Paper presented to the Health Economists' Study Group Meeting, Newcastle, June 29th – July 1st 2005. Not to be quoted without the authors permission.

Diversification and specialisation measurement

David Parkin*

City Health Economics Centre, Department of Economics, City University, London, UK.

Bruce Hollingsworth

Centre for Health Economics, Faculty of Business and Economics, Monash University, Melbourne, Australia.

Summary

An underdeveloped and under researched area in production economics is the economics of diversification and economies of scope. In particular there have been few applications in health care. These concepts are of importance in analysing the efficiency of hospitals, which are characterised by the existence of both diversified and specialist units, as it would be desirable to know if multi-service hospitals are justified on efficiency grounds. Two approaches to measurement of scope economies have been proposed that use non-parametric methods based on Data Envelopment Analysis, the only method founded on economic theory for measuring multiple input, multiple output production functions . This paper uses and compares both of these to analyse both cost and production functions for a sample of 38 UK hospitals. For the first time we model multiple input – multiple output economies of scope in health care, based on non-parametric cost and production functions. Economies of scope are estimated and the relative merits of the two approaches are discussed.

* Corresponding author : *Department of Economics, City University, Northampton Square, London EC1V 0HP, United Kingdom Telephone: +44 20 7040 0171; FAX: +44 20 7040 8500; e-mail: d.parkin@city.ac.uk*

1. Introduction

In analysing the production of health care in hospitals, a key observation is that they produce a range of outputs. As a result, methods for analysing the production of single product firms are inappropriate. There is a growing literature that uses methods applicable to multi-product firms, which has focussed on the technical efficiency of hospitals relative to their scale of operation and the existence of economies of scale [1]. However, a second observable feature is that hospital output is heterogeneous not only *within* hospitals, but also *between* hospitals. Hospitals differ in the range of outputs that they produce; general hospitals produce a wide range of different services, other hospitals are highly specialised. The economics of diversification, concerning the range rather than the scale of production, is of considerable importance in, for example, determining whether it is more efficient for hospitals to specialise or to maintain several specialties within a more general hospital.

The economics of diversification is an underdeveloped and under researched area in production economics [2]. There have been developments in the theory [3], but there have been few applications. One of its most important elements is the issue of economies of scope, where it may be cheaper to manufacture more than one product in a single firm than to manufacture single products in separate firms [4].

A few studies have tested for the existence of economies of scope in hospitals using econometrically estimated flexible functional forms for cost functions, but have not been markedly successful. Vita [5] explored this using a translog variable cost function, testing for weak cost complementarities in Californian hospitals. The results were, however, inconclusive. Li and Rosenman [6] employed the same test, but within a generalised Leontief cost function, and found the same results for hospitals in Washington State. Scott and Parkin [7] also used a translog specification to estimate a cost function for UK hospitals and used the same test, but concluded that the NHS data used meant that any empirical results would be misleading.

Other studies have used a non-parametric approach to this issue. Economies of scope are traditionally defined with reference to the additivity properties of cost functions. However, duality theory shows that such properties have equivalence in the additivity of production functions. Therefore, not only can economies of scope be estimated by comparing cost frontiers, the technical efficiency consequences of diversification can be investigated by comparing production frontiers, using non-parametric techniques based on Data Envelopment Analysis (DEA) [8]. This technique is useful for this purpose because it allows the use of multiple inputs and outputs. Prior [9] summarised studies in this area, which have mainly investigated nursing homes rather than more general hospitals, and appear to have been rather more successful than econometric studies in detecting economies of scope. Prior also found potential economies of scope in a sample of general hospitals in Spain; subsequently, Kittelsen and Magnussen [10]were also able to show economies of scope in Norwegian hospitals, which varied according to specialty.

Färe, Grosskopf and Lovell [3] and Kittelsen and Førsund [11] have proposed different DEA-based means of testing for the presence of scope economies in multiple input, multiple output production efficiency models. We will refer to these as the FGL and the KF approaches. The FGL approach compares diversified hospitals to synthetic diversified hospitals constructed from specialised hospitals, using the same frontier. The KF approach partitions hospitals into relatively specialised and relatively diverse hospitals and compares their production frontiers.

