



EUROPEAN HEALTH CARE OUTCOMES,  
PERFORMANCE AND EFFICIENCY

# Hospital-level differences – Quality, uses of resources, and their interrelationship on patient-group level

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# Motivations

- Not much information on quality and cost between hospitals
- What are the determinants of quality and cost of care at hospital level?
- An important policy question: are costs and quality related to each other:
  - If there is a positive correlation => better quality can be provided only by increasing costs
  - If there is a non positive correlation => potential for improving performance by containing costs with no reduction in quality, or improving quality without increasing costs

# Aims

- To compare quality and use of resources of hospital care using patient level data in treating of three important diseases (AMI, ischemic stroke and hip fracture) in five European countries
- Explore whether hospitals' quality and cost variation can be explained by hospital- and health-system-level characteristics
- To examine whether cost-quality trade-off exists by comparing hospital level costs and survival rates

## Measurement of quality and cost

- Quality: 30- day survival after onset of the disease
- Cost: use of resources (Approach 1) during the first acute hospital episode (i.e. including hospital transfers). Based on number of hospital days and use of procedures weighted by their relative costs
- Individual patient level data from Finland, Hungary, Italy Norway and Sweden from the years 2007-2008 (Norway 2009)

# Description of data

		Finland	Hungary	Italy	Norway	Sweden	Totally
		2007-2008	2007-2008	2007-2008	2009	2007-2008	
AMI	Number of patients	16978	26075	19109	10558	46304	119023
	Number of hospitals	30	63	42	39	67	241
	Mean 30 day-survival %	85,6	83,3	91,1	91,5	88,9	87,8
	Mean use of resources (€)	7274	8104	8981	7344	7359	7770
Stroke	Number of patients	16511	69034	14751		36290	136586
	Number of hospitals	26	85	35		65	211
	Mean 30 day-survival %	90,6	87,8	93,0		88,7	89,0
	Mean use of resources (€)	5272	5509	6251		7845	6180
Hip Fracture	Number of patients	10156	21300	14697	5464	30079	81696
	Number of hospitals	27	45	52	28	54	206
	Mean 30-day survival %	99,0	88,0	96,0	92,0	92,7	92,0
	Mean use of resources (€)	10722	20390	21938	12195	17776	17939

# Multilevel modelling

Hospital-level **random effects** are used as measures of performance (both quality and cost)

=> Makes it possible to compare quality and cost at hospital level

=> Allows to explore why some hospitals has better quality or higher cost than others

# Variables used in estimations



Patient level variables used in performance analysis (risk adjustment):

- Age (classified)
- Gender
- Comorbidities based on medical history of the previous year
- Hospital transfer to higher level

Hospital and regional level variables:

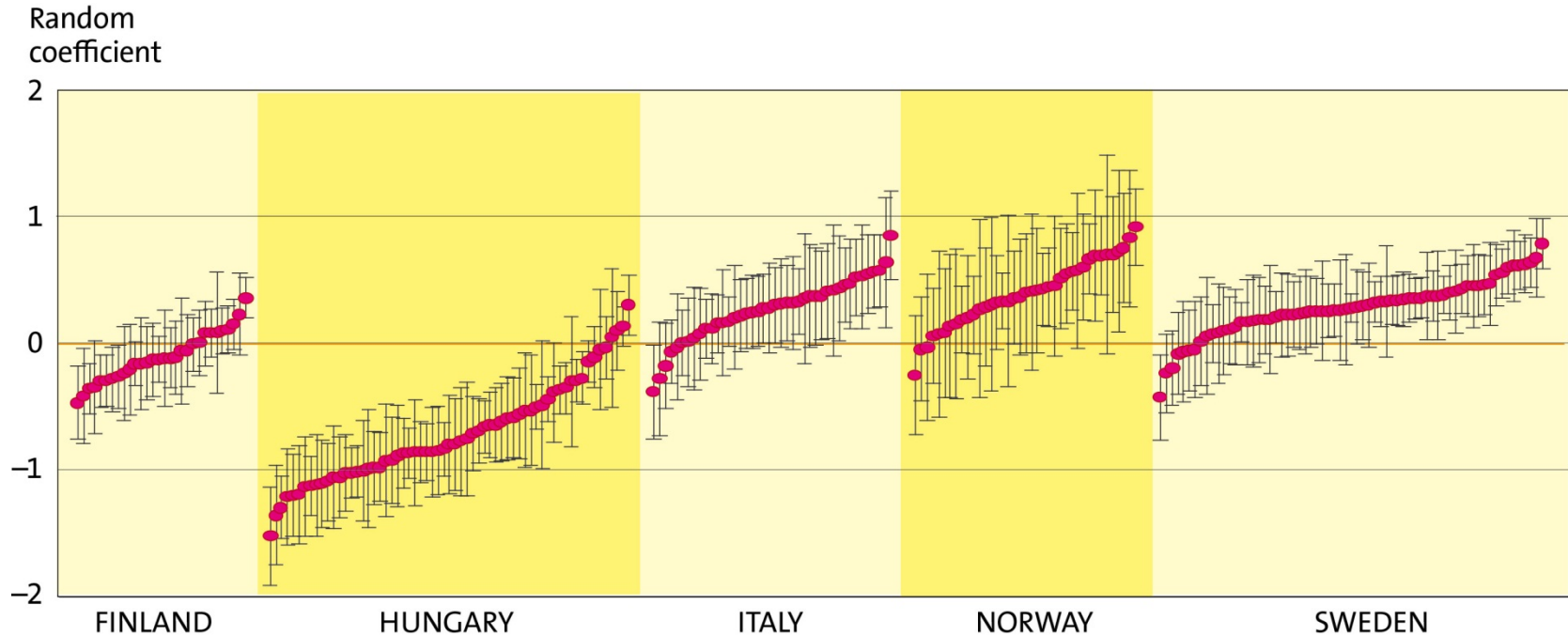
- Teaching/university status
- Availability specific services and resources (catheterisation laboratory, stroke unit)
- Regional concentration of care (Herfindahl-Hirschman Index (HHI))
- GDP per capita
- Population density

## Measurement of hospital quality performance (30-day survival)

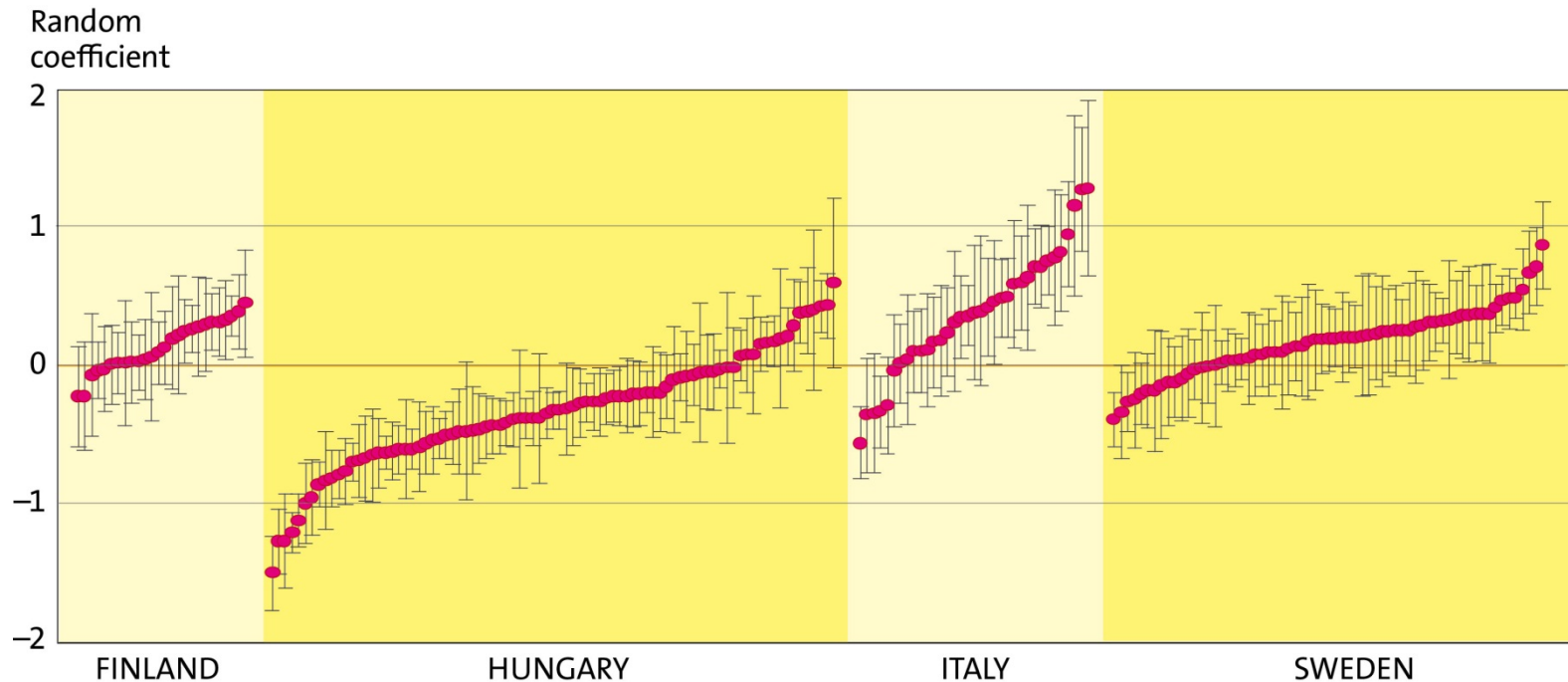
- Empirical Bayes estimates of hospital effects for quality obtained from a model, where age, gender, comorbidities and transfers to a higher level hospital are taken into account
- The effects do not as such have exact practical interpretation but we can estimate that survival difference between the lowest and highest hospital was 30 percentage points (min 67.5, max 97.5) in the care of AMI patients



