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Abstract

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 (BUP). Increased accessibility to services is observed for the last years, measured as the number of children receiving services every year. The question is to what extent this is related to increased productivity. The paper aims to estimate change in productivity among outpatient clinics. Questions whether change in productivity is related to the personnel mix of the clinics, growth in treatment capacity or change in financial incentives are analysed. We utilise a non-parametric method called Data Envelopment Analysis (DEA) to estimate a best-practise production frontier. The potential for efficiency improvement are estimated as the difference between actual and best-practice performance, while allowing for trade-offs between different staff groups and different mixes of service production. A Malmquist output-based productivity index is calculated, decomposed in technical efficiency change, scale efficiency change and frontier shifts. The paper analyses panel data on the psychiatric outpatient clinics of Norway for the period of 1996-2001. Output is measured as number of direct and indirect patient-related interventions (visits and consultations) while input is measured by usage of different types of personnel. The results indicate increased overall productivity, with important contribution from increased technical efficiency. Personell growth has a negative influence on productivity growth, while a growth in the share of university educated personell improves productivity. The financial reform of 1997 that gave greater weight for interventions per patient lead to lower productivity growth in the subsequent period for those that had an inital budgetary gain from the reform.

1. Introduction

A government white paper in 1996 presented both an increase in capacity and an increase in productivity as central political goals for the psychiatric health care sector (Ministry of Health and Social Affairs 1997). To secure an increase in resources a national plan has been implemented from 1999 (Ministry of Health and Social Affairs 1998). To increase productivity, however, no particular measures have been taken other than increased political and public focus on the utilisation of resources. The purpose of this paper is to assess the effects of this strategy of combined resource growth and "mild coercion". We do so by focussing on psychiatric services for children and youths.

In Norway roughly 95 per cent of psychiatric services for children and youths are delivered in an outpatient setting. They are mainly aimed at treating emotional and mental disorders as well as correcting undesired behavioural patterns. Services are delivered both as direct therapy to the patient and indirectly in the form of interaction with the patient's environment (relatives, schools etc). It is generally assumed that approximately 5 per cent of all youths under 18 are in need of specialised psychiatric health care (Verhulst, Berden et al. 1985; Lavigne, Gibbons et al. 1996). Based on this figure it was estimated that as much as 60 per cent of Norwegian youths in need of specialised psychiatric health care did not receive such care in 1996 (Halsteinli 1998). At the same time the number of consultations pr therapist day in psychiatric outpatient clinics were shown to be as low as 1.1 (Ministry of Health and Social Affairs 1997). Thus at this time, it was concluded that the sector seemed to be characterised by a too low capacity level as well as low level of productivity.

When levels of productivity are low, a natural response is to review the payment system with the aim of providing incentives for increased efficiency. In 1996 psychiatric outpatient clinics were financed via two sources; around 60 per cent of the income was provided from the counties by the way of a global budget or lump sum earmarked grants[2]. The additional 40 per cent was financed from the state via the National Insurance scheme and related partly to the number of patients treated and partly to the number of employees at the clinic. Up until 1997 the patient related income consisted of a one-time fee for the first consultation only. From 1997, however, an additional fee for multiple interventions was introduced. 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 95per cent of the outpatient clinic income remains unrelated to the patent related activity. Thus the strongest incentive provided by the financing system is still to increase number of employees.

With only marginal changes to the financing system the gap between demand and supply of services had to be closed by other means. The chosen strategy contained two elements; a strong public and political focus on low levels of productivity and a growth the amount of resources put in to the sector in order to increase capacity. Suspecting that variations in efficiency could be attributed to variations in organisational models, the National Board of Health in 1998 initiated a project that were to review the working processes of psychiatric outpatient clinics. This project received much attention within the sector, and the resulting report suggested several areas where changes might lead to improved productivity (Hatling and Magnussen 1999). As a follow up the National Board of Health has begun implementing practice guidelines from 2001.

That the authorities in a situation with severe undercapacity and seemingly low levels of efficiency chose not to focus on the financing system is interesting. We especially note that that this strategy is in stark contrast to the somatic sector where increased activity and productivity was sought after mainly by changing the financing system (Biørn, Hagen et al. 2002). This difference may, in part, be explained by the lack of patient classification systems *a la* the DRG system for psychiatric patients. Still the lack of psychiatric DRGs cannot fully explain why the authorities chose to stick to a financing system where the main incentive was to increase staffing rather than activity. 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.

