Productivity and efficiency of Norwegian higher education institutions

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Use of efficiency and productivity analyses

- Transparency in the public sector
- Tool for principal to control agents
- Tool for allocating budget
- Point of departure for improving efficiency and productivity
- Documentation of efficiency and productivity
  - External demand for efficient resource use
- Scale and structure of service providers

Handle with care

- Efficiency and productivity studies not done to discredit units
  - It is not a competition with winners and losers
- Comparability of units
  - Types of services
- Aggregation to university level
  - Different mix of studies
  - Use cost differences between types of study

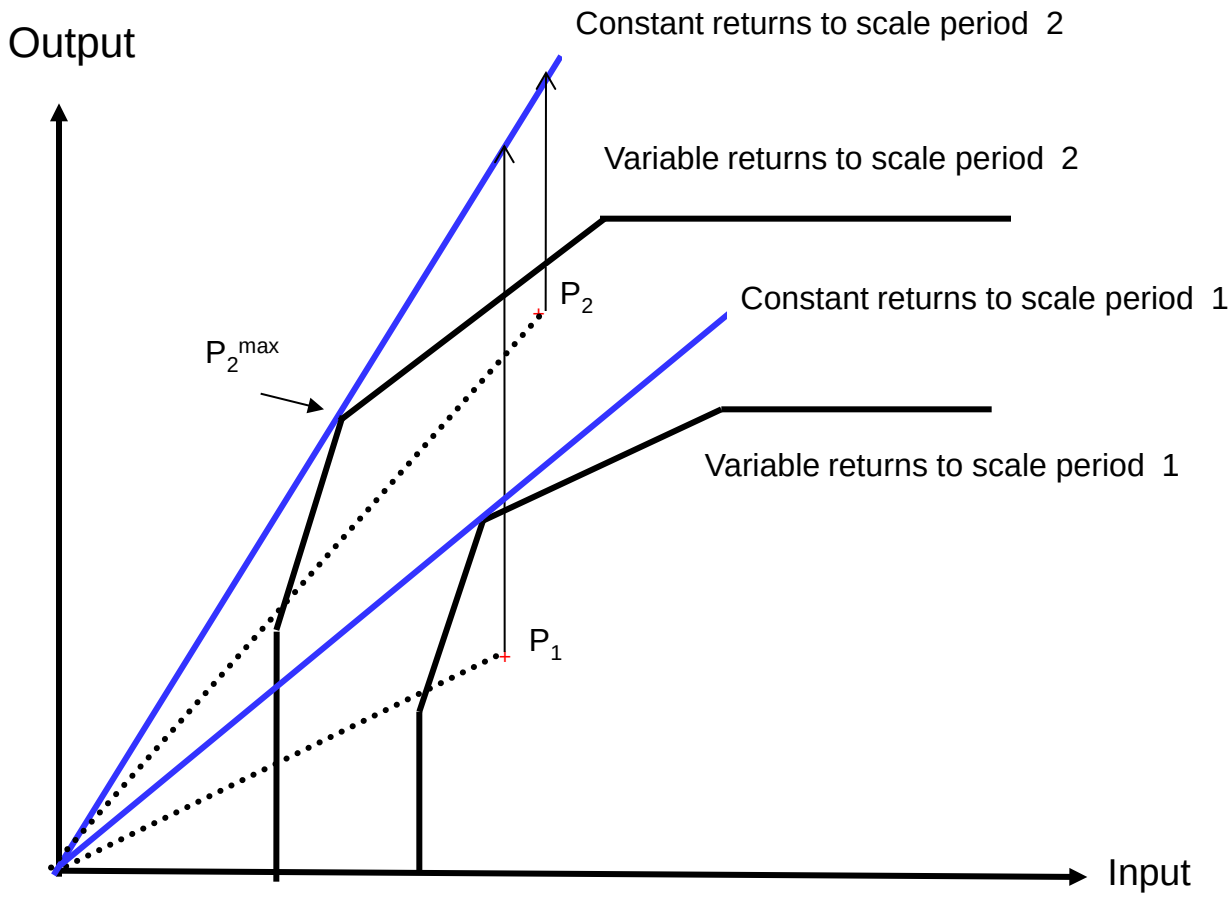
The specification used

- All data are pooled
  - The intertemporal frontier (Tulkens and van den Eeckaut, 1995) is used as a benchmark
  - Satisfies circularity
  - Productivity cannot be decomposed without esimating yearly frontiers
- Enveloped by a CRS technology

$$\hat{M}_i^s(u,v) = \frac{\hat{E}_i^s(x_{iv}, y_{iv}; \hat{S}^s)}{\hat{E}_i^s(x_{iu}, y_{iu}; \hat{S}^s)} \quad , \qquad i = 1,..,J,\ u,v = 1,..,T, u < v$$

