-	-
Equity-to-assets ratio$_{t-1}$	-	-	−3.008**	−0.950	-	-
	-	-	(1.210)	(0.880)	-	-
Cash flow$_{t-1}$	-	-	-	-	−1.131	−9.637***
	-	-	-	-	(3.163)	(2.907)
Public$_{t-1}$	16.355***	0.103	15.658***	0.479	14.897***	0.050
	(0.497)	(0.623)	(0.421)	(0.587)	(0.434)	(0.626)
PNFP$_{t-1}$	15.571***	0.349	14.929***	0.712	14.095***	0.396
	(0.407)	(0.423)	(0.378)	(0.439)	(0.394)	(0.438)
Beds$_{t-1} \times 10^{-3}$	−1.907***	−1.951***	−1.813***	−1.891**	−1.879***	−1.957**
	(0.673)	(0.751)	(0.676)	(0.751)	(0.665)	(0.776)
Chain member$_{t-1}$	0.221	−0.316	0.290	−0.276	0.247	−0.345
	(0.325)	(0.257)	(0.310)	(0.264)	(0.313)	(0.263)
Rural$_{t-1}$	−1.222	0.721	−1.290	0.741	−1.190	0.792
	(0.889)	(0.601)	(0.820)	(0.595)	(0.881)	(0.616)
East Germany$_{t-1}$	0.164	−0.426	0.136	−0.533	0.097	−0.481
	(0.577)	(0.408)	(0.544)	(0.423)	(0.572)	(0.423)
Share 65+$_{t-1}$	4.066	6.848	4.474	6.598	4.445	6.837
	(8.943)	(6.294)	(8.975)	(6.425)	(9.014)	(6.355)
Household income$_{t-1}$	−2.741*	−0.633	−2.815**	−0.722	−2.737*	−0.618
	(1.473)	(0.697)	(1.426)	(0.723)	(1.478)	(0.692)
2006	−0.278	0.837	−0.281	0.794	−0.298	0.812
	(0.793)	(0.663)	(0.787)	(0.662)	(0.788)	(0.667)
2007	−0.969	0.992	−0.949	0.943	−0.997	0.995
	(0.752)	(0.651)	(0.739)	(0.659)	(0.744)	(0.656)
2008	−0.057	0.899	−0.006	0.866	−0.083	0.917
	(0.703)	(0.637)	(0.692)	(0.641)	(0.691)	(0.639)
2009	−0.238	0.000	−0.159	0.001	−0.259	0.003
	(0.770)	(0.818)	(0.761)	(0.826)	(0.761)	(0.821)
2010	−0.861	1.156	−0.781	1.118	−0.905	1.165*
	(0.911)	(0.712)	(0.924)	(0.703)	(0.914)	(0.697)
Constant	−15.460***	−4.238*	−14.295***	−4.347**	−14.125***	−4.243**
	(2.678)	(2.170)	(2.480)	(2.106)	(2.640)	(2.079)
Pseudo-R^2	0.0752		0.0784		0.0841	
Log-Pseudolikelihood	-580.514		-578.474		-574.902	
Wald-χ^2 test	6,047.64***		3,798.98***		4,223.21***	
Observations	3,098		3,098		3,098	
Hospitals	731		731		731	
Balance sheets	567		567		567	

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. The alternative *Unconsolidated* is the base group. The abbreviation "Acq." stands for acquisition. *p<0.1 **p<0.05 ***p<0.01.