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[2] For the period analysed in this paper the 19 county councils were responsible for the financing and delivery of specialised health care services. From 2002 this responsibility are transferred to 5 state owned regional health corporations.

The effects of the financial reform of the somatic sector (Biørn, Hagen et al. 2002) indicates that the financial reform in the somatic sector led to a productivity growth of approximately 2 per cent. The goal for psychiatric outpatient care as it was formulated in public documents in 1996 was for a productivity growth of 50 per cent. This was, of course, optimistic, and the purpose of this paper is to see whether this strategy of combining external pressure, resource growth and a minor change in the financing system actually succeeded in increasing levels of productivity to the extent foreseen. We shall proceed to do this by utilising the concept of a decomposed Malmquist index to measure the *growth of productivity* over the six-year period, 1996-2001. We limit the discussion to Norwegian psychiatric outpatient clinics for children and youths ("BUP-clinics"[3]). The paper is structured as follows. In section 2 we provide a more thorough description of the behaviour in and activity of outpatient clinics for children and youth, and provide the background for the empirical analysis that follows. Section 3 discusses the measurement of inputs and outputs, and present the methodology used. Results are presented and discussed in section 4, while section 5 concludes the paper.

2. BUP clinics – organisation, behaviour and activity.

Generally the production of health care services takes place in an organisationally complex environment, making it difficult to formulate precise behavioural models. In the setting of BUP-clinics this is even more difficult. The main purpose of these clinics is to correct undesirable behaviour. This may involve only the patient and the therapist, but will often be more complex, involving several different therapists and include family (parents and siblings) and school. As is the case for many psychiatric illnesses it is often difficult to set a precise diagnosis. This leads to a situation where there are few standardised treatment programmes, and thus difficult to characterise the activity of outpatient clinics by means of homogenous diagnostic groups. Furthermore this leads to a situation where each outpatient clinic to a large degree has discretion regarding the type of personnel needed to provide treatment, the type and quantity of services that are to be delivered to the patients and the duration of treatment.

[3] The term BUP is an abbrivation for the Norwegian "children and youths".

There is clear evidence that different personnel groups both pursue different goals and have different views as for how the treatment process should be organised (Hatling and Magnussen 1999). In this setting it does not seem fruitful to use standard models of hospital behaviour (Chalkley and Malcomson 2000) where one hospital decision maker interact with one principal. Psychiatric outpatient clinics will be characterised by multiple decision makers providing an array of services in a heterogeneous environment both with respect to means and goals. We therefore choose to proceed on a more *ad-hoc* basis when we formulate the specific questions that we believe is worth pursuing in an empirical analysis

First, on a purely descriptive basis, we are interested in whether or not there is a growth in total productivity in the sector in the period 1996-2001, and given the aim of a 50 per cent increase, also in its magnitude.

Second, we are interested in studying where a growth in productivity has taken place. More specifically; is growth in productivity due to the good becoming better, or is it a case of the not so good catching up?

Third, previous analysis (Halsteinli, Magnussen et al. 2001) suggest that there are variable returns to scale in the sector and we would like to pursue this by looking at the relationship between productivity growth and scale.

Fourth, we wish to see whether the change in productivity, *ceteris paribus,* is negatively related to the growth in resources available. This assumption is derived from similar analyses in the somatic sector (Biørn, Hagen et al. 2002). Basically the argument is that increased budget levels will increase slack and thereby reduce productivity growth.

Fifth; we wish to see whether the change in productivity, *ceteris paribus*, is related to the diversification of the personnel. This is motivated by the assumption that a more homogenous staff mix will be more unified in the pursuit of goals and thereby spend less time on effort reducing activities. We have no real theoretical underpinning of this hypotheses, but we note that the argument is pursued in the sector (Larsen and Hustoft 2002).

Sixth, we wish to see whether the marginal change in the financing system had any effect on the growth in productivity, *ceteris paribus.*

We now turn to the question of how these issues should be treated empirically.

3. Data and methodology

The treatment process in BUP-clinics will consist of a series of interventions related to each patient. These interventions can be direct, i.e. by the way of consultations, others are indirect, i.e. by the way of contacts with the patients environment. The interventions will be of 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 alone, or in a group setting where more therapists are involved and also where the patients family is involved.

