# UNIVERSITY MERGERS IN ENGLAND: EFFECTS ON EFFICIENCY

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EWEPA Helsinki 2015
17th June 2015


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# Outline of talk

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- Introduction
- Background
- Reasons for merger in higher education
- Previous evidence on the consequences of mergers
- Model
- Results
- Conclusions

# Introduction

Various forms of relationships can be observed in the English higher education (HE) sector:

- shared purchasing and services
- joint ventures and alliances
- full merger

This paper is concerned only with merger:

- ‘Merger: two or more partners combining to create a single institution, which may retain the name and legal status of one of them or be an entirely new legal entity.’ (HEFCE 2012, p11)

# Introduction

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- The current economic climate puts pressure on publicly-funded sectors to deliver more for less – including English HE
- Funding cuts can be absorbed by efficiency savings – possibly achieved by mergers (*the efficiency theory*)

# Introduction

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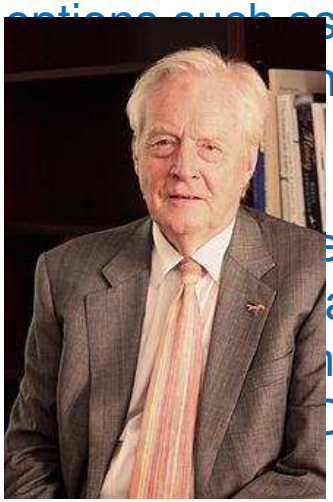
'If institutional failure cannot be prevented …, then the Council will explore options such as mergers or takeovers led by other providers so that the new form becomes a going concern.' (The Browne Report



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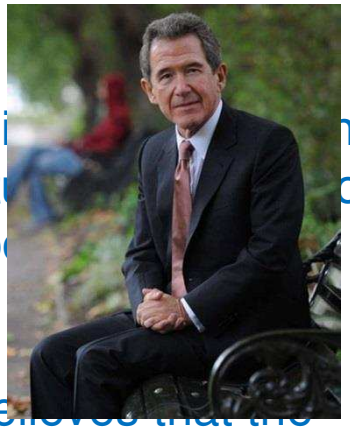
October 2012)



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# Introduction

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**Some questions:**

- Does the merger of 2 (or more) HEIs cause an increase in subsequent efficiency?
- Do the efficiency effects of merger take time to reap?

# Introduction

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**Some problems:**

- Historically there are comparatively few mergers in English higher education
- Merger activity and efficiency may themselves be endogenous
- So conventional econometric techniques of analysis may not be appropriate

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This paper uses a Bayesian approach organised around the use of Markov chain Monte Carlo (MCMC) and proposes a method of analysis which

- Assesses efficiency of  HEIs in England
- Takes into account the endogeneity of merger activity and inefficiency
- Quantifies the determinants of inefficiency and of merger activity
- Identifies whether there have been efficiency gains following merger

# Background

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- There have been very few mergers in English HE,
- These have varied in HEI composition
- These have largely been HEI-motivated