  - Homogenous of degree 1 in y_{iv}, x_{iu} ,(-1) in y_{iu}, x_{iv}

Malmquist productivity index



Bootstrapping to correct for the inherent sampling bias

- DGP: observations (x_i, y_i) are realisations of i. i. d. stochastic variables
  - Constructing pseudo observations using kernel density estimation of efficiency distribution

$$y_{imt}^{ps} = (y_{imt} / \hat{E}_{2it}^{s}) E_{2t}^{KDE}, i = 1,.., J,\ m = 1,..., M,\ t = 1,..., T$$

  - Estimating a new frontier 2000 times
- Calculating bias and confidence interval from

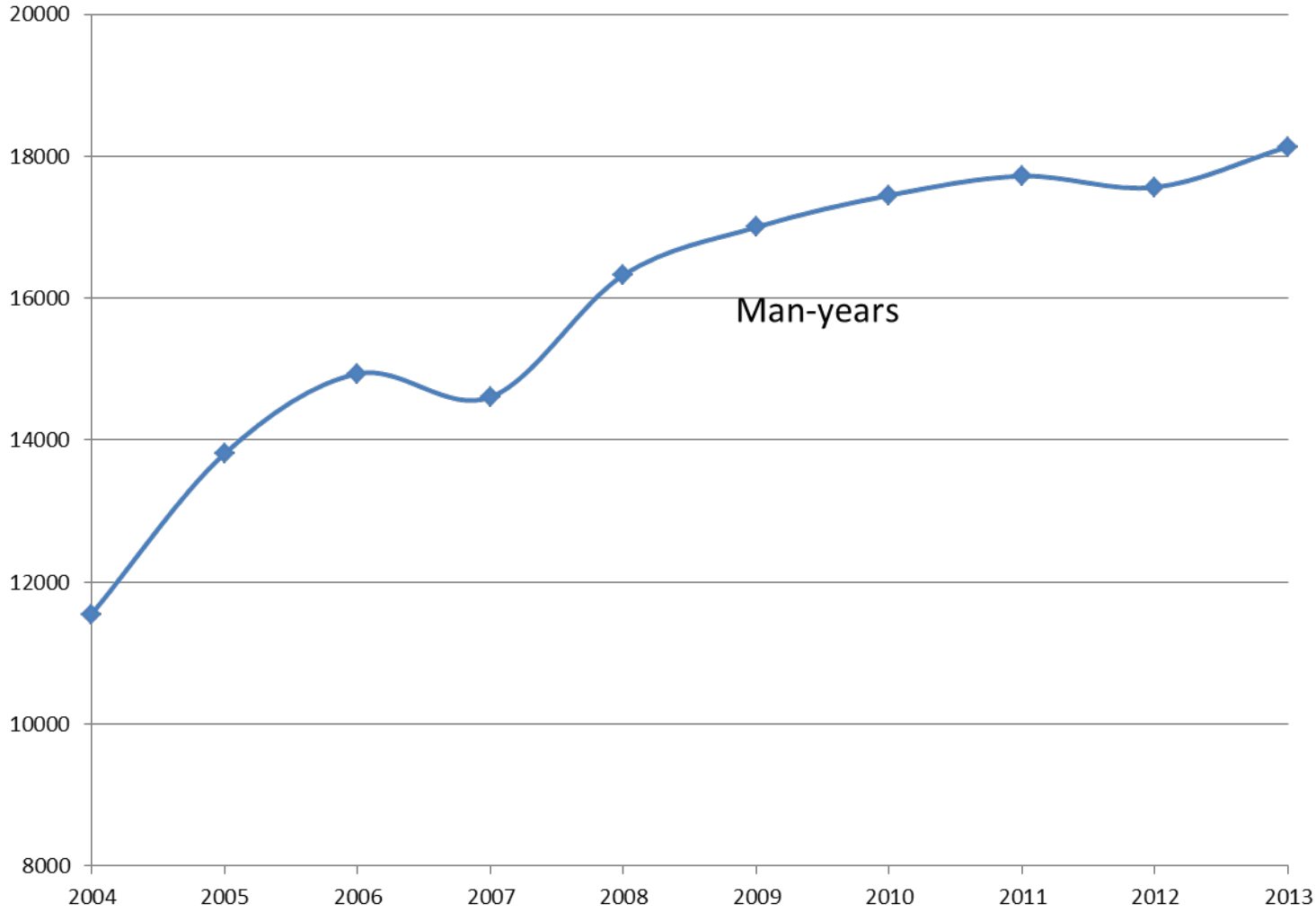
$$\tilde{M}^{s}(u,v) - \hat{M}^{s}(u,v)) \Big| \hat{S}^{s} \sim (\hat{M}^{s}(u,v) - M^{s}(u,v)) \Big| S^{s}$$