Ideally we would model the input-output relationship using data on number of treated patients in homogenous groups. If this were possible inefficiencies that arise from using too many interventions would be detected. As noted this is not possible, since we cannot define homogenous patient groups. Thus what we do is assume that interventions that are provided are necessary and choose to measure activity as number of direct and number of indirect interventions. We have elsewhere (Halsteinli, Magnussen et al. 2001) performed a detailed analysis of how different ways of measuring input/output affect the efficiency measures. There we concluded that a model using number of therapist hours spent on direct patient care, number of therapist hours spent on indirect care, number of university educated staff and other staff as inputs performed well in the sense that the use of these inputs and outputs sufficiently captured the information content in the other variables

When we in the present analysis have chosen a slightly different approach, we do this out of two purposes. Firstly the change in the financing system was related to changing the financing of interventions. Thus we believe that we may capture the potential effects of this better by measuring output as number of interventions. Secondly, in order to get as long a series as possible we have included data from years where the quality of the data on interventions are believed to be better than the quality of the data on number of hours. Thus we measure the growth in productivity by using the input and output variables in table 1.

Table 1: Descriptive statistics. Annual means for inputs, outputs and other variables.

	Year	1996	1997	1998	1999	2000	2001
Outputs							
Direct interventions	y_1^t	1 818 (1340)	1 947 (1597)	1 981 (1352)	2 058 (1414)	2 263 (1566)	2 533 (1822)
Indirect interventions	y_2^t	837 (734)	917 (802)	917 (774)	1 055 (779)	1 200 (823)	1 295 (856)
Inputs							
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		2 655 (1932)	2 864 (2289)	2 898 (1983)	3 113 (2052)	3 463 (2204)	3 829 (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

Standard deviations in brackets.

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 prices. As is common in public sector applications, output prices are nonexistent, and even input prices are difficult to get hold of. Building on Malmquist (1953) one can instead use an estimate of the technology or production possibility set to measure the change in productivity between periods (Caves, Christensen et al. 1982). If **x** is a vector of inputs and **y** is a vector of outputs, the production possibility set at time s is defined as

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

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 (Farrell 1957; Førsund and Hjalmarsson 1987) be defined as

$$\mathrm{TP}_t^s = \mathrm{Min}_{\theta,\lambda}\left\{ \theta/\lambda \,\middle|\, (\lambda \mathbf{y}^t, \theta \mathbf{x}^t) \in P^s \right\} \tag{2}$$

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 outputincreasing direction, the Farrell (1957) measure of technical efficiency is

$$\mathrm{TE}_t = \mathrm{Min}_{\lambda}\left\{ 1/\lambda \,\middle|\, (\lambda \mathbf{y}^t, \mathbf{x}^t) \in P^t \right\} \tag{3}$$

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

$$\mathrm{TP}_t^t = \mathrm{TE}_t \bullet \mathrm{SE}_t \tag{4}$$

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 productivity change from an input-output vector at time t to time u is then defined by

$$\mathrm{M}_{tu}^s = \mathrm{TP}_u^s / \mathrm{TP}_t^s \tag{5}$$

M_{tu}^s will be greater (less) than one when 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 choice of the reference technology is somewhat arbitrary. Färe, Grosskopf et al. (1994) suggests using the geometric mean of indices calculated with each of the two years used as reference, while Berg, Førsund et al. (1992) argues that circularity 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. $P^s = \bigcup_t P^t$, thereby fulfilling the circularity condition while at the same time utilising technology information from all time periods.