# Background

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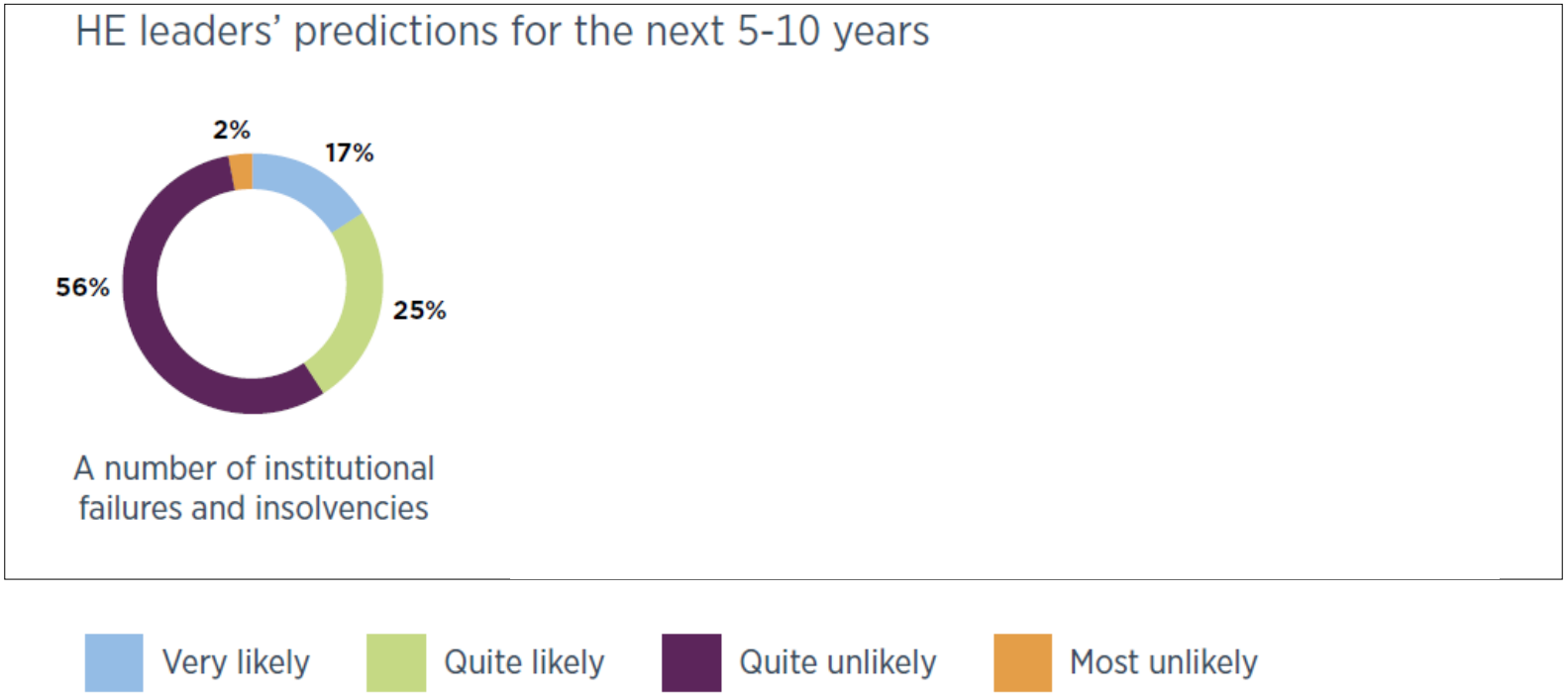
- This contrasts with the experience in Wales, for example:

  •"The Welsh government has stepped in to reduce the number of universities in Wales; maybe the English government will have to do the same."

  •"…experience suggests that universities [in England] will not make such radical changes for themselves…"

  •Sir Roderick Floud, *THE* 19-25 June 2014

# Background




Boxall and Woodgates (2014)

# Reasons for merger in higher education

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## 1. Efficiency theory

•A merger will occur if the merging HEIs believe they can be run more efficiently and effectively together than separately

- **Economies of scale**
- **Economies of scope**

•Efficiency theory is the main underlying cause of merger activity in GB (Rowley 1997)

•**Prediction:** merger leads to lower inefficiency

# Reasons for merger in higher education

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## 2. Strategy motive

- A merger will occur for reasons of **survival and/or growth** for at least one of the participants (Pritchard 1993; Rowley 1997; Harman and Meek 2002; Harman and Harman 2003)

•**Prediction:** inefficiency leads to merger

# Reasons for merger in higher education

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## 2. Strategy motive

- A merger will occur to enhance **reputation** (Skodvin 1999; Engwall 2007; Harman and Harman 2008; Tirronenen and Nokkala 2009; Aula and Tienari 2011)
- A merger will occur to improve **international competitiveness** (Mok 2005; Tirronenen and Nokkala 2009)
    - **Prediction:** merger leads to lower inefficiency