Table A6: Average marginal effects for single financial variables

	Model III		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.
EBITDA margin$_{t-1}$	−0.051	−0.144	-	-	-	-
	(0.060)	(0.120)	-	-	-	-
Equity-to-assets ratio$_{t-1}$	-	-	−0.050**	−0.021	-	-
	-	-	(0.022)	(0.021)	-	-
Cash flow$_{t-1}$	-	-	-	-	−0.015	−0.225***
	-	-	-	-	(0.053)	(0.073)
Public$_{t-1}$	0.274***	−0.005	0.261***	0.004	0.250***	−0.005
	(0.058)	(0.014)	(0.048)	(0.014)	(0.046)	(0.014)
PNFP$_{t-1}$	0.261***	0.002	0.249***	0.010	0.236***	0.003
	(0.054)	(0.010)	(0.045)	(0.010)	(0.043)	(0.010)
Beds$_{t-1} \times 10^{-3}$	−0.031**	−0.045**	−0.029**	−0.044**	−0.031**	−0.045**
	(0.013)	(0.018)	(0.012)	(0.018)	(0.012)	(0.019)
Chain member$_{t-1}$	0.004	−0.008	0.005	−0.007	0.004	−0.008
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)
Rural$_{t-1}$	−0.021	0.018	−0.022	0.018	−0.020	0.019
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)
East Germany$_{t-1}$	0.003	−0.010	0.003	−0.013	0.002	−0.011
	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
Share 65+$_{t-1}$	0.065	0.160	0.072	0.154	0.072	0.158
	(0.151)	(0.156)	(0.151)	(0.159)	(0.152)	(0.155)
Household income$_{t-1}$	−0.046*	−0.014	−0.047*	−0.016	−0.046*	−0.013
	(0.025)	(0.016)	(0.024)	(0.017)	(0.025)	(0.016)
2006	−0.005	0.020	−0.005	0.019	−0.005	0.019
	(0.013)	(0.016)	(0.013)	(0.016)	(0.013)	(0.016)
2007	−0.017	0.024	−0.016	0.023	−0.017	0.024
	(0.014)	(0.016)	(0.013)	(0.016)	(0.014)	(0.016)
2008	−0.001	0.021	0.000	0.020	−0.002	0.021
	(0.012)	(0.016)	(0.012)	(0.016)	(0.012)	(0.015)
2009	−0.004	0.000	−0.003	0.000	−0.004	0.000
	(0.013)	(0.019)	(0.013)	(0.02)	(0.013)	(0.019)
2010	−0.015	0.028	−0.014	0.027	−0.016	0.028
	(0.016)	(0.018)	(0.016)	(0.018)	(0.016)	(0.017)
Observations	3,098		3,098		3,098	
Hospitals	731		731		731	
Balance sheets	567		567		567	

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. The abbreviation "Acq." stands for acquisition. *p<0.1 **p<0.05 ***p<0.01.

Table A7: Robustness check – OLS coefficients

	Model I		*Model II*		*Model III*		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.
PD_{t-1}	−0.116	0.587*	-	-	-	-	-	-	-	-
	(0.107)	(0.315)	-	-	-	-	-	-	-	-
EBITDA $margin_{t-1}$	-	-	−0.048	0.053	−0.042	−0.144	-	-	-	-
	-	-	(0.057)	(0.120)	(0.050)	(0.120)	-	-	-	-
Equity-to-assets $ratio_{t-1}$	-	-	−0.044**	0.003	-	-	−0.040***	−0.023	-	-
	-	-	(0.018)	(0.022)	-	-	(0.015)	(0.021)	-	-
Cash $flow_{t-1}$	-	-	0.076	−0.308***	-	-	-	-	−0.002	−0.275***
	-	-	(0.050)	(0.103)	-	-	-	-	(0.040)	(0.103)
$Public_{t-1}$	0.035***	0.006	0.034***	−0.001	0.031***	−0.000	0.034***	0.009	0.034***	−0.003
	(0.009)	(0.012)	(0.010)	(0.015)	(0.010)	(0.014)	(0.008)	(0.013)	(0.009)	(0.013)
$PNFP_{t-1}$	0.018***	0.014	0.019***	0.007	0.015***	0.006	0.019***	0.016*	0.017***	0.006
	(0.005)	(0.009)	(0.006)	(0.011)	(0.005)	(0.010)	(0.005)	(0.009)	(0.005)	(0.009)
$Beds_{t-1} \times 10^{-3}$	−0.032***	−0.028**	−0.030***	−0.029**	−0.032***	−0.030***	−0.030***	−0.028**	−0.032***	−0.029***
	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)
Chain $member_{t-1}$	0.004	−0.008	0.004	−0.009	0.004	−0.008	0.004	−0.007	0.004	−0.010
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$Rural_{t-1}$	−0.020	0.021	−0.021	0.025	−0.021	0.024	−0.021	0.025	−0.021	0.025
	(0.016)	(0.019)	(0.016)	(0.018)	(0.016)	(0.018)	(0.016)	(0.018)	(0.016)	(0.018)
East $Germany_{t-1}$	0.007	−0.010	0.009	−0.014	0.008	−0.011	0.008	−0.013	0.007	−0.013
	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)
Share $65+_{t-1}$	0.106	0.138	0.104	0.143	0.103	0.159	0.101	0.156	0.103	0.145
	(0.152)	(0.168)	(0.150)	(0.167)	(0.152)	(0.169)	(0.151)	(0.170)	(0.151)	(0.169)
Household $income_{t-1}$	−0.030**	−0.017	−0.033**	−0.015	−0.031**	−0.014	−0.033**	−0.016	−0.031**	−0.015
	(0.015)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.015)	(0.016)
Constant	0.047	0.008	0.058	0.022	0.051	0.016	0.058	0.011	0.048	0.025
	(0.041)	(0.045)	(0.040)	(0.050)	(0.040)	(0.050)	(0.040)	(0.046)	(0.041)	(0.048)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,022	3,044	3,022	3,044	3,022	3,044	3,022	3,044	3,022	3,044
Clusters	553	558	553	558	553	558	553	558	553	558
R^2	0.016	0.015	0.018	0.015	0.016	0.011	0.018	0.010	0.016	0.015
F test	2.69***	2.33***	2.27***	2.22***	2.68***	2.30***	2.60***	2.35***	2.67***	2.37***