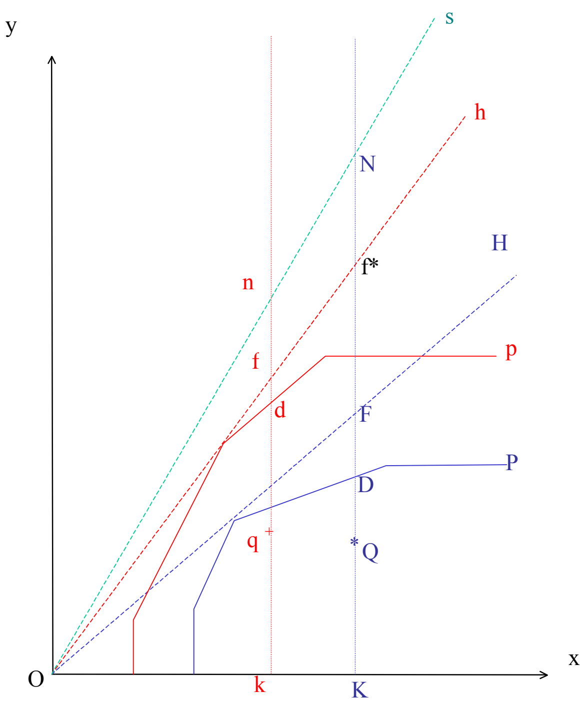
As shown in Färe, Grosskopf et al. (1994) the Malmquist index of productivity change could be decomposed into two terms, reflecting the change in the productivity of the frontier relative to the common reference technology, and the change in own period technical productivity $\mathrm{TP}_u^u / \mathrm{TP}_t^t$. 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

$$\mathrm{MF}_{tu}^s = \frac{\mathrm{TP}_u^s / \mathrm{TP}_u^u}{\mathrm{TP}_t^s / \mathrm{TP}_t^t}, \quad \mathrm{ME}_{tu} = \frac{\mathrm{TE}_u}{\mathrm{TE}_t}, \quad \mathrm{MS}_{su} = \frac{\mathrm{SE}_u}{\mathrm{SE}_t} \tag{6}$$

we can write the three-way decomposition as

$$\mathrm{M}_{tu}^s = \frac{\mathrm{TP}_u^s}{\mathrm{TP}_t^s} = \frac{\mathrm{TP}_u^s / \mathrm{TP}_u^u}{\mathrm{TP}_t^s / \mathrm{TP}_t^t} \frac{\mathrm{TP}_u^u}{\mathrm{TP}_t^t} = \frac{\mathrm{TP}_u^s / \mathrm{TP}_u^u}{\mathrm{TP}_t^s / \mathrm{TP}_t^t} \frac{\mathrm{TE}_u}{\mathrm{TE}_t} \frac{\mathrm{SE}_u}{\mathrm{SE}_t} = \mathrm{MF}_{tu}^s \, \mathrm{ME}_{tu} \, \mathrm{MS}_{su} \tag{7}$$

To apply the malmquist index and its decomposition empirically, one needs an estimate of the technology P^t in each time period. The DEA estimate, originally suggested by Farrell (1957)



$\mathrm{TP}_1^1 = \mathrm{KQ/KF}$ $\quad$ $\mathrm{TP}_2^2 = \mathrm{kq/kf}$

$\mathrm{TE}_1 = \mathrm{KQ/KD}$ $\quad$ $\mathrm{TE}_2 = \mathrm{kq/kd}$

$\mathrm{SE}_1 = \mathrm{KD/KF}$ $\quad$ $\mathrm{SE}_2 = \mathrm{kd/kf}$

$\mathrm{TP}_1^s = \mathrm{KQ/KN}$ $\quad$ $\mathrm{TP}_2^s = \mathrm{kq/kn}$

$$\mathrm{M}_{12}^s = \mathrm{kq/kn} \big/ \mathrm{KQ/KN}$$

$$\mathrm{MF}_{12}^s = \mathrm{kf/kn} \big/ \mathrm{KF/KN} = \mathrm{Kf}^* / \mathrm{KF}$$

$$\mathrm{ME}_{12} = \mathrm{kq/kd} \big/ \mathrm{KQ/KD}$$

$$\mathrm{MS}_{12} = \mathrm{kd/kf} \big/ \mathrm{KD/KF}$$

Figure 1: Efficiency and productivity measures with DEA frontier estimates for observation Q in period 1 and q in period 2

and further developed in the literature following Charnes, Cooper et al. (1978), can be written as

$$\hat{P}^t = \left\{ (\mathbf{y}, \mathbf{x}) \middle| \mathbf{y} \le \sum_{j=1}^{n} \lambda_j \mathbf{y}_j^t, \mathbf{x} \ge \sum_{j=1}^{n} \lambda_j \mathbf{x}_j^t, \sum_{j=1}^{n} \lambda_j = 1 \right\} \quad (8)$$

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 in (Banker, Charnes et al. 1984) to be the minimum extrapolation set that satisfies feasibility, convexity and free disposal. As a nonparametric method it fits closely to the data 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 outliers. On the other hand it may well underestimate the truly technical potential if no units are fully technologically efficient.