$$u, v = 1,.., T, u \neq v$$

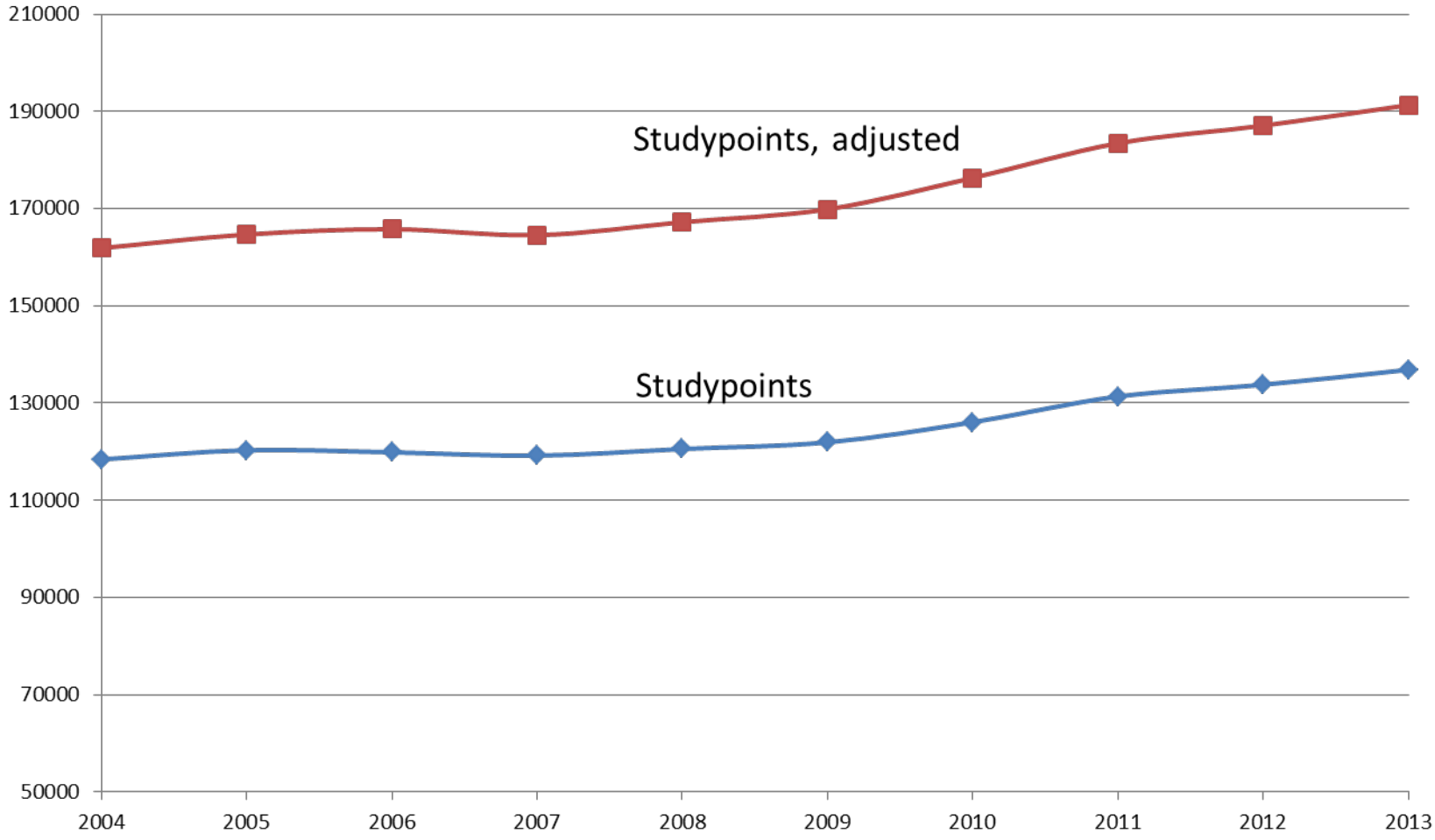
Variables of the basic model

- Units (38)
  - Universities and regional colleges
- Inputs
  - Total man-years
- Outputs
  - Study points measured by number of exams for shorter education (adjusted for study mix)
  - Study points measured by number of exams for longer education (adjusted for study mix)
  - Publishing points for scientific publications

