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Original Citation

Johnes, Jill and Tsionas, Mike (2015) University mergers in England: Effects on efficiency. In: European Workshop on Efficiency and Productivity Analysis, 15-18 June 2015, Helsinki, Finland. (Unpublished)

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UNIVERSITY MERGERS IN ENGLAND: EFFECTS ON EFFICIENCY

EWEPA Helsinki 2015
17th June 2015

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Outline of talk

- 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

- 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

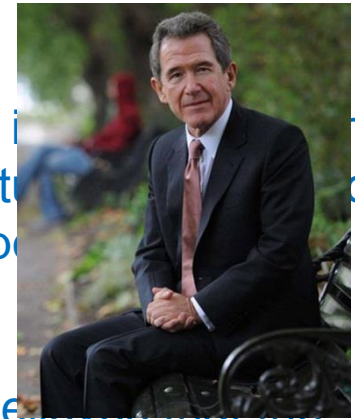
'If institutional failure cannot be prevented ..., then the Council will explore options such as mergers or takeovers led by other providers so that the new form becomes a going concern.' (The Browne Report



Sir Roderick Floud former president of the Higher Education Funding Council for England, reported that 'the world concentration of research funding is so high that you possibly cannot compete as a single institution'. Sir Roderick, vice-chancellor of Exeter University, reported in the *Guardian* (October 2012)



... he believed that the number of universities in the UK should be reduced to at least one-third if not



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?



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

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

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

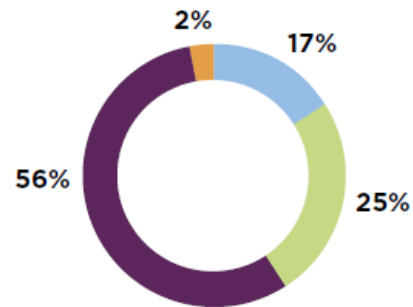


Background

- 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

HE leaders' predictions for the next 5-10 years



A number of institutional failures and insolvencies



Very likely



Quite likely



Quite unlikely



Most unlikely

Boxall and Woodgates (2014)

Reasons for merger in higher education

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

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

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

- **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

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

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 ($i = 1, \dots, N; t = 1, \dots, T$).



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

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

- $v_{it} \sim iidN(0, \sigma_v^2)$ 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 $\tilde{y}_m = y_m - y_1, m = 2, \dots, M$

Tendency to merge

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

Inefficiency

$$\begin{aligned} \log u_{it} &= \alpha_0 + \alpha_1 \log u_{i,t-1} + \mathbf{z}'_{it} \boldsymbol{\delta} + \alpha_2 W_{i,t-1}^* + \alpha_3 I_{i,t-1} + \xi_{it}, \\ \xi_{it} &\sim \text{iid}N(0, \sigma_{\xi}^2) \end{aligned}$$

