

Productivity Growth in Norwegian Psychiatric Outpatient Clinics for Children and Youths

Vidar Halsteinli,¹ Sverre A.C. Kittelsen,^{2*} Jon Magnussen³

¹Master of Sc., Research scientist, SINTEF Health Research, Trondheim, Norway

²PhD, Senior Research Fellow, Frisch Centre, and Health Economics Research Programme at the University of Oslo (HERO), Oslo, Norway

³PhD, Associate Professor, Norwegian University of Science and Technology (NTNU), and Health Economics Research Programme at the University of Oslo (HERO), Oslo, Norway

Abstract

Background: Norwegian government policy is to increase the supply of psychiatric services to children and young persons, both by increasing the number of personnel, and by increasing productivity in the psychiatric outpatient clinics. Increased accessibility is observed for the last years, measured as the number of children receiving services each year.

Aims of the Study: The paper aims to estimate change in productivity among outpatient clinics, and whether any change is related to personnel mix, budget growth or financial incentives.

Methods: We use a non-parametric method called Data Envelopment Analysis (DEA) to estimate a best-practice production frontier. A Malmquist output-based technical productivity index is calculated and decomposed in technical efficiency change, scale efficiency change and frontier shifts. Bootstrapping methods are used to estimate standard errors and confidence intervals for the technical productivity index and its decomposition. In a second stage, the technical productivity index is regressed on variables that may potentially be statistically associated with productivity growth. The paper analyses panel data for the period of 1996-2001.

Results: The results indicate increased overall technical productivity by about 4.5 per cent a year in the period, mostly due to frontier shift, but with important contribution from increased technical efficiency. Scale efficiency does not change. Personnel growth has a negative influence on productivity growth, whilst a growth in the portion of university educated personnel improves productivity. The financial reform of 1997 that gave greater weight to interventions per patient led to lower productivity growth in the subsequent period for those that had an initial budgetary gain from the reform.

Discussion: Technical productivity has increased substantially during the period of study, implying a degree of success in the government plan for increasing psychiatric health care. While the decomposition of technical productivity change is less robust to outliers than the Malmquist productivity index itself, the results indicate that both clinics that were previously efficient, and those that were inefficient, have increased their productivity, the latter somewhat more than the former. The size of the clinic is not related

to its technical productivity growth. A growth in the budget affects technical productivity negatively. While the clinics seem to respond to "mild coercion" by increasing productivity, this growth is slowed down by a policy that at the same time increases the availability of resources.

Implications for Health Policy: The instruments used in the government psychiatric plan have been adequate in stimulating the productivity and availability of psychiatric services. On the other hand it may be difficult to maintain the pressure for increasing the service level without stronger financial incentives, especially since the service suppliers are receiving strong activity based financial incentives for somatic care.

Implications for Further Research: Further research should focus on the effects of various organisational models of outpatient-clinics on both the level of, and change in, productivity. In this context the positive effect of increasing the portion of university educated personnel could provide a fertile starting point. It is also of interest to study whether productivity growth is accompanied by increased availability or increased treatment intensity.

Received 10 October 2004; accepted 27 October 2005

Introduction

It is generally believed that 5 per cent of all youths under 18 are in need of specialised psychiatric health care.^{1,2} In Norway it has been estimated that as much as 60 per cent of those in need did not receive such care in 1996.³ A government white paper in 1996 therefore presented both an increase in capacity and an increase in productivity as central political goals for the psychiatric health care sector.⁴ To secure an increase in resources a national plan was implemented in 1999, including a target increase in productivity by as much as 50 per cent.⁵ To increase productivity, however, no particular measures were taken other than increased political and public focus on the utilisation of resources. Thus the Norwegian policy may be described as a strategy of combined resource growth and "mild coercion". The question is whether this strategy has given the expected (or even desired) results.

The purpose of this paper is to assess the development in productivity in the five year period following the publication of the white paper in 1996. We are, on a purely descriptive

* Correspondence to: Sverre A.C. Kittelsen, Frisch Centre, Gaustadalléen 21, N-0349 Oslo, Norway.

Tel.: +47-229-58815

Fax: +47-953-25070

E-mail: Sverre.Kittelsen@frisch.uio.no

Source of Funding: The Norwegian Research Council, through HERO and the Norwegian Ministry of Health and Social Affairs, through SINTEF.

basis, interested in whether or not total productivity grew in the sector in this period, and given the aim of a 50 per cent increase, also in the magnitude of any productivity change. Lacking good measures of outcomes, we use instead measures of the quantity of services provided as outputs and calculate the change in *technical productivity* by use of non-parametric methods.

In addition to a descriptive analysis of technical productivity growth we also pursue four policy relevant issues. First we are interested in studying in which type of clinics technical productivity has grown. More specifically; is growth in technical productivity due to the good becoming better, or is it a case of the not so good catching up? Also, in a previous analysis,⁶ we suggest that there are variable returns to scale in the sector, and we would like to pursue this by looking at the relationship between technical productivity growth and scale.