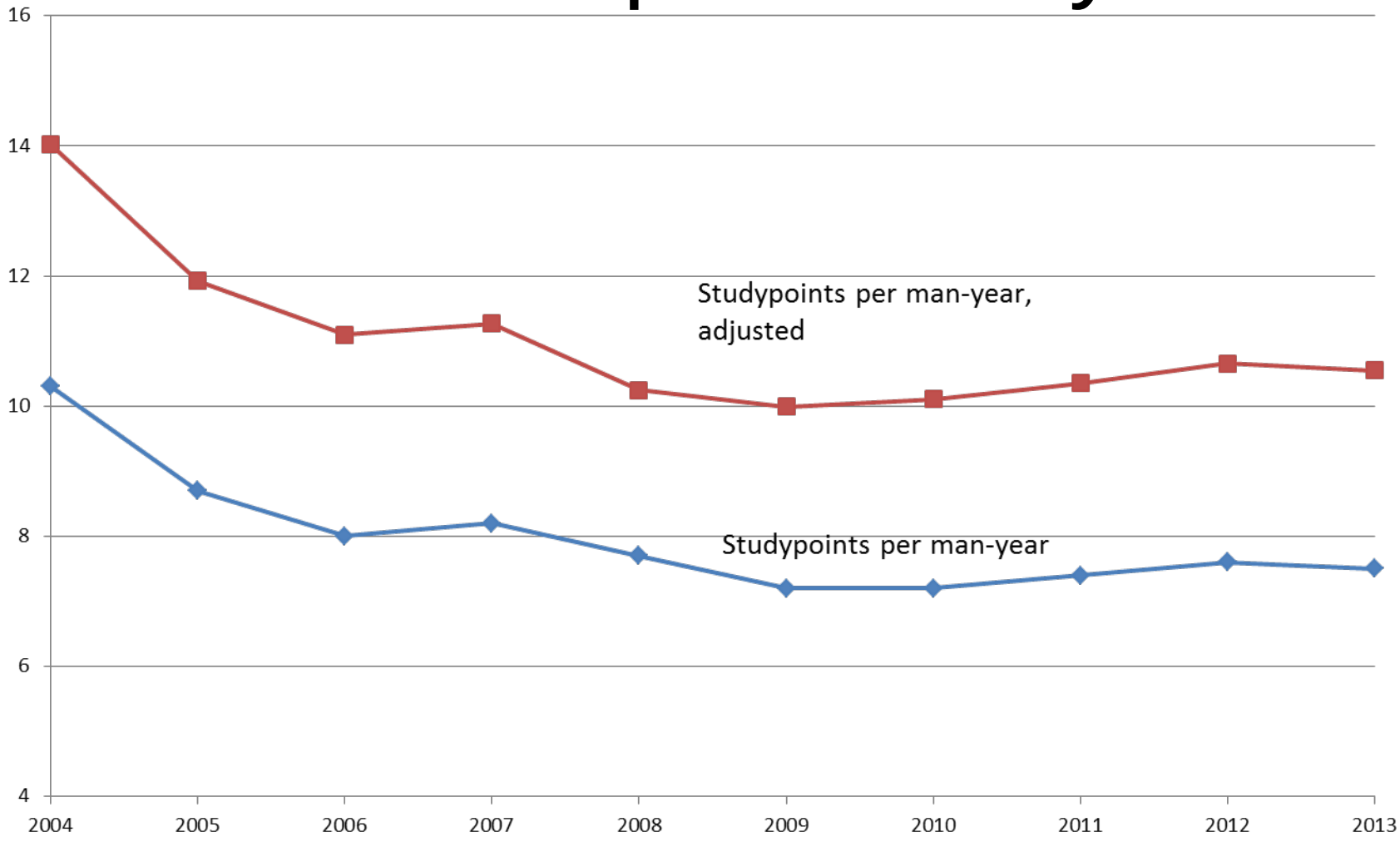
Man-years


20000
18000
16000
14000
12000
10000
8000
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Man-years

