Strategic groups and performance differences among academic medical centers

Jonas Schreyögg

Constantin von Reitzenstein

Background: The performance of academic medical centers (AMCs) differs from that of other hospitals because AMCs must combine the delivery of patient care with teaching and research.
Purpose: This study investigates the effects of strategic group membership as opposed to other structural determinants on the performance of AMCs.
Methodology: We used data from 24 German AMCs and applied data envelopment analysis with superefficiency to measure the performance of AMCs by considering AMC-specific inputs and outputs for patient care, teaching, and research. We used cluster analysis to identify strategic groups and applied regression analysis to explore their impact on performance.
Results: Our results reveal two strategic groups based on a specialization either in teaching or in research. The strategic group that specialized in research showed significantly better performance; structural variables did not play a major role.
Practice Implications: The results provide an important justification for managers to develop suitable strategic concepts for AMCs. If low organizational efficiency is detected, managers need to consider analyzing whether their AMC belongs to an appropriate strategic group. An emphasis on research may increase overall efficiency.

In many countries around the world, academic medical centers (AMCs) are faced with a difficult financial situation. They usually receive reimbursement for the delivery of health care in an amount similar with that received by nonteaching hospitals.

Key words: academic medical centers, data envelopment analysis, strategic groups, teaching hospitals

Jonas Schreyögg, MA, PhD, *is Assistant Professor, Department of Health Care Management, Berlin University of Technology, Germany; and is Adjunct Research Associate, Stanford University Center for Health Policy, California. E-mail: jonas.schreyoegg@tu-berlin.de.*
Constantin von Reitzenstein, MA, *is Research Fellow, Department of Health Care Management, Berlin University of Technology, Germany.*

Jonas Schreyögg was supported by the Commonwealth Fund Harkness Fellowship in Health Care Policy for the 2006–2007 academic year at Stanford University.

Health Care Manage Rev, 2008, 33(3), 225-233

Although they are compensated for their teaching workload, special case mix, or research activities, this compensation is often too low (Linna & Häkkinen, 2006; Lopez-Casanovas & Saez, 1999). Payers, such as health insurers and state institutions, frequently do not recognize that the organizational structure of AMCs differs from that of ordinary hospitals due to the former's role as multiservice organizations. Unlike other hospitals with teaching status, AMCs are usually part of a university or medical school, and their mission is to combine patient care, education, and research, which can often lead to a trade-off between these three goals. Good residency training means more intensive patient contact, which, however, can also slow down care processes and research. On the other hand, if physicians focus too intently on patient care, they may not have enough time to interact with students or pursue research. In this sense, patient care, education, and research can come into conflict with each other, reducing the performance of AMCs compared with ordinary hospitals.

Only few studies have been conducted to date on the performance of AMCs or teaching hospitals in general. These studies defined performance in different ways. One group of studies defined performance as clinical measures such as mortality, adverse events, or other measures for quality of care. The results of these studies suggest that performance in teaching hospitals is higher than in nonteaching hospitals (Ayanian, Weissman, Chasan-Taber, & Epsten, 1998; Brennan et al., 1991; Hartz et al., 1989; Keeler et al., 1992; Kuhn, Hartz, Gottlieb, & Rimm, 1991; Rosenthal, Harper, Quinn, & Cooper, 1997; Taylor, Whellan, & Sloan, 1999). The other group of studies defined performance as economic measures such as costs or efficiency frontiers based on costs. These articles suggest that nonteaching hospitals perform better than teaching hospitals. For a sample of U.S. hospitals, Grosskopf, Margaritis, and Valmanis (2001) were able to show that only 10% of teaching hospitals can effectively compete with nonteaching hospitals based on the provision of patient services. Moreover, Mechanic, Coleman, and Dobson (1998) found that costs per case were 44% higher for AMCs than for other teaching hospitals after adjusting for case mix, wage levels, and direct graduate medical education. This finding was confirmed by another study that focused only on teaching hospitals and showed that hospitals with smaller teaching loads performed better than AMCs (Rosko, 2004). This article follows a similar approach as the latter group of studies and defines performance as efficiency scores from data envelopment analysis (DEA) generated from inputs and outputs.

Previous studies suggest that it is difficult to adjust for structural factors that contribute to performance differences when comparing AMCs, teaching hospitals with smaller teaching loads, and nonteaching hospitals. In particular, indirect teaching costs are difficult to measure and represent a cost-increasing factor for teaching hospitals, which may be caused by unmeasured differences in case mix (Custer & Wilke, 1991). These findings suggest that, when measuring hospital performance, AMCs should be treated as a separate group and examined using different variables. However, only one study to date has concentrated solely on the performance of AMCs. Fisher, Wennberg, Stukel, & Gottlieb. (2004) revealed considerable differences among AMCs in the quality of care provided to patients. This study investigates the performance of AMCs using the concept of strategic groups. The framework of strategic groups is used to explain how strategic choice, as opposed to structural factors, influences the performance of AMCs.