Second, in a situation with resource growth it is of interest to analyse whether the change in technical productivity, *ceteris paribus*, is negatively related to the growth in resources available. Basically the argument is that increased budget levels will increase slack and thereby reduce technical productivity growth.

Third, we pursue the question of whether the change in technical productivity, *ceteris paribus*, is related to the composition of personnel. It has been shown that outpatient clinics with many different personnel groups tend to spend a higher amount of time in meetings than clinics with a more homogenous staff mix.⁷ It has therefore been argued that a more homogenous staff mix will be more unified in the pursuit of goals and thereby spend less time on effort reducing activities.⁸ It could further be argued that a more educated mental health workforce could be related to higher productivity as educational attainment may be positively related to productive skills. We therefore specifically analyze the relationship between the share of university educated personnel and growth in technical productivity.

Fourth, although changes in the financing system were not a specific recommendation in the 1996 white paper, some minor changes were done. For the period analysed in this paper the 19 county councils were responsible for the delivery of specialised health care services.* In 1996 psychiatric outpatient clinics were financed via two sources; 40 per cent came from the state via the National Insurance Scheme (NIS).⁹ The NIS funds are, however, mainly (close to 90 per cent) proportional to the number of employees at the outpatient clinics, and thus will only to a minor extent depend on the activity of the clinics.¹⁰ The remaining 60 per cent of the income was provided from the counties by the way of a global budget. In practice this budget would reflect the need for resources in order to cover the costs not covered by the NIS income. While the NIS funds gave an incentive to increase staffing by covering approximately 35 per cent of the labour costs, this could to some extent have been offset at the clinic level by the budget given by the county.

* From 2002 this responsibility was transferred to five state owned regional health corporations.

Up until 1997 the only patient-related income consisted of a one-time fee for the first consultation. From 1997, however, an additional fee for multiple interventions was introduced.¹⁰ Thus, for a given number of patients there was now a stronger incentive to provide more interventions per patient. It should be noted, however, that even after this change as much as 95 per cent of the outpatient clinic income has been distributed either as a lump-sum grant or according to the number of employees. This means that the strongest incentive provided by the financing system is still to increase the number of employees.

As noted, the goal for psychiatric outpatient care as it was formulated in public documents in 1996 was a productivity growth of 50 per cent. This is a large number in any setting, and it is interesting that the authorities in this situation chose not to focus more on the financing system. This strategy is in stark contrast to the somatic sector where increased activity and productivity was sought mainly by changing the financing system in the direction of an activity-based financing.¹¹ The situation in the somatic sector prior to the reform of the financing system in 1997 was not that dissimilar to the situation in the psychiatric sector. Long waiting lists and high waiting times was the main motivation for the reform. Furthermore, the financial reform in the somatic sector was partly justified by the belief that increase in resources alone would only lead to lower levels of efficiency.

Analyses of the financial reform of the somatic sector¹¹ indicates that it led to a technical productivity growth of approximately 2 per cent. We now turn to the question of whether the strategy of combined external pressure, resource growth and a minor change in the financing system actually succeeded in increasing levels of technical productivity of psychiatric outpatient clinics for children and youths to the extent foreseen. We shall proceed to do this by utilising the concept of a decomposed Malmquist index to measure the *growth of technical productivity* over the six-year period, 1996-2001.

Data and Methodology

Data

The outpatient clinic each year is the unit of observation, with an unbalanced panel of between 45 and 65 clinics in each of the six years from 1996 to 2001. The analysis is based on a production model with two outputs and two inputs. The two outputs are respectively (i) the number of direct interventions (y_1), and (ii) the number of indirect interventions (y_2) related to the patients each year. The two inputs are (i) the number of university educated personnel (x_1), and (ii) the number of other personnel employed (x_2). **Table 1** gives summary statistics for the inputs and outputs used in the technical productivity model, as well as for some other variables of interest.

The treatment process in outpatient clinics will consist of a series of interventions related to each patient. These interventions can be direct, i.e. in the form of consultations,

Table 1. Descriptive Statistics for the Outpatient Clinics. Annual Means and Standard Deviations Across Outpatient Clinics for Inputs, Outputs and other Variables

	Year	1996	1997	1998	1999	2000	2001
Outputs in Technical Productivity Model							
Direct interventions	y_1^t	1818 (1340)	1947 (1597)	1981 (1352)	2058 (1414)	2263 (1566)	2533 (1822)
Indirect interventions	y_2^t	837 (734)	917 (802)	917 (774)	1055 (779)	1200 (823)	1295 (856)
Inputs in Technical Productivity Model							
University personnel.	x_1^t	5.6 (4.2)	5.5 (4.5)	5.9 (4.5)	5.8 (4.0)	6.1 (4.2)	6.5 (4.9)
College and administrative personnel	x_2^t	7.8 (7.9)	7.9 (8.4)	8.0 (7.6)	7.6 (7.3)	8.0 (7.9)	8.7 (8.3)
Derived and Other Variables							
Interventions - total		2655 (1932)	2864 (2289)	2898 (1983)	3113 (2052)	3463 (2204)	3829 (2448)
Personnel - total	x^t	13.4 (11.7)	13.4 (12.6)	13.8 (11.6)	13.4 (10.9)	14.1 (11.7)	15.3 (12.6)
Patients treated		234 (135)	269 (175)	274 (156)	284 (156)	322 (189)	359 (219)
Direct interventions per therapist		167 (54)	180 (62)	184 (56)	192 (46)	198 (44)	203 (48)
Direct interventions per patient		7.6 (2.5)	7.0 (2.3)	7.1 (2.1)	7.1 (1.7)	6.9 (1.7)	6.9 (1.6)
Number of Outpatient Clinics		51	45	56	65	67	60

