Organisational capital and hospital performance: Analysis for three countries
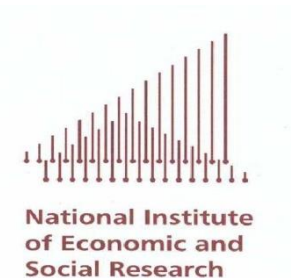
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Presentation at the SPINTAN workshop,
12-13 November 2015, Valencia

- The main aim is to explore the impact of intangible organisational capital on hospital performance

- Each country has different ways of producing health services and unique data sources so estimating identical specifications for each country is not feasible.

- Instead we try to work within a broad common framework but allow flexibility in terms of how variables are measured and the variables included in the regressions

Estimate:

$$\ln Y_{it} = \alpha + \Sigma\beta_j \ln L_{jjt} + \Sigma\gamma_k \ln K_{kit} + \pi \ln INT_{it} + \Sigma\delta_n Z_{nit} + e_{it}$$

where

Y = measure of performance

L = labour input

K = other inputs

INT = intangibles

Z = control variables

i = hospital

Measuring intangible investments

- All three countries use a similar method for own account OC based on 20% of payments to managers based on Corrado et al. (2005, 2009)

- All three include clinical managers as well as general managers

- Hospitals are <u>professional bureaucracies</u> characterized by distributed leadership between
  - doctors (differentiated by clinical levels)
  - qualified nurses and
  - administrative staff

Measuring intangible investments

- In Germany the percent of clinical professionals time devoted to management is taken from survey results

- For the UK, the NHS workforce census allows a distinction between professional and general managers although an assumption is required for hospital consultants

- In Hungary the workforce is classified according to if they are in a Leading position or not and if they are employed in the main activity, auxiliary activity or ancillary activity

- Also for Hungary there is information on purchased professional services

Performance

All three use cost weighted activities as a measure of overall performance of hospitals

For Germany this is adjusted for mortality rates

We are also exploring the use of other measures such as activity rates for major conditions such as heart disease, musculoskeletal conditions and cancer, waiting times and mortality rates

Control variables

All countries include the size of hospitals and of local area control measures such as unemployment

Others vary by country, e.g. hospital type, prevalence of diseases in the local population

Impact of Own Account Organisational Capital on German Hospital Performance

Presentation at SPINTAN workshop, Valencia, Nov 12-13 2015
Erika Schulz
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Overview

- 1. Measuring OC in German hospitals

- 2. Database: German Hospital Statistic

- 3. Descriptive Statistics

- 4. Empirical Results

- 5. Conclusion

- **Formula:**

$$INT_{ijt} = 0.2 * wage_{ijt} * FTE_{ijt} * \text{share of management tasks}_j$$

INT= Investments in organizational capital, i = hospital, j = professional group, t = time

Share of management tasks is based on a survey of time spent on managerial and administration tasks in German Hospitals (HIMSS EUROPE, 2015)

Includes consultants, medical directors, assistant physicians, qualified nurses and administration staff

The German data does not separately identify general managers

- Organisational Capital is calculated according to Görzig/Piekolla/Riley (2011)

- Capital stock at the end of the year is equal the investments in OC of the year plus the capital stock at the beginning of the year reduced by the depreciation rate

- **Formula**:

- $K_{OCit} = I_{OCit} + (1-\delta_{OC})K_{OCit-1}$. With δ as depreciation rate = 0.4

- The initial capital stock is calculated

- $K_{\varnothing-1} = \hat{I} \, (1-(1-\delta-g)^T)/(1-(1-\delta-g))$ with $\hat{I}$ is an estimated starting value of $I_{\varnothing-1}$ and g is the average growth rate of OC in the sample;

