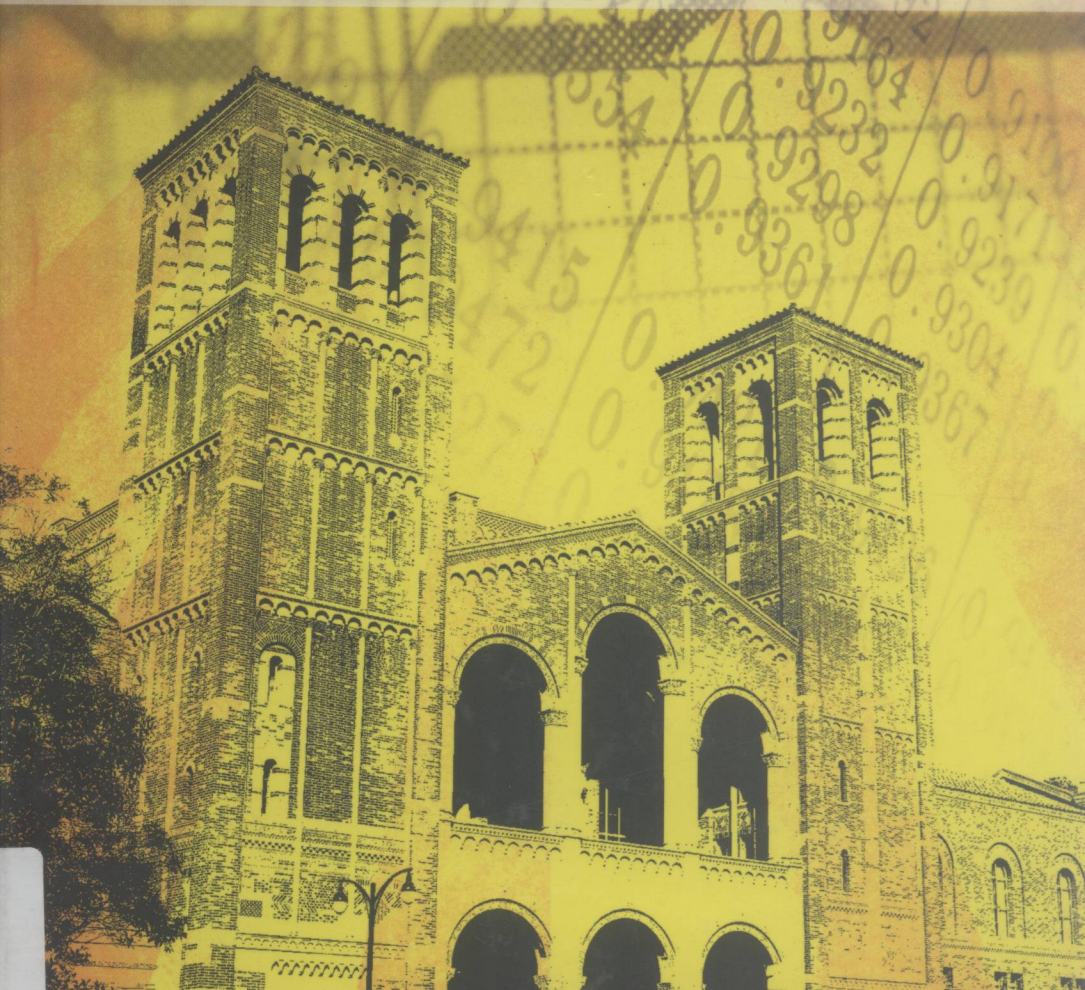




The Economic Analysis of Universities

Strategic Groups and Positioning
Susanne Warning



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Abbreviations

After WWII	Foundation after Second World War
AHI	Arts and Humanities Index
ApplU	University of Applied Sciences
ard	absolute research dominance
atd	absolute teaching dominance
av4	average over four years
av5	average over five years
BCC	Banker-Charnes-Cooper
CA	Cluster Analysis
cont.	continued
Corr	Correlation
Coun.	Country
crd	comparative research dominance
CRS	Constant Returns to Scale
ctd	comparative teaching dominance
DEA	Data Envelopment Analysis
Dep.	Department
DFG	Deutsche Forschungsgemeinschaft, German Research Foundation
e.g.	exemplum gratum
ECTS	European Credit Transfer System
FTE	Full Time Equivalents
GDP	Gross domestic product
GLS	Generalized Least Squares
I-O	Input-Orientation
i.e.	id est
ibid.	ibidem
IO	Industrial Organization
ISI	Institute for Scientific Information
MBA	Master of Business Administration
na	not available
no.	number of
O-O	Output-Orientation
OECD	Organisation for Economic Co-operation and Development
R	Research