Theoretical Framework

Although the concept of strategic groups originated with Hunt (1972), it is usually associated with Porter (1979). Porter argues that, in one industry, firms with similar assets pursue similar strategies with similar performance results in ways that cannot be explained by the structure–conduct–performance paradigm. Strategic variables such as marketing methods and the use of certain technologies can create effective mobility barriers. These barriers protect each strategic group from outside competition and may lead to performance differences (Osborne, Stubbart, & Ramaprasad, 2001; Short, Ketchen, Palmer & Hult, 2007; Tywoniak, Galvin, & Davies, 2007). McGee (2003) differentiates between market-related barriers (e.g., advertising, sales-force size, and breadth of product line) and asset-related barriers (e.g., product patents). Strategic groups only develop if mobility barriers (a) cannot be removed easily and (b) require certain investments often associated with sunk costs. Thus, high-performance firms have an incentive to establish barriers to prevent other firms from entering their domain.

Since the late 1970s, many empirical studies on different industries have been performed based on this concept. Many of these studies have chosen the pharmaceutical industry as their focus due to its heterogeneous market structure (Bogner, Thomas, & McGee, 1996; Leask & Parker, 2007; Mehra & Floyd, 1998). Few studies have investigated strategic groups in hospitals and health care providers, and in those that have investigated these groups, the empirical results have been mixed. Some studies found evidence supporting the existence of strategic groups (Ketchen, Thomas, & Snow, 1993; Madorran García & de Val Pardo, 2004; Marlin, Lamont, & Hoffman, 1994; Short, Palmer, & Ketchen, 2002), but other studies did not (Nath & Gruca, 1997). The concept has not been applied yet to AMCs, although the heterogeneity of the AMC market would seem to be fertile ground for its application. Warning (2004) applied the concept to universities investigating the link between performance and specialization in research or teaching. Our approach builds on concepts previously employed in strategic-group research conducted, in particular, in the realm of hospitals and institutions of higher education.

We assumed that AMCs might define different strategies to compete on the market for AMC services, much like organizations in other industries. As AMCs usually serve as tertiary hospitals, patient selection is less likely than in other hospitals. Consequentially, the case mix is likely to be influenced by structural factors rather than management strategies. We assumed that AMCs differentiate from each other by specializing in teaching or research. Clearly, a focus on research can be rewarding for an AMC, for example, due to improved possibilities to acquire research grants. However, we also assume that, similar with teaching universities in other academic disciplines (e.g., education), there are also AMCs focusing on teaching. These AMCs excel by providing ideal conditions for students to pass the Medical Licensing

Examination and other standardized examinations which may increase their number of graduates and again attract more and better students. This may increase revenues through tuition fees or public funding.

Mobility barriers are more likely to be present in research than teaching as the former requires more specific human capital than the latter. Research is also more likely to require investments in assets, leading to sunk costs such as specialized equipment for clinical trials or laboratories. Thus, we also assumed that an increase in research output is more costly than an increase in the number of graduates. This led to our first hypothesis:

Hypothesis 1: Membership in a strategic group that specializes in research rather than in teaching is associated with higher overall performance.

Moreover, strong capabilities in research may also lead to higher performance in the delivery of patient care. Especially because AMCs often cater to patients with severe conditions requiring complex treatment decisions, cutting-edge knowledge could facilitate patient care processes. Formally stated,

Hypothesis 2: Membership in a strategic group that specializes in research rather than in teaching is associated with higher performance in the delivery of patient care.

Research Design and Methods

Setting and data. Our study is based on cross-sectional data for German AMCs for the fiscal years 2002–2004. AMCs in Germany usually belong to the medical faculty of a public university, and the hospital is a fully integrated part of the medical faculty. There are also other teaching hospitals affiliated with medical faculties in Germany, but these offer much smaller teaching programs and were therefore not considered in this study. Most AMCs included were located in disparate geographic regions, but the environment in terms of funding was comparable. The criteria for being recognized as an AMC in Germany are similar with those found in Stark Rule's definition of AMCs in the United States. In 2004, diagnosis-related groups were introduced in all hospitals in Germany except for specialized psychiatric centers. AMCs are reimbursed using the same diagnosis-related group rate applied to all other hospitals. In addition, they receive limited reimbursement for heavy teaching loads and other circumstances (Schreyögg, Tiemann, & Busse, 2006). As a result, competitive pressure has increased considerably for AMCs in Germany and is comparable to the situation seen in the U.S. hospital sector.