2.1 Database: German Hospital Statistics

- Yearly census of all hospitals in Germany (2006-2012)
- Selection:
  - General Hospitals using a DRG reimbursement system and contract with the statutory health insurance
    - → relevant for availability of key variables
  - Only hospitals with an internist and/or surgical department
    - → better comparability
  - Exclusion of bottom and top 1 % hospitals for the key variables
    - → account for implausible/unreliable data
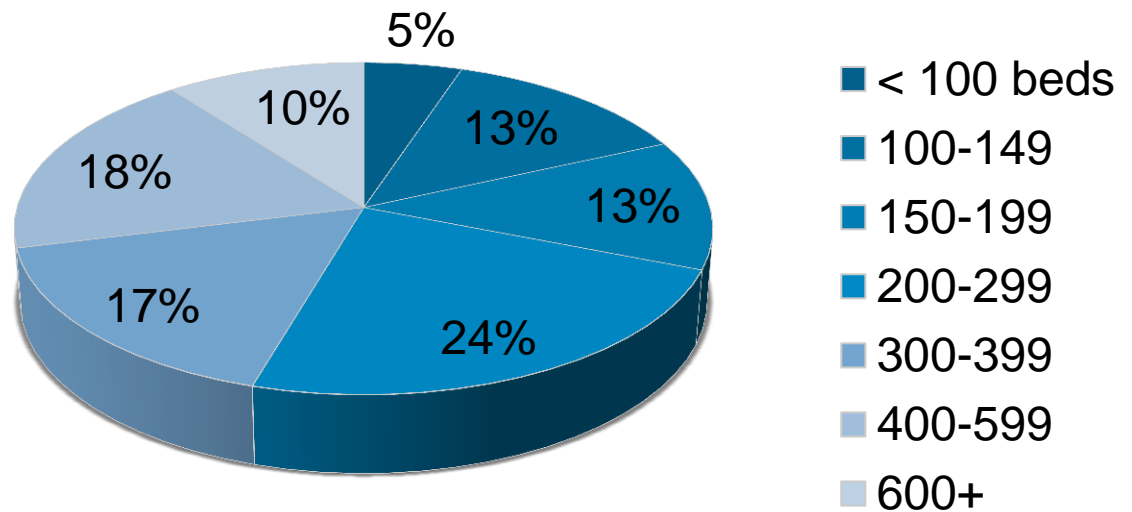 - Information available for all 7 years
    - → balanced panel

2.2 Database: Sample

Ownership

- Public
- Charitable
- Private
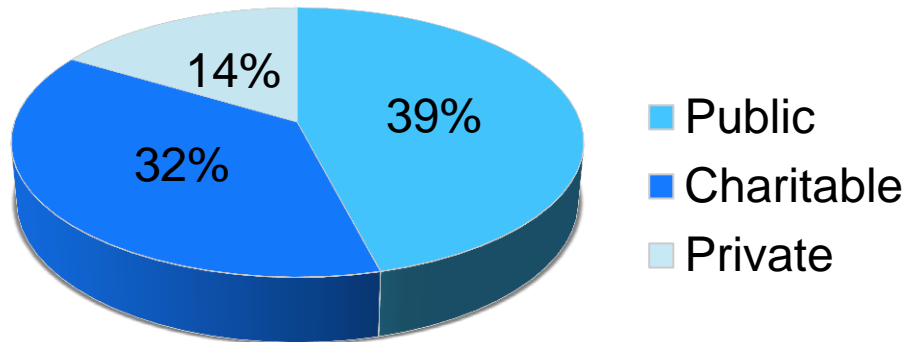
925 hospitals per year, in total 6475

Size

- < 100 beds
- 100-149
- 150-199
- 200-299
- 300-399
- 400-599
- 600+

Mean of number of staff per hospitals	2012
Doctors in managerial capacity	9
Assistant medical director	25
Assistant physician	67
Attending doctors	3
Doctors total	**101**
Qualified nurses	240
Unqualified nurses	26
Nursing personnel total	**266**
Medico-technical services	95
Functional services	83
Administrative services	44
Other personnell	66
Service personnel total	**288**
Total personell	**655**
Source: Federal Statistical Office, Hospital statistics.	

	Total per year			
	total (million)	public	charitable	private
2006	951	49%	40%	11%
2008	993	47%	40%	13%
2010	1.060	47%	40%	13%
2012	1.098	46%	41%	14%
	Per inpatient per year			
	average	public	charitable	private
2006	87	91	83	88
2008	86	89	82	87
2010	88	91	85	89
2012	87	89	84	85
Source: Federal Statistical Office; Hospital statistics				

- Specification A: $Ln\ Y_{it} = ln\ L_{it} + ln\ K_{it} + ln\ INT_{it} + Z_{it} + u_{it}$