# Previous evidence

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- **Statistical analyses:**
- China (Hu & Liang 2008; Mao 2009): efficiency, outcomes and productivity improved in year following merger; but did not in the second year
- England (Johnes 2014):
  - the typical merged HEI is significantly more efficient than either pre-merger or non-merging HEIs
  - the effects can vary by the types of HEI participating in the merger; there are both winners and losers

# Previous evidence

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## Statistical analyses: some caveats

- Previous statistical analyses fail to take into account
  - the complex relationship between inefficiency and merger
  - that other underlying characteristics might cause merging institutions to perform differently from non-merging ones

# Previous evidence

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## Statistical analyses: some caveats

- Any measurement of efficiency typically
  - does not incorporate any loss caused by the merger in learning experience on the part of students or staff
  - does not incorporate any social costs arising from reduction in diversity between HEIs in the sector

# Model

- Suppose: universities use *k* inputs ($k = 1, \dots, K$) to produce *l* outputs ($l = 1, \dots, L$)
- inputs and outputs are denoted by *X* and *Y* respectively
- subscript *it* represents university *i* in time period *t* ($i = 1, \dots, N; t = 1, \dots, T$).

# Model

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- Inefficiency is estimated using a standard translog output distance function (ODF):

$$\mathrm{D}(Y_{it}, X_{it}) = 1 \Rightarrow y_{1,it} = f\left(\tilde{y}_{m,it}, x_{s,it}\right) + v_{it} - u_{it}$$

- $v_{it} \sim iidN(0, \sigma_v^2)$ represents the error
- $u_{it} \sim iidN_+(0, \sigma_u^2)$ is the one-sided component, independently distributed and independent of the regressors
- lower case letters indicate logs, and $\tilde{y}_m = y_m - y_1, m = 2, \ldots, M$

# Model

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## Tendency to merge

- $W_{it}^{*} = \boldsymbol{z}_{it}'\boldsymbol{\gamma} + \rho_1 \log u_{it} + \rho_2 \log u_{i,t-1} + \varphi W_{i,t-1}^{*} + \phi I_{i,t-1} + \varepsilon_{it},\ \varepsilon_{it} \sim \text{iid} N(0,1)$
- $I_{it} = \mathbf{1}\left(W_{it}^{*} \geq 0\right)$ is an observed merging indicator which is 1 if a merger took place and zero otherwise
- $\boldsymbol{z}_{it}$ is a vector of covariates
- Tendency to merge also depends on current and past inefficiency and is also possibly persistent (autoregressive)

# Model

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## Inefficiency

$$\log u_{it} = \alpha_0 + \alpha_1 \log u_{i,t-1} + \boldsymbol{z}'_{it}\boldsymbol{\delta} + \alpha_2 W^*_{i,t-1} + \alpha_3 I_{i,t-1} + \xi_{it},$$
$$\xi_{it} \sim \text{iid} N\left(0, \sigma^2_\xi\right)$$

- The dependence of technical inefficiency on $W^*_{it}$ (latent merging indicator) and $I_{it}$ (actual merging indicator) helps to distinguish between "latent" and "actual" effects of mergers
- Allowing for persistent inefficiency implies that there may be adjustment costs and inertia in decreasing inefficiency which could be present even after a possible merger

# Model

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- At time period *t*-1 HEIs *i* and *j* merge to become a new HEI (*n*)
- Inefficiency improvement is calculated as: $\Delta u_{nt} = u_{nt} - u_{n,t-1}$
- Probabilities of such events are difficult to compute using the classical approach; Bayesian approach MCMC methods simplify the task
- We estimate the ODF in an unrestricted manner and examine the probability that improvements in inefficiency have occurred
- The required probability is $P(\Delta u_{nt} > 0|\text{Data})$ marginally on the parameters to account for parameter-related uncertainty
- MCMC: probabilities can be computed easily for all *n* and *t*
- These are probabilities of efficiency improvement after merger, **assuming that mergers and inefficiency are endogenous**

