Broadening Focus: Spillovers, Complementarities, and Specialization in the Hospital Industry

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Before Proceeding

Theory of Focus

- Less complexity, uncertainty and more expertise
- Law of factory focus (Schmenner and Swink, 1998), Adam Smith's specialization

Theory of Broadening

- Spillovers
- Complementarities

So far, the answer is **Related Diversification**: different focused operating units (OU) doing *related* business

- Spillover: Benefit from an activity increases the level of the focal activity (e.g., sharing the facilities)
- Complementarities: benefit from an activity increases the marginal benefit of increasing the focus on focal activity (e.g., general clinicians offer new insights, increasing the benefits of more focus)

Contribution

- Context: Cardiovascular care in a hospital
- Assess effects of specialization within operating units (vs whole companies) and the effects of related diversification
-

Why Cardiovascular care?

1. Hospitals have different areas
2. Data on each patient (estimate focus)
3. Clear measure
4. Specialization is relevant

Results

- Focus: increase quality performance
- Spillovers and complementarities
- Robust

Quality of output q_f is a function of *focus on the focal service* x_f, *focus on related services* x_r, and *other variables* Z.

$$q_f = g(x_f, x_r, Z)$$

Hyp 1: ↑ Unit's specialization leads to ↑ quality performance in that segment

Hyp 2: ↑ Unit's specialization in related business leads to ↑ quality performance in the focal business segment (spillover)

Hyp 3: ↑ Unit's specialization in related business leads to ↑ marginal benefit of specialization in the focal business segment (complement)

Hypothesis 1

$$\frac{\partial q_f}{\partial x_f} > 0$$

Hypothesis 2

$$\frac{\partial q_f}{\partial x_r} > 0$$

Hypothesis 3

$$\frac{\partial^2 q_f}{\partial x_f x_r} > 0$$

Data

Coronary Artery Bypass Graft (CABG) surgery patients

- In-hospital mortality as quality measure (and dependent variable), with proportion of patients as explanatory variable
- Nationwide Inpatient Sample (NIS) from Agency for Healthcare Research and Quality, including 1000 US hospitals
- All patients admitted are included
- Y1995-2004.
- 661,910 CABG surgery discharges at 774 hospitals
- (Don't have other quality measures)

Dependent Variables

$MORT_{ijt} = 1$ if patient i in hospital j in year t died.

$$ln\left(\frac{pr(MORT_{ijt} = 1|x_i)}{1 - pr(MORT_{ijt} = 1|x_i)}\right) = \alpha + \beta X_i$$

X_i vector of patient-level risk factors (demographics)

$$ln\left(\frac{p_{ijt}}{1-p_{ijt}}\right) = \alpha + \beta X_i$$

$$p_{ijt} = \frac{e^{\alpha+\beta X_i}}{1 - e^{\alpha+\beta X_i}}$$

$$\text{Predicted Mortality Rate} = PMR_{jt} = \sum_i \frac{p_{ijt}}{n}$$

$$RAMR_{jt} = \frac{OMR_{jt}}{PMR_{jt}} AMR$$

- Risk-adjusted mortality rate $RAMR_{jt}$
- Observed mortality rate AMR (across all hospitals)
- Predicted mortality rate PMR_{jt}

$$FOCUS_{jt} = \frac{\sum_{i=1}^{n_{jt}} CARDIO_{ijt}}{n_{jt}}$$

- $FOCUS_{jt}$ = percentage of patients in cardiovascular disease area
- $CARDIO_{ijt} = 1$ if patient i discharged from hospital j in year t

$$RELATED_{jt} = \frac{\sum_{i=1}^{n_{jt}} RELATED_{ijt}}{n_{jt}}$$

- $RELATED_{ijt} = 1$ if primary diagnosis for i discharged from j in year t is in an area related to cardiovascular care.
- n_{jt} = total number of patients discharged from hospital j in year t.
- $RELATED_{jt}$ = proportion of focus on (cardio-)related areas

$$
\begin{aligned}
RAMR_{jt} = \alpha_j + \gamma_t + \beta_1 RELATED2_{jt-1} + \beta_2 RELATED3_{jt-1} \\
+ \beta_3 \ln(FOCUS_{jt-1}) \times RELATED1_{jt-1} \\
+ \beta_4 \ln(FOCUS_{jt-1}) \times RELATED2_{jt-1} \\
+ \beta_5 \ln(FOCUS_{jt-1}) \times RELATED3_{jt-1} \\
+ \beta_6 \ln(VOLUME_{jt-1}) + \beta_7 X_{jt} + \varepsilon_{jt}
\end{aligned}
$$