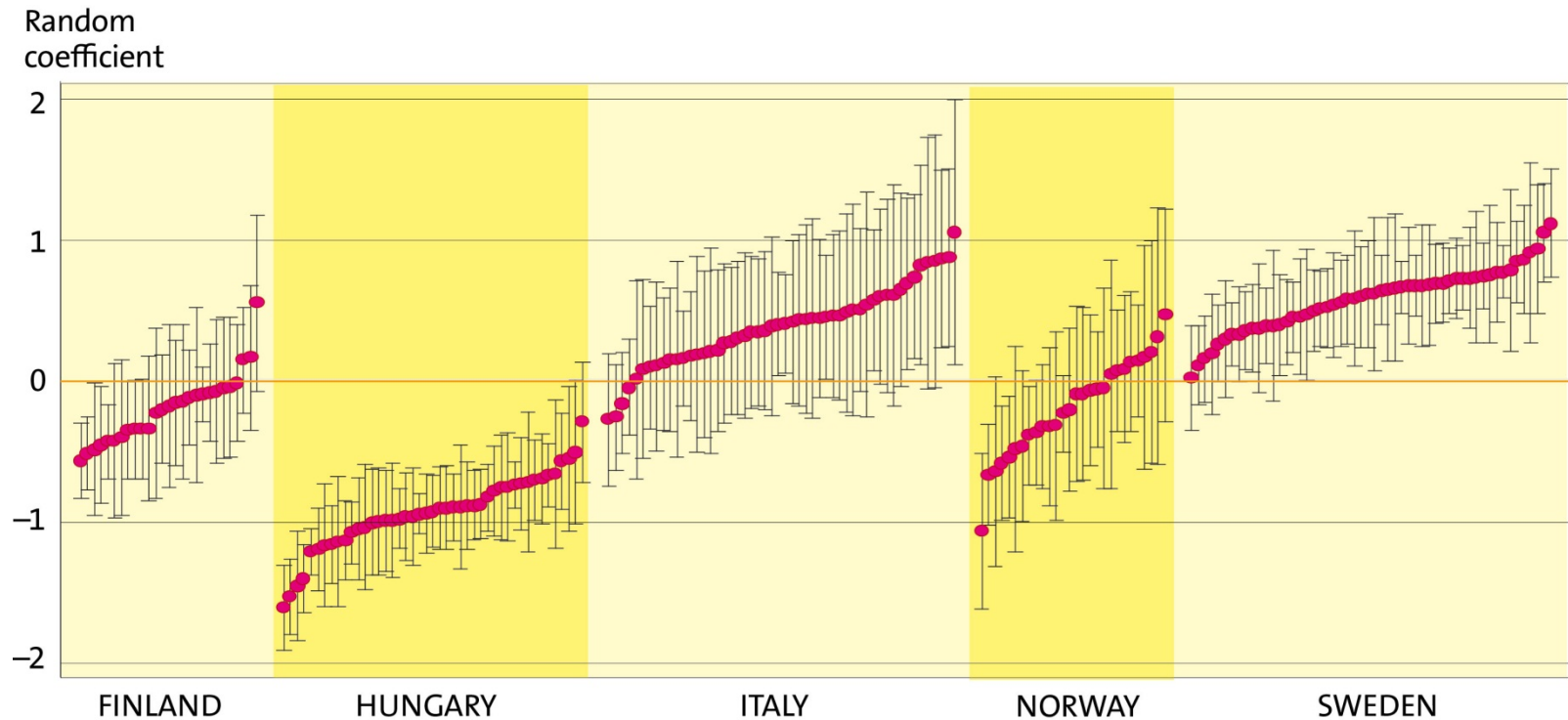
# Hospitals quality performance in care of AMI patients on empirical Bayes estimates of random coefficients



