

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

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Oliver Tiemann, Jonas Schreyögg

Dept. of Health Care Management,
Faculty of Economics and Management,
Berlin University of Technology

Introduction

- **A large number of empirical studies have investigated whether organizations with different ownership status differ in terms of efficiency**
 - **Their Findings have been contradictory; no clear evidence on impact of ownership**
 - > Many studies have data and methodological limitations
 - **The German hospital sector seems to be a fruitful field for inquiry**
 - > Large market (large data sample)
 - > Five different types of ownership have co-existed for decades
- > Objective: To determine the impact of ownership on hospital efficiency in Germany**

Theoretical Background

- **According to the theory of public goods**
 - > 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 theory, public choice and organization theories due to**
 - > Substantial differences in objectives, incentives and control mechanisms
 - > 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 efficiency**

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; e.g. 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 German hospital sector is facing an extensive process of consolidation and reorganization**
- > Hospitals enforce their efforts to cope with new competitive challenges by improving the efficiency of their operations**

Empirical evidence and development of hypotheses I

Latest literature reviews on hospital performance were conducted by Shen et al. in 2007 and Hollingsworth in 2003

- > The conventional assumption that private for-profit hospitals operate more efficiently was not supported by Shen et al.
- > Shen et al. showed that private for-profit hospitals put greater emphasis on earning profits (i.e. higher revenues per case due to higher prices)
- > Hollingsworth concluded that public hospitals in Europe and the United States appear to outperform private for-profit hospitals in terms of efficiency
- > **Hypothesis 1.** Public hospitals are more efficient than private for-profit or private non-profit hospitals

Empirical evidence and development of hypotheses II

Only a few studies have investigated the efficiency of the German hospital sector to date; most of them have important drawbacks:

- > The quality of the information used to assess efficiency is often problematic (e.g. aggregate state-level data)
 - > The absence of patient-related data precludes adequate control for differences in case-mix
 - > Studies often used DEA alone, two-stage analysis allows for inclusion of determinants of efficiency
 - > No quality issues addressed in efficiency models
- > Hypothesis 2.** The quality-adjusted efficiency of public hospitals is higher; differences can be expected to decrease due to a trade-off between efficiency and quality of care (Morey et al. 1992; Deily and McKay 2006)

Data sample

- **The data were derived from the annual hospital reports collected and administered by the German Federal Statistical Office**
 - > covers all public, private for-profit, and private non-profit hospitals in Germany
 - > contains hospital-level information on costs, hospital infrastructure, and patient-level information on age, diagnoses, and certain procedures performed per case
- **Because of data privacy issues, we got randomly selected data from only two-thirds of German acute care hospitals (n = 1318)**
- **Exclusion criteria: hospitals providing only psychiatric care, day clinics, number of beds ≤ 50 , content-based plausibility checks**
- > **Finally, a balanced panel for the years 2002 - 2006 was created; a total of 952 hospitals remained in the sample (n = 4760)**

Five types of ownership in the German hospital sector

- **Public I (50% of public providers)**
-> are legally and organizationally (i.e. management board, budget constraints) an integrated part of the public authority at the local level (e.g. municipalities)
- **Public II (15% of public providers)**
-> operate independently, but under public legal form
- **Public III (35% of public providers)**
-> operate independently, but these providers run under a private legal form; state is the main shareholder
- **Private non-profit**
- **Private for-profit**

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 while controlling for patient heterogeneity and exploring the impact of hospital organizational and environmental characteristics

Inputs and Outputs

Inputs

Clinical staff (FTE)

Nursing staff (FTE)

Medical and technical staff (FTE)

Administrative staff (FTE)

Other staff (FTE)

Supplies (in mn €)