- 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

- 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

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

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

- 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

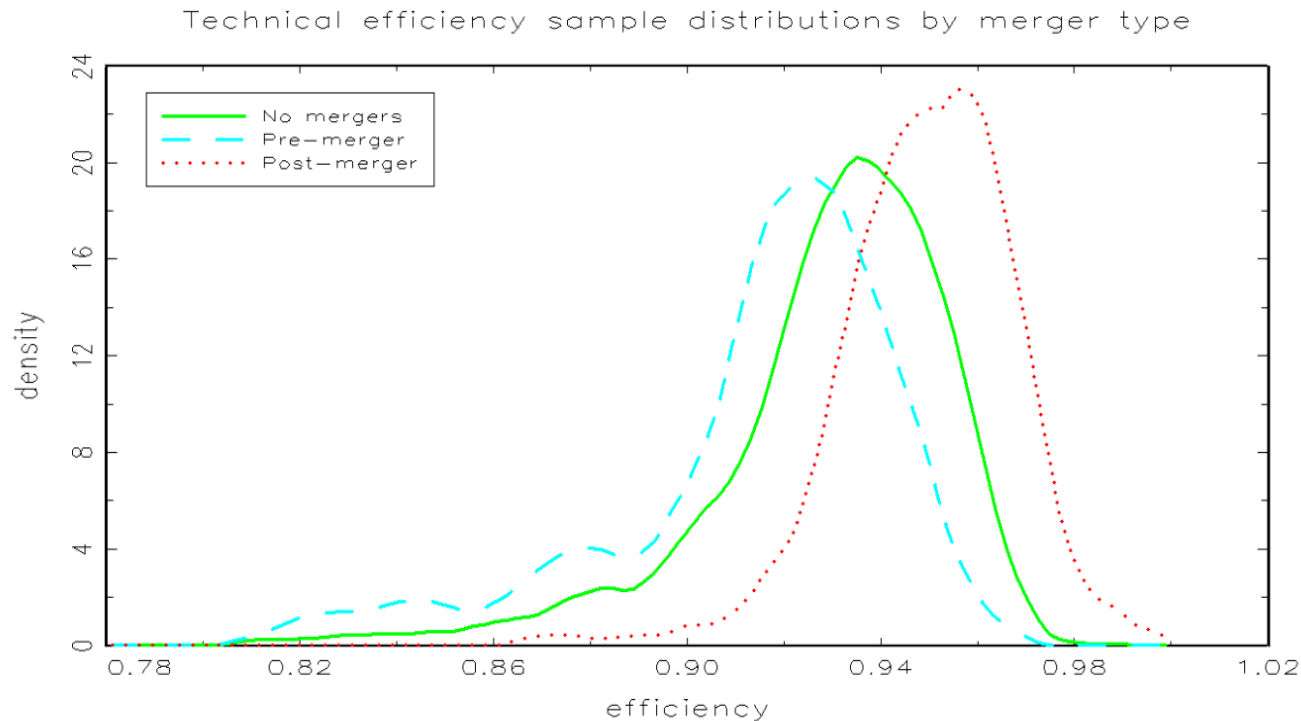


Results: Tendency to merge and inefficiency

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)	$3 \cdot 10^{-5}$ ($7 \cdot 10^{-6}$)	-0.0005 (0.0001)	$1 \cdot 10^{-5}$ ($1 \cdot 10^{-6}$)
UPSEC	-0.0002 (0.0001)	$3 \cdot 10^{-5}$ ($2 \cdot 10^{-6}$)	-0.0004 (0.0001)	$1 \cdot 10^{-5}$ ($3 \cdot 10^{-6}$)
LOWSEC	0.0002 (0.0001)	$1 \cdot 10^{-5}$ ($2 \cdot 10^{-6}$)	0.0001 (0.0001)	$2 \cdot 10^{-5}$ ($2 \cdot 10^{-6}$)
THIRD	0.0001 (0.0002)	$2 \cdot 10^{-5}$ ($4 \cdot 10^{-6}$)	0.0004 (0.0001)	$3 \cdot 10^{-5}$ ($1 \cdot 10^{-6}$)
UNC	0.0003 (0.0001)	$2 \cdot 10^{-5}$ ($1 \cdot 10^{-6}$)	0.0003 (0.0001)	$2 \cdot 10^{-5}$ ($1 \cdot 10^{-6}$)
$I_{i,t-1}$	-0.0138 (0.0012)	$-1 \cdot 10^{-5}$ ($1 \cdot 10^{-6}$)	-0.0212 (0.0013)	$-2 \cdot 10^{-5}$ ($1 \cdot 10^{-6}$)