Note: Standard deviations in brackets.

or they can be indirect, i.e. as contacts with the patients' environment. The interventions take a different form depending on the type of disorder, the social setting and the outpatient clinic itself. Interventions can take place in situations where the therapist and the patient is either alone, in a group setting where more therapists are involved, or where the patient's family is also involved.

Since we cannot measure health outcomes directly, the conceptually best way to measure the activity would be to use number of treated patients adjusted for case-mix differences. If this was possible, inefficiencies that arise from using too many interventions would be detected. However, we have no meaningful way of correcting for case-mix differences, and therefore using the number of treated patients as an output measure is likely to bias the productivity measures in favour of outpatient clinics with a relatively easy case-mix. We choose instead to use two measures of the number of services delivered to the patients as the outputs in the analysis, and define as the two outputs (i) the number of direct and (ii) the number of indirect interventions per year for each clinic (**Table 1**). We have elsewhere⁶ undertaken a detailed analysis of how different ways of measuring input/output affect the efficiency measures, and the results presented here are not sensitive to the chosen output specification.

Technical Productivity and its Decompositions

Productivity is normally perceived as the ratio of output to input, but in the presence of multiple inputs and outputs these are normally weighted by their price. As is common in public sector applications, output prices are nonexistent, and even input prices are difficult to get hold of. Building on Malmquist¹² one can instead use an estimate of the technology or production possibility set to measure the change in productivity between periods.¹³ If \mathbf{x} is a vector of inputs and \mathbf{y} is a vector of outputs, the production possibility set at time s is defined as

$$P^s = \{(\mathbf{y}, \mathbf{x}) | \mathbf{y} \text{ can be produced from } \mathbf{x} \text{ at time } s\} \quad (1)$$

Technical productivity of an input-output vector $(\mathbf{y}^t, \mathbf{x}^t)$ at time t with reference to a technology at time s can following^{14,15} be defined as

$$TP_t^s = \text{Min}_{\theta, \lambda} \left\{ \frac{\theta}{\lambda} \mid (\lambda \mathbf{y}^t, \theta \mathbf{x}^t) \in P^s; \theta, \lambda > 0 \right\} \quad (2)$$

This is a relative measure, which compares the input-output vector $(\mathbf{y}^t, \mathbf{x}^t)$ with the vector that is of optimal size, keeping constant the mix of inputs and the mix of outputs respectively. Note that while the own-period ($t = s$) technical

productivity will be less or equal to 1 for all feasible input-output vectors $(\mathbf{y}^t, \mathbf{x}^t) \in P^t$, this does necessarily not hold for cross-period comparisons.

Own-period technical productivity as defined in (2) can be decomposed into technical efficiency relative to the frontier of the production possibility set which in general will exhibit variable returns to scale (VRS), and scale efficiency which reflects inoptimal scale. Measured in an output increasing direction, the Farrell¹⁵ measure of technical efficiency is

$$TE_t = \text{Min}_\lambda \left\{ 1/\lambda \mid (\lambda \mathbf{y}^t, \mathbf{x}^t) \in P^t; \lambda > 0 \right\} \quad (3)$$

which in our context is always relative to own-period technology and therefore a number less or equal to one. Scale efficiency can then be defined as the ratio of technical productivity and technical efficiency, allowing us to write the decomposition as

$$TP_t^t = TE_t \cdot SE_t \quad (4)$$

If the technology P^s is constant returns to scale (CRS), technical efficiency and technical productivity will coincide and the scale efficiency will be one, which is why TP_t^t is sometimes known as CRS technical efficiency.

The Malmquist index of technical productivity change from an input-output vector at time t to time u is then defined by

$$M_{tu}^s = TP_u^s / TP_t^s \quad (5)$$

M_{tu}^s will be greater (less) than one when technical productivity improves (deteriorates). Both technical productivities in (5) are measured relative to the same technology P^s , just as a price-based index would use a constant set of weights. The interpretation of a technical productivity improvement is an increase in an index of output per unit of an index of input, where the output index is constant along an iso-input line and the input index is constant along an isoquant of the estimated technology. The choice of the reference technology is somewhat arbitrary. Fare *et al.*¹⁶ suggest using the geometric mean of indices calculated with each of the two years used as reference. However, Berg *et al.*¹⁷ argue that a technical productivity index should fulfil the circularity condition that the change from the first to the last period should be the product of the indices of each pair of periods in between (i.e. $M_{ac} = M_{ab}M_{bc}$ for periods a, b and c), and that this requires the use of a fixed base year. In this paper we will use the envelopment of all technology frontiers as the fixed reference frontier, i.e. $P^s = \cup_t P^t$, thereby fulfilling the circularity condition while at the same time utilising technology information from all time periods.