# Output distance function

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## X and Y variables

| | |
|---|---|
| PGINPUT | Total number of FTE PG students |
| UGINPUT | Total number of FTE first degree and other UGs |
| STAFF | Number of FTE academic staff |
| ACSERV | Expenditure on centralised academic services (in £000s) |
| ADMIN | Expenditure administration and central services (in £000s) |
| PGOUTPUT | Number of higher degrees plus other PG qualifications |
| UGOUTPUT | Number of first degree and other UG degrees awarded |
| RESEARCH | Income received in funding council grants plus income received in research grants and contracts (in £000s) |

# Tendency to merge and inefficiency models

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## Z variables

| | |
|---|---|
| LSIZE | Total number of students i.e. PGINPUT+UGINPUT (in logarithms |
| LSIZESQ | The square of LSIZE |
| FIRST | Proportion of first degree graduates achieving first class honours |
| UPSEC | Proportion of first degree graduates achieving upper second class honours |
| LOWSEC | Proportion of first degree graduates achieving lower second class honours |
| THIRD | Proportion of first degree graduates achieving third class honours |
| UNC | Proportion of first degree graduates achieving unclassified degree |

# Data

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- Higher Education Statistical Agency (HESA) data
- Unbalanced panel of data from 1996/97 to 2008/09 with n = 1694 (the number of HEIs varies from 126 to 138 in each year)
- All money units in 2008 values

# Results: Tendency to merge and inefficiency

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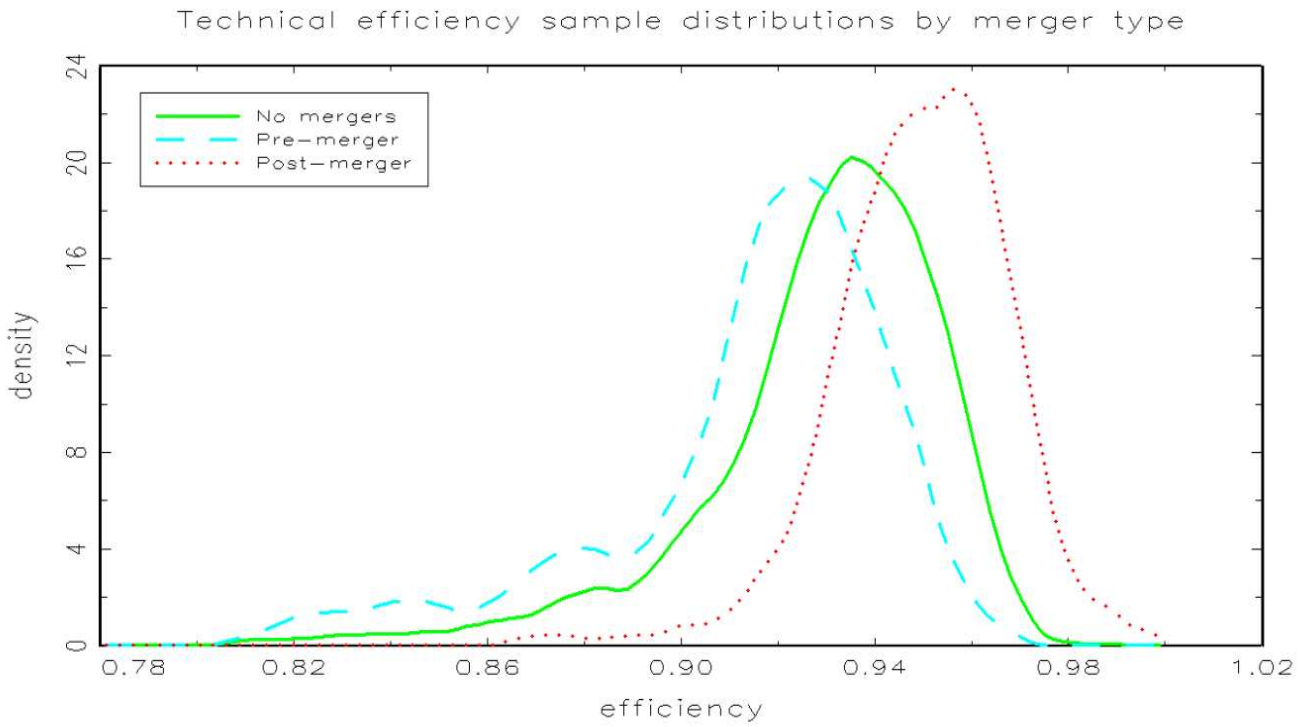
## Posterior means (and SDs); Marginal effects (and SDs)