- Variables:
  – Y = inpatients*cmi*survival rate (= approx. cost weighted output index)
  – L = total number of full-time staff
  – K = real material costs
  – INT = Investment in Organisational Capital (previous slide)*
  – Z = Control Variables

- Methods used:
  – Cross Section OLS for each year
  – Panel Fixed Effects

4.1 Results: cross sectional 2012

	Investment	Capital Stock
InvOrgCapital (log)	0,265***	0,157***
labour (log)	0,264***	0,353***
material costs (log)	0,340***	0,354***
sizecat	0,046***	0,049***
charitable	0.012	0.014
private	0,062***	0,059***
university hospital	-0,204**	-0,223***
share females	-0.055	-0,50
share 75+	0.038	0.049
op rate	0,082***	0,085***
mean length of stay	-0,024***	-0,025***
share qualified nurses	-0.043	0.034
GDP/capita	-0,002**	-0,002***
_const	-1,573***	-1,086***
number of observations	925	925
R^2	0.969	0.969

4.2 Results: Panel Analysis, FE with time dummies

	Investment	Capital Stock
InvOrgCapital (log)	0,227***	0,190***
labour (log)	0,272***	0,346***
material costs (log)	0,201***	0,214***
sizecat	0,056***	0,060***
charitable	0.008	0.005
private	0,028*	0,026*
share females	-0,175**	-0,165**
share 75+	-0443***	-0,467***
op rate	-0,009	-0,008
mean length of stay	-0,010***	-0,009***
share qualified nurses	-0,042	0,058**
GDP/capita	-0,000	-0,000
_const	1,203*	0,784**
number of observations	6475	6475
R²	0.961	0.961

4.3 Extension: wage weighted labour input, FE &TD

	Investment	Capital Stock
InvOrgCapital (log)	0,256***	0,217***
wage weighted labor (log)	0,224***	0,293***
material costs (log)	0,197***	0,211***
sizecat	0,055***	0,062***
charitable	0.003	-0,001
private	0.022	0.018
share females	-0,247***	-0,231***
share 75+	-0,470***	-0,501***
op rate	0.001	0.003
mean length of stay	-0,007**	-0,006*
share qualified nurses	-0,104**	0,000
GDP/capita	-0,000	-0,000
_const	1.225	0,779**
number of observations	6216	6216
R²	0.962	0.961

- Focus on patients with the need of special/urgent treatment
    - CHF = I11 Hypertensive heart disease
    - GIH = I67 Other cerebrovascular diseases
    - STR = I65 Stroke
    - I50 = I50 Cardiac failure
    - I63 = I63 Ischaemic stroke
    - AMI = I21-25 Ischaemic heart disease without Angina pectoris
- **Output: Y = inp. with diag. * survival rate of diag.**
- First results show also a significant positive impact of IOC on output

5. Conclusions

- IOC as well as OC have a significant influence on hospital output in both model specifications shown
- Contrary to our expectations the share of females and the share of elderly (75+) have no significant impact
- Larger hospitals and private hospitals perform better
- The length of stay has a significant negative impact
- Other control variables as proxies for competition show no significant influence.

Hospital performance in Hungary

The model-specification

prepared by Antonia HÜTTL and Agnes NAGY

Valencia, November, 12-13th, 2015

The variables

- The level of hospital performance expressed as the number of cases classified to DRGs as the dependent variable.

- The explanatory variables represent labour input, other running costs and organisational capital, both purchased and own produced.

- Purchased organisational capital is expressed as purchase of professional services.

- Own produced as the number of leading clinical professionals and high level general managers.

- Some additional control variables are also used.

Data sources

Two databases are merged at hospital level. One is managed by the National Health Insurance Fund (NHIF) and provides data on activities by DRGs. The second database consists of the financial reports of hospitals which are budget units classified to government.

We consider general hospitals to be comparable that are inpatient care facilities with department of surgery, gynaecology and general internal medicines.

Altogether we selected 60 hospitals from the 142 (2013) financed by NHIF according to DRGs. Data are available for the period 2010-2013.