# Hospitals quality performance in care of ischemic stroke patients on empirical Bayes estimates of random coefficients



# Hospitals quality performance in care of hip fracture patients based on empirical Bayes estimates of random coefficients



# What explains good quality performance?

## AMI

- Existence of a catheterisation laboratory in the hospital in all countries except Italy (+)
- Lower concentration care in Hungary and Norway (+)
- Higher GDP per capita in Hungary and Finland (+)

## Ischemic stroke

- University/teaching status in Hungary and stroke unit in Italy (+)
- Higher GDP per capita in Finland (+)

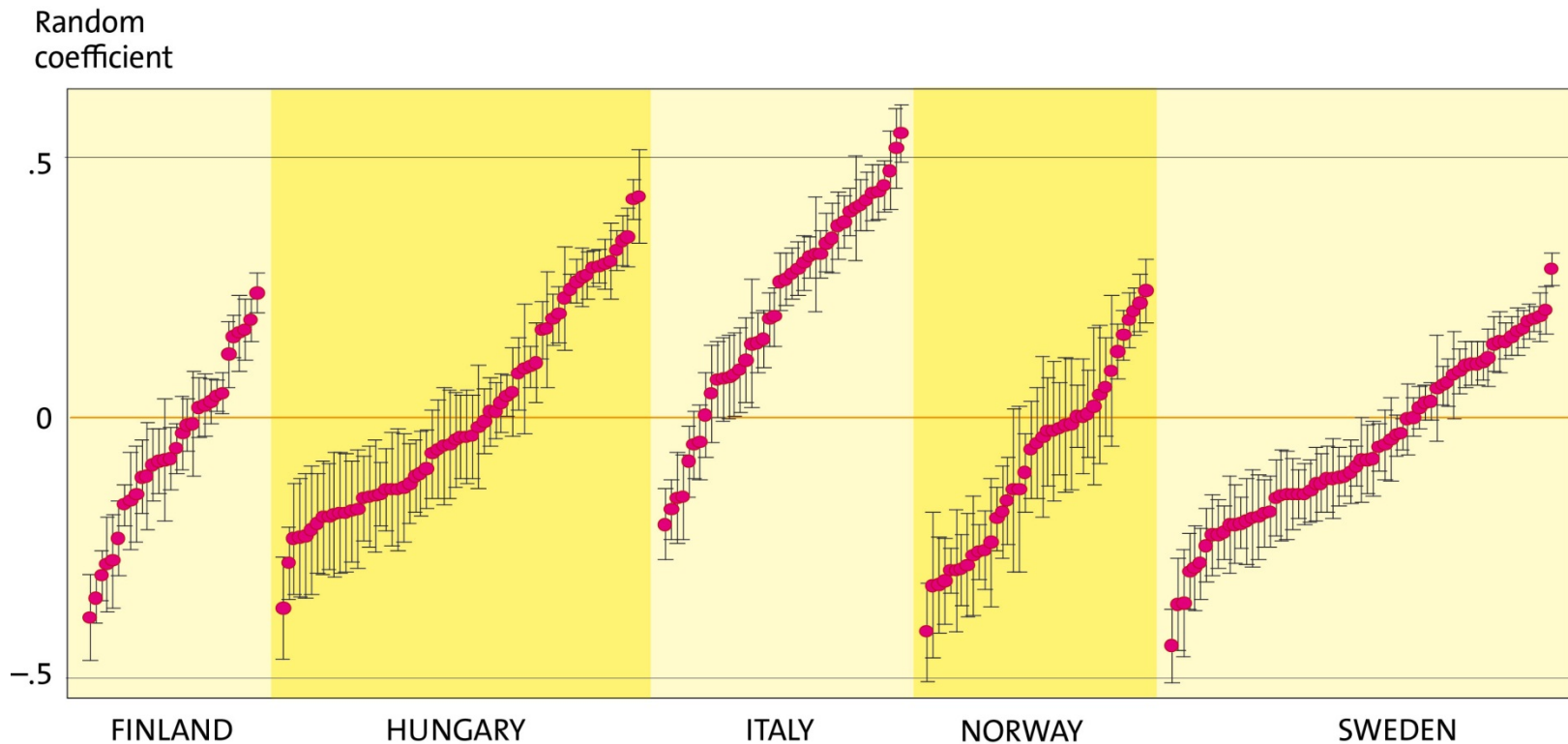
## Hip fracture

- Small volume in Italy (+)

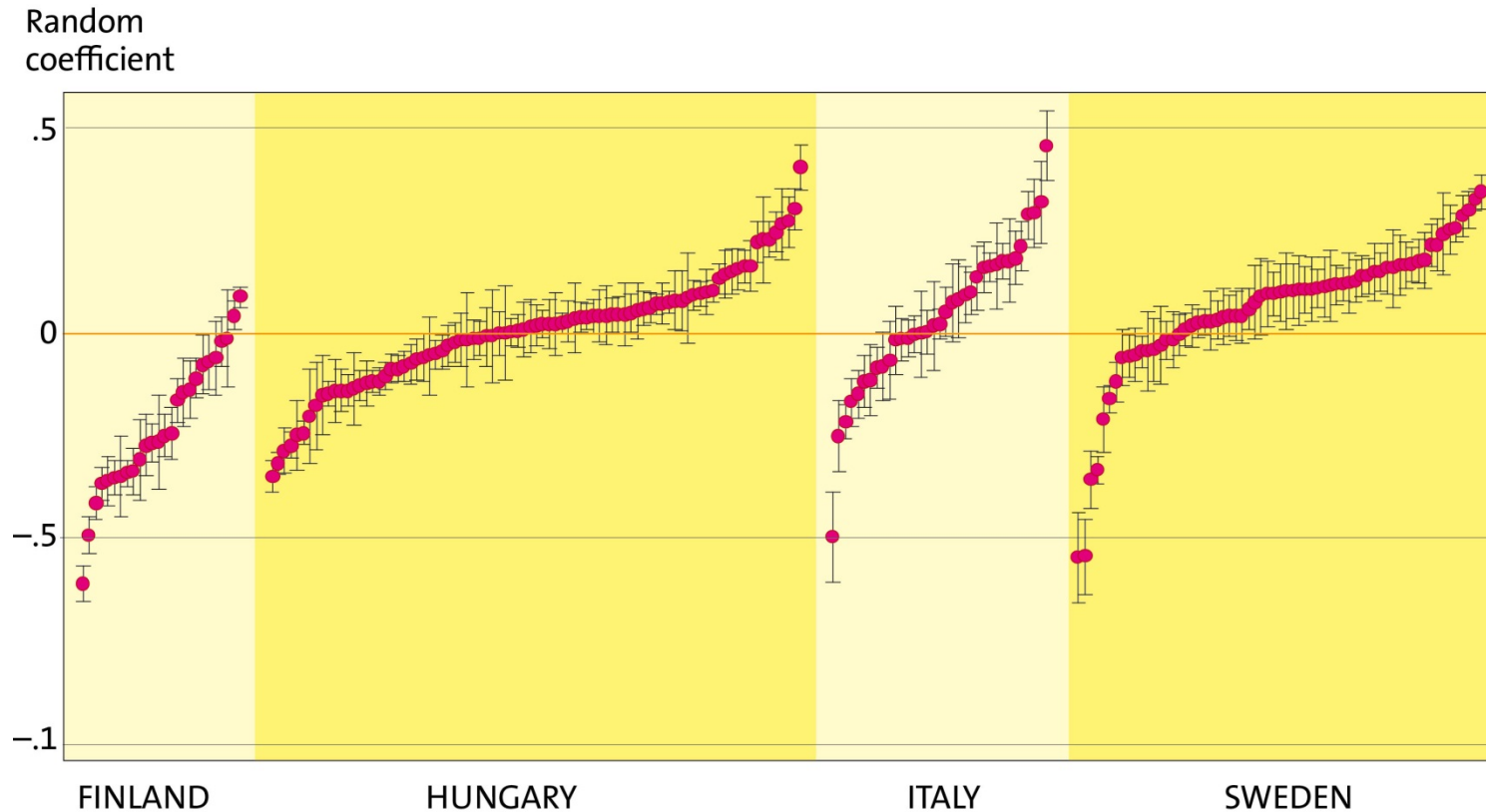
## Measurement of hospital cost performance (use of resources during the first acute hospital episode)