This paper uses both approaches to identification to investigate the economics of diversification and economies of scope using cost and production frontiers for a sample of UK hospitals. The aims are to determine if economies of scope are present in our sample, to compare the alternative methods and approaches and to illustrate the potential usefulness of them in health care applications.

2. Theory of Economies of Scope

Economies of scope arise from the possibility that inputs may be shared by different services, allowing the exploitation of spare capacity under conditions of limited demand for each service. There are many potentially shareable inputs in health care, such as in-patient beds, ambulatory facilities, surgical facilities, intensive therapy units and nursing, general medical, administrative and support staff. This would justify the multi-service hospital on efficiency grounds. Specialist hospitals would however be justified if there were many highly specialised inputs which were not suitable for sharing, or the level of demand for their specialist services meant that in practice there was no spare capacity in shareable inputs. It is even possible that for some output sets there are diseconomies of scope, where joint production is more costly than separate production.

Economies of scope are defined according to whether or not cost and production functions are *additive*, *sub-additive* or *super-additive* [3]. Given a cost function of the form:

$$C\left(u^1, u^2, p\right) \tag{1}$$

where C is the cost of producing outputs u^1 and u^2 given input prices p, an additive cost function is defined as:

$$C\left(u^1 + u^2, p\right) = C\left(u^1, p\right) + C\left(u^2, p\right) \tag{2}$$

which means that there are no economies or diseconomies of scope. A sub-additive cost function is defined as:

$$C\left(u^1 + u^2, p\right) \leq C\left(u^1, p\right) + C\left(u^2, p\right) \tag{3}$$

which means that there are economies of scope. A super-additive cost function is defined as:

$$C\left(u^1 + u^2, p\right) \geq C\left(u^1, p\right) + C\left(u^2, p\right) \tag{4}$$

which means that there are diseconomies of scope.

Duality theory demonstrates equivalence of these additivity properties of the cost function with those of the production function under conditions of cost minimisation [12]. For example, given a production function:

$$Q\left(u^1, u^2\right) \tag{5}$$

where Q is the quantity of outputs u1 and u2 produced, then sub-additivity of the cost function, defined in (3), is equivalent to super-additivity of the production function, defined as:

$$Q\left(u^1 + u^2\right) \geq Q\left(u^1\right) + Q\left(u^2\right) \tag{6}$$

again implying that there are economies of scope.

Efficiency gains due to economies of scope can therefore be measured by comparing the production frontiers $Q(u^1+u^2)$ and $Q(u^1)+Q(u^2)$, or by comparing the cost frontiers $C(u^1+u^2, p)$ and $C(u^1, p)+C(u^2, p)$. Such additivity properties can only be demonstrated in cross-sectional analysis by drawing on the insights of Koopmans [13], who analysed the conditions under which an aggregate production function could be derived from individual firms' production functions. An additive frontier can be created using synthetic diversified firms that are aggregations of real specialised firms. If real diversified firms are compared to the synthetic frontier, we can determine the additivity properties of the diversified technology, with accompanying implications for the existence of economies or diseconomies of scope.

3. Data and Methods

The data used are for 38 UK hospital Trusts in the Northern and Yorkshire Region for the year 1997/8. Table 1 summarises the variables which were used. Both a cost model and a production model were specified. The cost efficiency model consisted of a single input, overall cost, and five outputs, care episodes for general, maternity and mental patients, and attendances for A&E and other outpatients. The production model consisted of the same outputs, but had five inputs, which were staff numbers for nurses, doctors and other non medical staff, capital charge (as a proxy for size) and all other costs.

Division of Trusts into specialised and diversified Trusts was based on the NHS "functional classification" of hospitals, which has been used elsewhere in DEA analyses of technical and scale efficiency and productivity changes [14]. There are 12 "Priority Trusts", which specialise in treating the long term mentally ill and those with learning disabilities, 13 "Acute Trusts", which receive the majority of accident and emergency (A&E) cases and specialise in acute care and 13 "Combined Trusts", which undertake both priority and acute services. Our analysis therefore focussed on regarding the 25 Acute and Priority Trusts as specialised and the 13 Combined Trusts as diversified.