Selected Hospitals' and Total Active Inpatient Care

SELECTED HOSPITALS' ACTIVITY	2010	2011	2012	2013
Number of cases, '000	1 592,2	1 619,7	1 607,0	1 613,9
(Actual) weighted case number, '000	1 520,7	1 553,9	1 546,8	1 572,4
Number of nursing days, '000	8 934,3	8 875,1	8 804,9	8 734,1

TOTAL ACTIVE INPATIENT CARE	2010	2011	2012	2013
Number of cases, '000	2 179,3	2 210,9	2 191,1	2 199,0
(Actual) weighted case number, '000	2 266,1	2 314,3	2 294,9	2 319,8
Number of nursing days, '000	11 950,5	11 862,7	11 758,7	11 561,0

SELECTED/TOTAL, %	2010	2011	2012	2013
Number of cases	73,1	73,3	73,3	73,4
(Actual) weighted case number	67,1	67,1	67,4	67,8
Number of nursing days	74,8	74,8	74,9	75,5

Source: NHIF

Organisational capital

	Leading Position	Total employees
Employed in principal activity within the institution	46.3	
Employed in auxiliary activities	6.8	
Employed in ancillary activities	5.0	
Total	58.1	1213.4

Organisational capital and hospital performance in England

Mary O'Mahony, Silvia Beghelli and Lucy Stokes
SPINTAN workshop, 12-13 November 2015

National Institute of Economic and Social Research

SPINTAN
smartpublicintangibles

- Aim: to explore impact of intangibles (organisational capital) on hospital performance in England

- Hospitals in England

- Model specification

- Measuring intangibles

- Performance measures

- Other inputs and controls

- Descriptives and preliminary results

- Next steps

- Our focus is on NHS Acute Trusts
  - Hospitals in England are managed by Acute Trusts
  - Can be multiple sites within a Trust

- NHS only (private sector hospitals excluded)

- 158 Trusts within our sample (2010/11 to 2013/14)

- Small number of Trusts currently excluded due to mergers during this time period

Estimate:

$$Y_{it} = \alpha + \Sigma\beta_j L_{jjt} + \Sigma\gamma_k K_{kit} + \pi INT_{it} + \Sigma\delta_n Z_{nit} + e_{it}$$

where

Y = measure of performance

L = labour input

K = other inputs

INT = intangibles

Z = control variables

i = hospital trust

Measuring intangibles (organisational capital)

- Intangibles measured in terms of payments to managers

- Our data permit a division into general managers and clinical managers

- Hypothesis: general managers matter for targeted outcomes, e.g. waiting times, but clinical managers matter for more medical outcomes

- Detailed information on managers available from NHS workforce census, by Trust

- Information on average wages (not by Trust) available for aggregated groups

Measuring intangibles (organisational capital)

- General managers (senior and non-senior managers)
- Clinical managers:
  - Narrow definition: Nurse managers; scientific, therapeutic and technical managers and ambulance managers
  - Broad definition: also includes nurse consultants, modern matrons, STT consultant therapists, consultant scientists
  - "Managers are those who have overall responsibility for budgets, manpower or assets or who are held accountable for a significant area of work and who have little or no clinical contact." (NHS Occupation Code Manual)
- Consultants also contribute to organisational capital – assume 20% of their time (in absence of any better information)

Output/performance measures

- Cost weighted output index (CWOI)
  - Activities weighted by unit costs (fixed 2010 cost weights)
  - Constructed using NHS Reference Costs database
  - Covers all activity carried out in Acute Trusts
  - This is complicated by changes to classification of activity over time
  - We exclude top and bottom percentile in our analysis

- Waiting times
  - Numerous measures of waiting times exist, covering inpatient, outpatient and diagnostic waits

- Survival
  - Summary Hospital Level Mortality Indicators – compare observed with "expected" deaths

- Labour input
  - Detailed data on number of full time equivalent staff by occupational category at Trust level (NHS Workforce Census)
  - Experiment with various measures of labour input
    - total FTE staff, by broad occupational group, and wage-weighted measure

- Other inputs
  - Some data on intermediate inputs e.g. expenditure on cleaning and laundry services (Estates and Facilities Statistics)
 - Some data on capital investment

- Demographics - patients by gender and age group

- Measures of deprivation – based on unemployment and qualification levels in surrounding area

- Trust characteristics

  – size (number of beds)