As shown in¹⁶ the Malmquist index of technical productivity change could be decomposed into two terms, reflecting the change in the productivity of the frontier relative to the common reference technology, and the change in own period technical productivity TP_u^u / TP_t^t . Using (4), the last of these can in turn be decomposed into an index reflecting the change in technical efficiency and an index reflecting the change in scale efficiency. Defining

$$MF_{tu}^s = \frac{TP_u^s / TP_u^u}{TP_t^s / TP_t^t}, ME_{tu} = \frac{TE_u}{TE_t}, MS_{su} = \frac{SE_u}{SE_t} \quad (6)$$

we can write the three-way decomposition as

$$\begin{aligned} M_{tu}^s &= \frac{TP_u^s}{TP_t^s} = \frac{TP_u^s / TP_u^u}{TP_t^s / TP_t^t} \cdot \frac{TP_u^u}{TP_t^t} = \\ &= \frac{TP_u^s / TP_u^u}{TP_t^s / TP_t^t} \cdot \frac{TE_u}{TE_t} \cdot \frac{SE_u}{SE_t} = MF_{tu}^s \cdot ME_{tu} \cdot MS_{su} \end{aligned} \quad (7)$$

The Malmquist index is thus the product of the frontier shift (MF), the efficiency change (ME), and the scale efficiency change (MS) indices. For each of these, an index value above one indicates progress, and below one indicates regress.

Data Analytical Procedures - Measuring Technical Productivity

To apply the Malmquist index and its decomposition empirically, one needs an estimate of the technology P^t in each time period. Several different parametric and non-parametric specifications are possible for the technology or its frontier, the production function. The increasingly popular Data Envelopment Analysis (DEA) estimate, originally suggested by Farrell¹⁵ and further developed in the literature following Charnes, Cooper and Rhodes,¹⁸ can be written as

$$\hat{P}^t = \left\{ (\mathbf{y}, \mathbf{x}) \mid \mathbf{y} \leq \sum_{j=1}^n \lambda_j \mathbf{y}_j^t, \mathbf{x} \geq \sum_{j=1}^n \lambda_j \mathbf{x}_j^t, \sum_{j=1}^n \lambda_j = 1, \lambda_j > 0 \right\} \quad (8)$$

where $(\mathbf{y}_j^t, \mathbf{x}_j^t)$ is the input-output vector of observation j at time t . The DEA estimate is shown in¹⁹ to be the minimum extrapolation set, i.e. the smallest possible estimate of the production possibility set, that satisfies three basic assumptions. Firstly, the feasibility assumption implies that observed behaviour as characterised by the input-output vector is feasible, and this therefore precludes some forms of measurement error. Secondly, the convexity assumption requires that a convex combination of feasible input-output vectors is also feasible. Finally, the free disposal assumption requires that it is always possible to dispose of inputs or outputs, i.e. use more inputs or produce less output.

Any analysis of productivity is necessarily limited by the measures of inputs and outputs that are used. Since measures of health outcomes are not available, the outputs only describe aspects of the health services provided. Competing methods have their pros and cons, as discussed extensively in the literature (see e.g.²⁰). As a nonparametric method DEA has the advantage of fitting the data closely, and does not require the assumption of a specific functional form. The estimate of the DEA frontier is determined by the best-practice units in each period, and is sensitive to measurement error, and in particular to outliers. On the other hand it may well underestimate the true technical potential if no units are fully technologically efficient.

The statistical properties of DEA have only been explored in recent years, and as analytical results are hard to come by,

Table 2. Panel Means for the Malmquist Technical Productivity Index Relative to 1996, and its Decomposition

	Year	1997	1998	1999	2000	2001
Malmquist Technical Productivity Index M						
Arithmetic mean		1.114*** (0.005)	1.135*** (0.006)	1.201*** (0.010)	1.273*** (0.015)	1.290*** (0.019)
Geometric mean		1.068*** (0.005)	1.095*** (0.005)	1.156*** (0.010)	1.206*** (0.010)	1.225*** (0.009)
Decomposition Geometric Means						
Frontier shift index	MF	0.990 (0.038)	1.069 (0.047)	1.052 (0.043)	1.057 (0.040)	1.189*** (0.050)
Efficiency change index	ME	1.021 (0.044)	1.040 (0.040)	1.101*** (0.039)	1.094*** (0.038)	1.053 (0.039)
Scale efficiency index	MS	1.057 (0.038)	0.985 (0.034)	0.999 (0.034)	1.043 (0.034)	0.978 (0.038)

Note: Mean index values for 37 clinics with data for all years. Bootstrapped standard errors in brackets. Stars denote significance levels at 1% (***), 5% (**) and 10% (*) respectively.

