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Organisational Change, Absenteeism and Welfare Dependency

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Abstract

We show that recent attempts to reorganise and cut costs in the Norwegian health care and social services sectors have had the unintended side effects of raising the level of sickness absence and disability among the employees, and that these effects have persisted several years after completion of the reorganisation processes. Since a substantial proportion of the resulting costs are external to the decision-makers, we suspect that the pace of change may have been excessively high. Changes that were efficient from each service provider's point of view may have been inefficient from a social and a public-finance point of view.

1 Introduction

During the period from the early 1990's to 2003, Norway experienced a remarkable increase in sickness absence and health-related withdrawals from the labour market. The average number of sickness days paid for by the Social Security Administration increased by 75 per cent, from a low of eight days per worker in 1994 to 14 in 2003; see Figure 1, panel (a). And the rate at which new workers embarked upon absence spells that turned out to entail long-lasting Social Security dependence (for more than six months) increased at a similar pace, from two per cent of the labour force in 1994 to just above three per cent in 2000 (Fevang *et al.*, 2004). Many of these spells ended in permanent disability. Hence, the number of disability pensioners also rose sharply, from around 236,000 in the early 1990's to 301,000 by the end of 2003.

Policy makers are concerned that this development is somehow related to the advent of more 'brutal' work-environments, with fiercer competition, faster structural change, and increasing pressures towards individual adaptability. The pace of structural change has clearly increased in sectors of the economy that were previously sheltered against competition, such as public utilities, telecommunications, postal services, health care and social services. There are also indications that the general levels of downsizing and turnover have risen, see Figure 1, panel (c) and (d). In particular, firms' downsizing propensity has increased sharply after 1995, despite general improvements in the business cycle, see panel (b). The rise in turnover rates is a more predictable consequence of the cyclical developments. However, Dale-Olsen (2005) shows, on the basis of micro firm data, that even after controlling for business cycles (and changes in industry composition) the turnover rate in Norwegian firms displayed a significant positive trend during 1990-2002.[1]

- Figure 1 around here -

[1] There is clearly also a business cycle pattern in the sickness absence behaviour, but existing evidence (Nordberg and Røed, 2003; Askildsen *et al.*, 2005) indicate that this relationship is not very strong. And business cycle effects can obviously not explain the rise in absenteeism that occurred after the cyclical peak in 1998.

A more turbulent labour market may have raised the risk of work-related health impairments, and also made it more difficult for employees to be present at work with given health problems. As we show in the next section, there is some international evidence suggesting that large organisational changes sometimes do have adverse health consequences. According to the influential demand-control theory (Karasek, 1979; Karasek and Theorell, 1990), most work-related adverse reactions of psychological strain (fatigue, anxiety, depression, and physical illness) occur when the psychological demands of the job are high while the worker's decision latitude in the task is low. It is conceivable that enforced organisational changes involving downsizing of the staff increase the risk of such reactions, particularly at workplaces previously sheltered from competitive pressures. In Norway, as well as in other welfare state economies, there has been a recent drive towards making the public sector more efficient, and large organisational changes have been implemented to achieve this aim. Given the strong employment protection in this sector, it is a worry that publicly financed sickness and disability insurance (and 'voluntary' withdrawals from the labour force) sometimes serves as a substitute for layoff. Since the resulting transfer costs are external to the employer-employee pair, organisational changes may be implemented even when they are inefficient from both a social and a public finance point of view.[2]

The present paper examines the relationship between organisational change, absenteeism, and welfare dependency within the public sector. It focuses on a group of workers that was subject to substantial workplace turbulence during the 1990's, namely nurses working in hospitals, psychiatric institutions, nursing homes and community nursing.[3] Our empirical ba-

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[2] The sickness insurance system in Norway is universal, and provides a 100 per cent compensation rate for one year, and a substantially lower rehabilitation or disability benefit thereafter. Apart from the first 16 days of absence (which are covered by the employer), the costs are paid for in full by the Social Security administration. There is no experience rating.

[3] In a recent sample survey among doctors and nurses in the Norwegian hospital sector (Sørensen and Grimsmo, 2004), as much as 59 per cent of the respondents agreed to the statement that during the past few years, considerations regarding the unit's economic result had become a more important factor in their daily work (compared to 4 per cent who claimed it had become less important). A similar fraction of 54 per cent felt

sis is the municipalities' and counties' own employment registers for the 1992-2000 period. These registers confirm that the pace of organisational change has increased somewhat in the health care and social services sector. Despite a rather strong overall employment growth (the total number of man-years in the sector rose by 23.8 per cent from 1992 to 2000), we find that the fraction of nurses who experienced an episode of large downsizing at their own workplace (encompassing at least 20 per cent of the man-years) increased from an average of around 2.5 per cent per year in 1992-1995 to 3.2 per cent in 1996-2000 (the turnover rate increased at the same time from 11.4 to 14.0 per cent). An important distinguishing feature of downsizings in this part of the economy is that they typically occur without layoffs. What usually happens is that redundant (permanent contract) employees are offered alternative employment opportunities within the municipality/county. Hence, the topic addressed in this paper is not the impact of individual displacement, but rather the consequences of being subject to a substantial organisational change, possibly involving transfer to a new workplace. Our key idea is to use observed organisational changes, as they materialised in downsizing and/or large staff reshuffling, together with longitudinal data on the employees' individual work histories, to identify the causal effects of organisational change on the workers' concurrent absence behaviour and subsequent employment and welfare dependency patterns.

Based on the population of employed nurses in October 1992, we set up a competing risks mixed proportional hazards (MPH) model that facilitate an analysis of how workplace events affect employee behaviour in terms of transitions between presence and absence, between different jobs, and from a job to welfare dependency or unsubsidised non-employment. To make this possible, we have merged the employers' employment registers with various public administrative registers for the same period, covering all kinds of public transfers to

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that working speed had become a more important factor than before. In another study among community nurses and home aids (Andersen and Eidset, 2003), 57 per cent of the respondents claimed that strains resulting from time pressure had increased during the past two years (compared to 6 per cent who claimed it had been reduced). In comparison, only 24 per cent felt that the physical strain had increased over the same period.

individuals (sickness benefits, unemployment benefits, social assistance, rehabilitation benefits, and disability benefits). The statistical model we use imposes a minimum of unjustified parametric restrictions. The various selection processes, including selection into the initial state, are modelled by means of the non-parametric maximum likelihood estimator (NPMLE), which approximates the unknown distribution of unobserved heterogeneity in terms of a joint discrete distribution with an (a priori) unknown number of support points.

Our main finding is that major reorganisations do cause higher rates of absence and welfare dependency. Nurses employed at workplaces subject to large downsizing and/or substantial changes in the composition of their staff, experienced significantly higher rates of long-term sickness absence than nurses who worked in more stable economic environments. More seriously, they also experienced higher rates of entry into more lasting forms of Social Security dependency, such as rehabilitation and disability benefits. In addition, they had a significantly higher exit rate out the labour market without any form of income support. The paper is structured as follows: The next section provides a brief review of the existing literature. Section 3 describes the data. Section 4 introduces the statistical model. Section 5 presents the results, Section 6 discusses some policy implications, and Section 7 concludes.

2 Existing Evidence

There is an extensive international economics literature regarding individual costs of displacement; for overviews, see, e.g., Hamermesh (1987), Kletzer (1998) and Kuhn (2002). The main conclusion arising from this literature is that the costs associated with involuntary job loss are large and persistent, both in terms of subsequent income and employment propensity. A recent Norwegian study (Huttunen *et al.*, 2005) finds that displacement of male workers in the manufacturing industries raises the probability of permanent exit from the labour market substantially. While 18 per cent of the displaced workers in that study had left the labour force seven years after the occurrence of displacement, this was the case for only 8 per cent of the

control group with similar non-displaced workers. We have found no empirical evidence in the economics literature regarding the impact of organisational changes and increased job insecurity on individuals who do not themselves become displaced.