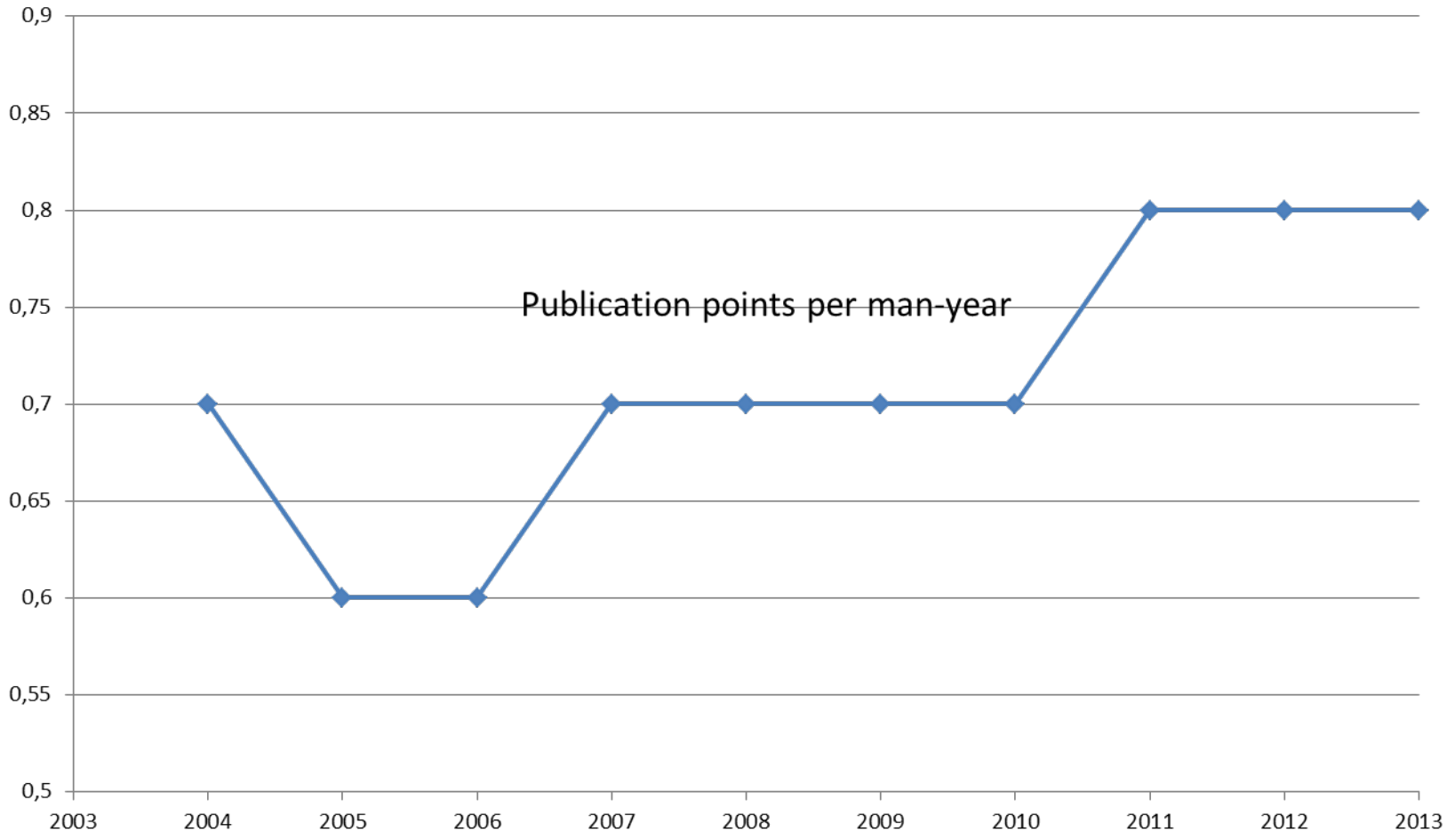
Studypoints



Partial productivity



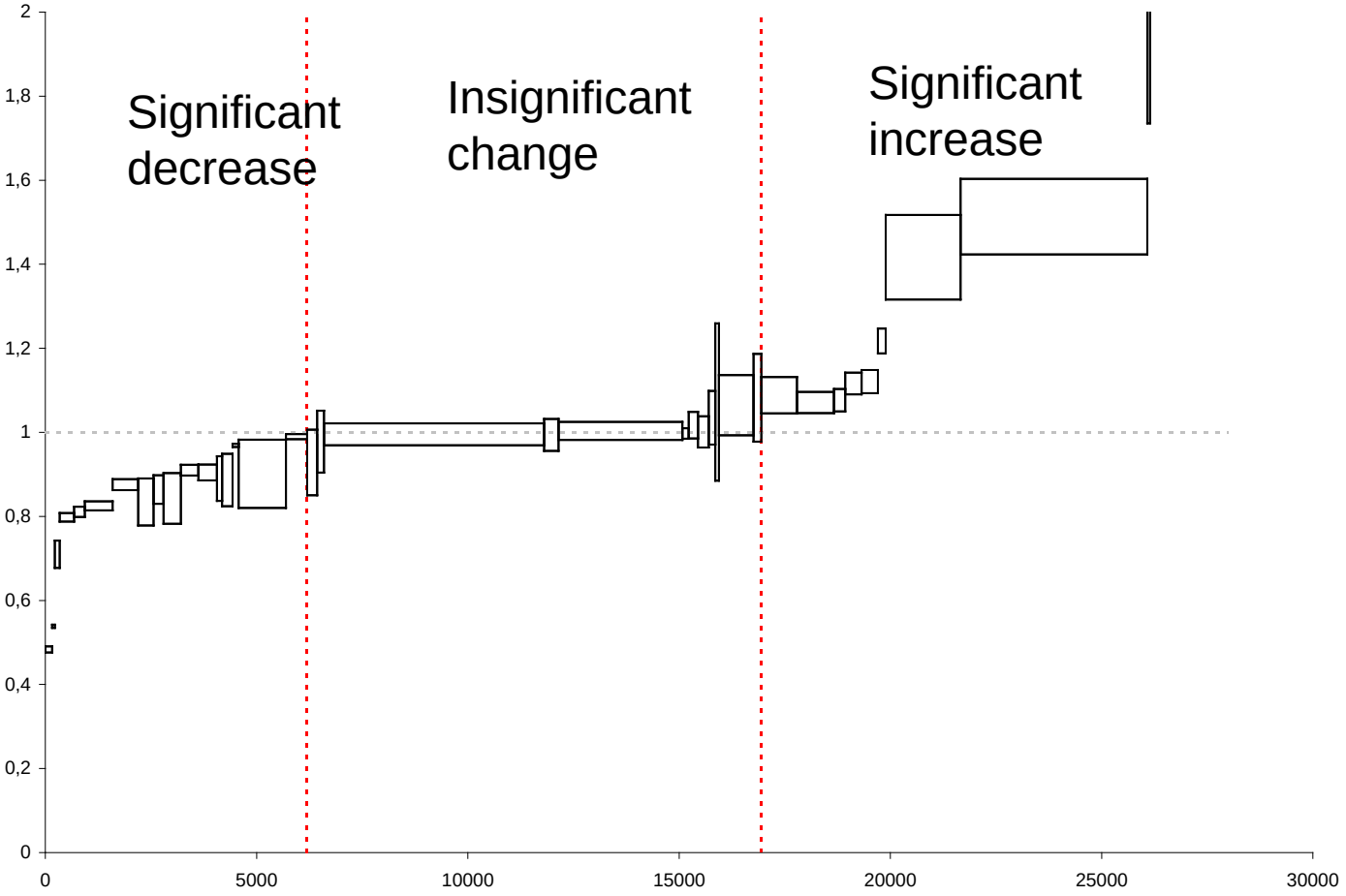
Partial productivity, cont.