Simar and Wilson²¹ suggest a bootstrapping method to assess the extent of sampling error and estimate bias and confidence intervals for the DEA efficiency estimates. Basically, their algorithm mimics the original data generating process in a large number of draws of simulated pseudo-samples, and uses the simulated distributions of the efficiency estimates as an estimate of the true sampling distribution. They extend their method to bootstrapping the Malmquist technical productivity index.²² The standard errors and confidence intervals of the indices are then calculated from the simulated distributions of the corresponding indices in the pseudo-samples. Whilst this procedure also provides bias-corrected estimates of the Malmquist indices, these may have a larger variance than the original estimates. Following²² we report standard errors and confidence intervals from the bootstrap calculation, but use the minimum mean square error (MSE) as the criterion to choose the best estimator for the indices themselves.

Data Analytical Procedures - Regression Analysis

By using the Malmquist set-up as described above, we are able to answer the first question formulated in the introduction. The last three, however, require additional analysis. Thus we use the Malmquist measures as dependant variables, and regress these on a set of explanatory variables. The regression should not be interpreted as a causal model, but rather as an exploration of statistical association. Specifically we formulate:

$$M_{t,t+1}^s = f(x^t, \dot{x}^{t,t+1}, \dot{u}^{t,t+1}, T^{t,t+1}, W^{t,t+1}) \quad (9)$$

and similar relationships for its components, where $x^t = x_1^t + x_2^t$, i.e. the total number of personnel in year t , used here as an indicator of the size of the clinic.

$$\dot{x}^{t,t+1} = \frac{x^{t+1}}{x^t} \text{ annual growth in personnel, capturing the}$$

growth in the size of the budget.

$$\dot{u}^{t,t+1} = \frac{[x_1^{t+1}/x^{t+1}]}{[x_1^t/x^t]}, \text{ annual growth in portion of}$$

personnel that are university educated, capturing to what extent the clinics are becoming less diversified with respect to the staff mix. If there is a relationship between the length of education and the quality of the staff this variable may also be interpreted as a measure of increase in staff quality.

$T^{t,t+1}$ is a time dummy, where the first period 1996-97 acts as a reference and is therefore dropped from the regression.

Finally, $W^{t,t+1} = w_{1996} T^{t,t+1}$, where w_{1996} is a dummy for those clinics that had a case mix in 1996 that meant that they stood to gain from the financial reform in 1996-97. The change in the financing system was such that a clinic with more than seven interventions per patient would receive a larger payment under the new system than the old, and so the dummy value is set at one for those clinics that exceeded this ratio in 1996. It is multiplied with the time dummy to capture any period-specific effects of the financial reform, which would be expected to be significant only for a limited number of years.

The regression analyses were performed using fixed effects, random effects and OLS models. Since the dependent variable is a technical productivity index that is a ratio of two efficiency measures for the same clinic, and two of the independent variables are also growth rates, the model is already largely a difference model and one need not expect additional individual clinic effects. Still, there might be clinic effect on growth rates, and a random effects model is more efficient than OLS if errors are correlated, so fixed effects and random effects models were estimated. Using a Hausman test²³ for fixed effects the null hypothesis of random effects was not rejected, while the coefficients of the random effects model were the same as in OLS. We therefore present the coefficient estimates from the OLS model, which are equally interpretable as estimates from the random effects model. As argued in the introduction, we do not formulate a