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. *Merger* comprises merged and unconsolidated hospitals, with $y = 1$ for merged hospitals and $y = 0$ otherwise. *Acq.* comprises acquired and unconsolidated hospitals, with $y = 1$ for acquired hospitals and $y = 0$ otherwise. *p<0.1 **p<0.05 ***p<0.01.

Table A8: Robustness check – Fixed effects coefficients

	Model I		*Model II*		*Model III*		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.
PD_{t-1}	−0.175	0.345	-	-	-	-	-	-	-	-
	(0.112)	(0.290)	-	-	-	-	-	-	-	-
EBITDA $margin_{t-1}$	-	-	0.067	0.114	0.073	−0.090	-	-	-	-
	-	-	(0.103)	(0.201)	(0.089)	(0.176)	-	-	-	-
Equity-to-assets $ratio_{t-1}$	-	-	−0.063	0.095	-	-	−0.045	0.034	-	-
	-	-	(0.045)	(0.088)	-	-	(0.042)	(0.083)	-	-
Cash $flow_{t-1}$	-	-	0.046	−0.298*	-	-	-	-	0.036	−0.196*
	-	-	(0.051)	(0.152)	-	-	-	-	(0.043)	(0.112)
$Public_{t-1}$	0.014	−0.079	0.015	−0.085	0.013	−0.078	0.013	−0.078	0.014	−0.082
	(0.010)	(0.078)	(0.010)	(0.079)	(0.009)	(0.078)	(0.009)	(0.078)	(0.009)	(0.079)
$PNFP_{t-1}$	0.008	−0.039	0.008	−0.039	0.008	−0.038	0.007	−0.037	0.009	−0.040
	(0.008)	(0.102)	(0.008)	(0.101)	(0.008)	(0.102)	(0.008)	(0.103)	(0.008)	(0.102)
$Beds_{t-1} \times 10^{-3}$	−0.018	−0.026	−0.023	−0.017	−0.021	−0.021	−0.022	−0.020	−0.021	−0.020
	(0.050)	(0.049)	(0.050)	(0.049)	(0.050)	(0.048)	(0.050)	(0.049)	(0.050)	(0.048)
Chain $member_{t-1}$	0.018	−0.443**	0.014	−0.441*	0.018	−0.443**	0.014	−0.441*	0.018	−0.445**
	(0.026)	(0.225)	(0.025)	(0.226)	(0.026)	(0.225)	(0.027)	(0.225)	(0.026)	(0.225)
$Rural_{t-1}$	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
East $Germany_{t-1}$	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Share $65+_{t-1}$	2.240**	−1.789**	2.311**	−1.888***	2.245**	−1.795**	2.286**	−1.829***	2.241**	−1.789**
	(0.916)	(0.715)	(0.928)	(0.703)	(0.916)	(0.716)	(0.927)	(0.701)	(0.916)	(0.710)
Household $income_{t-1}$	−0.324***	0.375***	−0.338***	0.397***	−0.329***	0.385***	−0.335***	0.389***	−0.328***	0.385***
	(0.115)	(0.136)	(0.117)	(0.141)	(0.116)	(0.137)	(0.117)	(0.141)	(0.116)	(0.138)
Constant	0.019	0.095	0.039	0.067	0.021	0.086	0.039	0.074	0.023	0.090
	(0.165)	(0.234)	(0.163)	(0.241)	(0.165)	(0.236)	(0.163)	(0.242)	(0.165)	(0.235)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,022	3,044	3,022	3,044	3,022	3,044	3,022	3,044	3,022	3,044
Clusters	553	558	553	558	553	558	553	558	553	558
R^2	0.030	0.052	0.030	0.055	0.029	0.051	0.030	0.051	0.029	0.053
F test	2.10**	2.95***	1.80**	2.66***	2.09**	3.03***	2.08**	2.96***	2.09**	2.98***