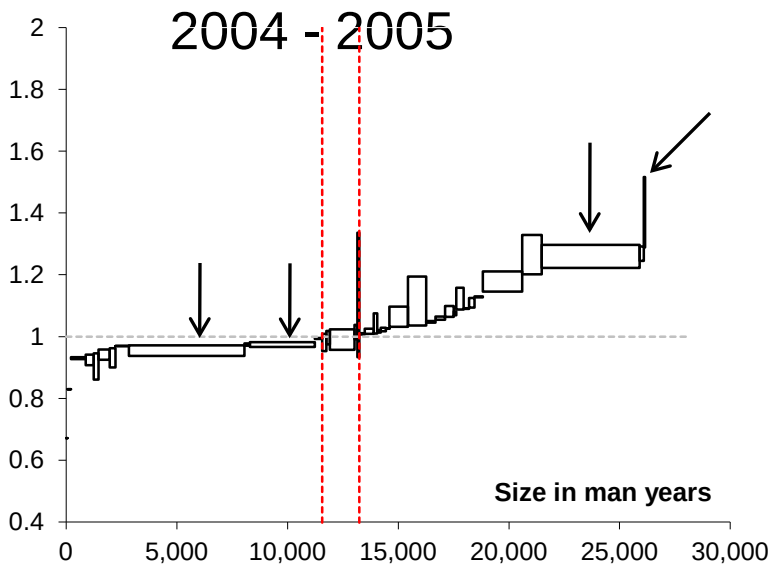
Weaknesses of the study

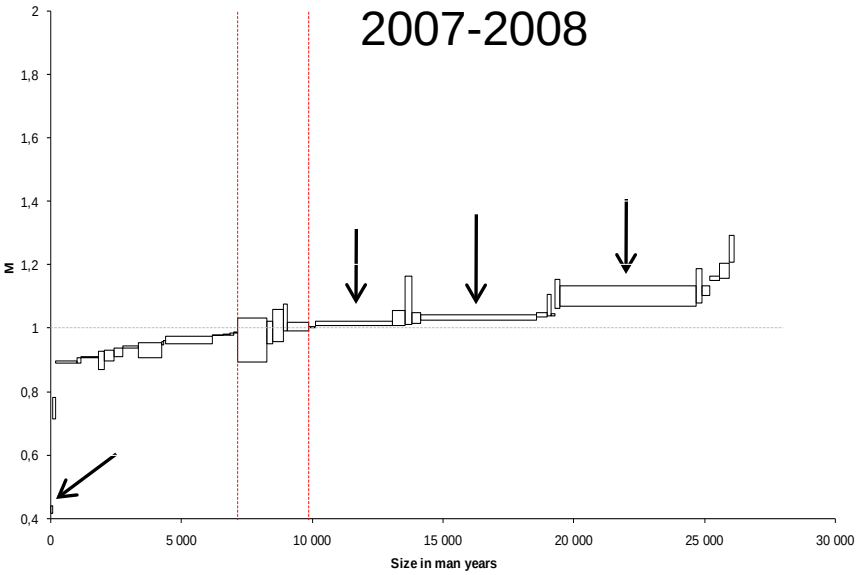
- Only number of exams count, not quality
- PhD degrees not an output variable
- Total man-years not split on administration and faculty
- Composition of studies not so easily comparable between units
  - Study points weighted with unit costs of students
- Level of aggregation too high

Productivity development 2004 - 2008 (37 units)