| | Posterior means | | Marginal effects | |
|---|---|---|---|---|
| | $W_{it}^*$ | $\log u_{it}$ | $W_{it}^*$ | $\log u_{it}$ |
| **constant** | -0.2481 (0.0972) | 0.0445 (0.0138) | --- | --- |
| $W_{i,t-1}^*$ | 0.1734 (0.0315) | -0.0107 (0.00315) | 0.072 (0.0212) | 0.034 (0.0021) |
| $\log u_{it}$ | 0.3115 (0.6781) | --- | 0.085 (0.071) | --- |
| $\log u_{i,t-1}$ | 0.0971 (1.2234) | 0.0126 (0.0031) | 0.0401 (0.373) | 0.0215 (0.0027) |
| **LSIZE** | 0.2341 (0.0732) | 0.02415 (0.0116) | 0.0151 (0.0022) | 0.0341 (0.0071) |
| **LSIZESQ** | -0.0110 (0.0113) | -0.0021 (0.0002) | -0.0035 (0.0001) | -0.0017 (0.0002) |
| **FIRST** | -0.0003 (0.0001) | $3\ 10^{-5}$ ($7\ 10^{-6}$) | -0.0005 (0.0001) | $1\ 10^{-5}$ ($1\ 10^{-6}$) |
| **UPSEC** | -0.0002 (0.0001) | $3\ 10^{-5}$ ($2\ 10^{-6}$) | -0.0004 (0.0001) | $1\ 10^{-5}$ ($3\ 10^{-6}$) |
| **LOWSEC** | 0.0002 (0.0001) | $1\ 10^{-5}$ ($2\ 10^{-6}$) | 0.0001 (0.0001) | $2\ 10^{-5}$ ($2\ 10^{-6}$) |
| **THIRD** | 0.0001 (0.0002) | $2\ 10^{-5}$ ($4\ 10^{-6}$) | 0.0004 (0.0001) | $3\ 10^{-5}$ ($1\ 10^{-6}$) |
| **UNC** | 0.0003 (0.0001) | $2\ 10^{-5}$ ($1\ 10^{-6}$) | 0.0003 (0.0001) | $2\ 10^{-5}$ ($1\ 10^{-6}$) |
| $I_{i,t-1}$ | -0.0138 (0.0012) | $-1\ 10^{-5}$ ($1\ 10^{-6}$) | -0.0212 (0.0013) | $-2\ 10^{-5}$ ($1\ 10^{-6}$) |