Table 2 **Summary Statistics and Correlations**

($N = 807$)	Mean	SD	Min	Max	*RAMR*	*Focus*	*Volume*	*Related*
RAMR	0.028	0.018	0.000	0.244	1			
Focus	0.197	0.088	0.067	0.884	−0.092	1		
Volume	19,125	10,255	2,490	68,464	0.007	−0.168	1	
Related	0.220	0.043	0.073	0.387	−0.038	−0.003	−0.172	1

Table 3 Regressions Testing the Effect of Focus and Relatedness on Mortality Rates

	RAMR					
Coefficient	(1)	(2)	(3)	(4)	(5)	(6)
ln(*VOLUME*)	−0.0041	−0.0043	−0.0039	−0.0040	−0.0042	0.0168
	(0.0035)	(0.0035)	(0.0034)	(0.0033)	(0.0034)	(0.0150)
ln(*FOCUS*)	−0.0116**	−0.0115**	−0.0136**			
	(0.00411)	(0.0044)	(0.0050)			
ln(*RELATED*)		−0.0046	−0.0011			
		(0.0036)	(0.0042)			
ln(*FOCUS*) × ln(*RELATED*)			−0.0145*			
			(0.0072)			
RELATED(*AboveMedian*)				0.0010		
				(0.0015)		
ln(*FOCUS*) × *RELATED*(*BelowMedian*)				−0.0056†		
				(0.0030)		
ln(*FOCUS*) × *RELATED*(*AboveMedian*)				−0.0245**		
				(0.0085)		
RELATED2					0.0002	−0.0012
					(0.0015)	(0.0026)
RELATED3					−0.0015	−0.0011
					(0.0021)	(0.0041)
ln(*FOCUS*) × *RELATED1*					−0.0042	−0.0065
					(0.0032)	(0.0126)
ln(*FOCUS*) × *RELATED2*					−0.0200*	−0.0158
					(0.0086)	(0.0147)
ln(*FOCUS*) × *RELATED3*					−0.0210**	−0.0536**
					(0.0071)	(0.0240)
Categories of related	None	None	None	Halves	Thirds	Thirds
Method	Random effects	Random effects	Random effects	Random effects	Random effects	Fixed effects
Observations	807	807	807	807	807	400
Number of hospitals	382	382	382	382	382	103
R-squared	0.051	0.054	0.055	0.056	0.066	0.130

Notes. Robust standard errors are clustered by hospital. Regressions include hospital random or fixed effects and year fixed effects. Random effects models also include indicators for the following hospital characteristics: urban location, teaching status, and geographic region. Standard errors are in parentheses.

**$p < 0.01$; *$p < 0.05$; †$p < 0.10$.

Results:

R.1 : *More focus* in cardiovascular care $\Rightarrow$ **lower** RAMR. 1 σ increase in focus $\Rightarrow$ 0.4 pp mortality reduction.