Outputs

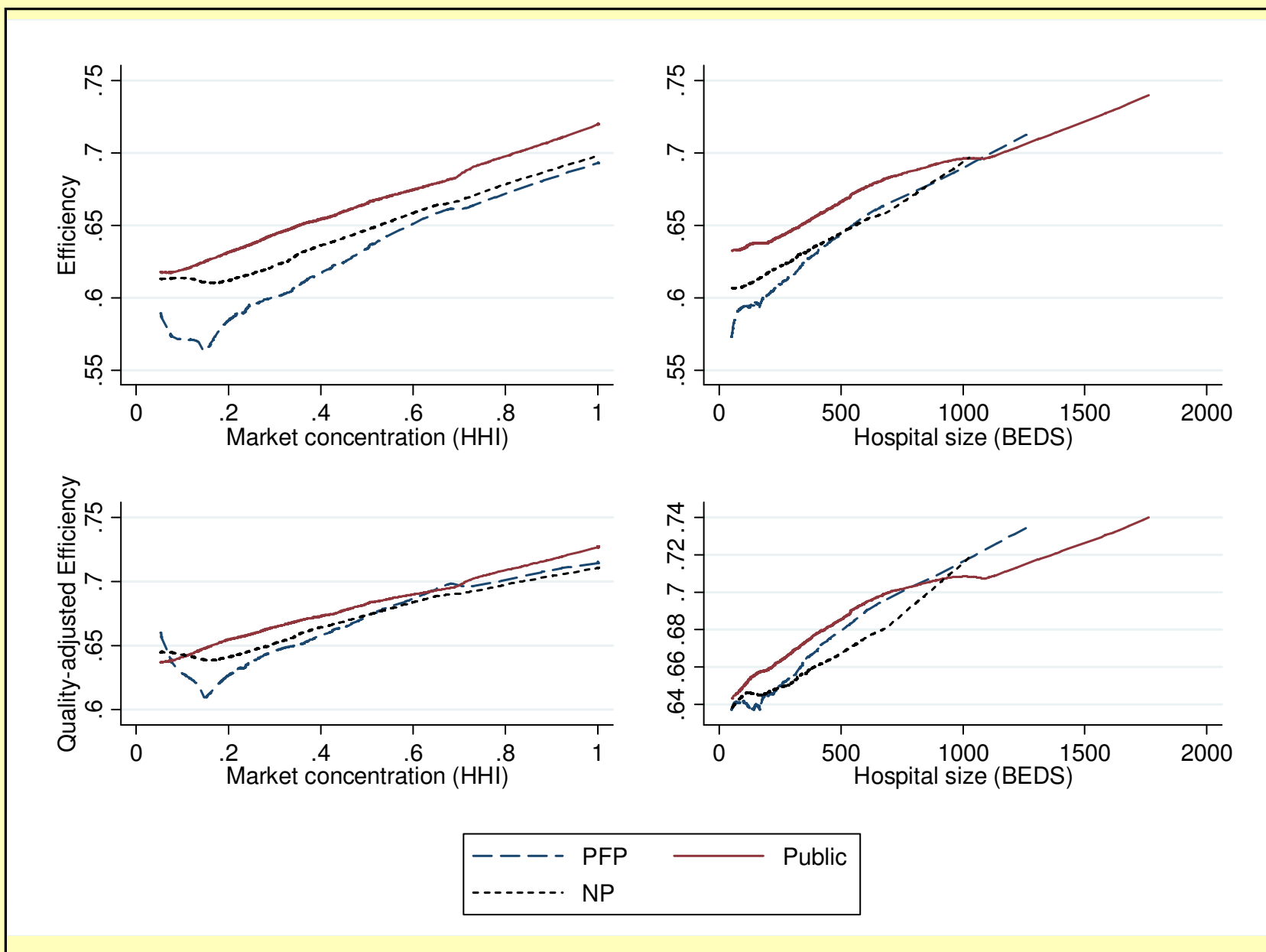
Hospital cases

Inverse inhouse mortality

Regression results

	DEA I	DEA II	DEA III
<i>Independent variables</i>			
PUBLIC I	0.024***	0.029***	0.018**
PUBLIC II	0.021*	0.037***	0.037***
PUBLIC III	0.027***	0.026***	0.018*
NFP	0.015*	0.017*	-0.010
PFP	served as reference category		
HHI	0.075***	0.074***	0.061***
BEDS (in thousands)	0.057***	0.078***	0.062***
EAST	0.013*	0.014*	0.024***
AMBULATORY	-0.015**	-0.016***	-0.025***
HIRED BEDS	0.041*	0.044**	0.033*
TEACH	0.000	-0.002	-0.008
CONVERSION	0.002	0.005	0.010
26 case-mix variables	included	included	included
* p≤0.05; ** p≤0.01; *** p≤0.001			

Market concentration, hospital size and ownership



Discussion I

- **Public hospitals performed significantly better than their private counterparts, while private non-profit hospitals outperformed private for-profit hospitals**
 - **Public hospitals should make use of their higher efficiency as a competitive advantage**
 - > e.g. participation in the German national cost data study (used to calculate DRG cost weights) to put pressure on competitors
 - **Interaction effects of ownership status and hospital size and market competition**
 - > significant positive impact of hospital size and a significant negative impact of competitive pressure on hospital efficiency
- > Ongoing privatization might not be appropriate in order to ensure the best use of the scarce resources in the hospital sector**
- > Private for-profit hospital chains may be advised to change their acquisition strategy concerning hospital size and location of hospitals**