- Empirical Bayes estimates of hospital effects for use of resources obtained from a model, where age, gender, comorbidities and transfers to a higher level hospital are taken into account. Indicators describe how many percentage points hospitals cost differs from the average cost of all hospitals (log transformation)

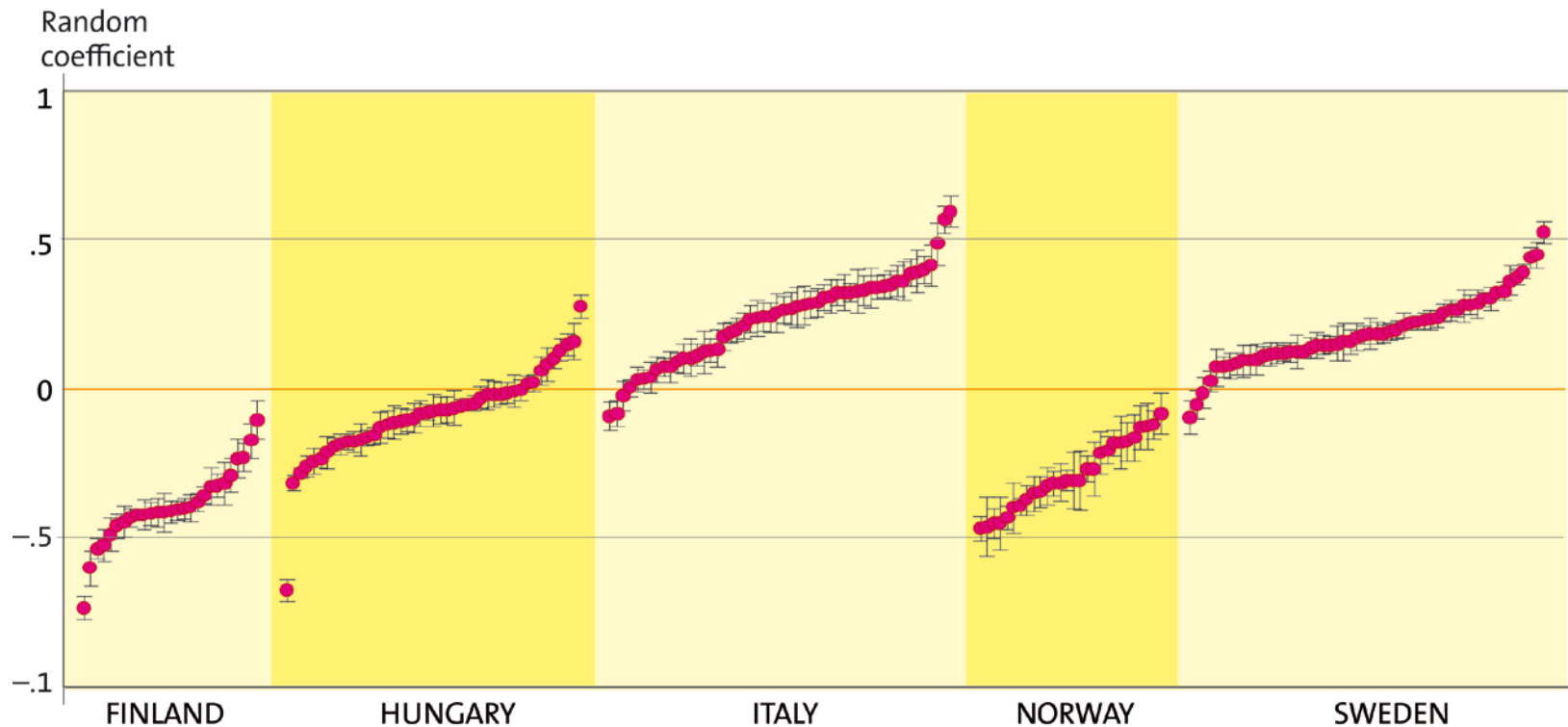
# Hospitals cost performance in care of AMI patients based on empirical Bayes estimates of random coefficient