This is clearly a very broad level of aggregation. However, it was not possible to identify enough variation in levels of specialisation in other health care specialties to allow a plausible analysis of economies of scope. To avoid contamination due to the inclusion of priority services, we would have had to restrict the analysis to Acute Trusts. However, the nature of UK general hospitals and our data on them mean that although there is some variation in case- and specialty-mix within them, it is too narrow to make a sensible division into relatively specialised and relatively diversified Trusts.

In using the FGL approach, we followed the empirical method described by Grosskopf and Yaisawarng [15], who used DEA to test for economies of scope in the provision of local social services, modelling municipalities as multi-product firms. The rationale for and details of this method are as follows.

The normal DEA method assesses the efficiency of a unit with reference to a product transformation frontier (PTF), generated by a production function, as in Figure 1. The PTF is derived from a production function that has a fixed level of input and two outputs, Q1 (for example medical services) and Q2 (for example surgical services). A hospital represented by the point B is inefficient, as it lies within the

PTF. The Farrell radial measure of efficiency is the ratio 0B/0A, which lies between 0 (effectively zero production) and 1 (as efficient as possible).

To test for the existence of economies of scope, the inputs of the hospital are adjusted so that it lies on its PTF, removing the effects of technical inefficiency. A synthetic frontier, based on linear combinations of specialised hospitals, is constructed which has the property that the underlying production frontier is additive and the rate of product transformation (RPT) is constant. If the hospital does not lie on the artificial frontier, then it is demonstrating economies or diseconomies of scope. Figure 2 demonstrates this.

The points q1 and q2 represent the levels of output achieved for a fixed level of input by specialised hospitals. The linear PTF on which these specialised hospitals lie is q1A1q2, which has a constant RPT and no economies of scope. A multi-output hospital at point A1 on the linear PTF demonstrates no economies or diseconomies of scope. Its relative efficiency, measured by the DEA efficiency score, is one. However, for a hospital at point A2, its true PTF is the frontier q1A2q2, which demonstrates economies of scope, and the efficiency ratio, 0A2/0A1, will be greater than one. A hospital at point A3 has a true PTF defined by the frontier q1A3q2, which demonstrates diseconomies of scope, and the efficiency ratio, 0A3/0A1, will be less than one.

The normal DEA method does not permit the efficiency ratio to take a value greater than 1. However, Anderson and Peterson [16] have developed a method for ranking efficient units in DEA that does have that property. Basically, it measures how far efficient units would be above the frontier if their own unit was excluded as a comparator in the analysis.

The synthetic diversified hospitals are created as combinations of real specialist hospitals. For example, if there is one specialist hospital producing one output and another specialist hospital producing another output, linear combinations of the outputs of these two specialised hospitals can be calculated to produce any number of synthetic diversified hospitals that produce both outputs. A frontier using a sample of such synthetic diversified hospitals is compared with the frontiers on which real diversified hospitals would lie if they were technically efficient.

The first step in analysing this was to apply standard DEA analysis to the diversified hospitals, adopting a standard input minimisation specification [1]. The second step was to adjust the costs of inefficient hospitals so that they all are on the efficient frontier. The third step was to create synthetic diversified hospitals as combinations of specialised hospitals. It was necessary to place an arbitrary bound on the possible number of synthetic hospitals by considering only all one- and two-way combinations of the specialised hospitals; one-way meaning that each hospital of each type combined with each hospital of the other type and two-way meaning that each one-way combination was further combined with one other hospital of both types. There are 13x12=156 one-way and (156x12) + (156x13) = 3,900 two-way, giving a total of 4,056. The final step was to undertake DEA analysis on 50 samples, each of which contained all 13 diversified hospitals plus 25 drawn at random from the set of synthetic diversified hospitals.

This resulted in 50 efficiency scores for each diversified hospital. The test for economies of scope is whether or not the means of these scores are equal to one. If they are significantly greater than one, this implies economies of scope and if less than one, diseconomies of scope.

The procedure for the production model was the same as that for the cost model except for the method of adjustment to make the diversified hospitals technically efficient. DEA target weights were used to decrease the inputs of inefficient hospitals to an efficient level so that they remain in the same proportion, but produce the same output as before.