There is, however, a relatively large literature within epidemiological research, suggesting that major organisational changes sometimes affect the employees' health adversely, in terms of increased risks of cardiovascular diseases, musculoskeletal diseases, and minor psychiatric morbidity; see, e.g., Ferrie (2001) and Sverke *et al*. (2002) for recent surveys of the literature, and Burke and Greenglass (2000), Burke (2003), Brown *et al.* (2003) and Sheward *et al.* (2005) for direct evidence regarding the health care and nursing sectors. These effects are not necessarily limited to increased job insecurity in the sense of layoff, but may include the loss of any valued condition of employment. Since data opportunities for identifying causal effects of this kind are rare (due to the large selection problems involved), most of the existing (reliable) research contributions have taken advantage of a relatively small number of 'quasi-natural' experiments. The most famous of these is the Whitehall II study (Ferrie *et al*., 1995; 1998a; 1998b; Ferrie *et al*., 2002). In 1988, a large reform process was initiated in the British civil service, which, for some departments involved a period of substantial uncertainty. One of the departments was later privatised. The evidence gathered from this 'experiment' shows that the civil servants who were subject to job insecurity during this process experienced adverse health effects, both in terms of self-rated health measures and clinical symptoms. And the members of the department under direct threat of job loss due to privatisation went from a position of advantage or no difference in health status (prior to the 'announcement' of the threat) to a significant disadvantage. Similar results are gathered from a number of Finnish municipalities, which during the large recession in the 1990's, to varying degrees went through downsizing processes (Vahtera *et al.*., 2000; Kivimäki *et al.*, 2000; Kivimäki *et*

al., 2001; Vahtera *et al.*, 2004). Downsizing turned out to be a risk factor for cardiovascular as well as musculoskeletal diseases, even for individuals who remained in employment.

Although there seems to be a negative causal relationship between job insecurity and health, it is not obvious that increased job insecurity leads to higher rates of sickness absence. The reason for this ambiguity is that job insecurity also acts as a disciplinary device, such that more insecurity yields less absence for a given health condition. According to the Finnish evidence, there is a significant positive association between the degree of downsizing and sickness absence among permanent employees, but not among temporary employees (Vahtera *et al.*, 2004). Hence, if the threat of direct job loss is sufficiently large, the disciplinary effects may neutralise or dominate the health effects. The Whitehall study also offers some evidence in that direction. Individuals affected by general organisational changes were subject to a rise in sickness absence, while individuals facing imminent privatisation of their department were subject to a decline (Ferrie, 2001).

3 The Data: Employment, Welfare Dependency, and Workplace Characteristics

The population under study in this paper comprises certified nurses in Norway who were employed by a Norwegian municipality (home or community nursing) or county (hospitals, psychiatric institutions), and did not receive any form of public income support (except parental leave or sickness benefits) by the end of October 1992 and who were below 53 years of age at that time. The data cover all municipalities and counties in Norway, except the Capital of Oslo, and include all permanent contract employees. Starting in October 1992, these individuals are monitored month by month during the subsequent eight years. Descriptive statistics are provided in Table 1. There are 43,167 individuals included in the analysis, of which more than 95 per cent are women. Half of the nurses are trained; i.e., they have at least three years

of College education, the other half are enrolled nurses, with vocational high-school education. Part I of Table 1 depicts the distribution of labour market positions at the time of sampling. All individuals are employed at this point (as a matter of data selection criterion), but the average number of contracted working hours is only 74% of the full-time equivalent.[4] Among young nurses, there is also a substantial absence due to parental leave. Absence due to long-term sickness (more than 16 working days) is around five per cent for the remaining trained nurses, and seven per cent for enrolled nurses. Part II of the table depicts the distribution of labour market states for the same group of individuals exactly eight years later. More than 80 per cent of the nurses are still in self-supporting work and most of them remain employed in health care or social services. However, particularly among the nurses who stayed on in these sectors, there is a sizable fraction of long-term sickness absence in 2000 (9.2 per cent). The absence level is much lower among nurses who switched to another sector of the economy (5.3 per cent). A point to note is that this does not seem to be explained by non-random selection; on the contrary, nurses who left had on average a higher level of sickness absence back in 1992 than those who remained in the health care or social services sectors (not shown in the table).

- Table 1 around here -

As indicated in the last row of Table 1, 16.9 per cent of the individuals in our sample received some kind of income support from the Social Security system by the end of October 2000. Approximately half of them (8.8 per cent) received a lasting benefit, i.e., a disability pension or a rehabilitation transfer. Layoff seems to be a rare event among nurses in the public sector, and only two out of thousand nurses claimed unemployment benefits.

The overall rates of welfare dependency were much higher for enrolled nurses (21 per cent) than for trained nurses (12 per cent). Figure 2 provides a summary description of how

[4] Actual working hours are higher because some nurses work more than contracted hours or have more than one job.

these fractions evolved over time for our analysis population. Since we have conditioned on participation in the labour force to start with, and since the average age of the analysis population increases with calendar time, there is of course no surprise that these curves indicate rising social security dependence. The rate of increase seems to be relatively stable over time, but with a strong seasonal pattern (the seasonality is primarily in sickness absence).

- Figure 2 around here -

By merging the event histories of the individuals with other administrative registers, we have been able to extract information about the workplaces and the municipalities/counties responsible for running them. In the remainder of this section, we discuss some features of these data that are of interest with respect to identifying the causal impact of organisational change on individuals' absence and exit behaviour. A full list of the explanatory variables that we actually use in the paper is presented in the next section, after we have set up the statistical model.

Our key indicators for organisational change at workplaces are incidences of large observed changes in the overall number of nursing man-years and (with some reservations explained below) large turnover of the nursing staff. These variables are both calculated from employment records in October each year. Let n_{js} be the number of nurses at workplace j by the end of October in year s, and let $\overline{n}_{js}$ be the corresponding total number of man-years (the full-time equivalent of n_{js}).[5] Furthermore, let in_{js} be the number of new nurses in year s (those who were not employed at the workplace in year s-1) and let out_{js} be the number of nurses who have left the workplace (those who were employed in year s-1, but not in s). We then define employment growth in year s as $(\overline{n}_{js} - \overline{n}_{js-1})/\overline{n}_{js-1}$ and turnover (reshuffling) as $\min(in_{js}, out_{js})/n_{js-1}$. In the empirical analysis, we are particularly concerned with the im-

[5] A 'workplace' is typically a service institution, such as a hospital or a nursing home. Community nursing is defined as one workplace for each of the 434 municipalities.

pacts of organisational changes that involve a substantive element of downsizing. Despite the relatively strong growth in the hospital and nursing sectors from 1992 to 2000 (2.7 per cent growth in the number of man-years per year), a number of workplaces reduced their staff, and as much as 14 per cent of the nurses in our study experienced that their workplace was downsized with more than 20 per cent of the man-years (36 per cent experienced downsizing of more than 10 per cent). Downsizing within nursing homes and community nursing was typically linked to a substantial reduction in the municipality's entire nursing staff, indicating that these organisational changes were driven by the need to cut overall costs in the municipality. Downsizing within hospitals and psychiatric institutions, on the other hand, were to a much larger extent driven by re-allocation of the jobs; in the hospital sector from small (and local) to large hospitals, and in the psychiatry sector from institutions to outpatient clinics.

While we consider changes in the overall number of nursing man-years to be exogenous with respect to the employment behaviour of each nurse, this is obviously not the case for the turnover variable (since each nurse affects turnover through own quit behaviour). In the statistical model, we handle this problem by restricting our indicator of large turnover to affect individual behaviour with a time lag. Large turnover does clearly not always reflect organisational changes; it may result from any source of employee dissatisfaction and/or from particularly good alternative employment opportunities.

Organisational changes at a workplace do not necessarily materialise in immediate and visible changes in its staffing. In the hospital sector, for example, we suspect that increased competitive pressures were generated by a reform in the hospital financing system, from fully exogenous budgets to gradually increasing elements of the pay-per-treatment principle. The reform was introduced in July 1997 in 15 of Norway's 19 counties (covering 75 per cent of the hospital-based nurses in our data). The remaining four counties followed suit, two of them already in January 1998 (raising the level of affected hospital nurses to 92 per cent), one in

January 1999 (raising it to 97 per cent), and the last one in January 2000. The aim of the reform was primarily to provide incentives for increased output (such as more surgical operations), and not to cut public health spending; hence, it did typically not result in downsizing. Since the reform was implemented in a staggered fashion, it is possible to identify its causal effect on sickness absence and welfare dependency, without relying on calendar time or fixed county differences, provided that the staggered introduction was exogenous. A possible reason for suspecting endogenous introduction is that counties with highly efficient hospitals had stronger incentives to implement the reform quickly than counties with less efficient hospitals. However, a recent study of technical efficiency in the Norwegian hospital sector found that there were no ex ante differences in efficiency between the early and late implementers of the reform (Biørn *et al.*, 2003, p. 281). The main reason why some counties decided to wait was that they wanted more discretionary control over medical priorities.