Our primary sources of data on patient care and teaching programs were the annual reports published by the hospitals and the budget reports published by the respective state ministries. If neither was available, we sent a request for the data to the hospitals or state ministries directly. Data on patient care and teaching programs were for the fiscal year 2004. Data on research, that is, publications and inventions, were obtained from the Centrum fuer Hochschulentwicklung (CHE) report (CHE Centrum fuer Hochschulentwicklung, 2006), a detailed ranking of German institutions of higher education, and were for the years 2002–2004. There were 33 AMCs in Germany in 2004, not counting certain exceptional cases, such as medical faculties with shared hospitals. Of these 33 AMCs, several were excluded because their structure differed considerably and several hospitals did not report any data. Ultimately, we were able to include 24 AMCs in the study.

Measuring Performance Using Data Envelopment Analysis

As mentioned previously, only one empirical study has measured the performance of AMCs to date. Earlier research on strategic management, health care organization, and institutions of higher education has advocated the use of multiple measures of organizational performance. In the case of AMCs, this seems even more necessary considering the highly complex system of goals with which these institutions are faced. Because AMCs are often public or not-for-profit entities, standard performance measures such as return on investment and profitability seem inappropriate. In this situation, performance is commonly measured by estimating efficiency scores using data envelopment analysis (Hao & Pegels, 1994; Harrison, Coppola, & Wakefield, 2004). Data envelopment analysis is a mathematical linear programming technique for evaluating the relative efficiency of organizations. It uses the ratio of weighted outputs to weighted inputs to determine relative efficiency, whereby the weights are not preassigned but rather determined by the model, thus avoiding any bias of subjectively assigned weights. The model constructs a piecewise linear frontier that envelops the inefficient units. It measures inefficiency as the radial distance from the inefficient unit to the frontier and produces an efficiency score reflecting the relative efficiency of each unit (Cooper, Li, Seiford, & Zhu, 2004). DEA allows the simultaneous consideration of multiple inputs and outputs, which seems particularly well-suited for measuring the performance of AMCs.

A drawback to the traditional DEA approach is that the number of inputs and outputs is limited by the sample size. If the number of inputs and outputs is too large in relation to the sample size, the efficiency score of a substantial number of units will be equal to 1, which only qualifies these units as efficient but does not allow for any further differentiation among the efficient units.

This especially creates problems when DEA scores are used as dependent variable for regression analysis in a second step as it does not ensure effective variation between the units. To cope with this problem, we used the concept of superefficiency, which is an extension of the traditional DEA approach and which is particularly recommended in case of small samples (Andersen & Petersen, 1993). Superefficiency indicates the extent to which an efficient unit exceeds the frontier formed by other efficient units. Thus, the concept of superefficiency allows for efficiency scores beyond 1 and for assigning a clear value to each efficient unit. The concept of superefficiency and its applications in the context of hospitals have been described in detail by Vera and Kuntz (2007).

In selecting inputs and outputs, we followed the example of other studies that had developed DEA frameworks for measuring the efficiency of teaching and nonteaching hospitals (Grosskopf, Margaritis, & Valmanis, 2001; Lehner & Burgess, 1995; Jacobs, Smith & Street, 2006) and institutions of higher education (Thursby, 2000; Avkiran, 2001; Warning, 2004). For the purposes of our study, we chose three inputs. The first input variable (SUPPLIES) was the amount spent on supplies including operational expenses but excluding payroll, capital, and depreciation expenses (in 100 million Euro). Additional input variables were the number of medical and nonmedical staff measured as a staff index (STAFF) and the number of academic staff weighted by their salaries (ACAD). For generating the staff index, we aggregated the number of full-time equivalent physicians, nurses, and other staff members. Each of the three groups was weighted by the average salary the group received in 2004 according to the German pay scale for public employees (BAT). Although not all AMCs pay their employees according to this pay scale any longer, it is a good approximation of the average salary in each group. Here, it is also important to note that, according to this pay scale, there are still differences in salaries between East and West Germany; we also took these differences into account. Similarly, the academic staff variable was created by taking the German pay scale for public servants into account. We originally intended to include beds as an additional input that would have served as a proxy for capital expenses. However, when testing correlations between input variables using the Bravais–Pearson correlation coefficient, it turned out that the number of beds was correlated with the STAFF variable. To avoid a biased DEA specification (Jacobs et al., 2006), we decided to refrain from using the number of beds as an input variable for the DEA model and to use it, instead, as a control variable at a later stage of the analysis. Correlations between the remaining three input variables were either low or moderate.