The basic features are illustrated for the one-input one-output case in figure 1, where capital letters are for the first period and small letters for the second. The DEA estimated frontiers of the technology for each period are labelled P and p respectively. The diagonal dotted lines marked OH/Oh, tangent to the technology, are the absolute productivity levels (y/x) of the units with optimal size, while Os is the common reference productivity enveloping all yearly technologies. Output efficiency is measured vertically in the figure, so that an observation Q with an actual production of KQ and a potential production of KD has a technical output efficiency of KQ/KD. Had the unit adjusted both input and output to become optimally sized, it could achieve an output-input ratio on OH, so that its own-period technical productivity is KQ/KF. Relative to the common reference technology the technical productivity is KQ/KN, and so a move to the second period observation with productivity kq/kn is clearly an improvement (M>1). In the figure this productivity improvement represents a positive frontier shift (MF>1), a scale efficiency improvement (MS>1), but a deterioration in technical efficiency (ME<1).

By utilising the Malmquist setup as described above, we are able to answer the first three of the questions formulated in section 2. The last three, however, requires additional analysis. Thus we use the Malmquist measures as dependant variables and regress these on a set of explanatory variables. Specifically we formulate:

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

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.

$\dot{x}^{t;t+1} = x^{t+1} \big/ x^t$, annual growth in personnel, capturing the growth in the size of the budget.

$u^{t;t+1} = \left[x_1^{t+1} / x^{t+1} \right] \big/ \left[x_1^t / x^t \right]$, annual growth in share of personnel that are university educated, capturing to what extent the clinics are becoming less diversified as regards 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 hospitals that had a case mix in 1996 that meant that they stood to gain from the financial reform in 1996-97. It takes the value 1 if the number of interventions per patient exceeded seven 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. Using a Hausmann test both the random and fixed effects models are rejected. Thus we only present results from the OLS model. As argued in section 2, we do not formulate a formal model of behaviour, so the regression is only meant to reveal statistical association using a simultaneous method.

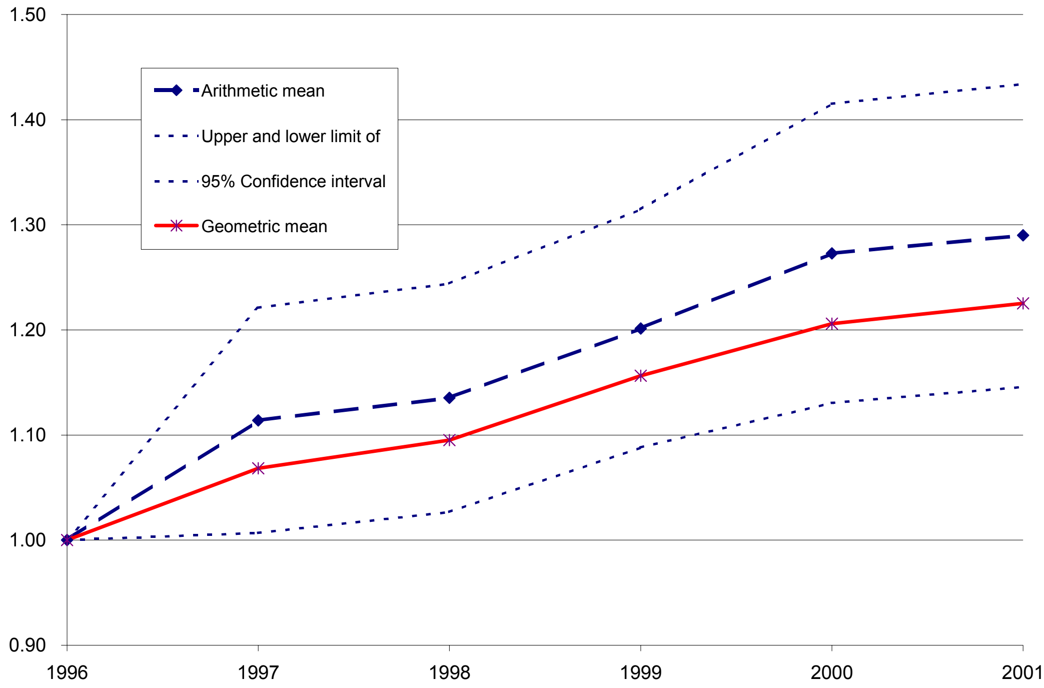


Figure 2: Productivity change $M_{96;t}$ relative to 1996. Arithmetic and geometric mean of 37 clinics with data for all years.