The KF approach does not attempt to assess scope economies with respect to a single overall frontier. Instead, it uses a piecewise frontier created from separate analyses of specialised and diversified hospitals. Each hospital is compared with both of those frontiers. An index, referred to as a convexity scope measure, is defined as

$$S = \frac{E_S}{E_D}$$

where E_S is the DEA efficiency score evaluated against the specialised hospital frontier and E_D is the DEA efficiency score evaluated against the diversified hospital frontier. If this takes values above 1, it suggests evidence of economies of scope; if below 1, diseconomies of scope. Mean values of S for specialised and diversified hospitals can be used to draw generalised conclusions about scope economies for the hospitals as a whole.

4. Results

Table 2 shows the results obtained using the FGL approach. It shows the mean efficiency scores for each diversified hospital, which are given an anonymised identification number, for the 50 DEA runs. For both the cost and production models, all of the scores are greater than one with a high level of statistical significance, implying that there are economies of scope in this sample of UK hospitals. Mean values and associated t-statistics were calculated sequentially after each DEA run, and for every hospital, and it was observed that in each case the mean became stable and t-tests recorded significance after 10 runs. There is a good correlation between the efficiency scores derived from the cost and production models, with a rank correlation of 0.802 ($p<0.001$), and a Pearson correlation of 0.959 ($P<0.0005$).

Tables 3 and 4 show a summary of the results obtained using the KF approach. The means suggest economies of scope, albeit weak ones, backing up the FGL results to a certain extent. It is interesting to note that in the cost function sample for the acute hospitals $S<1$, and for the priority hospitals $S>1$. This may reflect an interaction with scale effects, ie acute units are in general bigger, for example the big teaching hospitals. They have extra outputs (and inputs) we cannot take account of here - this may come out particularly in the cost model, rather than the production model. Acute hospitals may be operating with respect to different technology frontiers.

To initially begin looking at this a variable returns to scale DEA model was run on the two full samples, split by cost and production, Table 4 includes scale effects. Results show that in the cost model there is some evidence of economies of scale, whereas in the production model little evidence of scale is picked up. In the cost model the acute trusts have CRS, dominating the frontier when in the diversification sample.

5. Summary and Conclusions

This paper has illustrated two non-parametric approaches to detecting and measuring economies of scope, in terms both of a single input, multiple outputs and multiple input, multiple outputs models. The results from both suggest that there may be evidence of economies of scope in the UK hospital sector at a broad level of aggregation, with diversified Trusts being more efficient than specialised Trusts. Because the FGL approach corrects for technical and cost inefficiency, the reason for their relative efficiency is the combination of services they offer.

The two methods both have advantages. As noted, using the FGL approach enables us to associate differences in efficiency between specialised and diversified hospitals to scope economies rather than other sources of inefficiency. The ability of the KF approach to identify scope economies is compromised if the cost and production frontiers identified for specialised and diversified hospitals are different for other reasons. However, the KF approach allows examination of economies of scope for all hospitals in the data set individually, while the FGL approach is restricted in this respect to individual diversified hospitals. This would be valuable in analysing variations in the degree of scope economies and their cause. The KF approach is also far easier to implement, since it does not require the creation of synthetic hospitals and other time-consuming data manipulations.

This finding suggests that the existence of multi-service hospitals is justifiable on the grounds of efficiency. However, the outputs of the hospitals that we considered are not truly homogeneous, as they are themselves aggregates of different specialties and services within specialties. The acute versus priority services issue is not a full reflection of the nature of the choice between specialised and diversified hospitals. Nevertheless, it is in principle possible to adopt this method to the analysis of particular specialties and services that are or could be provided within either specialist units or general hospitals.

These results should be seen as illustrative of the method rather than definitive, and a larger and fuller data set would be necessary to draw more robust conclusions about the operating characteristics of UK hospitals. The method appears to provide useful results and to be straightforward to perform, and could be replicated in other areas. There are some well-known problems with DEA as it is currently used [17], but it remains the only method founded on economic theory that can analyse multiple input, multiple output models without the need for aggregation of either. Information about economies of scope provides a further addition to the many useful outputs of the technique.

Acknowledgements

This work uses data collected as part of a project funded by the NHSE Northern and Yorkshire R& D committee.