It is likely that many organisational changes have been implemented throughout the municipalities and counties in Norway that we are unable to observe. We expect that the general pressure towards change has been stronger the more severe has been the local financial strain. We have collected data from the municipalities/counties yearly accounts, such as average income per inhabitant, changes in gross yearly incomes, and the debt/income ratio. Unfortunately, these indicators of economic vigour are not as good as we would have liked. The reason for this is that we do not observe the economic needs in each municipality/county, and, since it is a stated aim of the income allocation system to provide equal standards across the whole country it is likely that variation in incomes to a large extent reflect variation in needs. There is, however, a small, but interesting source of municipality income that we consider to be exogenous, i.e., revenues generated from local natural resources (hydro power stations). Only a handful of municipalities have had the fortune of having these resources within their borders, but these municipalities are generally viewed as being extremely rich. For historical

reasons, they have succeeded in keeping these 'windfall' gains out of the generally redistributive income system for Norwegian municipalities. The information that can be extracted from them in the present context is admittedly limited, however, since they are few and relatively small, and, employ only 0.6 per cent of the nurses in our study (around 240 persons).

Finally, we have collected (imperfect) information about the cost efficiency of the municipalities' nursing sector and their privatisation strategies. The efficiency score measures are collected from Erlandsen *et al.* (1997) and Edvardsen *et al.* (2000). They refer to two different points in time (1995 and 1997) and are based on detailed accounts of costs and output in the nursing sector of each municipality. The scores are computed by means of Data Envelopment Analysis (DEA), and, in short, a municipality is considered to be fully efficient in the year under consideration if no convex combination of other municipalities exists that produces more care services along all product dimension, without also using more of at least some inputs.

Our privatisation indicator is collected from the so-called KOSTRA database (administered by Statistics Norway), and measures, for each municipality in Norway, the fraction of total social service expenditures that were allocated through private companies in 2003. Although the year of measurement lies well outside our observation window, we believe that this summary measure may provide some indication regarding the privatisation strategies that were pursued during the 1990's, and, hence, the pace of organisational change.

In addition to identifying the behavioural effects of organisational change, we also wish to examine the possible impact of labour market tightness on the nurses' employment and absence behaviour. Since the nurses in our study typically have a very strong employment protection, we expect discipline effects related to changes in labour market tightness to be moderate, perhaps with an exception for nurses with relatively small part time jobs (who might be underemployed). Unfortunately, the standard local unemployment rates do not rep-

resent the employment opportunities of nurses very well. We have therefore computed monthly county-specific unemployment rates for nurses in Norway particularly for the current project, based on the whole population of certified nurses in Norway (not only the permanent contract nurses covered in our analysis). These unemployment rates cover all kinds of unemployment registered at the employment offices.

4 The Model: The Dynamics of Absence and Welfare Dependency

In this section, we set up a competing risks hazard rate model, aimed at uncovering the causal effects of organisational change on the propensity to become and remain absent, and to become dependent on Social Security transfers on a more lasting basis. The model is set up in terms of monthly transition probabilities between various labour market states, conditioned on vectors of observed and unobserved explanatory variables. Let $t=1,2,...,97$ be the 97 months for which we can (potentially) observe labour market states, where $t=1$ is the first month (October 1992). The transition probabilities are assumed to depend on six groups of covariates; i) calendar time (t); ii) individual and environmental characteristics (x_{it}); iii) municipality/county characteristics (m_{it}); iv) workplace characteristics (z_{it}); v) duration of an ongoing sickness absence spell (d_{it}); and vi) unobserved individual (time-invariant) characteristics (v_i).

The first part of this model is the initial condition equation. Given that we have sampled nurses who were employed (and not on maternity leave) in the first month, there are only two possible states to begin with; they are either present at work or absent, due to sickness. Let $l(a)$ be a probability function, and let y_{0i} be an indicator variable taking the value *1* if individual i was absent from work (due to sickness) by the end of October 1992, and *2* otherwise. We then write the initial condition equation as

$$prob(y_{0i}=1)=l\left(x_{i1}^{'}\beta_0+m_1^{'}\alpha_0+z_1^{'}\delta_0+v_{0i}\right). \quad (1)$$

In subsequent months ($t>1$), transitions can be made to the following destinations:

Destination 1: Sickness absence (conditional on work presence in previous month)
Destination 2: Resumption of work (conditional on absence in the previous month)
Destination 3: A new job
Destination 4: Benefit claimant (unemployment, rehabilitation, disability).
Destination 5: Outside the labour force without benefits.

Individuals are included in the dataset as long as they have a job within the sectors for which we have data and do not claim Social Security benefits (other than for sickness absence). This implies that a transition to destinations 4 or 5 terminates the event history for that individual. A transition to destination 3 may also terminate the event history, but only if the new job is taken outside the workplaces covered by our longitudinal data. As long as the event history continues, the nurses are either present at work or absent due to sickness. According to the Norwegian legislation, sickness absence cannot last longer than 12 months; hence, at this point some kind of transition must take place. We assume that individuals can make transitions to new jobs and decide to leave the labour force (destinations 3, 4, and 5) regardless of whether they are currently sick or not. But sickness absence, and its duration, may have causal effects on the probability of making these transitions. These effects are modelled by means of a timing-of-events approach (Abbring and Van den Berg, 2003a; Gaure *et al.*, 2005), implying that we do not need exclusion restrictions in order to identify the causal effects of interest. A work spell is treated as exogenously censored when a person dies or leaves the country, or gives birth to a child. It is reactivated when/if a person returns to a position at the covered workplaces.

The hazard rates are specified in terms of Mixed Proportional continuous time Hazard rate model (MPH); see Abbring and Van den Berg (2003a; 2003b). The model is set up in terms of monthly integrated hazard rates $\varphi_k(w_{kit}, v_i)$, where *k=1,2,3,4,5* indicates the destination and w_{kit} is the vector of all observed variables relevant for individual *i* with respect to transition *k* in month *t*. We can then write the integrated hazards in the following way:

$$\begin{aligned}\varphi_k(w_{kit},v_{ki}) &= \exp\left(\beta_k x_{it}+\sigma_{kt}+\lambda_{kd}+\alpha_k m_{it}+\delta_k z_{it}+v_{ki}\right),\\ k &= 1,2,...,5,\\ t &= 2,3,...,97,\\ d &= 0,1,...,12.\end{aligned} \tag{2}$$

Note that σ_{kt} and λ_{kd} are calendar time and duration parameters, represented in the empirical model by separate dummy variables, one for each calendar month, and one for each possible sickness absence duration.

Let $y_{kit}=1$ if month *t* involved a transition to state *k* for individual *i*, and 0 otherwise. We can then write the likelihood contribution formed by individual *i*, conditional on all observed covariates (w_i) and on the six-dimensional vector of unobserved variables $\left(v_i=(v_{0i},v_{1i},v_{2i},v_{3i},v_{4i},v_{5i})\right)$ as

$$\begin{aligned}L_i(w_i,v_i) &= l(w_{0i},v_{0i})^{y_{0i}}\left(1-l(w_{0i},v_{0i})\right)^{(1-y_{0i})}\\ &\times\prod_{t\in N_i}\left[\prod_{k\in K_{it}}\left[\left[\left(1-\exp\left(-\sum_{k\in K_{it}}\varphi_k(w_{kit},v_{ki})\right)\right)\frac{\varphi_k(w_{kit},v_{ki})}{\sum_{k\in K_{it}}\varphi_k(w_{kit},v_{ki})}\right]^{y_{kit}}\right]\right.\\ &\left.\times\left[\exp\left(-\sum_{k\in K_{it}}\varphi_k(w_{kit},v_{ki})\right)\right]^{\left(1-\sum_{k\in K_{it}}y_{kit}\right)}\right],\end{aligned} \tag{3}$$

where N_i is the full set of observations available for individual *i* (apart from the initial condition), $K_{it}=\{2,3,4,5\}$ for individuals absent from work due to sickness and $K_{it}=\{1,3,4,5\}$ for individuals present at work. Since the likelihood contribution in (3) contains unobserved variables, it cannot be used directly for estimation purposes. We approximate the unobserved joint heterogeneity distribution in a non-parametric fashion with the aid of a discrete distribution. Let Q be the (a priori unknown) number of support points in this distribution and let $\{v_l,p_l\}$, $l=1,2,...Q,$ be the associated location vectors and probabilities. In terms of observed variables, the likelihood function is then given as

$$L(w_i) = \prod_{i=1}^{N} \underset{v_i}{E}[L_i(w_i, v_i)] = \prod_{i=1}^{N} \sum_{l=1}^{Q} p_l L_i(w_i, v_l), \quad \sum_{l=1}^{Q} p_l = 1. \tag{4}$$

