Effects of Ownership on Hospital Efficiency in Germany – a Tobit Panel Data Approach Based on DEA Efficiency Scores

7th European Conference on Health Economics, Rome, July 24, 2008

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Theoretical Background

- According to the social view
  - Public firms are capable of curing market failures
  - Public firms are expected to maximize social welfare whereas private firms are expected to maximize profits

- Strong critique of this theory by Agency-, Property Rights-, Public Choice- and Organization Theories due to
  - Large differences in objectives, incentives and control mechanism
  - Political interference that result in over employment, etc.
  - Differences in organizational characteristics (culture, organization structure, etc.)

- From a theoretical point of view private ownership is superior due to a higher performance
Characteristics of the German hospital sector

- Hospital costs are the largest proportion of health expenditures in Germany
  -> hospital sector was subject of a number of health care reforms; introduction of DRGs in 2002

- Substantial changes in terms of service provision and market structure
  -> Sectoral borders decline, average length of stay ↓ and number of cases ↑, increasing importance of quality insurance
  -> Number of beds were reduced due to overcapacities, formation of cooperation's and networks, ongoing privatization

  -> The hospital environment is characterized by a consolidation and reorganisation process

  -> Hospitals enforce their efforts to cope with new competitive challenges by improving the efficiency of their operations
Empirical Background

• Latest literature reviews; Shen et al. 2005, Hollingsworth 2003 and Sloan 2000
   -> Most of the studies show no significant differences between private-for-profit and non-for-profit hospitals
   -> In contrast to assumed behaviour in the economic theory, public hospitals are more efficient
   -> Private for-profit hospitals generate higher profits; this might be due to lower costs and especially due to higher prices and higher revenues per case

• Only a few studies examine the efficiency of the German hospital sector; studies have major drawbacks
   -> High level of aggregation (precludes adequate control of case-mix)
   -> Quality of efficiency parameters (detailed data rarely available)
   -> No accounting for the environmental and organizational characteristics (one-stage analysis)
   -> No indicators for quality of care included
Objectives

• To determine the relative efficiency of public, private-for-profit and non-for-profit hospitals in Germany

• To explain variation in technical efficiency of hospitals according to ownership status and other explanatory factors (organizational and environmental characteristics)

• To determine the changes in productivity over time

-> Based on previous studies our hypothesis is: Public hospitals are more efficient
Data sample

- Data were obtained for the years 2002-2005 from annual hospital reports which are administered by the Federal Statistical Office of Germany.

- Due to data security issues we got randomly selected data for two thirds of the German acute care hospitals (n=1423).

- Exclusion criteria: hospitals providing only psychiatric care, day clinics, number of beds ≤ 50, content based plausibility checks.

- Balanced panel for the years 2002-2005; 982 hospitals per year remained in the sample.
Five types of ownership in the German hospital sector

• Public I – organizationally and legally integrated in the public authorities
• Public II – organizationally and legally independent
• Public III – organizationally and legally constituted as private firms
• Non-for-profit
• Private-for-profit

Autonomy of the hospital management
Methods

1) Data Envelopment Analysis (DEA) to determine the technical efficiency of the hospitals in Germany

2) Bootstrapping-procedure in order to validate the DEA Efficiency Scores

3) Tobit-Random-Effects-Regression with bootstrapped dependent “DEA Efficiency Scores”
   -> To determine the effect of ownership status and other explanatory factors on hospitals efficiency
## Inputs and Outputs

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
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<tbody>
<tr>
<td>Clinical staff (FTE)</td>
<td>Hospital cases</td>
</tr>
<tr>
<td>Nursing staff (FTE)</td>
<td>Inverse inhouse mortality</td>
</tr>
<tr>
<td>Medical and technical staff (FTE)</td>
<td></td>
</tr>
<tr>
<td>Administrative staff (FTE)</td>
<td></td>
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<tr>
<td>Other staff (FTE)</td>
<td></td>
</tr>
<tr>
<td>Supplies (in mn €)</td>
<td></td>
</tr>
<tr>
<td>Independent variables</td>
<td>DEA I</td>
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<tr>
<td>---------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Public I (integrated)</td>
<td>0.023***</td>
</tr>
<tr>
<td>Public II (independent)</td>
<td>0.026**</td>
</tr>
<tr>
<td>Public III (private)</td>
<td>0.030***</td>
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<tr>
<td>Non-for-profit</td>
<td>0.006</td>
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<tr>
<td>Private-for-profit</td>
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</tr>
<tr>
<td>Market competition (HHI)</td>
<td>0.074***</td>
</tr>
<tr>
<td>Number of beds (in thds.)</td>
<td>0.039***</td>
</tr>
<tr>
<td>East Germany</td>
<td>0.023***</td>
</tr>
<tr>
<td>Ambulatory Care</td>
<td>-0.017***</td>
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<tr>
<td>Funding</td>
<td>-0.046**</td>
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<tr>
<td>Teaching</td>
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<tr>
<td>Conversion</td>
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<tr>
<td>28 Case-Mix variables</td>
<td>included</td>
</tr>
</tbody>
</table>

* p ≤ 0.05; ** p ≤ 0.01; *** p ≤ 0.001
Number of beds and ownership

![Graph showing the relationship between number of beds and efficiency for different ownership types.]

- Private-for-profit
- Public
- Non-for-profit
Market competition and ownership

The diagram illustrates the relationship between market competition (Hirschmann-Herfindahl-Index) and efficiency, with predicted values, across different types of ownership: private-for-profit, public, and non-for-profit. The x-axis represents market competition, while the y-axis represents efficiency. The lines show how efficiency changes with varying levels of market competition for each type of ownership.
Changes in productivity over time

Efficiency (predicted values)

Year

Private-for-profit

Public

Non-for-profit

2002

2003

2004

2005
Discussion I

• Public ownership status is superior due to a higher performance; private-for-profit and not-for-profit hospitals are inefficient to the same extent

• Interaction effects of ownership status and number of beds and market competition

> Ongoing privatization might not be appropriate in order to ensure the best use of the scarce resources in the hospital sector

> Private hospital chains might change their acquisition strategy concerning size and location of hospitals
Discussion II

• Limitations:
  1) Additional in- and outputs for example ambulatory cases
  2) Additional explanatory factors (environmental and organizational characteristics)

• Further research:
  -> To measure and compare the efficiency of privatized hospitals and to assess their ability to increase efficiency