R&D	Research and Development
ResearchQ	Research Quality
RQ	Research Quality
SCI	Science Citation Index
SciU	Scientific University
SCP	Structure Conduct Performance
SFA	Stochastic Frontier Analysis
SSCI	Social Science Citation Index
T	Teaching
T&R	Teaching and Research
TeachingQ	Teaching Quality
TQ	Teaching Quality
UK	United Kingdom
Univ.	Universities
US	United States
VRS	Variable Returns to Scale
ZA	Zivot-Andrews

Preface

When I began to work on the topic of university positioning in the year 2000, education, and higher education in particular, was on the verge of substantial changes and reforms in many countries. Discussions about performance and competition in the education sector, especially in the higher education sector, had started and intensified rapidly. University rankings became increasingly popular, even in Germany where universities previously had been considered on a par and the results of the PISA study directed attention to the education sector in general. As more and more rankings appeared in academic journals and in magazines, and proposals for reforms were put forward, education and especially higher education moved to the centre of interest for policy makers and the general public. Increased competition, manifest in a higher mobility of students and researchers as well as in higher awareness of performance and accountability, brought positioning of higher education institutions in this new competitive environment into the centre of discussion.

This book provides a theoretical and empirical analysis of strategic positioning of public universities, the type of institution to which the new competitive environment poses the greatest challenge. It will be shown that publicly funded universities are able to position themselves and have been positioning themselves for many years. Teaching and research quality serve as the two main strategic variables of universities, even in the absence of direct monetary incentives for providing high quality. The choice of quality levels in these two attributes determines a university's position in a national higher education sector. There are of course, other factors beyond the immediate control of university management that influence the university's position. Data from German public universities will be used to empirically test the theoretical reasoning.

After giving basic information on German higher education as an example of a university sector dominated by public institutions and presenting a selective survey of the literature on differences in universities' choices, i.e., heterogeneity, the book develops two theoretical approaches for the analysis of public universities. The first one, the concept of strategic groups, originates from management theory. It implies that due to different returns on investment, for the two dimensions teaching quality and research quality, there will be heterogeneity in the university sector. The second, a three-stage duopoly game of competition between universities, is motivated by the industrial economics literature. Universi-

ties in this model position themselves in terms of teaching quality and research quality in order to attract students. In equilibrium universities choose to be different from each other to enjoy a strategic effect. They differentiate maximally in one dimension and minimally in the other.

Using data for German publicly funded universities, the empirical tests apply Data Envelopment Analysis and econometric methods. Empirical evidence suggests that the strategic variables, teaching quality and research quality, affect productivity heterogeneously in the sense that their influence is significantly higher for the top universities than for the other institutions. There is heterogeneity across German universities that on closer inspection leads to the idea of a group structure based on performance. While the empirical analysis is based on German data, the theory and the empirical results offer important insights for all countries with a sector of higher education where publicly funded universities play a role.

Like every author of a book, I owe much to many people. This is the time and opportunity to express my deep gratitude to those who accompanied, inspired and guided me on this long journey.

The book originates from work done for my dissertation at the department of economics at the University of Konstanz, Germany, which I completed in spring 2005. During these years at Konstanz I had the privilege to enjoy the extremely stimulating atmosphere at the department and to grow familiar with a competitive research-oriented environment. In Konstanz I benefited especially from intensive and inspiring discussions with Professor Oliver Fabel. As my supervisor he directed my attention to the higher education sector and gave me the freedom to pursue my own way. I am very grateful to Oliver Fabel for the atmosphere in his research group, for the motivation to participate in conferences and establish first contacts in the scientific community and for his outstanding and continuing support. His influence was much stronger than he may have realized at that time.

I am also very grateful to Professor Dieter Sadowski who was on my dissertation committee. He provided me with a great work environment at the Institute for Labour Law and Industrial Relations in the European Union at the University of Trier, Germany, during the final stages of the project. His critical comments and questions undoubtedly helped to improve the book.