In order to estimate the model, we also have to specify a functional form for the initial condition probability function *l(a)*. In order to make it directly comparable to the other elements of the likelihood function, we specify it as a complementary log-log function, i.e., $l(a) = 1 - \exp(-\exp(a))$. Our estimation procedure is to maximise the likelihood function in (4) with respect to all the model and heterogeneity parameters repeatedly for alternative values of *Q*. The non-parametric maximum likelihood estimators (NPMLE) are obtained by starting out with *Q=1*, and then expand the model with new support points until the model is 'saturated' in the sense that it is no longer possible to increase the likelihood function by adding more points (Lindsay, 1983; Heckman and Singer, 1984). In practice, it has been demonstrated by Gaure *et al.* (2005) that the usage of an information criterion (with a weak punishment for parameter abundance) may reduce computational costs substantially, without reducing the quality of the estimates to any noticeable extent. In the present paper we use the Akaike Information Criterion (AIC) for model selection. At each stage of the estimation process, we examine the appropriateness of an additional mass-point by means of simulated annealing (Goffe *et al.*, 1994).[6] Monte Carlo evidence presented in Gaure *et al.* (2005) indicates that the parameter estimates obtained in this way are consistent, that they are normally distributed, and that the standard errors conditional on the optimal number of support points also are valid for NPMLE.

A full list of our observed explanatory variables is provided in Table 2. In total, the model contains 228 explanatory variables. An important point to bear in mind is that the parameters do not necessarily have a purely causal interpretation. The main reason for this is

[6] Localisation of the non-parametric maximum-likelihood estimators is an enormous computational task, and it could not have been done without extensive support from the High-Performance Computing Centre of the University of Oslo. Our optimisation algorithm is described in detail in Gaure *et al.* (2005).

that the employees' health condition is unaccounted for in the model (since it is intrinsically unobserved), and that many of our explanatory variables may be correlated to this 'omitted' factor. For example, the education/position variable not only captures the causal effect of selecting one education/position rather than another, but also the systematic difference in health status that correlates with this choice.

- Table 2 around here -

In order to interpret the estimation results that we present in the next section, note that exp(parameter×variable) enters into the various hazard functions as proportionality terms. This implies that that the exponential function of a parameter attached to a dummy variable measures the hazard rate for an observation with the corresponding dummy equal to 1, relative to an individual belonging to the reference group (with the appropriate dummy variables set to zero), ceteris paribus. The substantive significance of a given relative change obviously depends on the level of the hazard to start with. To facilitate correct interpretation of our estimation results, we therefore present in Table 3 an overview of the monthly transition rates actually observed in the data.

- Table 3 around here -

The model we estimated ended up with as much as 24 support points in the discrete joint distribution of unobserved heterogeneity.[7] All the results are robust towards the exact number of support points. In fact, there were only marginal changes in parameter estimates after the inclusion of 9-10 points (except in the heterogeneity distribution itself). In total, the estimated model contains 1,359 estimated parameters.

[7] This is a much higher number than what has previously been reported in the NPMLE literature; see Gaure *et al.* (2005), and references therein. However, we know of no previous attempts to estimate a six-dimensional heterogeneity distribution by means of a fully nonparametric maximum likelihood estimator.

5 Results

Selected estimation results are presented in Table 4. A key result, see part I of the table, is that large downsizing at a workplace not only causes a large (but trivial) increase in probability of making a job-to-job transition, as excess workers are channelled into other jobs in the municipality/county, but also raises the probability of becoming absent due to sickness, to become dependent on other welfare transfers and/or to pull out of the labour force. In particular, compared to a stable environment, a downsizing exceeding 20 per cent of the man-years at a workplace is associated with a small, but statistically significant rise in sickness absence, in the form of a 1-11 per cent increase in the hazard into sickness absence (95 per cent confidence interval) and a 7-20 per cent decline in the hazard out of sickness absence. The adverse health effects are probably somewhat larger than suggested by these numbers, since downsizing also entails a discipline effect tending to reduce sickness absence for any given health condition. Despite strong employment protection, downsizing implies that some nurses may be forced to accept inferior jobs; hence, we would expect disciplinary effects to be present. Our results indicate that the adverse health effects dominate the disciplinary effects. This finding is in line with previous results reported for Finnish municipalities (Vahtera *et al.* 2004); see Section 2. The effects of large downsizing on the hazard into other forms of welfare dependency and on unsubsidised exits from the labour force are much larger in proportional terms than the effects on sickness absence, though from a lower base, conf. the average transition rates in Table 3. A downsizing exceeding 20 per cent of the employees yields a 23-64 per cent increase in the hazard to more lasting Social Security dependence, and a 29-79 per cent increase in the hazard to unsubsidised non-employment (95 per cent confidence intervals).

More moderate downsizing incidences (10-20 per cent of the man-years) do not seem to affect sickness absence at all; they do, however, increase the hazard to 'other benefits' by 7-30 per cent and to 'non-employment without benefits' by 21-46 per cent. Even more minor

downsizing incidences (0-10 per cent of the man-years) have no significant effects at all, except its trivial impact on the hazard to a new job.

- Table 4 around here -

Parameter estimates measuring the proportional impact on the various hazard rates are not easily combined into a convenient summary measure. Hence, to assess the substantive significance of the estimated downsizing effects, we provide a simple simulation exercise; i.e., we use the estimated model (the point estimates) to simulate event histories, based on observed individual characteristics in October 1992 and drawings from the estimated distribution of unobserved heterogeneity. These simulations are produced under alternative assumptions regarding downsizing incidences. Since there are some events (such as pregnancy and maternity leave) and developments in time varying covariates that are treated as exogenous in the model, the simulations cannot reproduce the real data perfectly.[8] Moreover, the model does not account for the nurses' return to work after exits to other benefit or non-employment. In the simulation exercise, we therefore assume that all nurses, who have exited to any of these two states, return to work at rates corresponding to the observed averages (by destination and by duration since exit) in the real data. Figure 3 illustrates the simulated impact of a one-year downsizing process for an 'average' nurse; i.e., we compare the overall frequencies of welfare dependency in a situation with no downsizing at all (stable employment in all periods) with a situation characterised by a 20 per cent downsizing from October 1992 to October 1993, and stable employment thereafter.[9] The immediate effect of downsizing is to raise the level of sickness absence by approximately 10 per cent (a half percentage point). During the one-year downsizing process, this effect doubles to approximately 20 per cent (1 percentage

[8] We are also unable to identify the new employer in cases of simulated job-to-job transitions. In the simulation we therefore assume that a job-to-job transition does not change the vector of employer characteristics (in essence, such transitions are disregarded).

[9] The presented results are actually averages taken over 10 complete simulations, hence there is little stochastic uncertainty in the simulations.

point). But, as can be seen from Figure 3, the higher rate of Social Security dependence in the downsizing simulation persists long after the downsizing process itself is completed, and it takes approximately six years before the effects are entirely exhausted. The reason for this is that the higher fraction of nurses on sick leave during the downsizing process subsequently causes more nurses to enter into more lasting forms of Social Security dependence as well (there are, by assumption, no direct lagged individual effects of downsizing). An alternative way of viewing the simulation results is to note that without any downsizing, the Social Security system would, on average, have to pay for around 6.1 per cent of the man-years during the first year of our data-period. In the downsizing regime, this number would increase to 7.2, implying that the direct externality cost corresponds to 1.1 per cent of a man-year (or 18 per cent of the initial Social Security costs). These numbers may not appear worryingly large. However, if we also include the lagged (dynamic) effects for the subsequent years, the cost increases to around 3.1 per cent of a man-year per affected employee (or around 50 per cent of the initial yearly Social Security costs). Moreover, if we also include lost work due to the increased level of withdrawals from the labour force (not shown in the figure), the total cost increases to around 5.8 per cent of a man-year.