4. Results and discussion

I section 2 we proposed six 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.

Total productivity growth

Figure 2 depicts the development in productivity from 1996 (=100) to 2001 both as an arithmetic mean and a geometric mean of the individual productivity changes. There is a substantial and significant (at the 2.5 per cent level) growth in productivity in this period. Mean level of productivity in 2001 is more than 25 per cent higher than it was in 1996. This implies an average annual growth in productivity of 4.5 per cent[4]. 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.

[4] The number 4.5 per cent is based on a data set consisting of the 37 outpatient clinics that provided data for all the years between 1996 and 2001. The Salter diagram is based on a data set consisting of the 48 outpatient clinics that provided data for (at least) the first and last year.

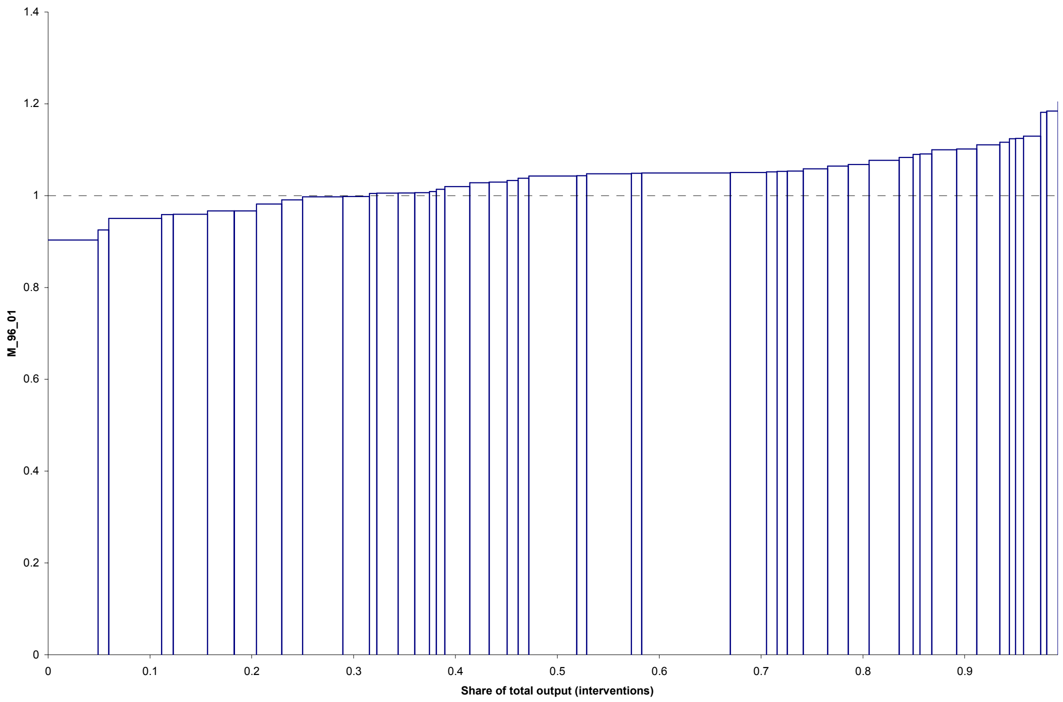


Figure 3: Salter diagram of productivity change $M_{96;01}$ from 1996 to 2001. 48 units with data for both years.

As were to be expected, however, there are substantial differences between BUP-clinics in productivity growth. Figure3 shows the distribution of average annual growth in a Salter-diagram with the width of the columns illustrating the size of the clinics as measured by the share of total number of interventions. Of the 48 clinics with data for the first and last year period, 11 showed an annual decline in productivity; the lowest with an annual decline of nearly 10per cent. More than three-quarters of the clinics, however, had an annual growth in productivity, 9 of these with an 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 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? Figure 4 shows total productivity growth decomposed in three effects; front shift, efficiency shifts and scale shifts.