Over time, I have enjoyed very helpful discussions with former and current colleagues. At the University of Konstanz I am grateful to Bodo Hilgers, Gerald Eisenkopf, Erik Lueders, Dirk Schindler and Ulrich Wacker. To Erik E. Lehmann I am especially grateful for many very helpful discussions at the early stages of the project and for our close cooperation during our time at Konstanz. At the Institute for Labour Law and Industrial Relations in the European Union I am grateful to Catharina Leilich, Mihai Paunescu and Martin Schneider. For technical support, especially in the final stage of the book, I want to thank Helena Frick. For proofreading I am very grateful to Douglas Bice and Adam M.

Lederer who read different versions of the manuscript very carefully.

Parts of the research for this book were undertaken while I was a visiting researcher at the Institute for Developing Strategies at Indiana University's School of Public and Environmental Affairs in Bloomington, USA, in 2003. I benefited greatly from discussions with David B. Audretsch on various issues related to universities. I am grateful for his hospitality and his benevolence and encouragement, which have outlasted the dissertation project. Furthermore, I am grateful to Rui Baptista and Adam M. Lederer for numerous discussions on higher education systems.

I also want to thank Mikulas Luptacik for the hospitality at the Institute for Quantitative Economics at the Vienna University of Economics and Business Administration, Austria. He provided me with the opportunity to become familiar with Data Envelopment Analysis. For many discussions I am also grateful to Dieter Gstach.

I am very grateful to John J. Siegfried for constructive comments on a main paper and to participants of the International Industrial Organization Conference 2003 in Boston, USA, who motivated and encouraged me to continue working on this topic. Comments and suggestions from participants of the conferences of the Allied Social Sciences Association, the European Economic Association, the European Association for Research in Industrial Economics, the European Association of Labour Economists, the German Economic Association and the German Economic Association for Business Administration and a number of workshops also helped to improve this book.

Three anonymous referees from Edward Elgar provided extremely detailed and helpful comments. I want to express my deep gratitude to those colleagues whose suggestions helped to improve my analysis and to make my line of reasoning more compelling. I am also grateful for the support and advice from Francine O'Sullivan and Jo Betteridge at Edward Elgar who steered my book project with benevolence and efficiency.

Vera E. Troeger proved to be a dear and reliable friend and a competent and supportive colleague especially in discussions on methodological issues. To her I want to express my deep gratitude, as I do to Thomas Plümper and Peter Welzel for their unfailing support and willingness to discuss ends, sometimes loose, and to serve as sounding boards for ideas, sometimes callow. During this project they gave me encouragement, assured me of the worthiness of my efforts and told me about the new challenges awaiting me.

For financial support I am grateful to the Universitätsgesellschaft Konstanz which awarded me with the Promotionsförderpreis in 2002 and thus supported my stay at Indiana University. To EADS, Friedrichshafen, I am very grateful for the Dornier Forschungspreis 2006.

The usual qualifying remark applies; none of the above mentioned is to be held responsible for the final contents of this work or for any error contained within it.

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1 Introduction

Higher education, especially when it is publicly funded, receives increased scrutiny from politicians and the public as competition in this sector increases. This book contributes to the examination of higher education, using examples drawn from Germany. Section 1.1 motivates and introduces the line of the argument of this book. To illustrate its logic and intuition, Section 1.2 presents the organization of the study.

1.1 MOTIVATION

Higher education is a service sector moving towards a more competitive environment both nationally and internationally. Governments in a number of countries have recently taken steps to reform and strengthen their university systems. These reforms may be particularly relevant where publicly funded universities play a dominant role, as, for example, in Germany. There are a number of interesting questions that arise when we look at public universities in a competitive environment: If government provides financial means primarily on the basis of an institution's size, do they compete in quality? What is the role of research quality and teaching quality in such competition? Will these public universities turn out to be homogeneous or will they differ as a result of competition? When we look at the literature, we find that there is a lack of both theoretical and empirical research on public universities of the type found in Europe. This book helps to fill the gap in the economics of universities literature by showing theoretically and empirically how such institutions position themselves in competition. While the empirical analysis is based on German data, the results offer important insights for all countries where publicly funded universities play an important role in providing higher education.

If we take Germany as an example, we observe that international comparisons of universities have gained more and more attention during recent years. In worldwide rankings of higher education institutions, performance of German universities is rather weak. Universities from the United States, such as Harvard, Berkeley, Stanford and MIT, or from Britain, such as Cambridge and Oxford, typically hold the top ranks in international comparisons. According to the most

reliable of these global rankings, only one German institution – the Technical University of Munich – is placed among the top 50 universities in the world (Ranking of World Universities 2004).