To measure the output of AMCs, we considered five output variables. Including the number of inpatient and outpatient cases is generally recommended to measure patient care output (Jacobs et al., 2006). The first output variable, INPATIENT, reflects the inpatient case mix of each hospital. All hospitals in Germany use the same methodology to determine the case mix as defined by the German diagnosis-related groups. The second output variable, OUTPATIENT, is the number of outpatient visits, including outpatient surgeries and emergency room visits. Currently, the data available for outpatient cases do not allow adjustment for severity; we, therefore, included the unadjusted number of outpatient visits as an output variable. To measure the teaching output, the number of graduates is a generally accepted output measure in the literature (Avkiran, 2001; Warning, 2004). Therefore, we constructed an index that reflects the number of persons who passed medical-related degrees of different levels (EDUCATION). Whereas graduate, postgraduate, and doctoral degrees were counted as one point each, passing the so-called *Habilitation*—a German postdoctoral degree required to qualify for professorship positions—was counted as three points. Most examinations are standardized throughout Germany and are therefore comparable between different sites. The number of publications listed in the Science Citation Index is commonly used as a measure of the research output of higher education institutions (Thursby, 2000; Warning, 2004). We thus included an output variable called PUBLICATIONS, which consisted of the number of publications each AMC had in the Science Citation Index (i.e., as a proxy for quantity) multiplied by the number of times each publication was cited (i.e., as a measure of quality). However, the field of medical research is driven not only by publications but also by inventions; because of this, we also included the number of inventions registered in the official patent register as a fifth output variable (INVENTIONS).

A descriptive overview of the inputs and outputs used for our DEA model is given in Table 1. These reveal large variations between AMCs.

First, we ran a full DEA model with all of the inputs and outputs defined above. To investigate the impact that alterations to the model specifications would have on how the AMCs compared with each other and to allow for the analysis of partial performance (e.g., performance of patient care), we created four additional DEA models. The specifications of all five models are summarized in Table 2.

Strategic Group Measures and Clustering Procedure

Cluster analysis is a common way to identify strategic group structures. To identify possible strategic groups, we proceeded in three steps to increase the validity of

Table 1

Descriptive overview of aggregated inputs and outputs used for DEA

	M	*SD*	Minimum	Maximum
Inputs				
SUPPLY	120	65	25	314
STAFF	3,344	1,345	1,682	7,618
ACAD	105	44	52	248
Outputs				
OUTPATIENT	263,817	198,636	40,000	900,000
INPATIENT	70,847	29,774	34,286	165,066
EDUCATION	612	389	132	2,052
PUBLICATIONS	3,884	2,773	845	13,589
INVENTIONS	20	4	3	43

the cluster. First, we defined variables that most likely reflected an AMC's emphasis on either research or teaching. Studies of higher education institutions have suggested that the realized publication:graduate ratio is a suitable variable for clustering (Warning, 2004). Thus, we also included this variable in this study and added the realized invention:graduate ratio as a second variable. To prevent these variables from acting in concert in our analysis and possibly leading to erroneous clusters (Ketchen et al., 1993), we tested for multicollinearity, which we, however, did not detect. Second, we used Ward's approach—a hierarchical clustering method—as a guide to estimate the number of clusters present in the data as well as squared Euclidean distance to calculate proximities between variables. Third, we performed a *K* means analysis—a form of nonhierarchical cluster analysis—to test the validity of the results. *K* means analysis has the ability to reassign members to certain clusters using the results of Ward's method as a starting point (Ketchen & Shook, 1996).

Hypothesis Testing

After identifying valid clusters, we performed an OLS regression analysis to assess whether membership in the defined groups led to differences in performance. Although most studies use variance analysis to test for the existence of strategic groups, we applied regression analysis and considered a number of control variables in addition to a dummy variable for group membership. The use of control variables is particularly important in the health care context because there are usually certain structural or regulatory determinants of hospital performance that a hospital cannot fully influence. The first control variable was the number of licensed and staffed beds (BEDS), which served as a proxy for capital (Harrison et al., 2004). We also used the case mix index (CMI) as a proxy for the overall severity of treated cases. The amount of research grants acquired (GRANTS) was included as grants lead to increased input and might thus reduce performance. Finally, we included a dummy variable (URBAN) that differentiated between urban and rural location. A hospital located in a metropolitan area with population of at least 200,000 was characterized as an urban hospital and received a value of 1 for the dummy urban variable. This dummy variable was included to control for local differences in the levels of wages for staff belonging to groups other than those included in our staff index (e.g., support staff). However, as suggested by Warning (2004), urban location can also