In the first four years it seems that the growth in productivity is evenly distributed between shifts in the best practice frontier and catching up. From 2000 to 2001, however, there is a

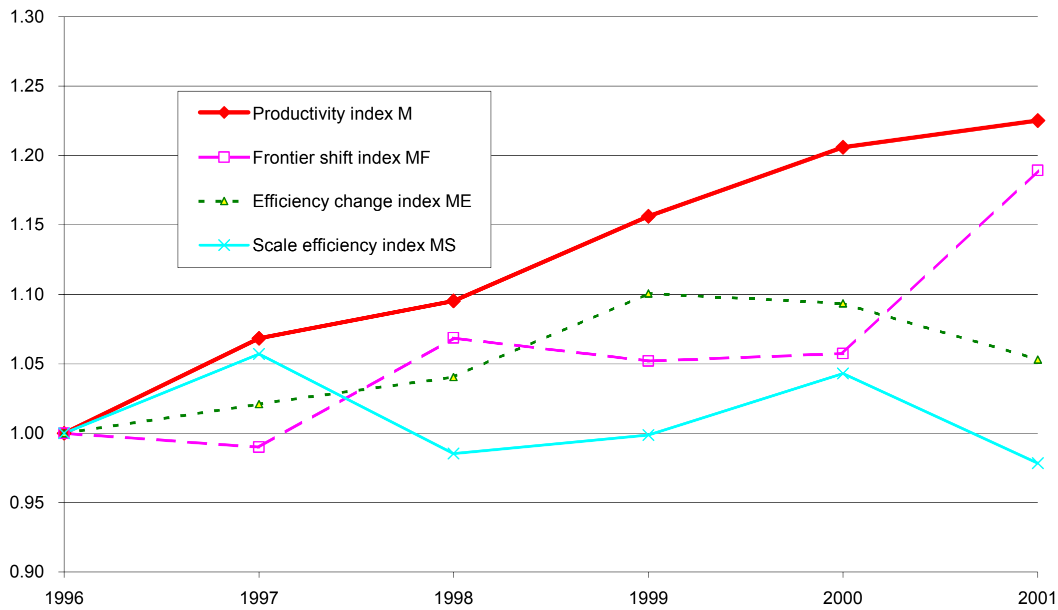


Figure 4: Decomposition of productivity index M=MF*ME*MS. Geometric mean of 37 clinics with data for all years.

large positive shift in the best practice frontier, and a resulting decrease in the catching up effects. There seems to be no substantial change in scale efficiency in this period. Thus, on average, productivity growth in this period has been higher in outpatient clinics with initial low levels of productivity. We note, however, that while front shifts usually are termed "technical change" this may be misleading in this case. It is more likely that frontier shifts are the result of the best practice technology closing in on the theoretical frontier, than that this is the result of true technical change. Also, the position of the best practice frontier will depend only on a few of the observations. In our case observations from 2001, three BUP-clinics alone account for more than 50 per cent of the reference technology dominates the frontier. Thus the results of the decomposition of the efficiency measures will depend on the measurements of the inputs and outputs. Still we note that the front shift from 2000 to 2001 remains even when "extreme" observations are removed.

Scale efficiency

Productivity growth does not seem to be explained by an increase in scale efficiency. Also, from the regression analysis (table 2), the size of the clinics does not influence the productivity growth.

Table 2: Regression on the Malmquist productivity index and its components.