  – Foundation Trust status

  – whether teaching hospital

- Prevalence of disease in surrounding area

  – Using data from the Quality and Outcomes Framework for GP practices

  – Prevalence of coronary heart disease and cancer

Per cent workforce by occupational group

	2010	2011	2012	2013
General managers	2.5	2.4	2.3	2.3
Clinical managers (narrow definition)	1.0	1.0	1.1	1.1
Clinical managers (broad definition)	1.7	1.7	1.7	1.7
Consultants	4.6	4.7	4.8	4.8
Other doctors	7.8	7.9	7.8	7.7
Nurses	31.4	31.0	31.2	31.1
Scientific, therapeutic and technical staff	12.5	13.1	13.3	13.3
Support to clinical staff	27.8	27.3	27.5	27.8
Other infrastructure support	13.4	13.4	13.2	13.1

Variation in managers across NHS Acute Trusts
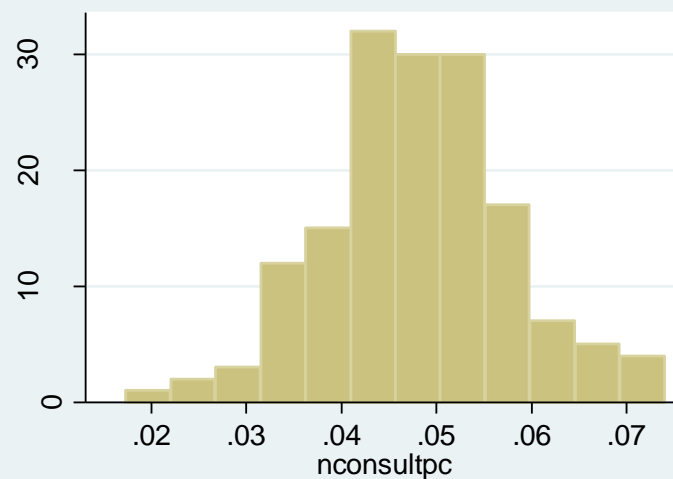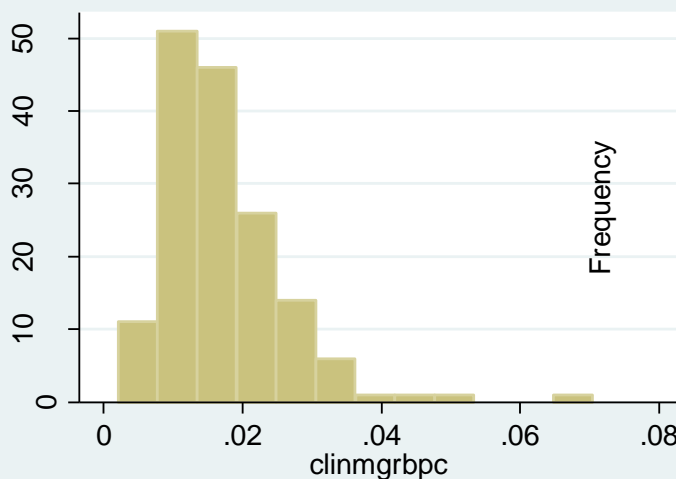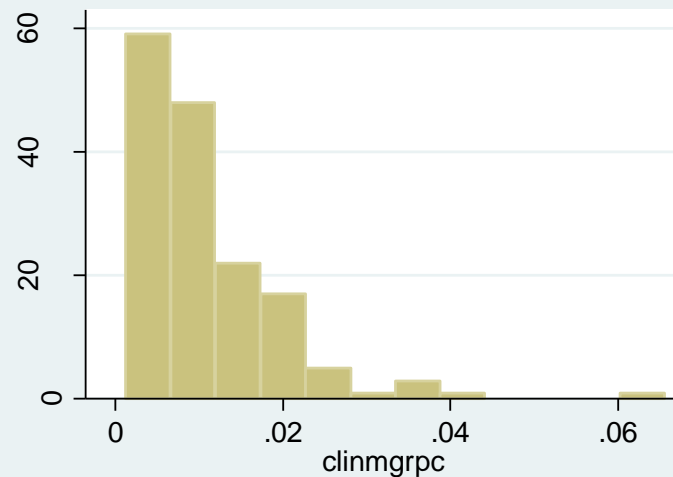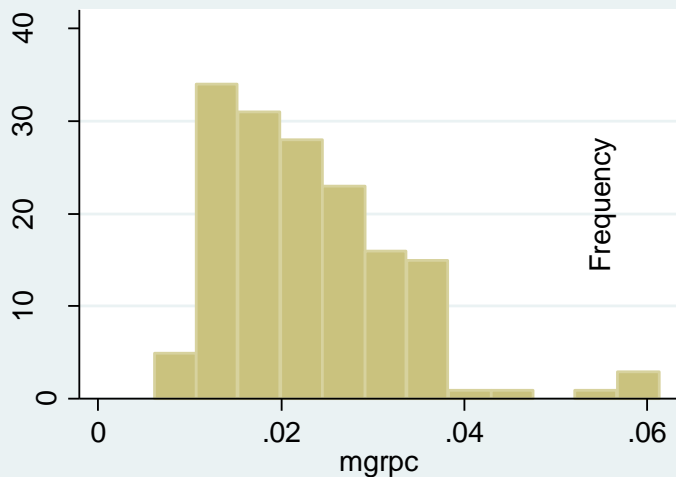
Preliminary results, CWOI: without controls