- Figure 3 around here -

These calculations are of course partial, in the sense that all other explanatory variables are kept constant. In practice, downsizing often goes hand in hand with other types of organisational change. We now take a brief look at the effects of other 'pressure indicators', with reference to estimates and standard errors reported in Table 4, part I. Institutions that have been through a period of significant staff reshuffling (more than 15 per cent turnover) have somewhat higher hazard rates to both sickness absence and other types of benefits, than more stable institutions. A high level of privatisation in a municipality's social services (by 2003) and a high efficiency score for its care sector (see Section 3) seems to be associated

with higher hazard rates into sickness absence, even conditioned on downsizing and turnover, although the efficiency score parameters are not individually significant at the 5 per cent level. The variables capturing economic vigour in the municipality/county (see Table 2) have generally small and statistically insignificant effects, and these are therefore not reported. Interestingly, the only exception from this pattern is the exogenous windfall gain dummy variable (identifying municipalities with large rents from hydro power stations), which stands out with a significantly negative effect on the Social Security dependency hazard.

The introduction of the pay-per-treatment reform in the hospital sector did apparently not affect the hazards into sickness absence or work resumption, but it quite significantly raised the hazards to Social Security dependence and unsubsidised withdrawals from the labour force, while it reduced the hazard rate into other jobs. Together, these findings suggest that the reform did not imply impaired job opportunities in general, but that it nevertheless pushed some workers out of their jobs, partly on the Social Security Administration's account.

Local unemployment among nurses has the expected effects of reducing the hazard rates into sickness absence and increasing the hazard rates into Social Security dependence, particularly for fulltime nurses; see part II of Table 4. The former of these effects is weak, however, and it is somewhat surprising that it seems to be largest for nurses in fulltime position (who have the strongest protection against underemployment). This may suggest that the unemployment effect on sickness absence for this group of workers is not primarily a discipline effect, but rather a workload (stress) effect, reflecting that very low unemployment among nurses implies a shortage of qualified labour in some institutions.

The hazard rates depend strongly on the current state (present or absent) and on the duration of an ongoing sickness spell. This is illustrated for a typical nurse (defined such that the transition rates after one month of sickness matches the corresponding data frequencies) in Figure 4. The work resumption hazard displays significant negative duration dependence un-

til approximately nine months of sickness absence. However, as the moment of benefit exhaustion (after 12 months) approaches, there is a substantial increase in the work resumption hazard, leaving little doubt that economic incentives matter. The transition rate to other types of benefits is almost negligible for nurses present at work and during most of a sickness absence spell as well. This illustrates that the typical path into long-lasting Social Security dependence goes through a one-year period of sickness absence.

- Figure 4 around here -

We do not discuss the results regarding the impact of individual and job characteristics in any detail. But, it is clear from the estimates reported in part III of Table 4 that there are large differences in individual hazard rates according to education and job type. A point to note is that the lower position an individual has in the work hierarchy, the higher are the sickness absence and benefit hazards, and the lower is the work resumption hazard. Although there clearly exist several interpretations of this relationship, the finding is in accordance with a substantial body of medical research that has identified a strong social gradient in individuals' health status (see Marmot, 2004, for a recent survey). Enrolled nurses are more absent than ordinary trained nurses who are more absent than specialised nurses. Nurses in nursing homes are much more absent than nurses in hospitals. There are also large differences in hazard rates according to gender, family situation, and age (not shown). Parents with small children, particularly lone parents, have high hazard rates into sickness absence. Unsurprisingly, pregnant women also have high hazard rates into sickness absence, and the hazard increases strongly as the birth comes closer (not shown). More interestingly, we find that the impact of pregnancy on the sickness absence hazard rate has increased significantly over time, suggesting either that it has become more difficult to be present at work with minor health problems,

or that the threshold for claiming benefits has been lowered due to changes in social norms (Lindbäck, 1995a; 1995b).[10]

The estimated discrete heterogeneity distribution has no direct convenient interpretation. However, Monte Carlo evidence reported by Gaure *et al.* (2005) suggests that the first and second order moments are consistently estimated (although with large and unknown uncertainty). The correlation coefficients may be of some interest, since they characterise the unobserved selection process into the various states. The correlation coefficients that can be derived from our multivariate 24-point distribution are presented in Table 5, and indicate, e.g., that individuals with a high unobserved absence propensity also have high non-employment propensities and low work-resumption propensities. It may be noted that the sign of the correlation coefficients were robust with respect to the exact number of support points in the heterogeneity distribution.

- Table 5 around here -

6 Policy Implications

The finding that organisational changes have adverse consequences in terms of withdrawals from the labour force and increased welfare dependency does of course not imply that they should not be implemented. The benefits of change, in terms of more cost-effective usage of resources, may outweigh the costs associated with, e.g., a higher level of sickness absence. However, the costs' failure to show up in the accounts of the reorganising institutions may in some cases have been decisive for the decision to implement the changes. A possible policy response towards this externality is to internalise it, by requiring employers to pay some of the costs associated with Social Security benefits, either directly or through some kind of experi-

[10] Note that our estimated effect does not result from the increase over time in the average age at time of birth; on the contrary, when we include an interaction term of age and pregnancy in the model, it turns out that the effect of pregnancy *declines* significantly with age. This may be interpreted as supporting evidence for the norms-hypothesis, since new social norms are likely to enter through new cohorts.

ence rating. However, this would clearly reduce the firms' incentives to hire individuals with poor health in the first place, and hence undermine attempts to make the labour market accessible to all individuals (which have also been given very high priority by Norwegian authorities). A second response is to cut sickness benefits. But a possible side effect of lower benefits is to foster a sickness presenteeism externality, since sick nurses may not take fully into account the damage they inflict on other workers or patients if they show up on the workplace with infectious diseases, or with diseases that seriously reduce the quality of their work (Chatterji and Tilley, 2002).

The issue of health-cost externalities may be particularly acute within public sector institutions that are under pressure to cut expenditures, such as the health care and nursing institutions analysed in this paper. First, the total workload facing the employees in these institutions may be more or less given in the short run, implying that less manpower is translated directly into a higher pressure on the nurses who survive the downsizing process. Previous evidence (Greenglass and Burke, 2001) indicates that a nurse's individual workload is the most significant and consistent predictor of distress during restructuring processes in hospitals. Second, the institutional combination of strong employment protection and compressed wages that prevails within the public sector in Norway, imply that workers considered (by the management) to have low productivity (who would have faced a high risk of layoff as a result of a downsizing process in a less regulated market) come under a very strong pressure to improve their performance. If they are not able or willing to do so, they may even be persuaded to quit voluntarily, or to claim sickness or disability benefits; hence, the strong employment protection may promote exits through a 'sickness route' as a sort of substitute for exits

through the 'unemployment route'. A sufficiently long period of sickness absence may even imply that the employment protection is lifted.[11]

The main policy implication arising from our findings is that cost-minimisation at each institution may not be the appropriate strategy towards minimising overall social or public costs. In particular, more gradual changes, which do not force workplaces to downsize beyond their means (which are fairly limited, given the level of employment protection in the public sector), may be preferred over more drastic measures, even when they are less cost-effective from each public institution's point of view. A point to note is that we have found no evidence that more gradual downsizing processes (affecting less than 10 per cent of the man-years per year) entail increased risks of sickness absence or exit from the labour market.

Although we have focused on the presence of cost externalities in our discussion of the estimation results, it should be kept in mind that sickness absence also entails large direct costs for the institutions themselves; both because they have to pay for the first 16 days of absence, and because there are administrative costs associated with obtaining and training qualified substitutes. If the causal relationship between organisational change and sickness absence is not fully understood, this may increase the likelihood that cost-inefficient changes are implemented, particularly when institutions are under pressure to cut costs in the short run. Hence, scientific knowledge regarding this relationship should be valuable for employers, as well as for policy makers.