# Results: Technical efficiency by merger type





# Results: New model compared to other models

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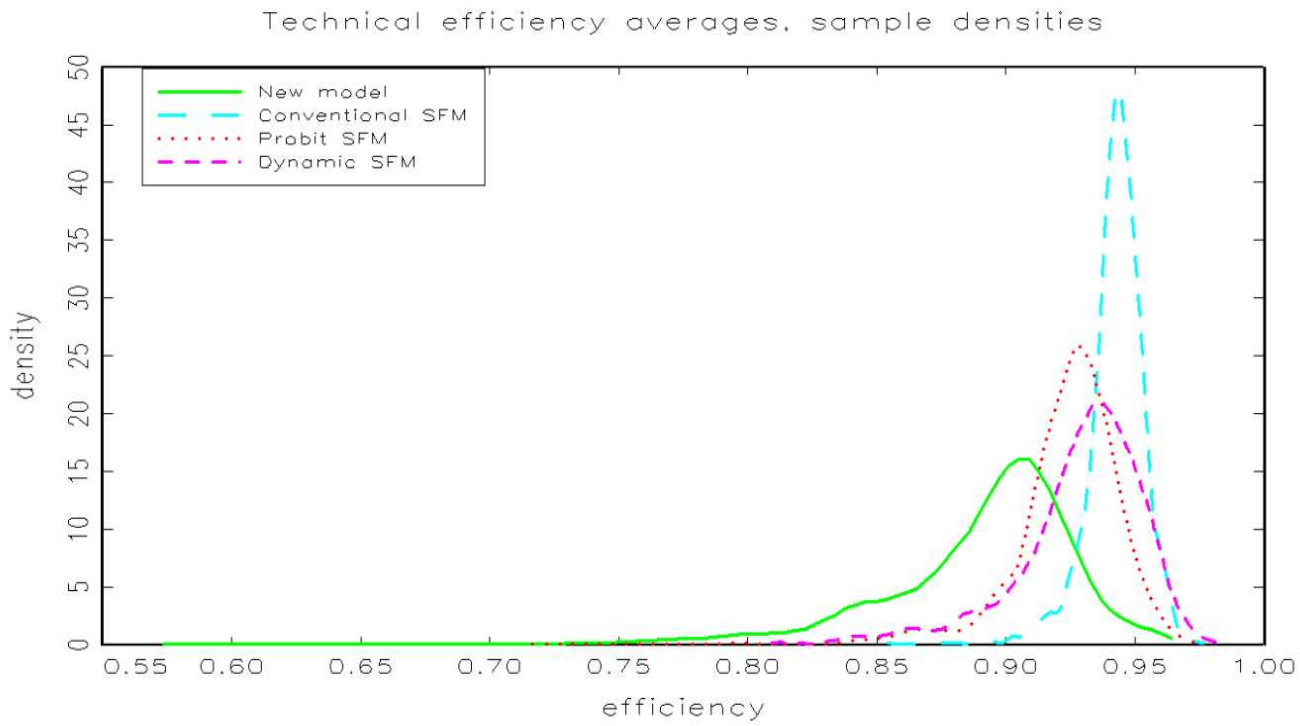
## Comparison of models: Bayes factors of new model against 3 alternatives

| | Entire sample |
|---|---|
| New model against: | |
| Conventional SFM $\rho_1 = \rho_2 = \varphi = \alpha_1 = \alpha_2 = \alpha_3 = 0$ | 61.332 |
| Probit SFM $\alpha_1 = \alpha_2 = \alpha_3 = 0$ | 31.225 |
| Dynamic SFM $\gamma = \rho_1 = \rho_2 = \varphi = \alpha_1 = \alpha_2 = \alpha_3 = 0$ | 11.344 |