Discussion II

- **Limitations:**

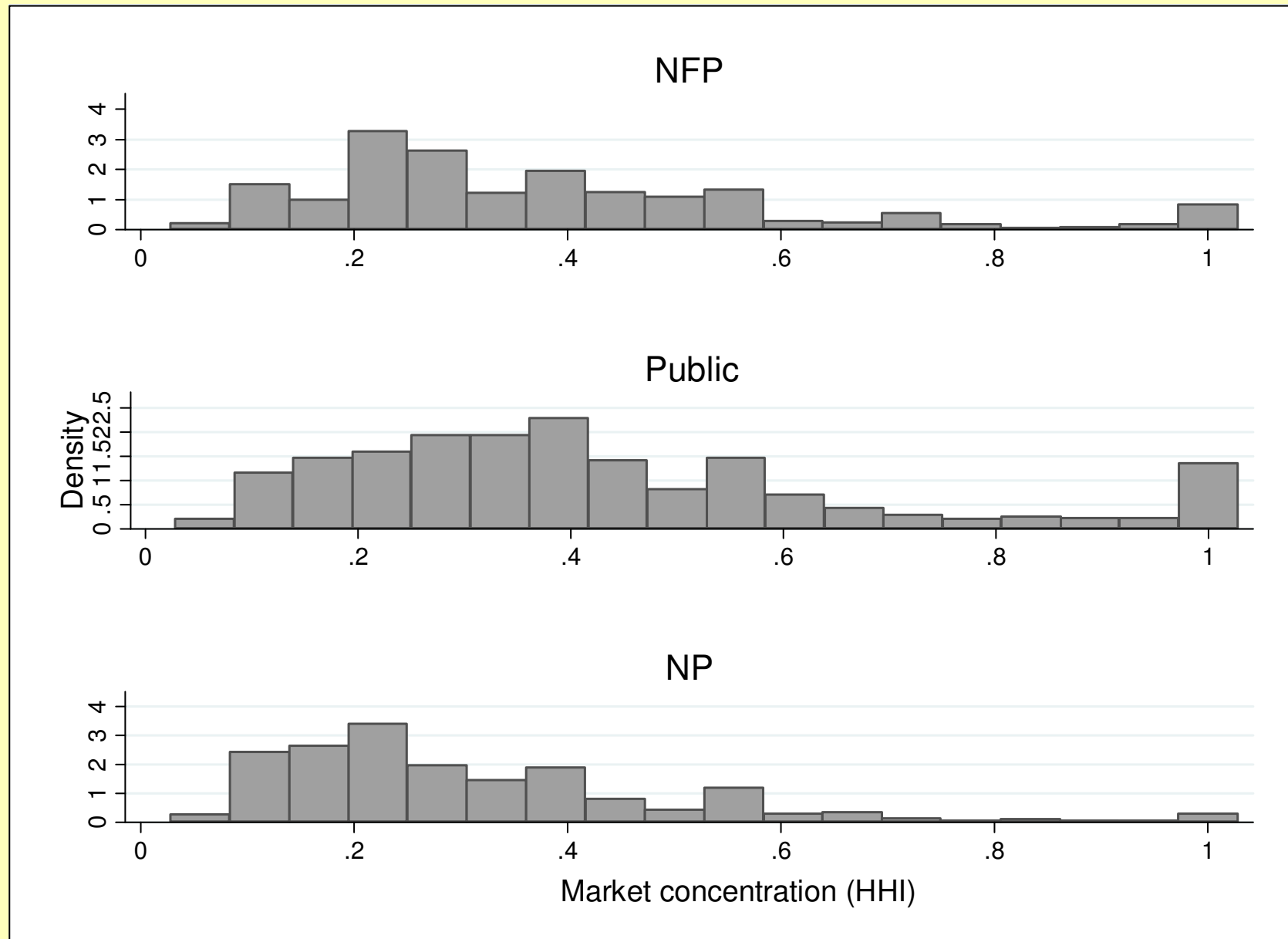
- 1) Additional in- and outputs (e.g. ambulatory cases as an output or capital as input)
- 2) Additional explanatory factors (i.e. environmental and organizational characteristics)
- 3) Mortality as the only indicator for quality of care
- 4) SFA in addition to DEA