Table 2

Specification of DEA models

	Inputs	Outputs
Full model	STAFF, SUPPLY, ACAD	INPATIENT, OUTPATIENT, EDUCATION, PUBLICATIONS, INVENTIONS
Full model without inventions	STAFF, SUPPLY, ACAD	INPATIENT, OUTPATIENT, EDUCATION, PUBLICATIONS
Patient care model	STAFF, SUPPLY	INPATIENT, OUTPATIENT
Research model	STAFF, SUPPLY, ACAD	PUBLICATIONS, INVENTIONS
Teaching model	ACAD	EDUCATION

Table 3

Correlation matrix of efficiency scores for different models

	Teaching model	Patient care model	Research model	Full model (without inventions)	Full model
Teaching model	1.00	–	–	–	–
Patient care model	−.43	1.00	–	–	–
Research model	.51	.05	1.00	–	–
Full model (without inventions)	.05	.05	.35	1.00	
Full model	.07	.70	.41	.97	1.00

indicate that urban AMCs face higher demand by students, researchers, and patients and therefore have fewer incentives to increase performance to attract these groups. We performed three regression models using the DEA superefficiency scores from three different DEA specifications as dependent variables.

Results

A correlation matrix with the efficiency scores of individual AMCs for the five models is presented in Table 3. Our results suggest that there was a moderate negative correlation between teaching and patient care, which indicates a substitutional relationship. However, we were unable to find a substitutional relationship between teaching and research. Including inventions as an output variable clearly did not have a major effect on the results because the correlation between the full model and the full model without inventions is very high. The correlation matrix indicates that, although patient care efficiency dominates overall efficiency, the inclusion of additional variables (i.e., compared with the patient care model) has an important effect on the model's comprehensiveness.

The cluster analysis identified two strategic groups based on the definition of our variables. The first group consisted of AMCs specializing in research, whereas the second group consisted of AMCs specializing in teaching. Analysis of variance supported the existence of strategic groups because significant differences were detected between the groups for both defining variables ($p < .01$). Table 4 displays the mean and standard deviation for the variables used to determine strategic groups and for the variables used in the regression analysis. The table also reveals that throughout the three models efficiency scores are higher for the group specializing in research. In general, the mean scores are higher for the full model than for the patient care model because the full model contains more inputs and outputs.

Table 5 summarizes the regression results for the three regression models. Throughout the models, group membership was coded as a dummy variable (research group = 1; teaching group = 0). Regressions with efficiency scores for the full model and the full model without inventions showed that group membership had a significant impact on the overall performance of AMCs—a finding that supports our first hypothesis. However, the relationship was weaker for the model without inventions ($p < .05$) than it was for the full model ($p < .01$). In both models, the control variables had only a minor impact on performance. The regression with the patient care model also revealed a significant relationship between group membership and performance of patient care, a finding that supports our

Table 4

Characteristics of strategic groups

	Beds	CMI	Grants	Urban	Full model	Full model (without inventions)	Patient care model	Publications: Graduates	Inventions: Graduates
Research group (n = 9)									
M	1,053.77	1.32	37.11	0.67	1.27	1.22	0.95	2.96	0.04
SD	533.12	0.11	27.68	0.05	0.25	0.24	0.17	1.12	0.01
Teaching group (n = 15)									
M	774.47	1.29	22.47	0.53	1.01	1.00	0.67	1.96	0.02
SD	203.45	0.12	9.45	0.52	0.16	0.15	0.21	0.47	0.01

Note. CMI = case mix index.

Table 5

Regression results for each model

	Full model	Full model (without inventions)	Patient care model
Independent variables			
Research group	0.27***	0.21**	0.14*
Beds	0.18	0.19	0.01
CMI	−0.58	−0.62*	−0.72**
Grants	−0.09	−0.09	−0.01
Urban	−0.14*	−0.12	−0.10
Constant	1.71****	1.74****	1.86****
R^2	0.39	0.35	0.21

Note. The coefficient for beds is multiplied by 1,000. CMI = case mix index.

*$p < .1$; **$p < .05$; ***$p < .01$; ****$p < .001$.

second hypothesis. The significance level of the coefficient for group membership was, again, lower for the patient care model than it was for the other two models ($p < 0.1$), whereas the impact of the control variable CMI increased. The drop in impact was also documented by the lower R^2 of .21 compared with .35 and .39 in the other two models. However, it seems that emphasis on research had a positive effect in all three models. Among the control variables, only urban location had a significant negative impact in the first model, whereas CMI had a significant negative impact on performance in the second and third models.