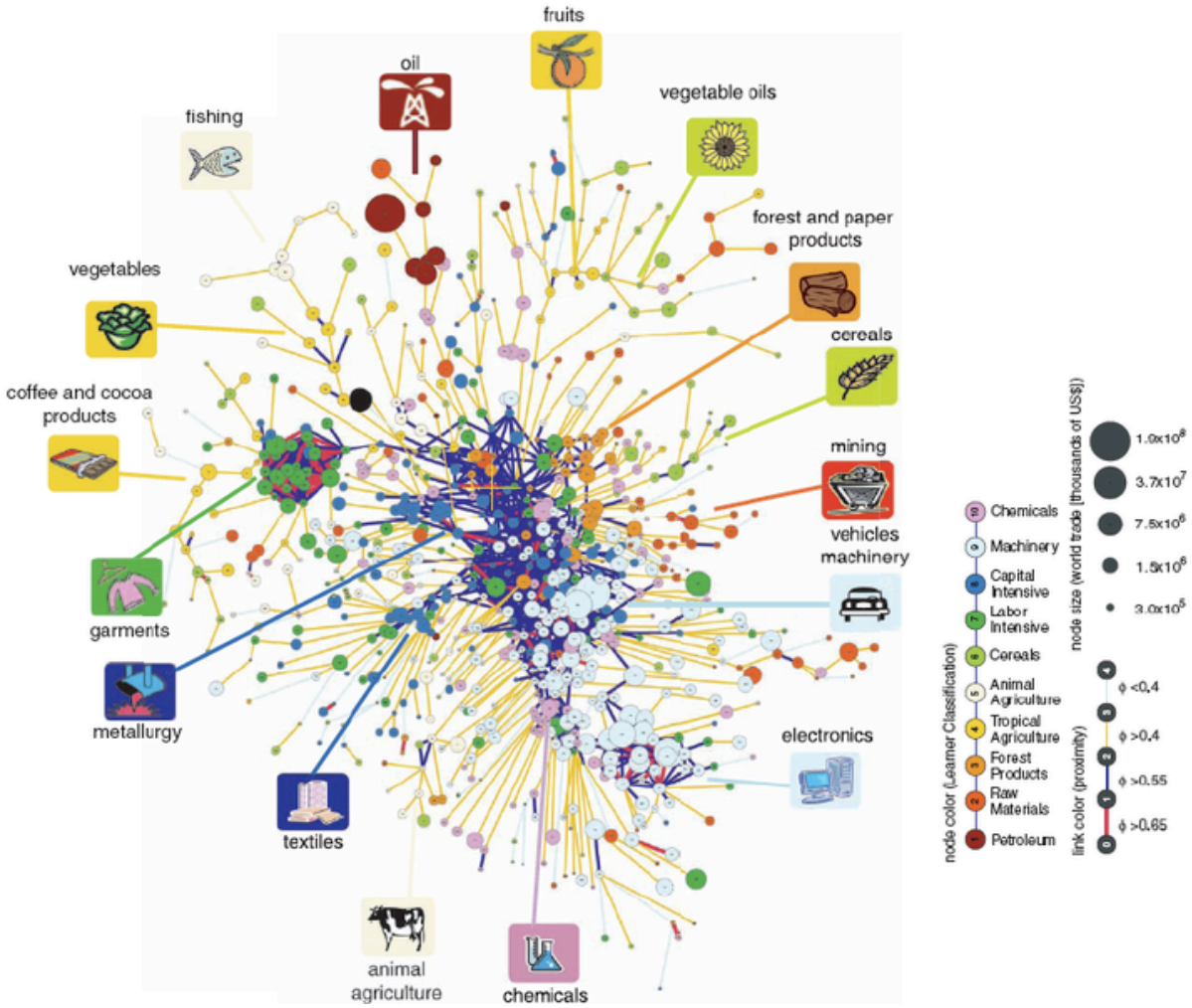
- **Hypothesis 2**: *Spillovers* from related services (e.g., endocrinology) not statistically significant on their own.
- **Hypothesis 3**: Evidence of **complementarities**. For high-relatedness hospitals, 1 SD increase in focus $\Rightarrow$ 0.7 mortality reduction.