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. *Merger* comprises merged and unconsolidated hospitals, with $y = 1$ for merged hospitals and $y = 0$ otherwise. *Acq.* comprises acquired and unconsolidated hospitals, with $y = 1$ for acquired hospitals and $y = 0$ otherwise. *p<0.1 **p<0.05 ***p<0.01.

Table A9: Robustness check – Multinomial logit coefficients – Sample with single balance sheets

	Model I		*Model II*		*Model III*		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.
PD_{t-1}	−4.139	13.239***	-	-	-	-	-	-	-	-
	(10.990)	(4.408)	-	-	-	-	-	-	-	-
EBITDA $margin_{t-1}$	-	-	−10.898**	0.655	−8.184*	−5.156	-	-	-	-
	-	-	(4.905)	(5.131)	(4.463)	(5.875)	-	-	-	-
Equity-to-assets $ratio_{t-1}$	-	-	−2.796	−1.351	-	-	−2.509*	−2.103**	-	-
	-	-	(1.736)	(1.006)	-	-	(1.432)	(1.059)	-	-
Cash $flow_{t-1}$	-	-	7.421**	−7.236**	-	-	-	-	−0.300	−8.155***
	-	-	(3.184)	(2.852)	-	-	-	-	(4.241)	(2.724)
$Public_{t-1}$	14.239***	−0.169	14.603***	−0.435	14.425***	−0.332	14.496***	−0.059	14.828***	−0.510
	(0.492)	(0.640)	(0.600)	(0.602)	(0.556)	(0.557)	(0.484)	(0.642)	(0.525)	(0.647)
$PNFP_{t-1}$	13.458***	0.644	13.921***	0.464	13.714***	0.439	13.778***	0.746	14.056***	0.362
	(0.401)	(0.556)	(0.454)	(0.471)	(0.436)	(0.463)	(0.380)	(0.549)	(0.443)	(0.540)
$Beds_{t-1} \times 10^{-3}$	−1.355**	−1.485*	−1.230*	−1.628*	−1.390**	−1.685**	−1.210*	−1.570*	−1.355**	−1.677*
	(0.674)	(0.826)	(0.718)	(0.867)	(0.705)	(0.860)	(0.680)	(0.843)	(0.674)	(0.877)
Chain $member_{t-1}$	−0.450	−0.534	−0.565	−0.495	−0.538	−0.545	−0.413	−0.465	−0.449	−0.530
	(0.376)	(0.371)	(0.396)	(0.389)	(0.395)	(0.388)	(0.374)	(0.374)	(0.376)	(0.367)
$Rural_{t-1}$	−2.160**	0.698	−2.126**	0.784	−2.109**	0.660	−2.008**	0.743	−2.140**	0.771
	(0.954)	(0.656)	(0.930)	(0.655)	(0.938)	(0.664)	(0.921)	(0.644)	(0.942)	(0.654)
East $Germany_{t-1}$	0.591	−0.956*	0.868	−0.966*	0.773	−0.884	0.599	−0.997*	0.604	−0.951*
	(0.601)	(0.524)	(0.617)	(0.574)	(0.598)	(0.586)	(0.608)	(0.523)	(0.605)	(0.526)
Share $65+_{t-1}$	−6.533	−1.311	−6.987	0.607	−7.496	0.025	−5.130	0.220	−6.489	0.162
	(9.376)	(6.971)	(8.979)	(6.959)	(9.231)	(6.938)	(9.322)	(6.940)	(9.447)	(7.025)
Household $income_{t-1}$	−3.962**	−1.351	−4.011**	−1.314	−3.992**	−1.285	−3.941**	−1.435*	−3.976**	−1.253
	(1.787)	(0.824)	(1.811)	(0.834)	(1.798)	(0.841)	(1.760)	(0.860)	(1.785)	(0.814)
Constant	−11.636***	−1.683	−11.433***	−1.314	−11.542***	−1.475	−11.888***	−1.318	−12.267***	−1.452
	(3.741)	(1.850)	(3.710)	(1.864)	(3.757)	(1.874)	(3.638)	(1.879)	(3.746)	(1.838)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R^2	0.1053		0.1188		0.1034		0.1074		0.1079	
Log-Pseudolikelihood	-328.973		-323.986		-329.659		-328.169		-327.985	
Wald-χ^2 test	2,093.94***		1,954.74***		1,929.62***		2,323.74***		2,290.17***	
Observations	2,137		2,137		2,137		2,137		2,137	
Hospitals	480		480		480		480		480	
Balance sheets	480		480		480		480		480	