7 Conclusion

In this paper, we have traced the employment and benefit paths of nurses in Norway during the period from 1992 to 2000 (given that they were employed at the start of this period), and

[11] Workers in Norway are legally protected against dismissals during the first 6 or 12 months of their sickness spell, depending on their seniority within the firm. After that, continued work incapacity may be considered a just cause for dismissal.

investigated the extent to which institution-specific events, such as downsizing of the workforce, have affected their propensity to claim Social Security benefits and/or leave the labour force. Our results provide evidence that large downsizing of the workforce causes statistically significant increases in the employees' non-employment rates as well as in their propensity to claim sickness and other health related benefits, even when layoffs are not used as part of the downsizing strategy. Downsizing yields higher hazard rates to sickness absence, and lower hazard rates back to work, once a sickness spell has started. It also yields higher hazard rates from sickness absence into more long-lasting Social Security dependency, and a higher hazard rate from employment to non-employment (without benefits).

According to our point estimates, a single episode of workplace downsizing exceeding 20 per cent of the man-years, on average bring about increased Social Security costs corresponding to around 3.1 per cent of the man-years at that workplace (prior to the downsizing). Whether this number is of substantive significance clearly depends on the overall cost-effectiveness of the many downsizing processes that have been implemented in the Norwegian health care and social services sector. To the extent that they were only marginally cost-effective from the institutions' viewpoint, the unaccounted for Social Security costs may have been decisive for their implementation. Although the causal effects estimated in this paper are derived from a very flexible statistical model, they are likely to conceal substantial heterogeneity; while some reorganisation processes probably are implemented without adverse (or even with favourable) health consequences, others may involve much larger adverse effects than our estimates suggest. It is of course also important to bear in mind that economic decisions embodying the power to raise the level of sickness absence and disability among employees, may involve human costs that (by far) exceed the payments from the Social Security system.

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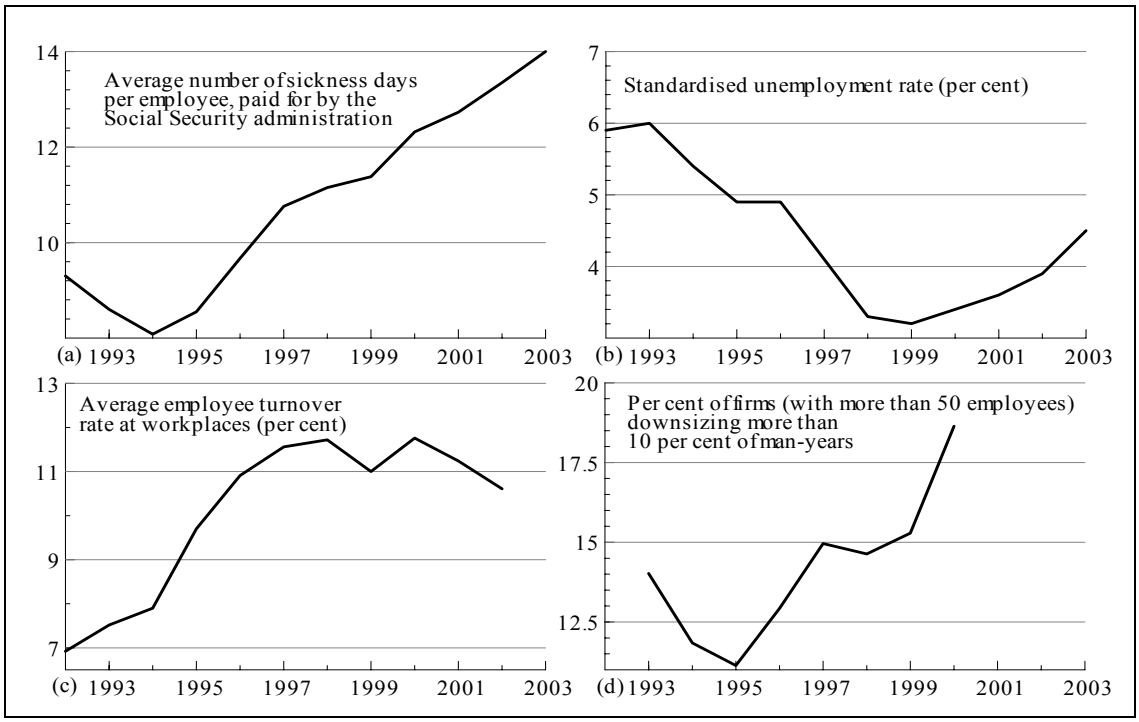

Figure 1. Sickness absence, unemployment, turnover, and downsizing in Norway 1993-2003
Sources: **Absence data**: the Norwegian Social Security Administration (Rikstrygdeverket); **unemployment data**: OECD; **turnover data**: based on micro-data used in Dale-Olsen (2005), and kindly provided us by the author; **downsizing data**: based on micro data collected by Statistics Norway, and kindly provided us by Morten Henningsen (these data may be subject to future revision).

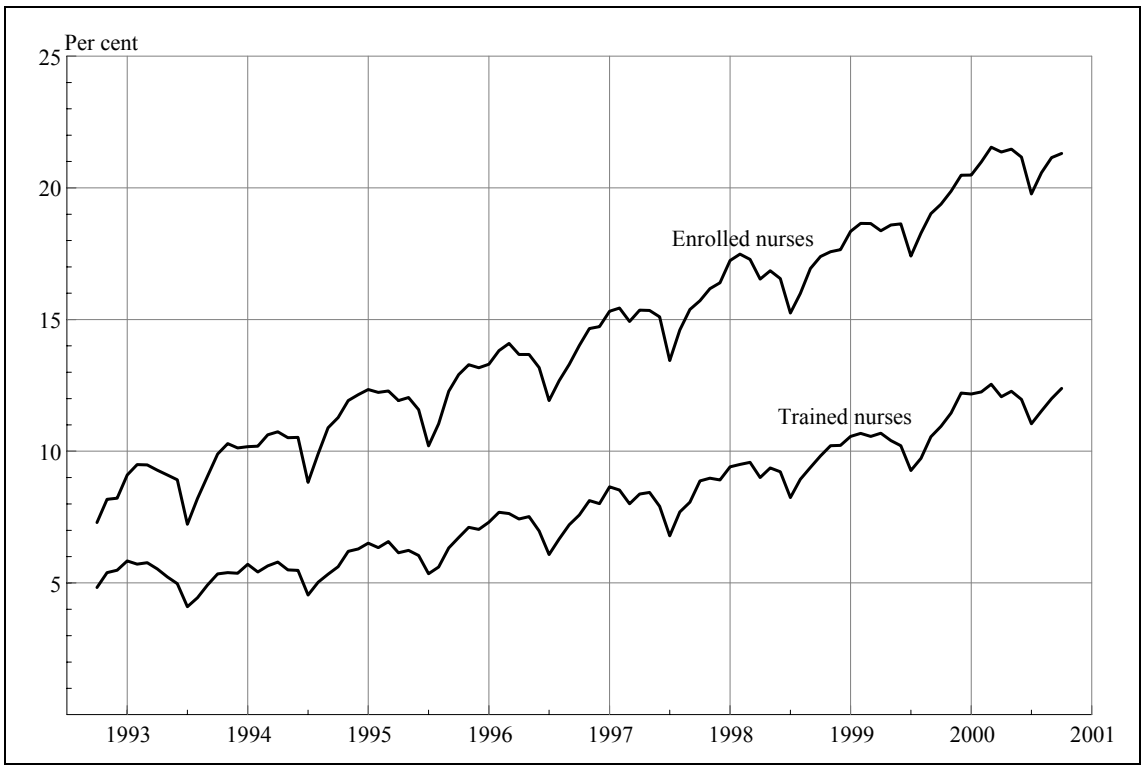

Figure 2. Per cent of nurses (employed in October 1992) receiving some kind of public income support (including sickness benefits) October 1992-October 2000.