- **Future research:**

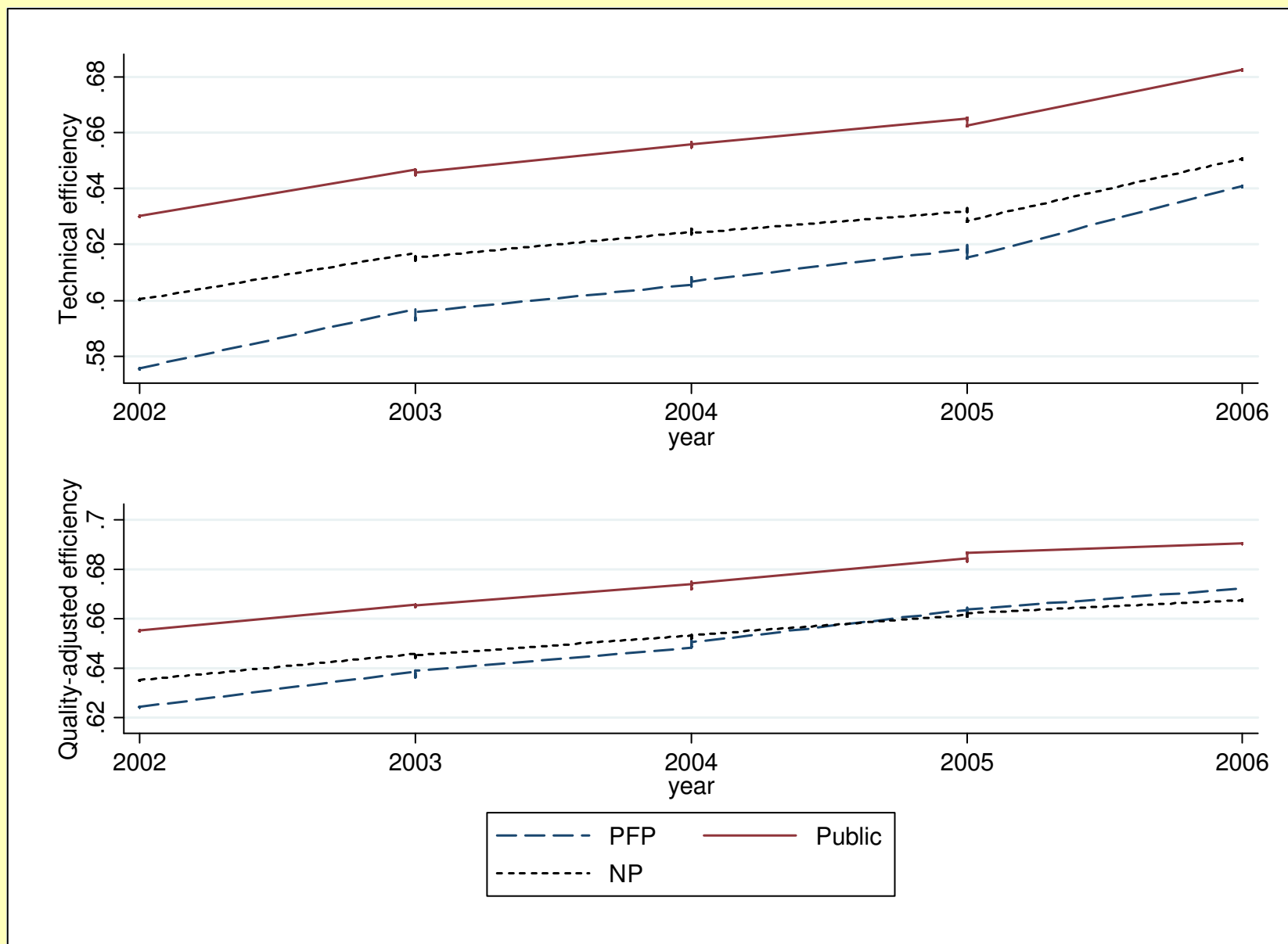
- > To measure and compare the efficiency of privatized hospitals and to assess their ability to increase efficiency

Backup

Market Concentration and Ownership



Changes in Productivity over time



Specification of DEA Models

Models*	Trimming	Output
DEA I	With university hospitals	INPATIENT
DEA II	Without university hospitals	INPATIENT
DEA III	Without university hospitals	INPATIENT & INVERSE-MORTALITY

*Models are estimated per year (2002-2006)

Measuring Hospital Performance

- **Hospitals are often public or non-profit entities; standard performance measures seem inappropriate (e.g. return on investment and profitability)**
 - > In this situation, performance is often measured by efficiency criteria
- **Our study focuses on technical efficiency; a key concept in measuring performance which refers to the optimal use of resources in the production process**
 - > In particular, technical efficiency is a measure of how well an organization produces output from a given amount of input

Descriptive Overview

Average resource consumption per case^a

Ownership status	Clinical staff ^b	Nursing staff ^b	Med.-Tech. staff ^b	Admin. staff ^b	Other staff ^b	Supplies ^c
Public I	0.008	0.021	0.017	0.004	0.009	1.544
Public II	0.011	0.024	0.025	0.006	0.011	2.369
Public III	0.007	0.020	0.013	0.003	0.008	1.338
Private non-profit	0.006	0.021	0.012	0.004	0.007	1.197
Private for-profit	0.007	0.019	0.012	0.004	0.006	1.595

^aPooled sample including university hospitals and hospitals with beds ≥ 50 , ^b in FTE, ^c in ths €