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. The alternative *Unconsolidated* is the base group. The abbreviation "Acq." stands for acquisition. *p<0.1 **p<0.05 ***p<0.01.

Table A10: Robustness check – Multinomial logit AME – Sample with single balance sheets

	Model I		*Model II*		*Model III*		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.
PD_{t-1}	−0.059	0.257***	-	-	-	-	-	-	-	-
	(0.147)	(0.090)	-	-	-	-	-	-	-	-
EBITDA $margin_{t-1}$	-	-	−0.145**	0.016	−0.108*	−0.098	-	-	-	-
	-	-	(0.071)	(0.099)	(0.063)	(0.114)	-	-	-	-
Equity-to-assets $ratio_{t-1}$	-	-	−0.037	−0.025	-	-	−0.033*	−0.040*	-	-
	-	-	(0.024)	(0.019)	-	-	(0.020)	(0.021)	-	-
Cash $flow_{t-1}$	-	-	0.101**	−0.141**	-	-	-	-	−0.002	−0.157***
	-	-	(0.045)	(0.058)	-	-	-	-	(0.057)	(0.056)
$Public_{t-1}$	0.191***	−0.007	0.195***	−0.012	0.193***	−0.010	0.194***	−0.005	0.199***	−0.014
	(0.035)	(0.012)	(0.035)	(0.011)	(0.036)	(0.011)	(0.036)	(0.012)	(0.036)	(0.012)
$PNFP_{t-1}$	0.181***	0.009	0.185***	0.005	0.184***	0.005	0.184***	0.011	0.189***	0.003
	(0.033)	(0.011)	(0.034)	(0.009)	(0.034)	(0.009)	(0.034)	(0.011)	(0.035)	(0.010)
$Beds_{t-1} \times 10^{-3}$	−0.018*	−0.028*	−0.016*	−0.031*	−0.018*	−0.032*	−0.016*	−0.030*	−0.018*	−0.032*
	(0.009)	(0.016)	(0.010)	(0.017)	(0.010)	(0.017)	(0.009)	(0.017)	(0.009)	(0.017)
Chain $member_{t-1}$	−0.006	−0.010	−0.007	−0.009	−0.007	−0.010	−0.005	−0.009	−0.006	−0.010
	(0.005)	(0.007)	(0.005)	(0.008)	(0.005)	(0.008)	(0.005)	(0.007)	(0.005)	(0.007)
$Rural_{t-1}$	−0.029**	0.014	−0.029**	0.016	−0.028**	0.013	−0.027**	0.015	−0.029**	0.015
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
East $Germany_{t-1}$	0.008	−0.019*	0.012	−0.019*	0.011	−0.017	0.008	−0.019*	0.008	−0.018*
	(0.008)	(0.010)	(0.008)	(0.011)	(0.008)	(0.012)	(0.008)	(0.010)	(0.008)	(0.010)
Share $65+_{t-1}$	−0.087	−0.024	−0.093	0.014	−0.100	0.003	−0.069	0.006	−0.087	0.005
	(0.126)	(0.135)	(0.120)	(0.134)	(0.125)	(0.135)	(0.125)	(0.134)	(0.127)	(0.135)
Household $income_{t-1}$	−0.053**	−0.025	−0.053**	−0.024	−0.053**	−0.024	−0.052**	−0.027	−0.053**	−0.023
	(0.026)	(0.016)	(0.026)	(0.016)	(0.026)	(0.017)	(0.025)	(0.017)	(0.026)	(0.016)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,137		2,137		2,137		2,137		2,137	
Hospitals	480		480		480		480		480	
Balance sheets	480		480		480		480		480	

Notes: Average marginal effects. Robust standard errors in parentheses. Clustered at balance sheet level. The abbreviation "Acq." stands for acquisition. *p<0.1 **p<0.05 ***p<0.01.