# Hospitals cost performance in care of ischemic stroke patients based on empirical Bayes estimates of random coefficient



# Hospitals cost performance in care of hip fracture patients based on empirical Bayes estimates of random coefficient





# What explains high resource use?

## AMI

- Existence of a catheterisation laboratory in the hospital (+)
- University/teaching status Finland, Italy and Sweden (+)
- Lower concentration care in all countries except Italy (+)
- Lower GDP per capita in Finland and Sweden (+)
- Lower population density In Norway (+)

## Ischemic stroke

- University/teaching status in Sweden (+)
- Lower concentration of care in Hungary and Finland
- Lower population density in Sweden (+)

## Hip fracture

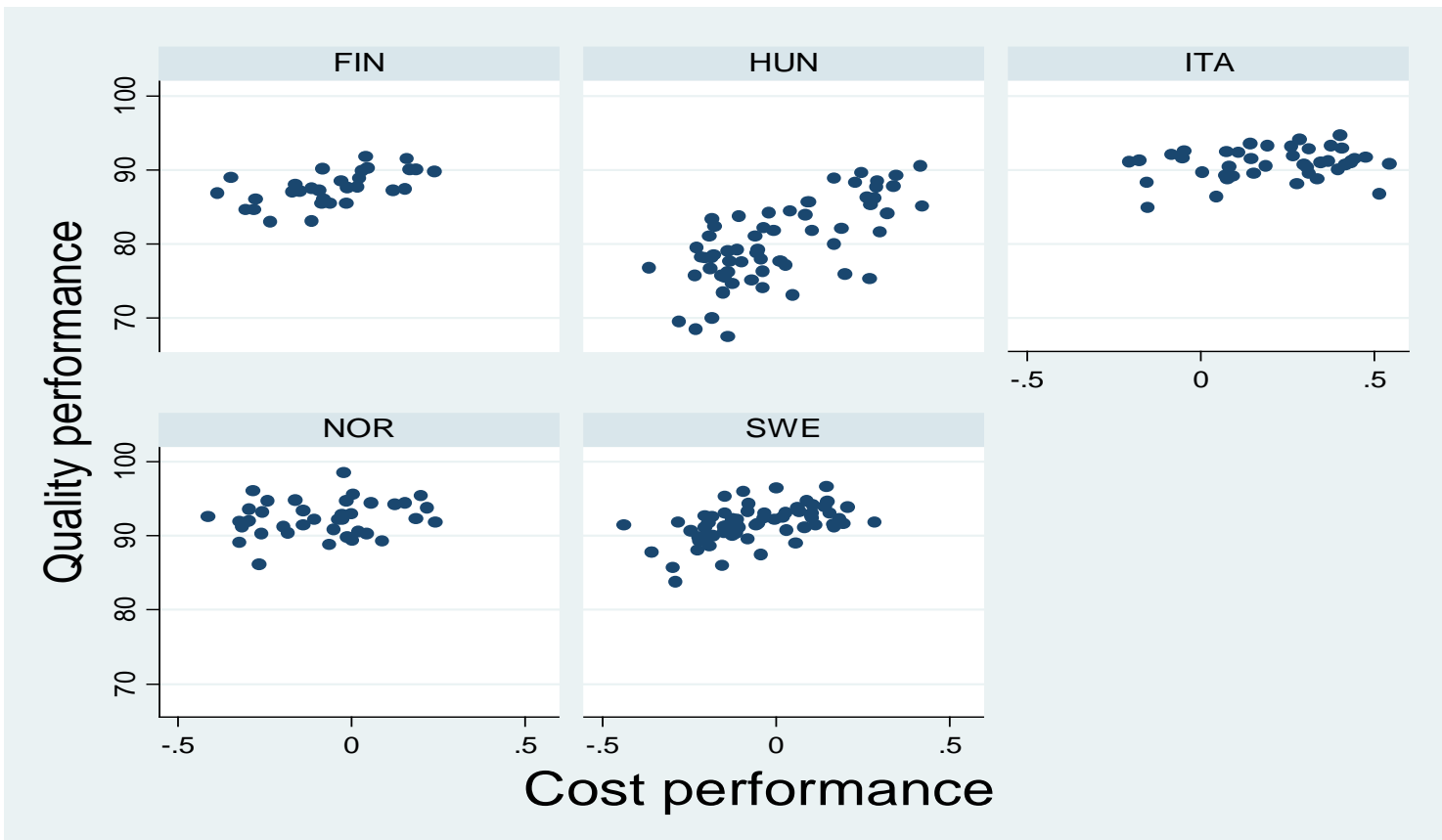
- University /teaching status in Sweden (+)
- High volume in Italy (+)

# Relationship between quality and cost



- Simple analysis: Hospitals quality performance plotted against cost performance
- More comprehensive analysis that takes into account simultaneous relationship between cost and survival using a two-stage procedure: first estimation the cost function and in the second stage the quality model is augmented with residuals from the first stage
- Both give similar results: trade-off exist in care of AMI in Hungary and Finland and to some extent Sweden
- No positive relationship in ischemic stroke and hip fracture

# Cost and Quality among AMI patients



## The results of two stage estimation

- AMI: an increase in cost of EUR 1000 (i.e. about 12–14 % of the average cost per patient) is associated with increase in 30 day-survival
  - in Hungary by 3.0–1.7 percentage points,
  - in Finland by 1.6–1.0 percentage points
  - in Sweden by 0.9 – 0.0 percentage points
- No positive relationship in ischemic stroke and hip fracture

# Conclusions (1)

- Remarkable differences between hospitals and countries in both survival and cost
- The differences cannot be explained by the characteristics of the health care system; and inclusion of hospital or regional variables does not change the ranking of countries.
- Some evidence supporting an increasing horizontal integration in care for the three conditions: An increase in the concentration of the regional hospital system was associated with a decrease in costs in all countries except Italy.

## Conclusions (2)

- An analyse considering whether hospitals which perform well in terms of quality in treating one patient group are performing well also in treating another patient group=> no correlation in hospitals quality between the three conditions
  - Using information quality on one specific health problem cannot be used as an only tracer to be generalized whole hospital level quality of care.
  - A comprehensive benchmarking requires performance information on many health conditions
- In the care of AMI a positive correlation between cost and quality. The effect was strongest in Hungary where the survival is lowest
- But positive cost–quality association was inconsistent and not present in all countries and not in stroke and hip fracture =>potential exist for improving hospital performance by containing cost or improving quality