Public institutions of higher education in Germany neither choose quality-related tuition as a price signal, nor do they systematically build up reputation by hiring outstanding researchers. Scholars working at American academic institutions have won about ten times more Nobel Prizes than the scholars from all German academic institutions together. Among politicians, prospective students and the general public, awareness of the quality of higher education in Germany has risen considerably. Against this background, German politicians have recently begun a discussion on how to improve the performance of German universities. As yet, their best idea seems to be a quality contest among German universities for excellence programs, in which the winners will receive higher funding.

At first sight, this does not look like a remarkable policy turnaround; however for Germany this change is not a trivial move, since in the past German policy always aimed to guarantee equal conditions in the German higher education sector. The concept of special financial support for 'elite universities' is therefore a new one. Traditionally, German universities of a similar size receive approximately equivalent transfers from the state governments, regardless of the quality they provide in teaching or in research. In addition, universities had only very limited freedom to select their students until very recently. Students in general are free to decide on the subject of study, on the length of study and on the university they want to attend. Most of these characteristics are more or less in a process of reform.

A closer look at German universities reveals that despite the politicians' preoccupation with equality there is dispersion in the performance of these institutions. No doubt German universities are more homogeneous than their US counterparts, still there is considerable variation in quality. In short: there is heterogeneity among German universities. This immediately raises important research questions with policy implications: Where does this observed heterogeneity come from in a system of public funding for universities, designed to establish institutions of equal quality? In which dimensions do universities actually differ?

This study provides new insights into the competitive behavior of public universities in general and the structure and conduct in German higher education in particular. Two theoretical approaches – one from management theory, the other from industrial organization – will be transferred and adapted to the sector of higher education in Germany. Applying the theoretical concepts, while taking into account important institutional factors such as public funding of universities or the absence of tuition and fees, provides new insights into the behavior of German universities and the structure evolving in German higher education. Results show that it makes sense for universities to be heterogeneous with respect

to teaching quality or research quality. These are the two strategic variables that drive the theoretical part of this study. In the empirical part of this study, another aspect is highlighted: Universities differ in their overall performance. Clusters or groups of high-ranked and low-ranked universities can be identified and the strategic variables teaching quality and research quality, supplemented by variables beyond the short- or medium-term control of university management, such as the competitive environment, regional factors and university characteristics like size or composition of fields, explain group membership. The empirical analysis in this study tests three hypotheses on heterogeneity and the role of teaching quality and research quality. It provides empirical tests for the theoretical approaches and confirms the relevance of the theoretical insights as the hypotheses cannot be rejected.

Teaching and research quality serve as the two main strategic variables of universities, even in the absence of direct monetary incentives for providing high quality levels. Influencing quality levels in these attributes determines, jointly with other factors beyond the immediate control of university management, a university's position in the national higher education sector. These two strategic variables have an impact on the performance of universities, which will be measured in the empirical analysis by a Data Envelopment Analysis score of overall efficiency. Both in the theoretical and in the empirical part of the study, strategic variables are found to influence the structure of the university sector.

The concept of strategic groups, which is the first of the two theoretical approaches applied to German universities in this study, originates from management theory. In its original version it explains why firms in an industry form a group structure with homogeneous performance within the group and heterogeneous performance between groups. This can immediately be transferred to the university sector. Specific investments act as barriers to mobility between groups and play a prominent role in this concept. Heterogeneity in the sector is the result of different returns to investment in research quality and investments in teaching quality. Universities investing in high research quality – by hiring top researchers or by improving research conditions – improve their reputation, resulting in a relatively long-lasting comparative advantage. The concept of strategic groups describes how these specific investments work like barriers to mobility. If a university wants to enter the group of high-ranked universities, it has to undertake research-related investments even though the returns of these investments will be apparent only later.

Furthermore, the impact on performance of teaching quality and research quality differs between high-ranked and low-ranked universities. This holds especially for research quality as the empirical analysis confirms. Quality has a higher impact for high-ranked universities than for low-ranked universities. Non-linear returns on investments explain these different effects on the two groups of universities. Neither potential employers nor students observe a university's small improvements in research. Only if a university ranks among the

very best universities in a specific discipline, does quality become known to the public. Whether a department performs poorly or is just average is hardly known to the public. As a consequence, improving research quality at higher ranked universities has a stronger impact on productivity than it has at low-ranked universities. Thus, different returns to investments in teaching quality and research quality lead universities to choose different positions in these two dimensions, as increasing quality for the low-ranked group promises less success than for the high-ranked group. Taken together, universities become more heterogeneous and a group structure evolves.