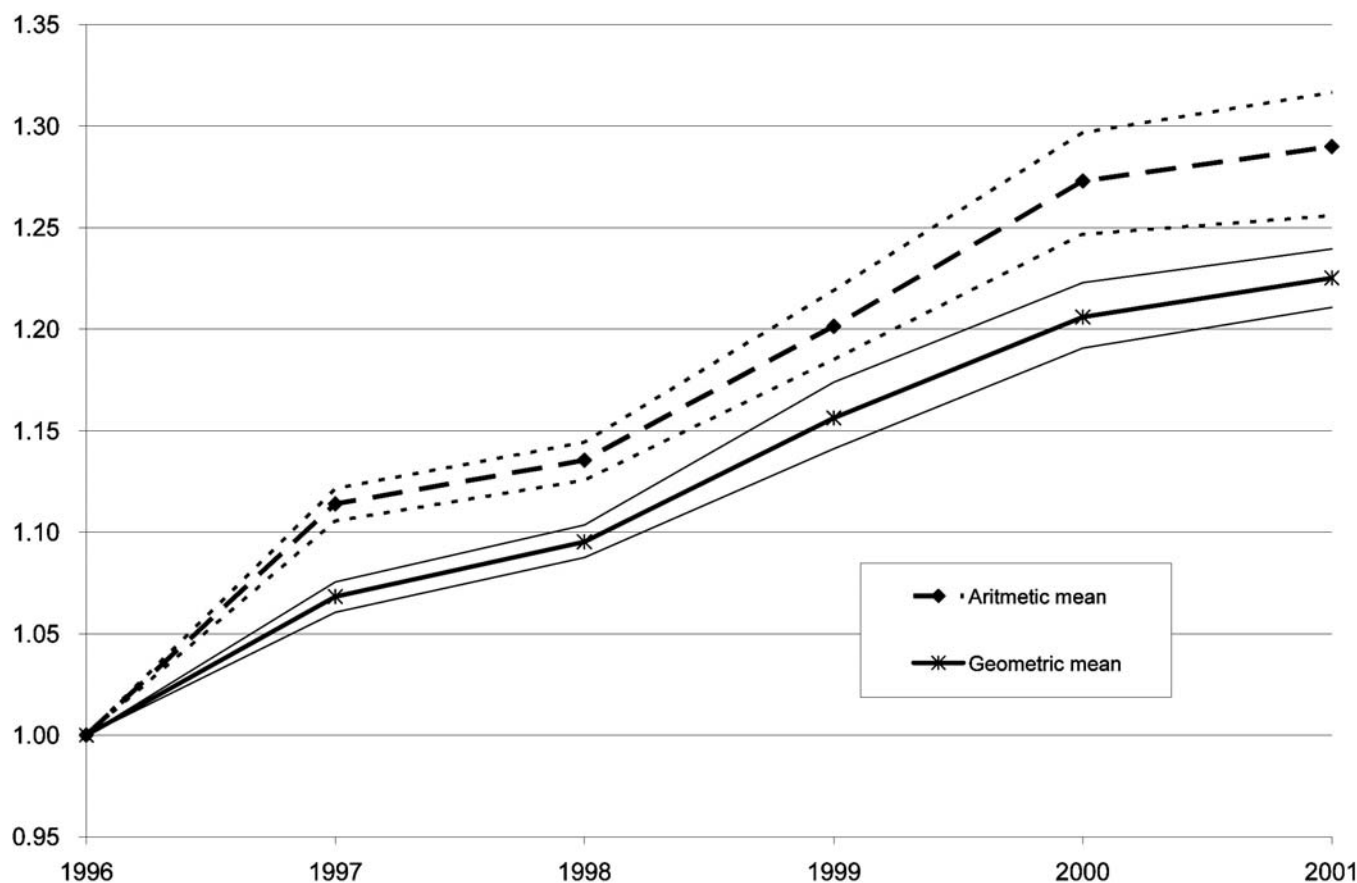


Figure 1. Technical productivity level $M_{96,t}$ relative to 1996. Arithmetic and geometric mean of 37 clinics with data for all years, with bootstrapped 90% confidence intervals.

formal model of behaviour, so the regression is only meant to reveal statistical association using a simultaneous method.

Results and Discussion

In the introduction we proposed four questions for the empirical analysis in this paper. Based on the Malmquist-indices and the regression models we now turn to the results of this analysis.

Technical Productivity Growth

The main results for the average Malmquist technical productivity index and its decomposition are given in **Table 2**, where a number greater than one indicates progress. The standard errors are from the bootstrap simulations, but it turns out that mean square error is larger for all bias-corrected index values than for the original uncorrected estimates, and so the latter are used as point estimates. The first block of the table shows the development in technical productivity from 1996 (= 1.0) to 2001 both as an arithmetic mean and a geometric mean for the 37 clinics with observations in all years. The stars indicate that both means in all years are significantly greater than one. **Figure 1**

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depicts these technical productivity changes graphically with their 90 per cent confidence intervals. There is a substantial and significant growth in technical productivity in this period, and the bootstrapped confidence intervals are quite narrow. Mean level of technical productivity in 2001 is more than 25 per cent higher than it was in 1996, based on the 37 clinics that provided data for all years. This implies an average annual growth in technical productivity of 4.5 per cent. Thus relative to a goal of a 50 per cent change, the sector seems to have come half the way six years after the goal was formulated.

As was to be expected, however, there are substantial differences between the individual clinics in technical productivity growth. **Figure 2** shows the distribution of annual growth averaged over the five yearly indices in a Salter-diagram with the width of the columns illustrating the size of the clinics as measured by the portion of total number of interventions. The figure also shows the 90 per cent confidence intervals from the bootstrap simulations, and it will be noticed that these are not always symmetric around the original estimates since the intervals are constructed around the bias-corrected estimates that had higher MSE. Of the 48 clinics with data for the first and last year period, eight showed a significant annual decline in technical productivity; the lowest with an annual decline of nearly ten per cent. Another nine clinics had a confidence interval that included