Hypothesis

Conclusion

My Take

- Product Space
- Complexity of the problem of multiobjective optimization

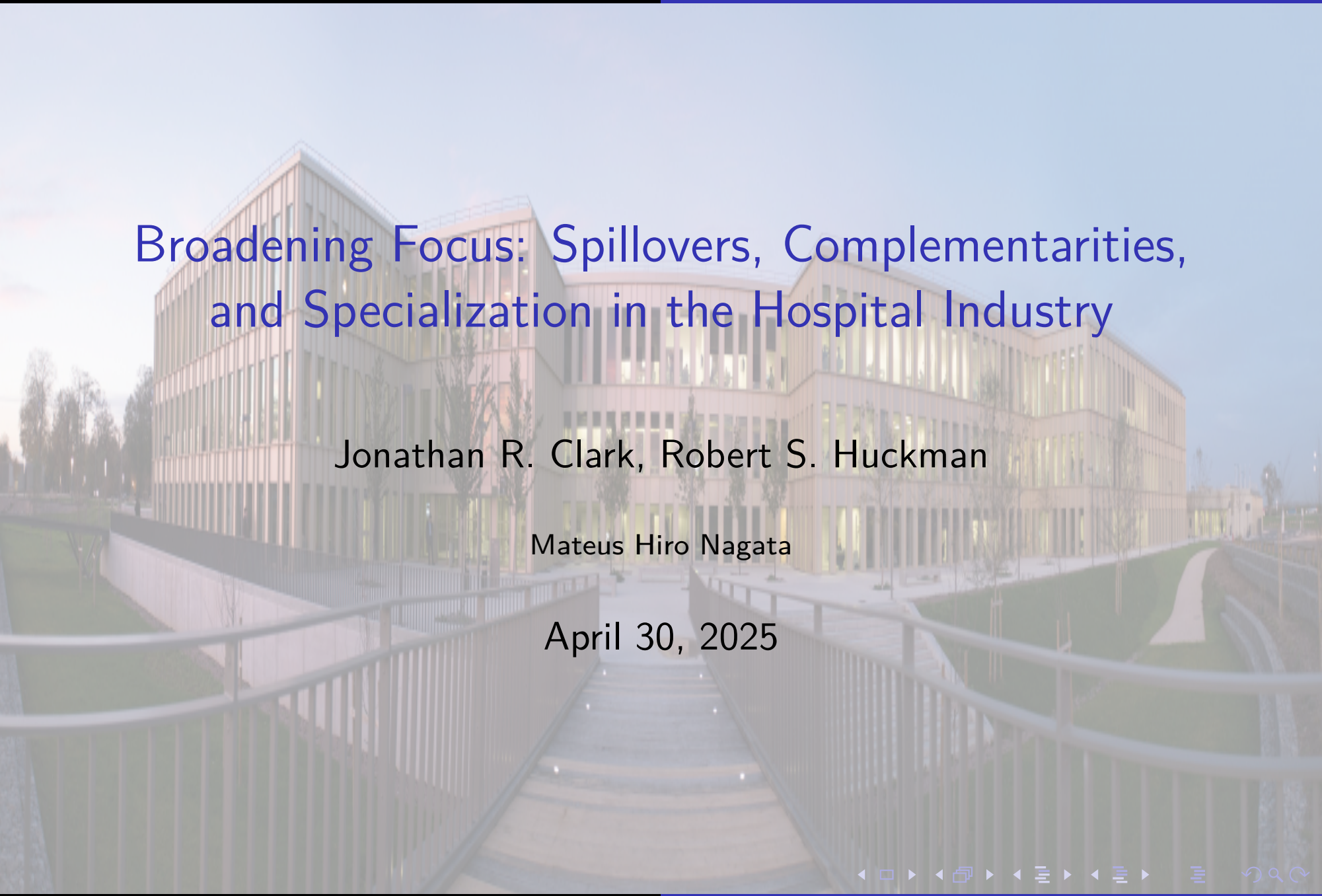

fruits
oil
vegetable oils
fishing
forest and paper products
vegetables
cereals
coffee and cocoa products
mining
vehicles
machinery
garments
metallurgy
electronics
textiles
animal agriculture
chemicals
node color (Leamer Classification)
Chemicals
Machinery
Capital Intensive
Labor Intensive
Cereals
Animal Agriculture
Tropical Agriculture
Forest Products
Raw Materials
Petroleum
node size (world trade [thousands of US$])
1.0x10^8
3.7x10^7
7.5x10^6
1.5x10^6
3.0x10^5
link color (proximity)
ϕ <0.4
ϕ >0.4
ϕ >0.55
ϕ >0.65

Possible Issues

- Specification and endogeneity
- Too narrow situation and focus
- Don't consider costs
- Consider operation, not innovation

Conclusion

- Positive effects of focus and breadth through complementarity but not of spillovers
- Related diversification positive effects not only across operating units but also within operating units



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