	2010-11	2011-12	2012-13	2013-14
All managers	0.911***	0.827***	0.884***	0.905***
	(0.000)	(0.000)	(0.000)	(0.000)
N	153	153	153	153
r2	0.70	0.65	0.67	0.68
General managers	0.113**	0.041	0.005	-0.037
	(0.042)	(0.504)	(0.938)	(0.551)
Clinical managers	0.776***	0.770***	0.858***	0.920***
	(0.000)	(0.000)	(0.000)	(0.000)
N	153	153	153	153
r2	0.77	0.72	0.75	0.77

Note: p-values in parentheses, ***significant at 1% level, **significant at 5% level

Preliminary results, CWOI: with controls

	2010-11	2011-12	2012-13	2013-14
General managers	0.021	-0.004	-0.024	-0.006
Clinical managers	0.130**	0.120*	0.105	0.177***
Total staff	0.660***	0.536***	0.702***	0.759***
Number of beds	0.145**	0.196***	0.118**	0.033
Per cent female	0.979***	0.826***	0.544*	1.554***
Per cent aged over 75	1.109***	1.496***	1.076***	1.171***
Per cent emergency admissions	0.02	0.041	0.257	0.288*
Unemployment rate	-0.006	-0.003	-0.001	0.015**
Population with degree or above	-0.003	-0.001	0.001	0.002
Teaching hospital	-0.018	0.013	-0.005	0.005
Capital investment	0.002	0.018	0.001	-0.028***
Coronary heart disease (prev)	-2.148	1.118	0.925	-1.416
Cancer (prev)	-8.06	-11.884	-13.312**	-0.931
_cons	10.273***	11.095***	11.148***	9.484***
N	153	153	153	153
r2	0.95	0.913	0.93	0.946

- On average:
  - general managers account for around 2.5 per cent of the workforce in NHS Acute Trusts;
  - clinical managers account for a further 1-2 per cent
  - there is notable variation across Trusts
- Correlations indicate that organisational capital as proxied by payments to managers is positively associated with output
- This is driven by clinical managers, rather than general managers
- This remains the case when controlling for labour and other inputs, as well as characteristics of the hospital, patient population and local area

- Explore alternative outcome measures

  - waiting times, patient reported outcome measures, survival, mix between inpatient stays and day case procedures

- Also explore outcomes for major disease categories

- Check robustness to alternative model specifications

- Make use of panel component of data – though concerns over short panel

- Inclusion of additional data – information on Foundation Trust status and additional expenditure data

- Recent literature suggests the positive impact that a higher nurse-to-patient ratio has on the treatment and outcome quality of hospitals. This is something we would like to test and – if positive – include as further quality indicator into our model

- Testing to what extent qualification has an impact on the outcome quality and – if positive – include a "qualification index" as further quality indicator into our model

- Testing whether a certain team-mix leads to a better outcome quality

- Test the different quality standards introduced by the new hospital structure law (KH Strukturgesetz), e.g. minimum number of operations

Run regressions using similar specifications as for the UK and Germany

An additional pilot estimate will be carried out where the dependent variable will be **managerial performance, measured by the stocks of liabilities** (mainly to suppliers). In Hungary a sustainable amount of trade credit is a sign of solid hospital management.