References

1. Hollingsworth, B. Non-parametric and parametric applications measuring efficiency in health care. *Health Care Management Science*; 2003; 6(4): 203-218.
2. Penrose, E., *The theory of the growth of the firm.* Oxford: Blackwell, 1959.
3. Färe, R., Grosskopf, S., Lovell, C. *Production Frontiers.* Cambridge: Cambridge University Press, 1994.
4. Panzer, J.C. and Willig, R.D. Economies of Scope. *American Economic Review* 1981; 71(2): 268-272.
5. Vita, M. G. Exploring Hospital Production Relationships With Flexible Function Forms. *Journal of Health Economics*. 1990; 9(1): 1-22.
6. Li, T. and Rosenman, R. Estimating Hospital Costs With A Generalised Leontief Function. *Health Economics*. 2001; 10(6): 523-538.
7. Scott, A. and Parkin, D. Investigating Hospital Efficiency in the new NHS: The Role of the Translog Cost Function. *Health Economics*. 1995; 4(6): 467-478.
8. Cooper W, Seiford LM, Tone K. *Data Envelopment Analysis*. Kluwer: Dordrecht, 2000.
9. Prior, D. Technical Efficiency and Scope Economies in Hospitals. *Applied Economics*. 1996; 28: 1295-1301.
10. Kittelsen, S. and Magnussen, J. *Economies of scope in Norwegian hospital production – a DEA analysis*. Health Economics Research Programme Working Paper 8, University of Oslo, 2003.
11. Kittelsen, S. and Førsund, F. Efficiency analysis of Norwegian district courts. *Journal of Productivity Analysis*, 1992; 3: 299-307.
12. Gravelle, H. and Rees, R. *Micro Economics*. Essex: Longman Group, 1992.
13. Koopmans, T.C. Analysis of Production as an Efficient Combination of Activities, in Koopmans, T.C., editor, *Activity Analysis of Production and Allocation: Proceedings of a conference*. Cowles Foundation Monograph Number 13, Yale University, 1951.
14. Hollingsworth, B and Parkin, D. Efficiency and productivity change in the English National Health Service: can Data Envelopment Analysis provide a

robust and useful measure? *Journal of Health Services Research and Policy* 2003; 8(4): 230-236.

15. Grosskopf, S. and Yaisawarng, S. Economies of scope in the provision of local social services. *National Tax Journal.* 1990; 43(1): 61-74.

16. Anderson, P. and Peterson, N. A procedure for ranking efficient units in data envelopment analysis. *Management Science.* 1993; 39 (10): 1261-1264.

17. Parkin, D. and Hollingsworth, B. Measuring Productive Efficiency of Acute Hospitals in Scotland, 1991-1994: Validity Issues in Data Envelopment Analysis. *Applied Economics*. 1997; 29(11): 1425-1438.