# Results: New model compared to other models





# Results: Efficiency improvement

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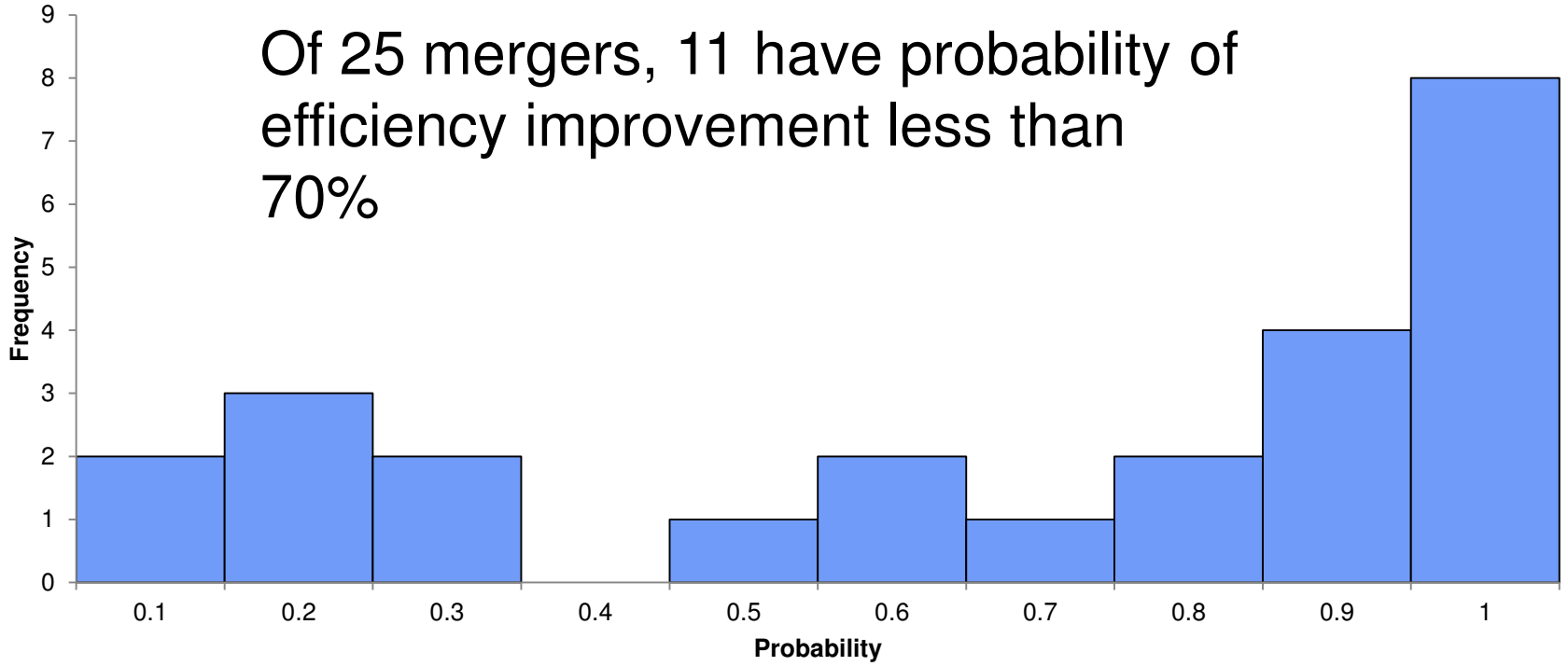
$$P(\Delta u_{nt} > 0|\text{Data}) \text{ where } \Delta u_{nt} = u_{nt} - u_{n,t-1}$$

Of 25 mergers, 11 have probability of efficiency improvement less than 70%



# Results: Efficiency improvement

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**What are the characteristics of a "successful" merger?**

- **Geography** (Skodvin 1999)?
- An examination of the distance between merging HEIs reveals no particular patterns
- **Similar culture and mission** (HEFCE 2010)?
- Of the 11 mergers with probability of efficiency improvement < 70%, 6 are between HEIs of the same type
- **Grants** from HEFCE's Strategic Development Fund?
- For example: the Manchester merger attracted a grant of £10 million **plus** a further £10 million in repayable grants