The second of the two theoretical approaches applied is a duopoly model of a three-stage game where universities position themselves in terms of teaching quality and research quality in order to attract students whose preferences are heterogeneous. In the first stage, universities choose teaching and research quality. Then they decide on the support level they want to provide to their students. Finally, students choose a university on the basis of teaching quality, research quality and the support level the university offers. These support levels capture the fact that German students do not have to pay tuition and fees and at the same time enjoy several infrastructure benefits from their university. In equilibrium universities choose to be different from each other to enjoy a strategic effect. They differentiate maximally in one dimension and only minimally in the other. The analysis shows that maximum differentiation prevails in the dimension where the interval of quality levels is larger. At this point an insight from the first theoretical approach, the concept of strategic groups, can be used to identify the dimension with maximum differentiation. The concept of strategic groups implies that heterogeneity in research is greater than in teaching, which is confirmed by the empirical analysis. Therefore, the equilibrium with maximum differentiation in research quality and minimum differentiation in teaching quality is the most plausible outcome from the industrial economics model of university positioning. As a result, research should have a higher impact on the probability of being in the high-ranked or low-ranked group of universities. Again, the empirical analysis confirms this insight.

Empirical evidence suggests that the strategic variables, teaching quality and research quality, have a productivity-increasing impact in German universities. However this impact is not the same for all universities, which causes the formation of groups in the sector. As claimed earlier, teaching quality and research quality affect productivity heterogeneously in the sense that their influence is significantly higher for the top universities than for the other institutions. In addition, the influence for being among the high-ranked universities based on productivity in Germany is higher from research quality than from teaching quality. Both empirical findings suggest heterogeneity across German universities, which on closer inspection leads to the idea of a group structure based on performance.

Combining two theoretical explanations for heterogeneity in higher education

– strategic groups and the formal equilibrium model – this study contributes to the literature on the strategic positioning of public universities in an environment without market prices for higher education. To test both theoretical approaches and the hypotheses derived from them empirically, a new dataset for German public universities was created. While there is a strong focus on the strategic variables of teaching quality and research quality, a considerable number of other variables had to be collected in order to control for effects from outside the university. There can be no doubt that more detailed and systematic data would have facilitated the empirical analysis. Data limitations, however, are an almost ubiquitous problem in research. Given the need to combine theory with empirical tests, this study is a first and useful attempt to shed some light on heterogeneity in the German university system and to explain heterogeneity as the result of university decisions in a system politically designed to create and sustain homogeneity.

1.2 ORGANIZATION OF THE BOOK

The study is structured as follows: Chapter 2 provides information on the institutional background of German higher education and presents some stylized facts. Chapter 3 then surveys theoretical as well as empirical contributions found in the literature on university positioning and briefly introduces general explanations of heterogeneity in an industry. Chapters 4 and 5 develop two theoretical approaches to examine and explain positioning of German universities, taking into account the characteristics of a publicly financed university system. The theoretically derived hypotheses are tested in Chapters 6 and 7 using non-parametric and parametric empirical methods. To illustrate the relation of the chapters and their logical positions in the argument, Figure 1.2 displays these relations among the different parts of the book.

Chapter 2 presents some stylized facts and institutional information on German higher education that is overseen by the federal states. Coordinating institutions and the role of the federal government are briefly mentioned. Using a production-theoretic framework, I provide data on the main output factors, teaching and research, as well as on the main input factors, scientific staff and capital. Compared to other countries, German higher education shows a rather low rate of new entrants into the university system. Altogether, the findings suggest that universities position themselves not only internationally but also nationally.

Next, Chapter 3 reviews the literature on positioning of universities, focusing on the two main attributes of universities, teaching and research. There are theoretical explanations for how universities allocate resources to teaching and research. While literature provides few explanations for heterogeneity of universities, general theoretical approaches for firms in for-profit industries offer