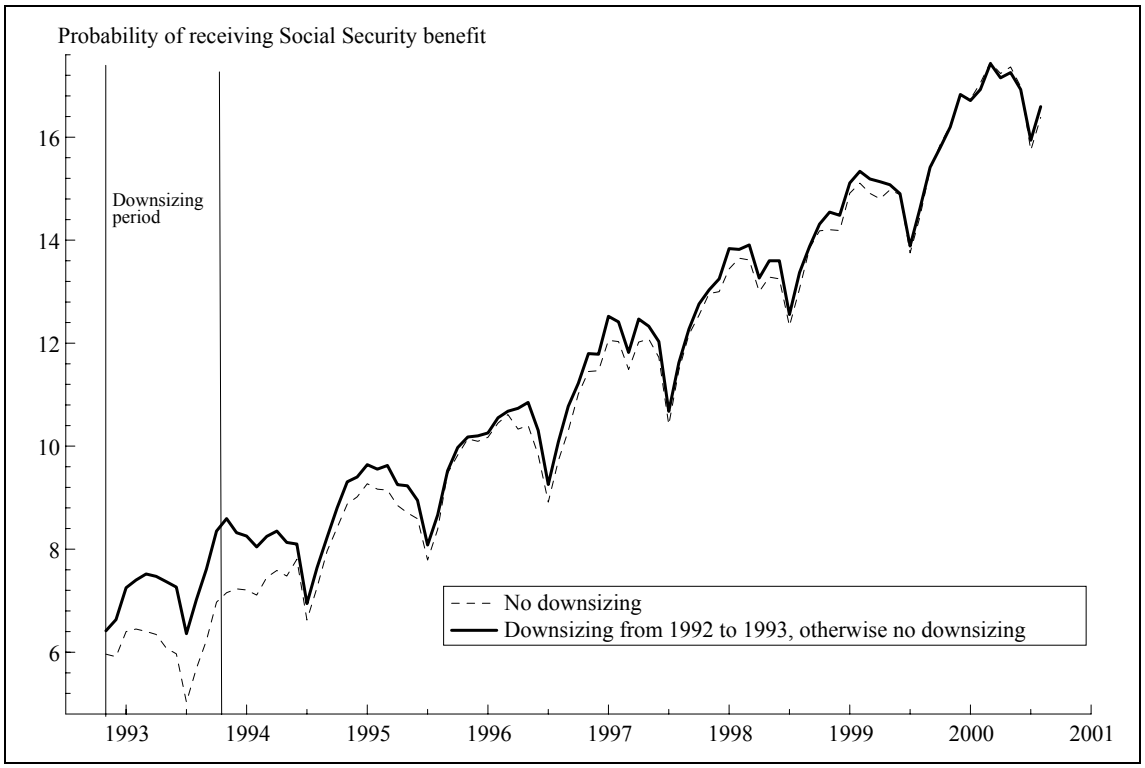

Figure 3. Simulated average Social Security dependency rates with and without an initial downsizing period (lasting from October 1992 to October 1993), and stability thereafter.
Note: Social Security dependency includes sickness benefits, rehabilitation benefits, disability benefits, social assistance, and unemployment benefits.

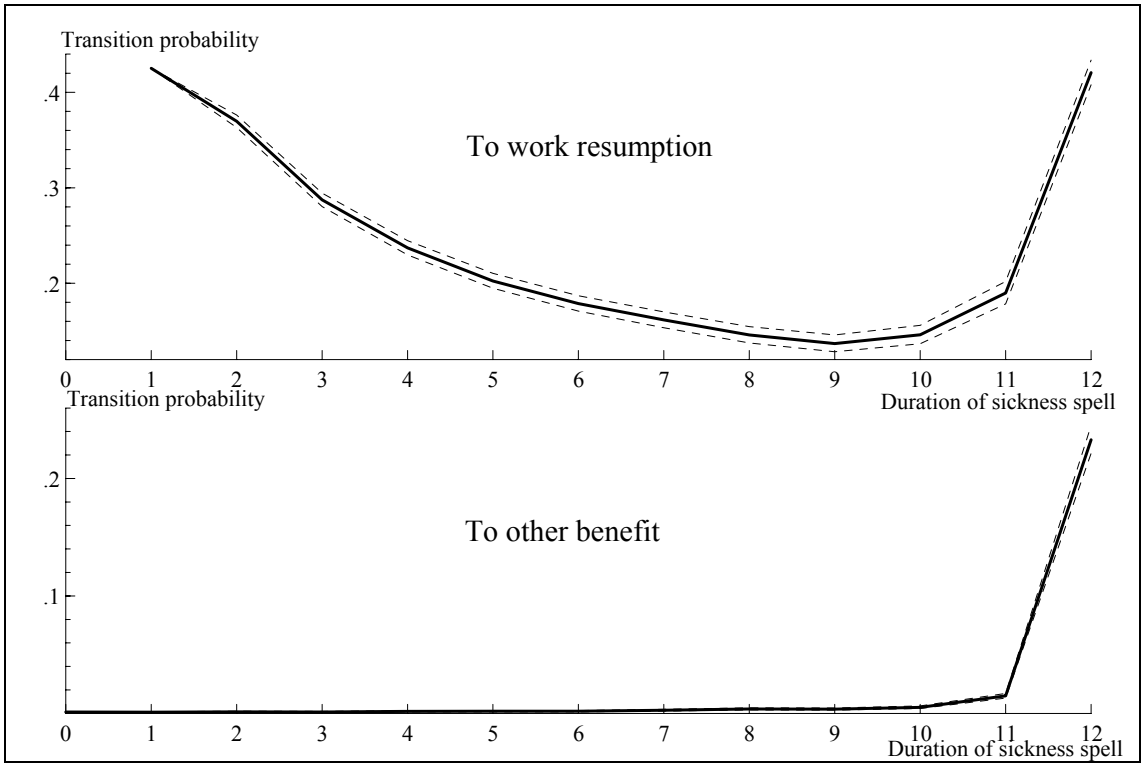

Figure 4. Estimated transition probabilities, normalised such that the transition probabilities in the first sickness month correspond to the observed averages (with 95 per cent point-wise confidence intervals).
Note: Confidence intervals reflect statistical uncertainty in each of the two hazard rates separately.

Table 1
Population Under Study. Descriptive Statistics.

	All	Trained Nurse in 1992		Enrolled Nurse (Nurse's aid) in 1992	
		Age<35 in 1992	36-52 in 1992	Age<35 in 1992	36-52 in 1992
Number of individuals	43,167	9,905	12,112	6,412	14,868
Mean age in 1992 (years)	38.0	30.0	42.6	30.0	43.1
Females (%)	95.4	93.1	94.6	96.4	97.2
I. Status by the end of October 1992:					
Mean number of contracted working hours relative to full time position (%)	74.2	79.1	77.9	66.7	71.2
Working in hospital (%)	42.0	64.3	58.9	14.8	25.3
Working in nursing home (%)	35.8	17.5	21.6	59.1	49.4
Working in psychiatric institution (%)	6.2	4.5	6.1	6.9	7.2
Working in community nursing (%)	16.0	13.7	13.4	19.2	18.3
Absent due to parental leave (%)	3.6	8.5	1.1	7.2	0.7
Fraction of remaining workers absent due to long-term sickness (%)*	6.1	5.3	4.7	7.2	7.3
II. Status by the end of October 2000					
Still working without income support, in the health-care and social service sector (%)	81.0	81.1	83.4	79.9	79.6
Out of which absent due to parental leave (%)	0.8	2.0	0.0	2.0	0.0
Fraction of remaining workers absent due to long-term sickness (%)*	9.2	6.7	8.4	9.0	11.6
Still working without income support, but in another sector of the economy (%)	2.9	4.1	3.5	3.2	1.5
Out of which absent due to parental leave (%)	0.8	1.5	0.0	1.9	0.0
Fraction of remaining workers absent due to sickness (%)*	5.3	4.2	4.5	5.5	8.6
Fully disabled (%)	3.4	0.6	2.9	1.7	6.4
Partly disabled (%)	2.5	0.5	2.6	1.1	4.3
Under rehabilitation (%)	2.9	1.9	2.1	4.5	3.6
Unemployed (%)	0.2	0.1	0.1	0.3	0.2
Living on means tested social security (%)	0.0	0.0	0.0	0.1	0.1
Outside labour force without income support (%)	5.5	9.8	3.7	8.1	2.9
Not registered (dead or migrated to another country without benefits) (%)	1.6	1.9	1.7	1.1	1.4
Receiving some kind of Social Security benefit (including sickness benefits) (%)	16.9	9.0	15.2	15.1	24.2

*Long-term sickness is defined as having been absent from work for at least 16 working days. Shorter absence spells are not recorded in administrative registers, since they are not paid for by the Social Security system (but by the employer).