Table A11: Robustness check – OLS coefficients – Sample with single balance sheets

	Model I		*Model II*		*Model III*		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.
PD_{t-1}	−0.047	0.393*	-	-	-	-	-	-	-	-
	(0.125)	(0.230)	-	-	-	-	-	-	-	-
EBITDA $margin_{t-1}$	-	-	−0.108**	0.037	−0.082*	−0.100	-	-	-	-
	-	-	(0.047)	(0.103)	(0.044)	(0.087)	-	-	-	-
Equity-to-assets $ratio_{t-1}$	-	-	−0.030**	−0.023	-	-	−0.029**	−0.037**	-	-
	-	-	(0.015)	(0.016)	-	-	(0.013)	(0.017)	-	-
Cash $flow_{t-1}$	-	-	0.081	−0.183**	-	-	-	-	−0.006	−0.188**
	-	-	(0.052)	(0.087)	-	-	-	-	(0.042)	(0.074)
$Public_{t-1}$	0.025***	−0.004	0.023***	−0.010	0.020***	−0.008	0.024***	−0.002	0.024***	−0.013
	(0.007)	(0.011)	(0.007)	(0.010)	(0.007)	(0.010)	(0.007)	(0.011)	(0.007)	(0.012)
$PNFP_{t-1}$	0.013***	0.012	0.012***	0.007	0.009**	0.007	0.014***	0.014	0.013***	0.004
	(0.004)	(0.011)	(0.004)	(0.010)	(0.004)	(0.009)	(0.004)	(0.011)	(0.004)	(0.011)
$Beds_{t-1} \times 10^{-3}$	−0.020**	−0.016	−0.019**	−0.016	−0.020**	−0.017*	−0.019**	−0.015	−0.020**	−0.017*
	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)
Chain $member_{t-1}$	−0.004	−0.011	−0.005	−0.010	−0.005	−0.011	−0.004	−0.010	−0.004	−0.011
	(0.005)	(0.007)	(0.005)	(0.007)	(0.005)	(0.007)	(0.005)	(0.007)	(0.005)	(0.007)
$Rural_{t-1}$	−0.030**	0.017	−0.030**	0.019	−0.030**	0.016	−0.029**	0.018	−0.030**	0.018
	(0.013)	(0.015)	(0.013)	(0.015)	(0.013)	(0.015)	(0.013)	(0.015)	(0.013)	(0.015)
East $Germany_{t-1}$	0.013	−0.017*	0.016*	−0.020*	0.015	−0.017*	0.014	−0.019*	0.014	−0.019**
	(0.009)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)
Share $65+_{t-1}$	−0.031	0.013	−0.024	0.029	−0.029	0.030	−0.027	0.030	−0.031	0.028
	(0.143)	(0.139)	(0.143)	(0.139)	(0.144)	(0.140)	(0.143)	(0.140)	(0.144)	(0.140)
Household $income_{t-1}$	−0.035***	−0.029*	−0.036***	−0.027*	−0.035***	−0.026*	−0.037***	−0.028*	−0.036***	−0.026*
	(0.013)	(0.016)	(0.013)	(0.016)	(0.013)	(0.015)	(0.013)	(0.016)	(0.013)	(0.015)
Constant	0.054	0.060*	0.062*	0.072*	0.060	0.063*	0.061	0.065*	0.055	0.069*
	(0.037)	(0.035)	(0.037)	(0.037)	(0.037)	(0.036)	(0.037)	(0.036)	(0.037)	(0.036)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,094	2,107	2,094	2,107	2,094	2,107	2,094	2,107	2,094	2,107
Clusters	468	475	468	475	468	475	468	475	468	475
R^2	0.019	0.015	0.021	0.016	0.020	0.012	0.020	0.013	0.019	0.015
F test	1.951**	2.089**	1.764**	1.938**	1.938**	2.064**	1.999**	2.119**	1.945**	2.183**

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. *Merger* comprises merged and unconsolidated hospitals, with $y = 1$ for merged hospitals and $y = 0$ otherwise. *Acq.* comprises acquired and unconsolidated hospitals, with $y = 1$ for acquired hospitals and $y = 0$ otherwise. *p<0.1 **p<0.05 ***p<0.01.