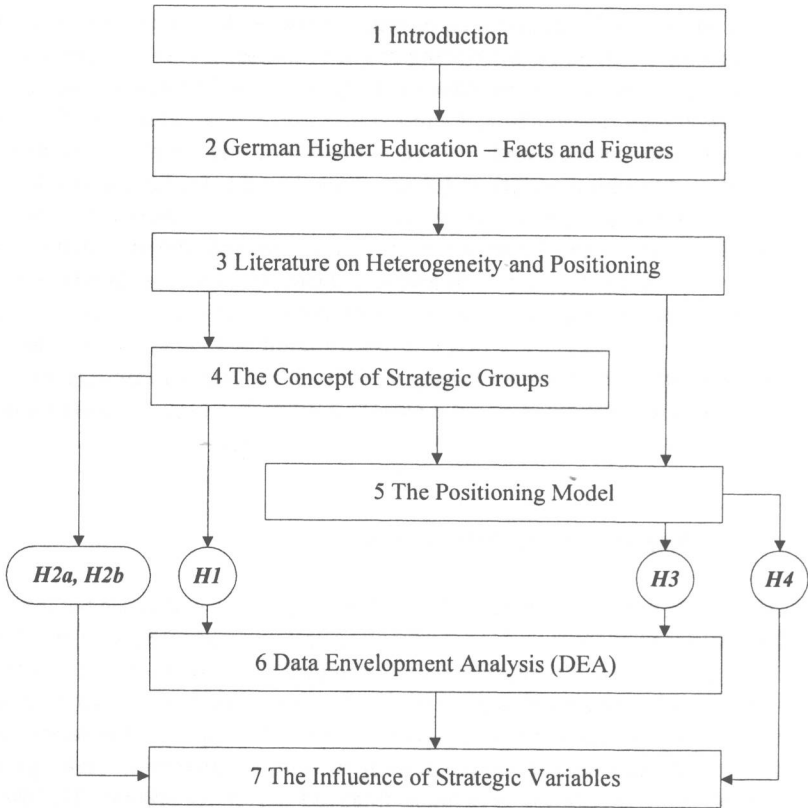


Figure 1.1 Relation of the Chapters

a variety of explanations for heterogeneity and different positioning of firms within a sector. The two approaches examined more in detail are the concept of strategic groups from management theory and the differentiation models from industrial organization. There are, however, empirical studies on higher education that put forward heterogeneity in teaching and in research, mapped by performance in these two dimensions. Also, studies on overall performance of universities are widespread and provide clues for the existence for heterogeneity.

Chapters 4 and 5 develop theoretical approaches for explaining heterogeneity in higher education. One-dimensional indicators in German higher education and overwhelming empirical evidence for heterogeneity beg for an explanation. Both approaches offered in Chapters 4 and 5 deal with positioning of universities in a higher education sector. Chapter 4 transfers the concept of strategic groups from business firms to universities, focusing on performance differences by examining teaching and research quality as strategic variables that influence a university's position. Different returns to teaching quality and research quality

lead to a group structure in the sector of higher education. The hypotheses claim that heterogeneity is greater in research than in teaching (*H1*) and that the impact of teaching quality and of research quality is greater for the group of high-ranked universities than for the group of low-ranked universities (*H2a*, *H2b*). An explanation in the tradition of industrial organization in Chapter 5 supplements this explanation for heterogeneity originating from business administration.

Chapter 5 develops a two-dimensional formal differentiation model to reveal positioning of universities in equilibrium. Taking into account the stylized facts of German higher education, especially public financing and students paying no tuition and fees, the model concentrates on teaching and research as separate tasks of universities and predict equilibrium with maximum differentiation in one dimension and minimum differentiation in the other dimension. It hypothesizes that universities attach greater weights to teaching than to research (*H3*). Taking findings from the concept of strategic groups into account, I argue that maximum differentiation occurs in research, while minimum differentiation occurs in teaching. The hypothesis claims that the probability of being a high-ranked university depends more on research quality than on teaching quality (*H4*).

Based on data from 1997 through 2000, Chapters 6 and 7 test the hypotheses derived from the theory of strategic groups and the positioning model for German universities. Applying the non-parametric method of Data Envelopment Analysis, Chapter 6 empirically reveals not only heterogeneity in teaching and research (*H1*), but also overall performance differences across institutions of higher education in Germany. Chapter 7 examines these performance differences with econometric methods by considering teaching quality and research quality as strategic variables, controlling for given university characteristics, competitive factors and environmental variables which are not under the control of university management. Taken together, the results lend support to the hypothesis of strategic groups. They confirm the existence of a heterogeneous impact of research quality (and, respectively, teaching quality) on performance (*H2a*, *H2b*). Finding differences in the influence of the two strategic variables on membership of the high-ranked university group supports the positioning model (*H4*). To sum up, Chapters 6 and 7 provide empirical evidence for heterogeneity across German universities which results in a group structure suggested by the theoretical approaches in Chapters 4 and 5. Finally, Chapter 8 summarizes the results.