Discussion

According to our literature review, this is the first study to measure the performance of, and to examine the existence of, strategic groups among AMCs. We developed a framework that allowed the performance of AMCs to be measured and have demonstrated that strategic group theory is a useful concept for identifying patterns of strategic choice among AMCs. Our study adds to earlier approaches to strategic group research by building upon findings drawn from research on strategic groups among hospitals and higher education institutions. In our methodology, we considered a broad range of inputs and outputs that had been found to be relevant for performance in other studies. The DEA framework allowed us to define one comprehensive single measure of performance that considered the multiple aims of AMCs. By using a superefficiency approach that allowed for efficiency scores beyond 1, we improved on the approach used to measure efficiency in other studies. To define strategic groups, we incorporated recent advances in cluster analysis and tested the impact on performance by using an OLS approach that controlled for structure-related variables.

Our results revealed significant differences between groups of AMCs in terms of their focus on research. By controlling for a number of other variables, we were able to demonstrate that group membership affects overall performance. The results remained stable even after the model had been altered, although the model that did not include inventions as an output variable showed a slightly less significant association. Thus, we are able to confirm our first hypothesis that membership in a strategic group that specializes in research rather than teaching is associated with higher overall performance. As concluded in previous studies (Nath & Sudharshan, 1997), identifying criteria that are assumed to represent mobility barriers is the crucial point in strategic group research. Therefore, our findings suggest that research activity represents an important strategic variable and a mobility barrier for AMCs.

The impact of strategic group membership on performance in the delivery of patient care was lower than the impact on overall performance. However, we can still confirm our second hypothesis that membership in a strategic group that specializes in research rather than teaching leads to higher performance in the delivery of patient care. It seems plausible that staff members in research-orientated AMCs have cutting-edge knowledge that can facilitate care processes, especially in highly complex cases. However, the finding that a research specialization among AMCs leads to higher performance has not been found elsewhere. An important question arising from this is whether these results can be generalized beyond AMCs—that is, whether other hospitals can also increase their performance by initiating research programs. To address this question, future studies might seek to replicate this approach when investigating hospitals that are more loosely affiliated with higher academic institutions.

Clearly, the impact of structure-related variables is minimal, which confirms the relevance of strategic variables as opposed to structure-related variables. Urban location turned out to be significant in the first model, thus confirming our assumption that urban location would have a negative impact on performance. Because the significance of the impact of CMI increased in the patient care model, it can be assumed that differences in case mix can explain at least some differences in performance among AMCs. As expected, a higher CMI lowers the performance of AMCs.

Our study results are consistent with other studies that have found evidence supporting the existence of strategic groups among hospitals (Ketchen, Thomas & Snow, 1993; Madorran García & de Val Pardo, 2004; Marlin, Lamont, & Hoffmann, 1994; Short, Palmer, & Ketchen, 2002). However, our findings contrast with those of Warning (2004), who was not able to identify any strategic groups among universities (i.e., as opposed to university hospitals) with regard to research versus teaching. This might be explained by the complex interaction between patient care, teaching, and research in AMCs, which is different from the interaction between teaching and research in universities that do not have medical departments. Future research is needed to examine this complex interaction in AMCs in greater detail.

When interpreting our results, it is important to keep in mind that our study has several limitations. The small sample size is clearly one of these. Although small samples are common in studies on strategic groups (Bogner et al., 1996; Leask & Parker, 2007), our findings would have been more robust had our sample size been larger. A common critique of the DEA methodology is that efficiency scores vary depending on the inputs and outputs included (Jacobs et al., 2006). We addressed this concern by including different model variations that confirmed the robustness of our results. However, there might have been other relevant outputs, such as the number of emergency admissions, which we were not able to include and which may have led to other results.

Concerning the definition of strategic groups, there might have been other potential dimensions characterizing strategic behavior such as networking with general hospitals and specialties offered. The use of variables representing these dimensions was mainly limited by the availability of data. Further research should include more variables on possible strategic dimensions as well as on the structure and the regulatory environment of AMCs, which may also explain performance differences.

Finally, it might have been appropriate to include variables for quality of care, such as adjusted readmission rates, which could affect the model performance scores. However, the use of quality variables was constrained by the availability of suitable data. Moreover, we do not feel that this has subjected our study results to bias as teaching status has been found to be related to quality (Ayanian et al., 1998; Keeler et al., 1992; Taylor et al., 1999).