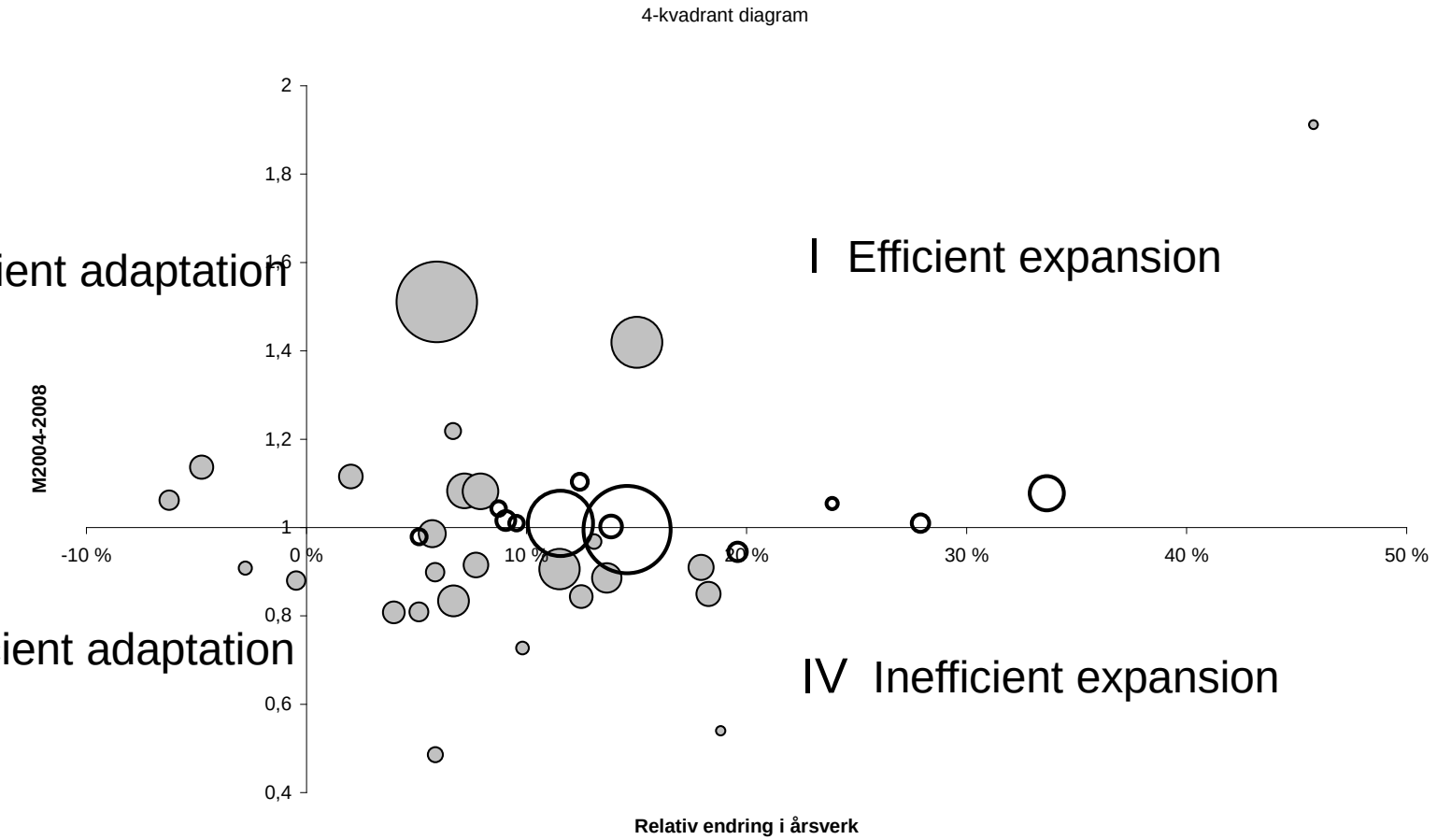


Following individual units





Change in productivity and labour resources 2004 -2008



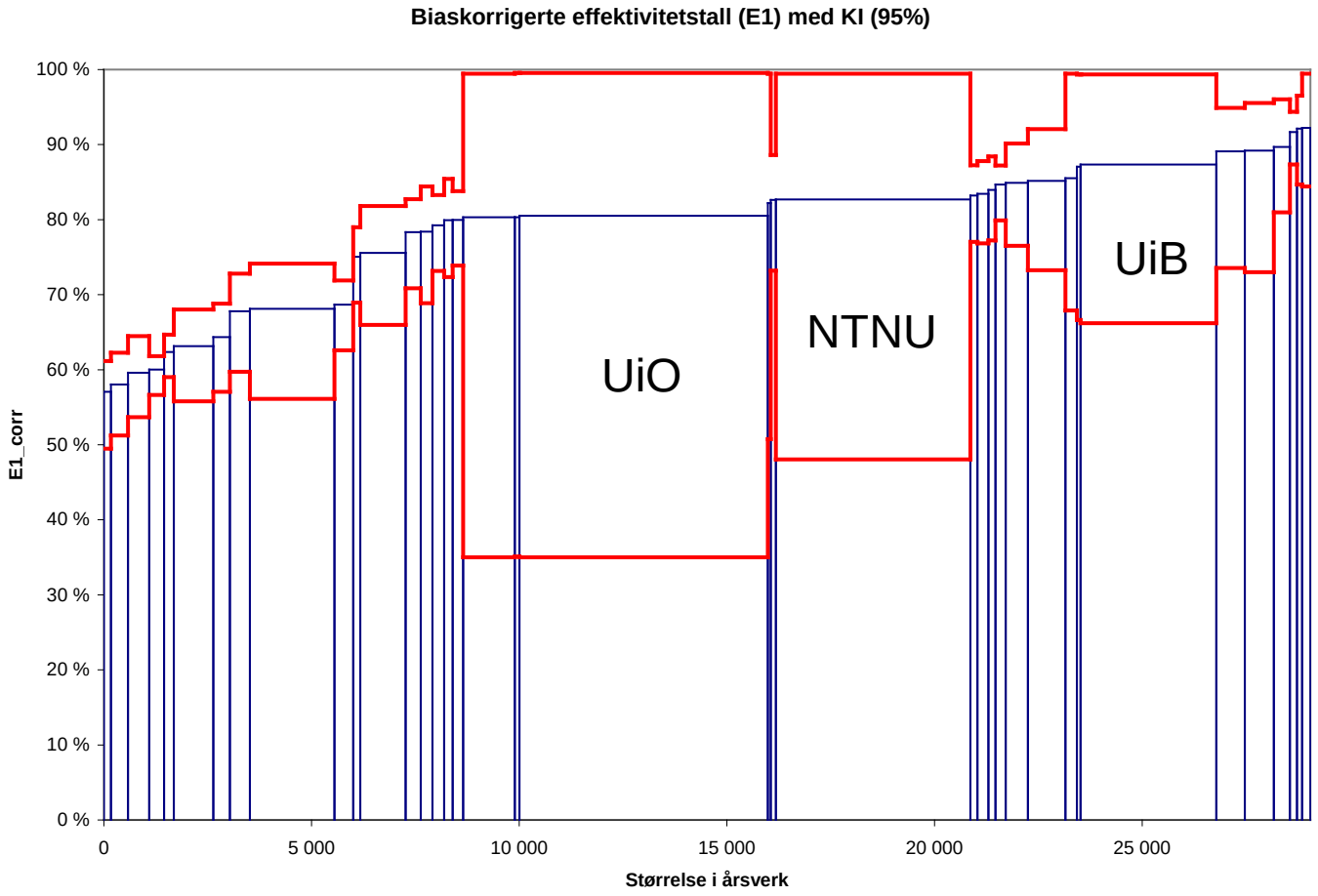
II Efficient adaptation

I Efficient expansion

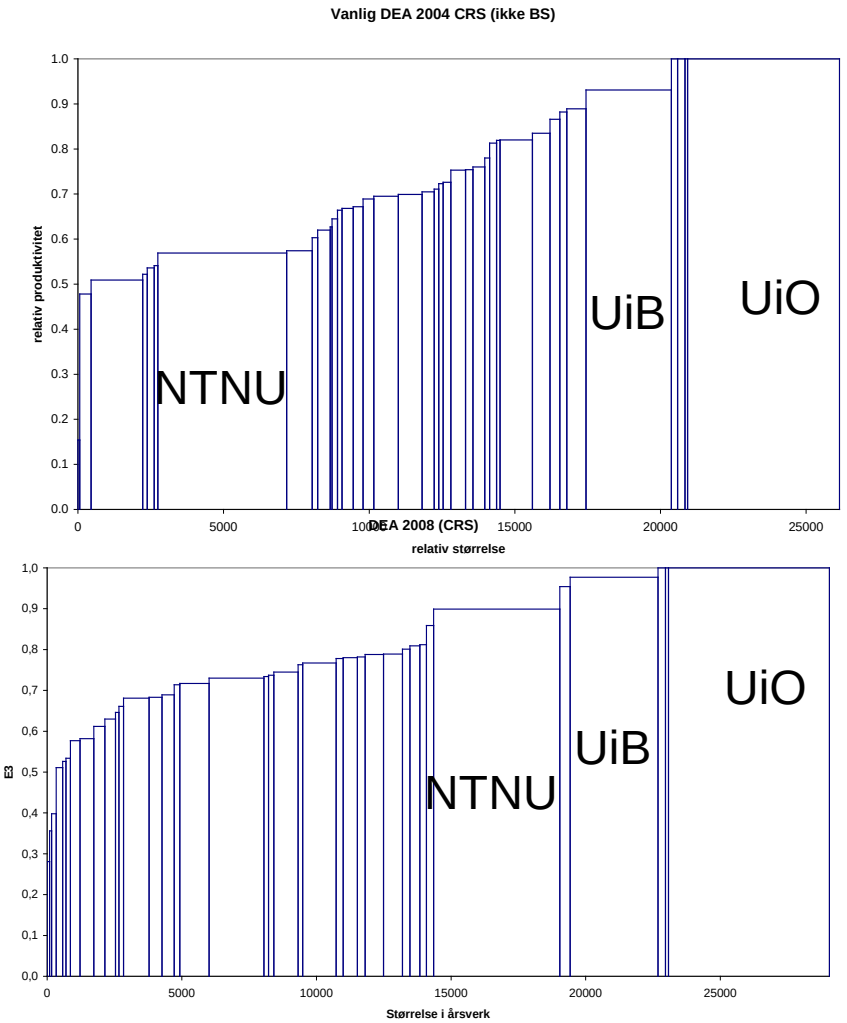
III Inefficient adaptation

IV Inefficient expansion

Saving potential resources, 2008



Scale efficiency 2004, 2008



Scope

- Cost of stand-alone versus joint production
  - Problem: very few and special stand-alone institutions
- Relationship between productivity and research versus education
- Relationship between productivity and many studies – few studies
  - Degree of specialisation
- Short education – long education