Results: Technical efficiency by merger type

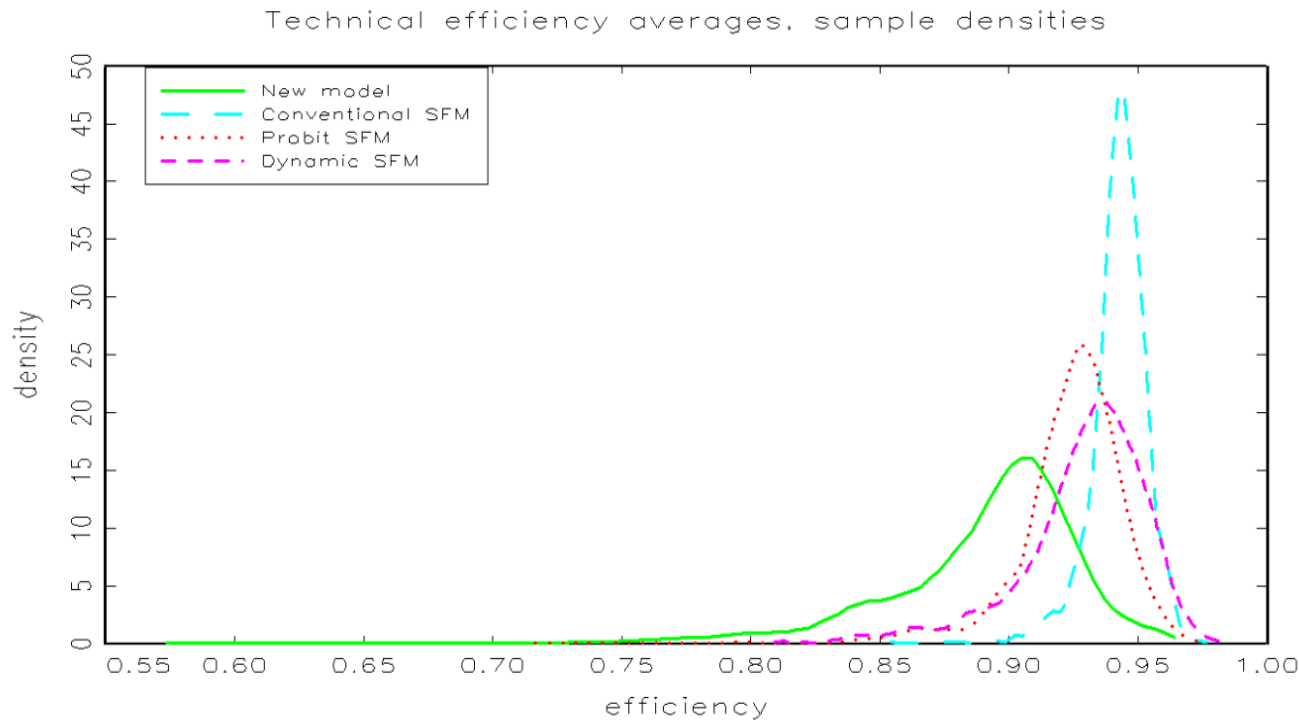


Results: New model compared to other models

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

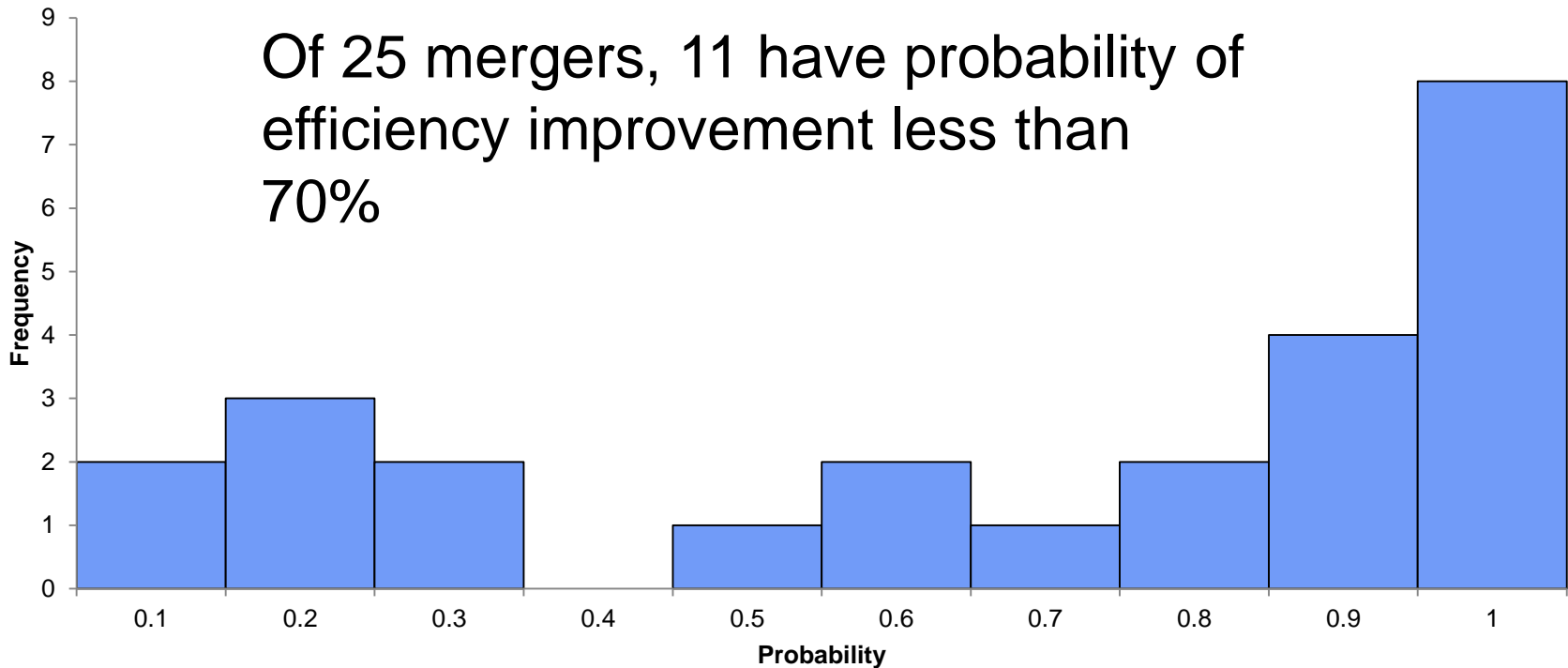
Results: New model compared to other models