Practice Implications

Managers and scholars share the quest to explain performance of AMCs. This study provides important insights into the interplay of strategic choice, structural determinants, and performance of AMCs. First, our findings suggest that strategic choice of AMCs does in fact matter for performance, whereas structural determinants are of minor importance. This provides an important justification for managers to develop suitable strategic concepts for AMCs and provides a rebuttal to those who maintain that the performance of AMCs is mainly driven by external influences. Second, our study suggests that membership in a strategic group focusing on research may increase performance. Thus, if low organizational efficiency is detected, managers need to consider analyzing whether their AMC belongs to an appropriate strategic group. A clear emphasis on research may not only increase overall efficiency, but also increase efficiency of patient care. Finally, as research obviously represents a mobility barrier, a change in strategic direction will only take effect over the long term.

Acknowledgments

The authors would like to thank the participants of the 2007 Annual Meeting of the Academy of Management and two anonymous reviewers for their excellent comments.

References

Andersen, P., & Petersen, N. C. (1993). A procedure for ranking efficient units in data envelopment analysis. *Management Science*, *39*, 1261–1264.

Avkiran, N. K. (2001). Investigating technical and scale efficiencies of Australian universities through data envelopment analysis. *Socio-Economic Planning Sciences*, *35*, 57–80.

Ayanian, J. Z., Weissman, J. S., Chasan-Taber, S., Epstein, A. M. (1998). Quality of care for two common illnesses in teaching and nonteaching hospitals. *Health Affairs*, *17*, 194–205.

Bogner, W. C., Thomas, H., & McGee, J. (1996). A longitudinal study of the competitive positions and entry paths of European firms in the U.S. pharmaceutical market. *Strategic Management Journal*, *17*, 85–107.

Brennan, T. A., Hebert, L. E., Laird, N. M., Lawthers, A., Thorpe, K. E., Leape, L. L., et al. (1991). Hospital characteristics associated with adverse events and substandard care. *JAMA*, *265*, 3265–3269.

CHE Centrum fuer Hochschulentwicklung. (2006). *CHE Forschungsranking*. Guetersloh: Centrum fuer Hochschulentwicklung.

Cooper, W., Li, S., Seiford, L. M., & Zhu, J. (2004). Sensitivity analysis in DEA. In W. W., Cooper, L. M., Seiford, & J., Zhu (Eds.), *Handbook on data envelopment analysis* (pp. 75–98). Norwell, MA: Kluwer Academic Publishers.

Custer, W. M., & Wilke, R. J. (1991). Teaching hospital costs: The effects of medical staff characteristics. *Health Services Research*, *25*, 831–857.

Fisher, E. S., Wennberg, D. E., Stukel, T. A., & Gottlieb, D. J. (2004). Variations in the longitudinal efficiency of academic medical centers. *Health Affairs Web Exclusive*, Var 19–32.

Grosskopf, S., Margaritis, D., & Valmanis, V. (2001). Comparing teaching and non-teaching hospitals: A frontier approach. *Health Care Management Science*, *4*, 83–90.

Hao, S., & Pegels, C. C. (1994). Evaluating relative efficiencies of Veteran Affairs medical centers using data envelopment, ratio and multiple regression analysis. *Journal of Medical Systems*, *18*, 55–67.

Hartz, A. J., Krakauer, H., Kuhn, E. M., Young, M., Jacobsen, S. J., Gay, G., et al. (1989). Hospital characteristics and mortality rates. *New England Journal of Medicine*, *321*, 1720–1725.

Harrison, J. P., Coppola, M. N., & Wakefield, M. (2004). Efficiency of federal hospitals in the United States. *Journal of Medical Systems*, *28*, 411–422.

Hunt, M. S. (1972). *Competition in the major home appliances industry 1960–1970*. Unpublished doctoral dissertation, Harvard University, Boston.

Jacobs, R., Smith, P. C., & Street, A. (2006). *Measuring efficiency in health care*. MA: Cambridge University Press.

Keeler, E. D., Rubenstein, L. V., Kahn, K. L., Draper, D., Harrison, E. R., McGinty, M. J., et al. (1992). Hospital characteristics and quality of care. *JAMA*, *268*, 1709–1714.

Ketchen, D. J., Thomas, J. B., & Snow, C. C. (1993). Organizational configurations and performance: A comparison of theoretical approaches. *Academy of Management Journal*, *36*, 1278–1313.

Ketchen, D. J., & Shook, C. J. (1996). The application of cluster analysis in strategic management research: An analysis and critique. *Strategic Management Journal*, *17*, 441–458.

Kuhn, E. M., Hartz, A. J., Gottlieb, M. S., & Rimm, A. A. (1991). The relationship of hospital characteristics and the results of peer review in six large states. *Medical Care*, *29*, 1028–1038.