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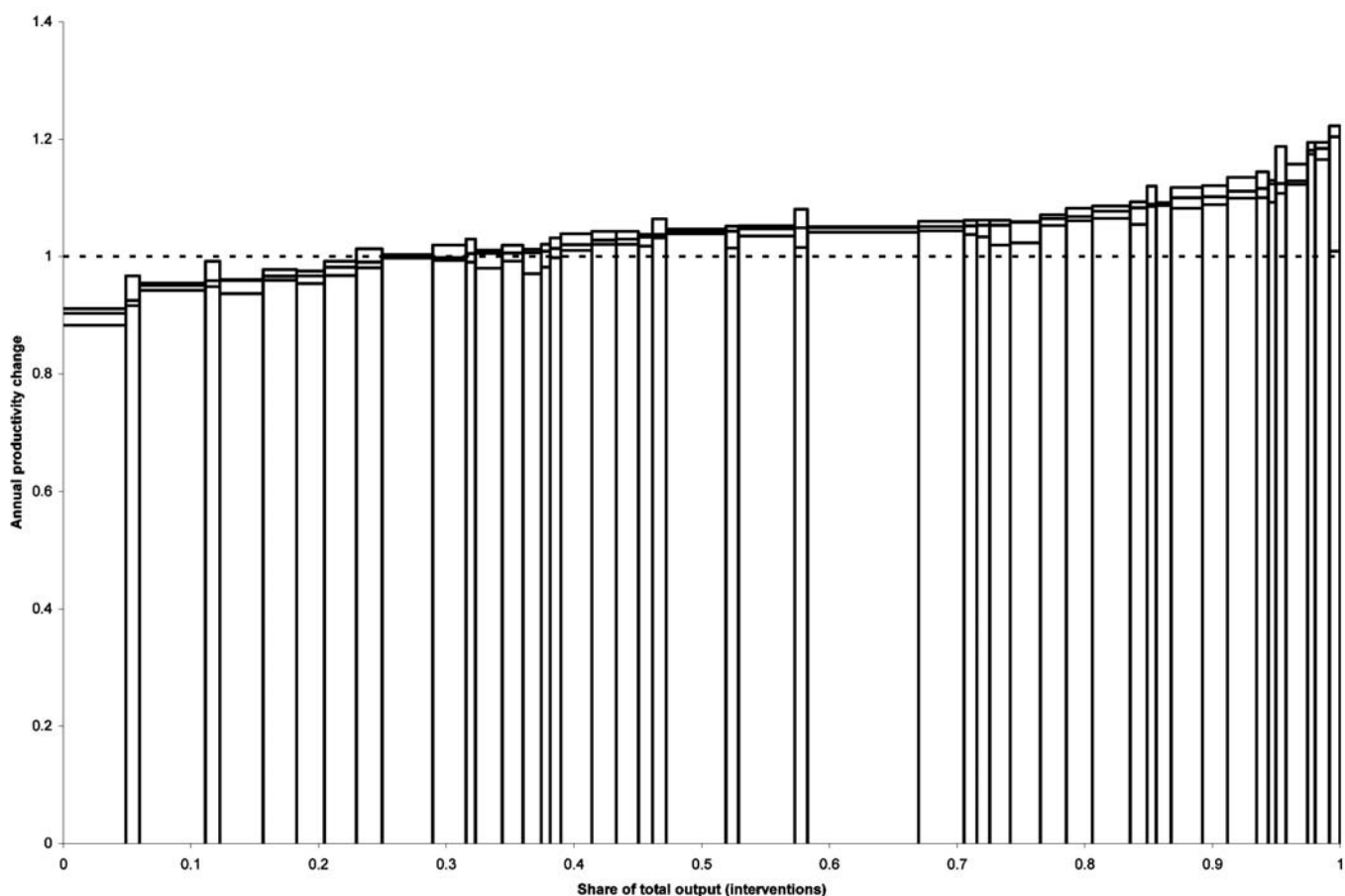


Figure 2. Salter diagram of annual technical productivity change $(M_{96;01})^{1/5}$ from 1996 to 2001. 48 units with data for both years. Bootstrapped 90% confidence intervals.

the unit line, and we therefore cannot conclude that these clinics showed a growth or decline in technical productivity. The remaining 31 clinics representing more than 60 per cent of total output measured in interventions, however, had a significant annual growth in technical productivity, 9 of these with an estimated annual growth rate in excess of 10 per cent.

Catching Up or Frontier Shift?

From a policy point of view it is of interest to see whether the level of technical productivity is increasing because of shifts in the best-practice technology or because there is a change in the levels of efficiency relative to a constant best-practice technology. In other words; are the good getting better, or are the not so good catching up? The third possibility is that the clinics are adjusting their sizes to benefit from any economies of scale. The lower block of **Table 2** shows technical productivity growth decomposed in three effects; front shift, efficiency shifts and scale shifts.

In the first four years it seems that the growth in technical productivity is evenly distributed between shifts in the best-practice frontier and catching up. From 2000 to 2001, however, there is a large positive shift in the best-practice frontier, and a resulting decrease in the catching up effects, though the latter is still positive for the period as a whole.

There seems to be no substantial change in scale efficiency in this period. Thus, on average, technical productivity growth in this period has been higher in outpatient clinics with initial low levels of technical productivity. We note, however, that the standard errors in **Table 2** are quite large, and very few of the decomposed indices are significantly different from 1.0, nor from each other. This is mainly because the position of the annual best-practice frontier will depend only on a few of the observations, unlike the technical productivity index M itself, which depends on the envelopment of the frontiers from all years. In our case of observations from 2001, three clinics dominate the frontier and alone account for more than 50 per cent of the annual reference technology. While the Malmquist index is quite robust to outliers, the results of the decomposition will thus depend heavily on the accuracy of the measurements of inputs and outputs in these clinics. With few significant results, we will not pursue the decomposed measures further.