Figure 1: Efficiency and the Product Transformation Frontier

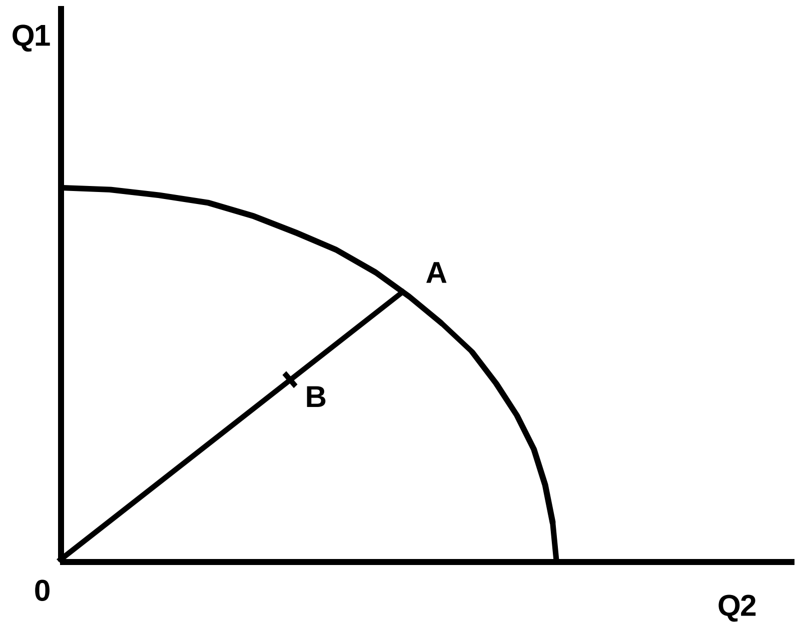

Figure 2: Economies of scope and the Product Transformation Frontier

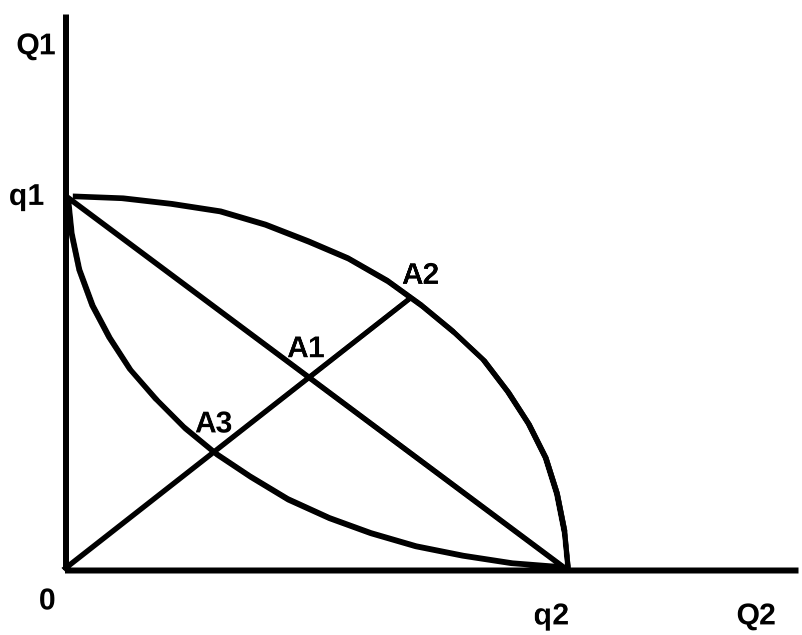

Table 1: Description of data variables

	OUTPUTS					INPUTS					
	General FCEs	*Maternity FCEs*	*Mental FCEs*	*Out-patient attendance*	*Accident & Emergency attendance*	*Doctors*	*Nurses*	*Non Medical staff*	*Other costs £*	*Capital charge £*	*Overall costs £*
Acute											
Average	86,388	5,627	24	58,957	73,793	257	1,305	1,435	27,196	4,404	87,968
St Dev.	40,090	3,591	69	29,654	38,191	140	714	972	17,405	3,090	53,374
Min.	30,709	1,874	0	18,305	6,269	90	524	437	7,257	1,354	29,683
Max.	139,712	11,947	243	125,261	131,567	485	2,469	3,655	61,524	12,358	193,796
Priority											
Average	291	0	1,571	2,103	3,096	40	792	586	7,937	1,013	33,710
St Dev.	373	0	1,150	1,651	7,774	35	333	345	3,924	485	16,732
Min.	0	0	0	0	0	12	323	239	3,654	307	14,362
Max.	1,146	0	2,066	1,683	25,843	51	920	894	8,929	1,178	40,245
Combined											
Average	39,802	3,405	1,183	27,949	43,451	149	940	1,022	13,476	2,501	54,186
St Dev.	20,727	2,083	546	14,755	22,758	51	322	298	4,997	871	17,149
Min.	495	0	491	2,360	0	34	427	411	3,998	815	22,371
Max.	74,389	7,637	2,293	51,283	70,970	226	1,531	1,630	22,440	3,729	86,850

FCEs=Finished Consultant Episodes

Table 2: Efficiency scores of diversified hospitals relative to synthetic diversified hospitals created from specialised hospitals