Leask, G., & Parker, D. (2007). Strategic groups, competitive groups and performance within the U.K. pharmaceutical industry: Improving our understanding of the competitive process. *Strategic Management Journal*, *14*, 723–745.

Lehner, L. A., & Burgess, J. F. (1995). Teaching and hospital production: The use of regression estimates. *Health Economics*, *4*, 113–125.

Linna, M., Häkkinen, U., & Linnakko, E. (1998). An econometric study of costs of teaching and research in Finnish hospitals. *Health Economics*, *7*, 291–305.

Linna, M., & Häkkinen, U. (2006). Reimbursing for the costs of teaching and research in Finnish hospitals: A stochastic frontier analysis. *International Journal of Health Care Finance and Economics*, *65*, 83–97.

Lopez-Casanovas, G., & Saez, M. (1999). The impact of teaching status on average costs in Spanish hospitals. *Health Economics*, 6, 641–651.

Madorran García, C., & de Val Pardo, I. (2004). Strategies and performance in hospitals. *Health Policy*, *67*, 1–13.

Marlin, D., Lamont, B. T., & Hoffman, J. J. (1994). Choice situation, strategy, and performance: A reexamination. *Strategic Management Journal*, *15*, 229–239.

McGee, J. (2003). Strategic groups: Theory and practice. In D. O., Faulkner, & A., Campbell (Eds.), *The Oxford handbook of strategy: A strategy overview and competitive strategy* (vol. 1, pp. 261–301). United Kingdom: Oxford University Press.

Mechanic, R., Coleman, K., & Dobson, A. (1998). Teaching hospital costs—implications for academic missions in a competitive market. *JAMA*, *280*(11), 1015–1019.

Mehra, A., & Floyd, S. W. (1998). Product market heterogeneity, resource imitability and strategic group formation. *Journal of Management*, *24*, 511–531.

Nath, D., & Gruca, T. S. (1997). Convergence across alternative methods for forming strategic groups. *Strategic Management Journal*, *18*, 745–760.

Nath, D., & Sudharshan, D. (1994). Measuring strategy coherence through patterns of strategic choices. *Strategic Management Journal*, *15*, 43–61.

Osborne, J. D., Stubbart, C. I., & Ramaprasad, A. (2001). Strategic groups and competitive enactment: A study of dynamic relationships between mental models and performance. *Strategic Management Journal*, *22*, 435–454.

Porter, M. E. (1979). The structure within industries' and companies' performance. *Review of Economics and Statistics*, *61*, 214–227.

Rosenthal, G. E., Harper, D. L., Quinn, L. M., & Cooper, G. S. (1997). Severity-adjusted mortality and length of stay in teaching and non-teaching hospitals: Results of a regional study. *JAMA*, *278*, 485–490.

Rosko, M. D. (2004). Performance of US teaching hospitals: A panel analysis of cost inefficiency. *Health Care Management Science*, *7*, 7–16.

Schreyögg, J., Tiemann, O., & Busse, R. (2006). Cost accounting to determine prices: How well do prices reflect costs in the German DRG-system? *Health Care Management Science*, *9*, 269–280.

Short, J. C., Palmer, T. B., & Ketchen, D. J. (2002). Resource-based and strategic group influences on hospital performance. *Health Care Management Review*, *27*, 7–17.

Short, J. C., Ketchen, D. J., Palmer, B. T., & Hult, T. M. (2007). Firm, strategic group, and industry influences on performance. *Strategic Management Journal*, *28*, 147–167.

Taylor, D., Whellan, D., & Sloan, F. (1999). Effects of admission to a teaching hospital on the cost and quality of care for Medicare beneficiaries. *New England Journal of Medicine*, *340*, 293–302.

Thursby, J. G. (2000). What do we say about ourselves and what does it mean? Yet another look at economics department research. *Journal of Economic Literature*, *38*, 383–404.

Tywoniak, S., Galvin, P., & Davies, J. (2007). New institutional economics' contribution to strategic groups analysis. *Managerial and Decision Economics*, *28*, 213–228.

Vera, A., & Kuntz, L. (2007). Process-based organization design and hospital efficiency. *Health Care Management Review*, *32*, 55–65.

Warning, S. (2004). Performance differences in German higher education: Empirical analysis of strategic groups. *Review of Industrial Organization*, *24*, 393–408.

Zuckerman, S., Hadley, J., & Iezzoni, L. (1994). Measuring hospital efficiency with frontier cost functions. *Journal of Health Economics*, *13*, 255–280.