Results: Efficiency improvement

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

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

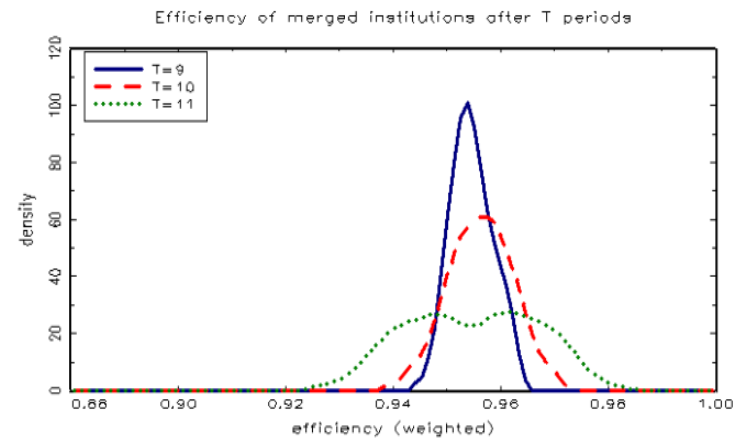
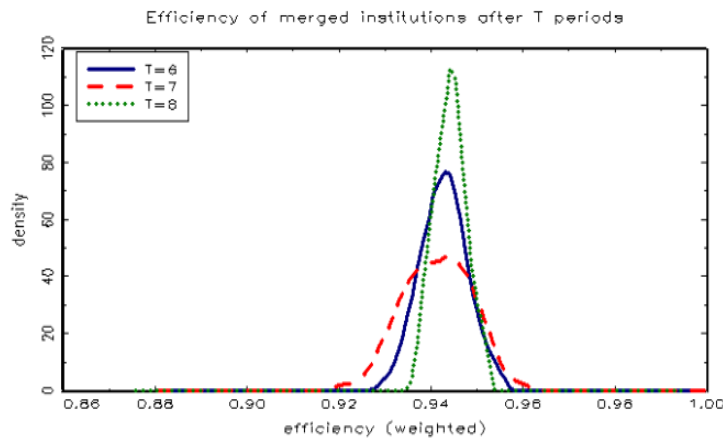
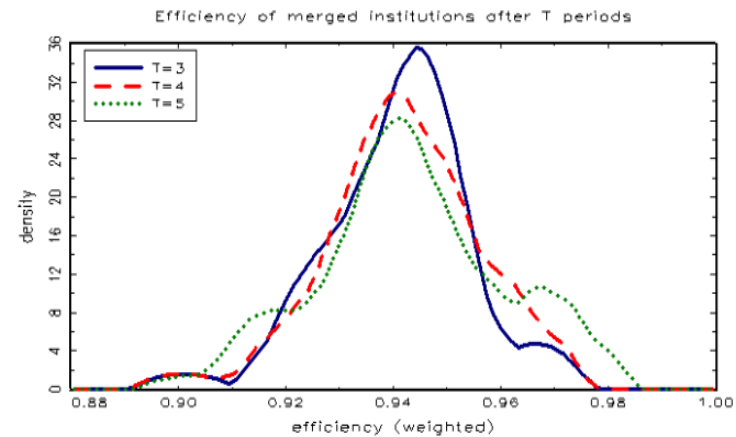
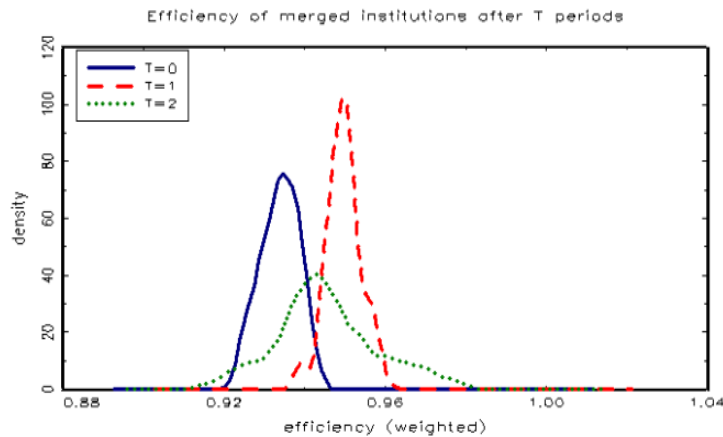


Results: Efficiency improvement

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



Conclusions

- 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

- 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

- **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!