# Results: Efficiency of merged HEIs over time

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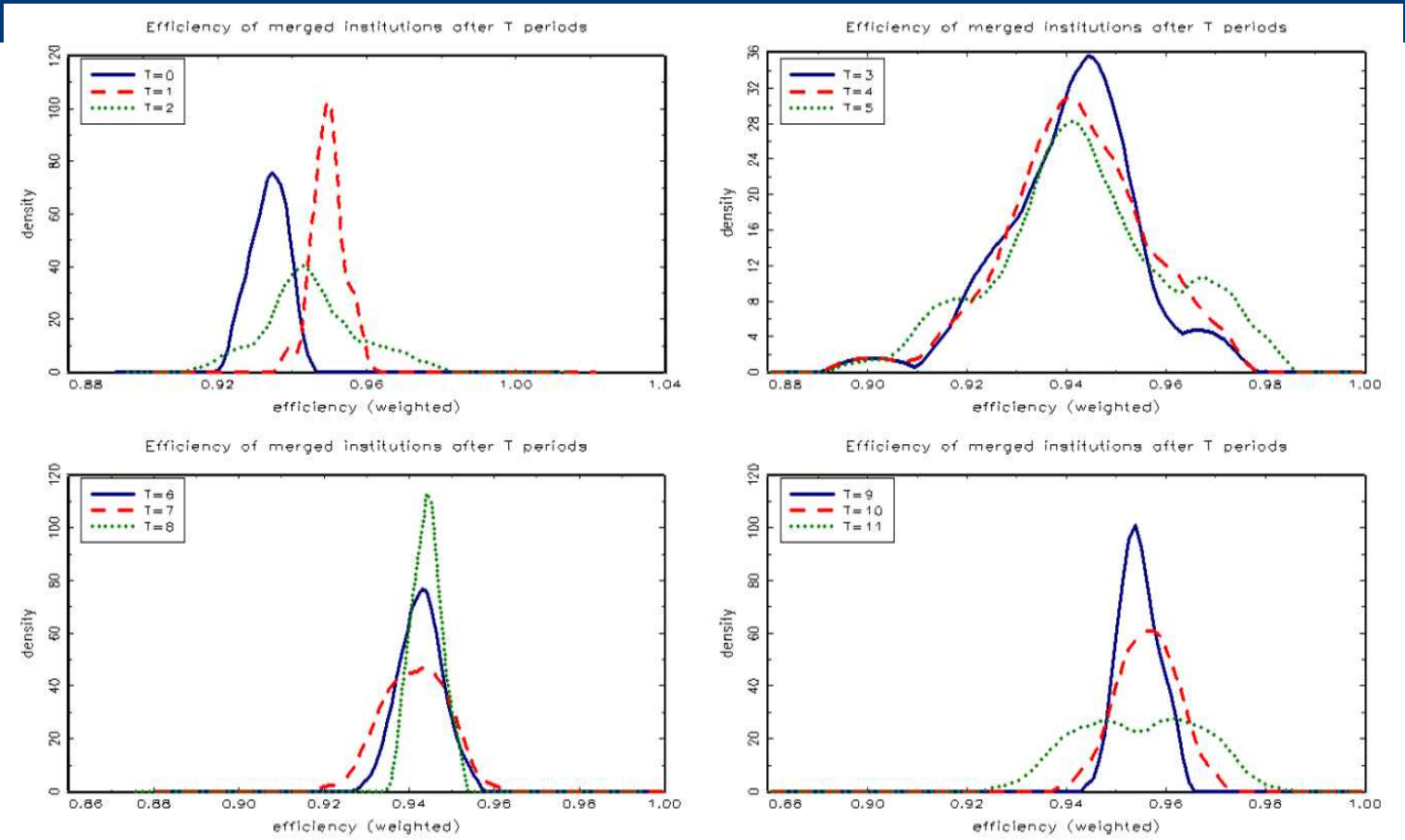




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# Conclusions

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- Inefficiency is significantly, positively affected by **tendency** to merge and **action** of merging (in the previous time period)
- Tendency to merge is not significantly affected by inefficiency
- The new model taking into account endogeneity of merging and inefficiency performs better than 3 nested models which do not
- Inefficiency and tendency to merge are positively, significantly related to the size of HEI; the relationship is non-linear

# Conclusions

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- Merging HEIs are typically more efficient than pre- and non-merging HEIs
- Efficiency improvement is not experienced across all mergers: 11 of 25 mergers examined have probability $< 0.70$ that efficiency does not improve in time $t$ compared to $t$-1 (year of merger).
- Mean efficiency peaks soon after merger, and plateaus at a value of 0.94 to 0.95; dispersion around the mean is wide particularly in the 3 to 5 periods after merger.

# Conclusions

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- **Caveats:** measurement of efficiency does not incorporate
  - loss imposed by the merger in terms of learning (and teaching) experience on the part of students (or staff)
  - possible social costs arising from reduction in diversity between HEIs in the sector caused by merging
  - regional economic effects of HEI closures

Thank you!