Dependent variable		$M^{s}_{t;t+1}$	$MF^{s}_{t;t+1}$	$ME_{t;t+1}$	$MS_{t;t+1}$
Total personnel year t	x^{t}	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)
Growth in personnel t to t+1	$\dot{x}^{t;t+1}$	-0.654*** (0.133)	-0.119 (0.072)	-0.432*** (0.144)	-0.054 (0.066)
Growth in university share t to t+1	$\dot{u}^{t;t+1}$	0.269** (0.121)	0.243*** (0.066)	0.066 (0.132)	-0.034 (0.061)
Time dummy year 1997 to 1998	$T^{97;98}$	-0.005 (0.071)	0.053 (0.039)	0.014 (0.077)	-0.102*** (0.035)
Time dummy year 1998 to 1999	$T^{98;99}$	-0.031 (0.069)	-0.030 (0.038)	0.041 (0.075)	-0.087** (0.035)
Time dummy year 1999 to 2000	$T^{99;00}$	-0.073 (0.069)	0.016 (0.037)	-0.087 (0.074)	-0.052 (0.034)
Time dummy year 2000 to 2001	$T^{00;01}$	-0.037 (0.069)	0.106*** (0.038)	-0.062 (0.075)	-0.116*** (0.034)
Winner * time dummy 1996 to 1997	$W^{96;97}$	-0.113 (0.069)	-0.041 (0.038)	-0.064 (0.075)	-0.046 (0.035)
Winner * time dummy 1997 to 1998	$W^{97;98}$	-0.136* (0.072)	0.025 (0.039)	-0.066 (0.078)	-0.089** (0.036)
Winner * time dummy 1998 to 1999	$W^{98;99}$	-0.018 (0.068)	-0.019 (0.037)	-0.061 (0.073)	0.060* (0.034)
Winner * time dummy 1999 to 2000	$W^{99;00}$	0.032 (0.065)	-0.031 (0.036)	0.038 (0.071)	0.027 (0.033)
Winner * time dummy 2000 to 2001	$W^{00;01}$	-0.014 (0.066)	0.025 (0.036)	0.017 (0.071)	-0.051 (0.033)
Constant		1.545*** (0.199)	0.889*** (0.109)	1.475*** (0.216)	1.175*** (0.099)
Number of valid observations		228	228	228	228
R-squared		0.153	0.232	0.071	0.234
Adjusted R_squared		0.106	0.189	0.019	0.191
F		3.25***	5.4***	1.36	5.48***

Standard errors in brackets. Stars denote significance levels at 1% (***), 5% (**) and 10% (*) respectively. Random effects and fixed effects models were rejected by the Hausman test.

Growth in budget

We measure growth in budgets by growth in number of personnel. From the regression analysis we see that growth in budget affects productivity growth negatively. On average a 1 per cent increase in total staff will decrease productivity growth with 0.65 per cent. This result is interesting because it tells us that although outpatient 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. It should be noted, however, that there are explanations to why an increase in budgets would slow down productivity growth other than a decrease in effort. Specifically, at any given point in time, a share of the staff will be in training for a speciality. When there is a growth in staffing this share is likely to increase, and this will most likely slow down productivity growth. We also note that a slowdown of productivity growth in clinics with a large growth in budget size mainly comes as a “falling behind effect”. This would suggest that outpatient clinics with an initial high level of productivity is better equipped to handle a growth in staffing than clinics with a low initial level of productivity. To understand why this should be we would need, however, to perform a more detailed analysis of the effects of internal organisational factors on productivity.

Staff diversification

Growth in the share of university educated staff increases productivity growth. On average a 1 per cent increase in the share of university staff increases productivity by 0,27 per cent. This supports our hypotheses that a more unified staff mix will increase productivity. If one accepts the notion that staff quality is related to share of university educated personnel[5] this also implies than an increase in staff quality will lead to a higher growth in productivity. We also note that this effect is mainly due to a frontier shift. Thus an increase in staff quality/share of university educated staff is most effective in clinics that already have a high level of efficiency. The way we have specified our model productivity will be measured relative to the best practice units that have a similar staff mix. Thus we cannot say whether staff diversification, ceteris paribus, leads to a higher or lower level of productivity.

Change in financing system

The change in the financing system did not seem to influence productivity growth, except in the period after the reform, when a slightly significant effect lead to lower productivity growth for those that had an initial budgetary gain from the reform This effect seems to have worked through a reduction in scale efficiency. The lack of a substantial effect of the financing system is not surprising, though, given the very marginal change in the system.

[5] And this notion will be highly controversial, at least in the Norwegian setting.

5. Concluding comments

Low levels of productivity and excess demand for services led authorities to implement a twofold strategy; increased focus on productivity combined with an increase in resources. From 1996 to 2001 average productivity growth was 25 per cent, and the chosen strategy has seemingly been a success. Although there is clear evidence of a frontier shift, we see that the "not so good" on average have increased their productivity more than the best practice units giving a sector that is more homogenous in 2001 than it was in 1996. Productivity growth has been slowed down due to an increase in the availability of resources, but this may be due to an increase in training costs, in which case it is likely to be transitional. Overall we conclude that productivity growth has been substantial, and further research should focus on the effects of various organisational models of BUP-clinics and both the level of and change in productivity. In this context the positive effect of increasing the share of university educated personnel could provide a fruitful starting point.

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