Table A12: Robustness check – Fixed effects coefficients – Sample with single balance sheets

	Model I		*Model II*		*Model III*		*Model IV*		*Model V*	
	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.	Merger	Acq.
PD_{t-1}	−0.148	0.333	-	-	-	-	-	-	-	-
	(0.118)	(0.334)	-	-	-	-	-	-	-	-
EBITDA $margin_{t-1}$	-	-	0.064	0.010	0.086	−0.086	-	-	-	-
	-	-	(0.088)	(0.137)	(0.085)	(0.134)	-	-	-	-
Equity-to-assets $ratio_{t-1}$	-	-	−0.041	0.001	-	-	−0.023	−0.025	-	-
	-	-	(0.043)	(0.043)	-	-	(0.040)	(0.045)	-	-
Cash $flow_{t-1}$	-	-	0.048	−0.108	-	-	-	-	0.049	−0.104
	-	-	(0.044)	(0.095)	-	-	-	-	(0.046)	(0.089)
$Public_{t-1}$	0.011	0.027**	0.013	0.026*	0.011	0.029**	0.011	0.029**	0.012	0.026*
	(0.008)	(0.014)	(0.008)	(0.015)	(0.008)	(0.014)	(0.008)	(0.014)	(0.008)	(0.014)
$PNFP_{t-1}$	0.007	0.037***	0.007	0.036***	0.007	0.037***	0.007	0.037***	0.008	0.036***
	(0.007)	(0.013)	(0.007)	(0.013)	(0.007)	(0.013)	(0.007)	(0.013)	(0.007)	(0.013)
$Beds_{t-1} \times 10^{-3}$	−0.039	−0.041	−0.042	−0.036	−0.040	−0.037	−0.041	−0.038	−0.041	−0.036
	(0.054)	(0.043)	(0.055)	(0.042)	(0.054)	(0.042)	(0.054)	(0.042)	(0.054)	(0.041)
Chain $member_{t-1}$	0.016	−0.007	0.015	−0.007	0.017	−0.007	0.014	−0.008	0.017	−0.008
	(0.019)	(0.014)	(0.018)	(0.015)	(0.018)	(0.015)	(0.020)	(0.014)	(0.019)	(0.015)
$Rural_{t-1}$	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
East $Germany_{t-1}$	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Share $65+_{t-1}$	0.980	−2.170***	1.028	−2.159***	0.981	−2.154***	0.988	−2.115***	0.976	−2.159***
	(0.657)	(0.789)	(0.656)	(0.787)	(0.659)	(0.790)	(0.652)	(0.780)	(0.658)	(0.787)
Household $income_{t-1}$	−0.243*	0.342**	−0.255**	0.351**	−0.247*	0.351**	−0.250**	0.345**	−0.247*	0.351**
	(0.128)	(0.159)	(0.127)	(0.163)	(0.129)	(0.161)	(0.127)	(0.163)	(0.129)	(0.161)
Constant	0.158	−0.113	0.172	−0.123	0.161	−0.125	0.173	−0.121	0.162	−0.123
	(0.172)	(0.215)	(0.171)	(0.223)	(0.174)	(0.218)	(0.171)	(0.223)	(0.173)	(0.218)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,094	2,107	2,094	2,107	2,094	2,107	2,094	2,107	2,094	2,107
Clusters	468	475	468	475	468	475	468	475	468	475
R^2	0.025	0.030	0.026	0.029	0.025	0.028	0.025	0.028	0.025	0.029
F test	1.850**	2.421***	1.594*	2.094**	1.853**	2.429***	1.852**	2.432***	1.852**	2.441***

Notes: Robust standard errors in parentheses. Clustered at balance sheet level. *Merger* comprises merged and unconsolidated hospitals, with $y = 1$ for merged hospitals and $y = 0$ otherwise. *Acq.* comprises acquired and unconsolidated hospitals, with $y = 1$ for acquired hospitals and $y = 0$ otherwise. *p<0.1 **p<0.05 ***p<0.01.