Scale Efficiency

As noted in the decomposition, technical productivity growth does not seem to be explained by an increase in scale efficiency. To investigate the possible connection between the technical productivity growth and the absolute size of the

Table 3. Regression on the Malmquist Technical Productivity Index $M_{t,t+1}$

		Coefficient	Standard error
Total personnel year t	x^t	0.000	(0.001)
Growth in personnel t to $t + 1$	$\dot{x}^{t,t+1}$	-0.654***	(0.133)
Growth in university portion t to $t + 1$	$\dot{u}^{t,t+1}$	0.269**	(0.121)
Time dummy year 1997 to 1998	$T^{97;98}$	-0.005	(0.071)
Time dummy year 1998 to 1999	$T^{98;99}$	-0.031	(0.069)
Time dummy year 1999 to 2000	$T^{99;00}$	-0.073	(0.069)
Time dummy year 2000 to 2001	$T^{00;01}$	-0.037	(0.069)
Winner * time dummy 1996 to 1997	$W^{96;97}$	-0.113	(0.069)
Winner * time dummy 1997 to 1998	$W^{97;98}$	-0.136*	(0.072)
Winner * time dummy 1998 to 1999	$W^{98;99}$	-0.018	(0.068)
Winner * time dummy 1999 to 2000	$W^{99;00}$	0.032	(0.065)
Winner * time dummy 2000 to 2001	$W^{00;01}$	-0.014	(0.066)
Constant		1.545***	(0.199)
Number of valid observations		228	
R-squared		0.153	
Adjusted R_ squared		0.106	
F		3.25***	

Note: Stars denote significance levels at 1% (***), 5% (**) and 10% (*) respectively. For ease of interpretation the model statistics shown are from OLS, but the coefficients are numerically equal to those obtained in a random effects model. The variance of the random effects term is 0.000. The random effects model was not rejected in favour of the fixed effects model by the Hausman test in STATA 8 with $\text{Chi}^2(11) = 1.88$ and a P-value of 0.9989.

clinic, **Table 3** shows the results of the regression analysis. The coefficients in the table should not generally be interpreted as causal effects, but as the marginal change in the Malmquist technical productivity index associated with a change in the variable in question that may or may not describe a causal effect. The size of R-squared is a measure of goodness of fit, and a value of 0.153 is not large, but there are three coefficients that are significant at the ten per cent level. The size of the clinics is not among these and does not therefore influence the technical productivity growth.

Growth in Budget

The total budget of the outpatient clinics is largely based on the total number of therapists. Thus, we measure growth in budgets by growth in number of personnel. From the regression analysis we see that growth in budget affects technical productivity growth negatively. On average a 1 per cent increase in total staff is associated with a decrease in technical productivity growth of 0.65 per cent. This result is interesting because it tells us that although outpatient clinics seem to respond to “mild coercion” by increasing technical productivity, this growth is slowed down by a policy that at the same time increases the availability of resources. It should be noted, however, that there are explanations as to why an increase in budgets would slow down technical productivity growth other than a decrease in effort. Specifically, at any given point in time, a portion of the staff will be in training for a speciality. When there is a growth in staffing this portion is likely to increase, and this will most likely slow down technical productivity growth.

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Staff Diversification

Growth in the portion of university educated staff increases technical productivity growth. On average a 1 per cent increase in the portion of university staff is associated with an increase in technical productivity by 0.27 per cent. If one accepts the notion that staff quality is related to portion of university educated personnel (which will be highly controversial, at least in a Norwegian setting), this implies that an increase in staff quality will lead to a higher growth in technical productivity. One possible explanation is that clinics with a growth in the portion of university educated personnel spend less time in internal meetings and discussions and more time on treating patients.⁷

Change in Financing System

The change in the financing system did not seem to influence technical productivity growth, except in the period after the reform, when a slightly significant effect led to lower technical productivity growth for those that had an initial budgetary gain from the reform. The lack of a substantial effect of the financing system is not surprising, though, given the very marginal change in the system.

Conclusions

In the mid 90ties, low levels of productivity and excess demand for services led authorities to implement a twofold strategy; increased focus on productivity combined with an

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increase in resources. From 1996 to 2001 average technical productivity growth is estimated at 25 per cent, and the chosen strategy has seemingly been a success. There is clear evidence of a frontier shift, and the “not so good” on average seem also to have increased their technical productivity more than the best-practice units, giving a sector that is more homogenous in 2001 than it was in 1996.

While we offer no formal test of any causal relationship, this impressive record seems to be more related to the strong public focus on productivity than to the increase in available resources. While the increase of the availability of resources also contributes to the growth of the *level* of services provided, the regression estimates indicates that a partial effect of this resource growth at the individual clinic level is to reduce the *growth rate* of technical productivity.

Overall we conclude that technical productivity growth has been substantial, and further research should focus on the effects of various models for organising the psychiatric outpatient clinics on both the level of, and change in, technical productivity. In this context the positive effect on the technical productivity growth rate of increasing the portion of university educated personnel, and the negative effect of growth in resources, could provide fertile starting points.

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