	Cost model			Production model		
Hospital	**Mean**	**Standard Deviation**	**t-ratio**	**Mean**	**Standard Deviation**	**t-ratio**
NY32	1.41	0.30	9.56	1.53	0.29	12.82
NY33	1.69	0.27	18.11	1.67	0.38	12.72
NY34	1.39	0.26	10.86	1.49	0.27	13.04
NY35	1.50	0.33	10.98	1.53	0.39	9.79
NY36	1.56	0.44	9.19	1.80	0.45	12.55
NY37	1.50	0.25	14.60	1.67	0.58	8.31
NY38	1.57	0.31	13.01	2.63	0.58	19.92
NY39	3.12	1.75	8.55	4.08	2.08	10.48
NY40	1.53	0.27	13.81	1.7	0.34	14.66
NY41	1.64	0.47	9.68	2.26	0.61	14.61
NY42	1.66	0.28	17.05	1.87	0.42	14.63
NY43	1.87	0.31	19.97	2.19	0.49	17.47
NY44	3.47	1.38	12.71	5.78	3.28	10.30

The critical value for t at the $p<0.01$ level is 2.32

Table 3: Summary of convexity scope measure for specialised and diversified Trusts

	Cost model		Production model	
	Specialised Hospitals	Diversified Hospitals	Specialised Hospitals	Diversified Hospitals
Number S > 1	11 (44%)	6 (46%)	2 (8%)	1 (8%)
Number S = 1	5 (20%)	4 (31%)	12 (48%)	10 (77%)
Number S < 1	9 (36%)	3 (23%)	11 (44%)	2 (15%)
Mean value of S	0.973	1.03	0.966	1.00

Table 4: Convexity scope measure for individual Trusts

	Cost model				Production Model			
	E_S	E_D	S	Scale*	E_S	E_D	S	Scale*
Specialised								
NY01	100	100	1	C	100	100	1	C
NY02	100	100	1	C	100	100	1	C
NY04	65.31	93.24	0.700	C	79.56	100	0.796	C
NY05	55.47	63.23	0.877	C	71.14	89.9	0.791	C
NY06	91.01	100	0.910	I	100	100	1	C
NY07	100	100	1	C	100	100	1	C
NY08	72.23	100	0.722	D	97.77	100	0.978	C
NY10	86.33	100	0.863	C	99.71	100	0.997	C
NY11	89.95	100	0.900	C	97.44	100	0.974	C
NY12	98.41	100	0.984	C	100	100	1	C
NY13	95.75	100	0.958	C	100	100	1	C
NY15	84.91	100	0.849	I	100	100	1	C
NY16	100	100	1	C	100	100	1	C
NY18	40.51	38.15	1.06	D	46.89	52.1	0.9	D
NY19	100	67.75	1.48	I	100	88.74	1.13	C
NY20	54.69	51.59	1.06	D	65.07	69.41	0.937	I
NY21	56.02	51.56	1.09	D	99.42	100	0.994	C
NY22	83.5	79.99	1.04	I	100	100	1	C
NY24	89.26	85.15	1.05	I	100	100	1	C
NY26	74.32	71.19	1.04	C	95.12	100	0.951	C
NY27	44.93	39.2	1.15	D	84.89	94.56	0.898	C
NY28	11.71	10.35	1.13	C	28.42	21.13	1.345	C
NY29	14.99	14.36	1.04	D	32.11	59.29	0.542	C
NY30	100	100	1	C	100	100	1	C
NY31	90.15	86.36	1.04	C	100	100	1	C
Diversified								
NY32	79.55	84.34	0.943	D	100	100	1	C
NY33	100	90.19	1.11	C	100	100	1	C
NY34	91.54	89.29	1.03	D	100	97.23	1.03	D
NY35	89.5	89.89	0.996	D	96.82	98.28	0.985	D
NY36	100	97.81	1.02	I	100	100	1	C
NY37	97.31	85.39	1.14	I	96.84	96.83	1.00	I
NY38	100	100	1	C	100	100	1	I
NY39	45.68	46.53	0.983	I	64.12	65.95	0.972	C
NY40	91.81	86.18	1.07	D	100	100	1	C
NY41	100	100	1	C	100	100	1	C
NY42	99.62	86.07	1.16	D	100	100	1	C
NY43	100	100	1	C	100	100	1	C
NY44	100	100	1	C	100	100	1	C

* C = Constant Returns to Scale, D = Decreasing Returns to Scale, I = Increasing Returns to Scale.