Table 2
List of explanatory variables

Variable	Functional form / number of variables
I. Individual explanatory variables and environmental characteristics (x_{it})	
Gender	One dummy variable
Age	38 dummy variables (<24, 24, 25,…,60)
Education/position	Four dummy variables (enrolled nurse, trained nurse, trained nurse with additional specialized education, trained nurse in administrative position)
Basic working time	Three dummy variables (less then 50%, 50-80%, >80%)
Shift work	Three dummy variables (shift, not shift, unknown)
County	18 dummy variables, one for each county
Single parent	One dummy variable
Children 0-6	One dummy for having children below six years
Children 6-12	One dummy for having children between six and 12
Pregnancy	Seven dummy variables (for 7,6,…,1 months left until birth, respectively, plus one interaction term between a dummy for pregnancy and a linear time trend)
G.P. reform	One dummy for nurses living in one of the four municipalities that were subject to a G.P. panel doctor reform during the estimation period
Local unemployment rate for nurses	Three linear terms, one for each type of basic working time
II. Employer (municipality/county) characteristics (m_{it})	
Debt by the end of last year, relative to total incomes that year	Two linear terms, one for municipalities and one for counties
Total income this year, relative to number of inhabitants above 67 years	Three dummies for municipalities and three dummies for counties (low income, medium income and high income)
Percentage change in tax and transfer incomes last year, relative to incomes the year before that	Two linear terms, one for municipalities and one for counties
Very rich municipality	One dummy for municipalities with pure rents from natural resources above 10,000 NOK per inhabitant (“kraftkommuner”)
Absolute majority of privatisation-friendly political parties(H and F)	Two dummy variables (majority this period, majority this period, but not previous period)
Urbanity	Three dummy variables for municipalities and three dummy variables for counties
Small municipality	One dummy for municipalities with less than 5,000 inhabitants
Efficiency score municipalities 1995/1997	Three dummy variables (fully efficient, medium efficiency, low efficiency). 1995-score is attributed to observations before 1997, and 1997-score thereafter.
Degree of privatization in care sector, 2003	Three dummy variables (less than 1%, 1-20%, more than 20%)
III. Workplace characteristics (z_{it})	
Type of workplace	Four dummy variables (nursing home, community nursing, psychiatric institution, somatic hospital)
Change in the number of man-years from last year to this year	Six dummy variables (more than 20% reduction, 10-20% reduction, 0-10% reduction, 0-10% increase, 10-20% increase, more than 20% increase)
Turnover from the year before last year to last year	Three dummy variables (less than 5% turnover, 5-15% turnover, more than 15% turnover)
Number of nursing man-years	Four linear terms, one for each type of workplace
Pay-per-treatment in hospitals	One dummy, indicating that the employer workplace is currently part of the pay-per-treatment experiment
IV. Calendar time	97 dummy variables, one for each calendar month
V. Duration of sickness spells	13 dummy variables, one for not being absent due to sickness, and one for each possible ongoing duration (1,2,…,12)

Table 3
Average observed monthly transition rates (per cent)

	I	II	III	IV	V
	To sickness absence	To work resumption	To a new job	To other benefit*	To non-employment (without benefits)
From job presence	2.48	-	0.66	0.12	0.20
From sickness absence after					
1 month absence	-	42.47	0.48	0.11	0.16
6 months absence	-	13.87	0.68	0.34	0.29
12 months absence**	-	29.28	0.94	33.54	0.25

* Approximately 75 per cent of these transitions are to health-related (G.P. certified) benefits, such as rehabilitation and disability benefits. The rest are mainly transitions to unemployment benefits.
** Due to time aggregation, not all sickness spells are terminated after exactly 12 months.

Table 4
Selected parameter estimates (standard errors in parentheses)

	I	II	III	IV	V	VI
	Transitions (hazard rates)					Initial condition
	To sickness absence	To work resump-tion	To a new job	To other benefit	To non-employ-ment (without benefits)	Sickness absence in first month
I. Workplace and employer character-istics						
Changes in # man-labour years at work-place from previous year						
>20% reduction	0.063**	-0.012**	2.155**	0.352**	0.420**	0.149
	(0.027)	(0.030)	(0.025)	(0.075)	(0.083)	(0.152)
(10,20]% reduction	0.003	-0.041	0.707**	0.187**	0.338**	-0.029
	(0.019)	(0.021)	(0.030)	(0.057)	(0.060)	(0.119)
(0,10]% reduction	-0.005	-0.020	0.252**	0.045	0.005	-0.027
	(0.010)	(0.011)	(0.019)	(0.032)	(0.032)	(0.068)
[0,10]% increase	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
(10,20]% increase	0.019	-0.006	-0.075**	-0.099*	-0.201**	-0.085
	(0.013)	(0.015)	(0.027)	(0.046)	(0.046)	(0.098)
>20% increase	-0.018	-0.027	-0.013	-0.101	-0.116	0.233
	(0.017)	(0.019)	(0.034)	(0.060)	(0.062)	(0.123)
Turnover rate at workplace previous year						
<5%	-0.044**	-0.019	-0.098**	-0.011	-0.235**	0.038
	(0.016)	(0.017)	(0.027)	(0.050)	(0.058)	(0.097)
[5,15]%	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
>15%	0.022*	-0.007	0.126**	0.112**	0.095**	-0.087
	(0.010)	(0.011)	(0.018)	(0.034)	(0.033)	(0.071)
Efficiency in the municipality's care sector according to DEA analysis, see Section 3)						
High efficiency	0.032	-0.007	0.042	0.002	-0.007	-0.001
	(0.019)	(0.019)	(0.029)	(0.054)	(0.057)	(0.100)
Medium efficiency	0.027	-0.016	0.036	0.081	-0.011	-0.041
	(0.015)	(0.016)	(0.025)	(0.044)	(0.048)	(0.080)
Low efficiency	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Privatisation in municipality's care sec-tor in 2003 (% of total expenditures)						
More than 20%	0.101*	0.012	-0.031	0.085	0.123	-0.066
	(0.050)	(0.017)	(0.063)	(0.161)	(0.118)	(0.232)
1-20 %	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Less than 1%	-0.019	-0.001	-0.100**	0.012	0.073	-0.123
	(0.019)	(0.017)	(0.024)	(0.052)	(0.049)	(0.081)
Very rich municipality (due to 'windfall gains' from power stations)	0.030	0.116	0.421**	-0.676*	0.161	0.379
	(0.079	(0.078)	(0.102)	(0.298)	(0.193)	(0.339)
County has introduced pay-per-treatment in hospitals	0.001	0.033	-0.199**	0.130*	0.145**	
	(0.018)	(0.020)	(0.033)	(0.063)	(0.058)	
II. Labour market tightness for nurses						
County unemployment × dummy for less than 50% position	-0.012	-0.010	0.000	0.180**	-0.017	
	(0.008)	(0.009)	(0.014)	(0.021)	(0.026)	
County unemployment × dummy for 50-80% position	-0.011	-0.005	-0.004	0.143**	0.010	
	(0.007)	(0.008)	(0.014)	(0.022)	(0.026)	

Table 4
Selected parameter estimates (standard errors in parentheses)

	I	II	III	IV	V	VI
	Transitions (hazard rates)					Initial condition
	To sickness absence	To work resump-tion	To a new job	To other benefit	To non-employ-ment (without benefits)	Sickness absence in first month
County unemployment × dummy for more than 80% position	-0.021**	-0.006	0.022	0.106**	0.118**	
	(0.007)	(0.007)	(0.013)	(0.022)	(0.024)	
III. Individual and job characteristics						
Gender						
Female	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Male	-0.395**	0.143**	0.322**	-0.100	-0.120	-0.379**
	(0.032)	(0.032)	(0.033)	(0.098)	(0.067)	(0.152)
Education						
Enrolled nurse	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Trained nurse	-0.315**	0.063**	0.704**	-0.831**	0.454**	-0.405**
	(0.016)	(0.015)	(0.020)	(0.052)	(0.034)	(0.069)
Specialised trained nurse	-0.416**	0.115**	0.579**	-0.895**	0.177**	-0.458**
	(0.021)	(0.021)	(0.028)	(0.078)	(0.051)	(0.107)
Type of workplace						
Nursing home (municipality)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Community nursing (municipality)	-0.036*	0.008	0.103**	0.035	0.142**	-0.010
	(0.016)	(0.015)	(0.022)	(0.045)	(0.042)	(0.077)
Psychiatric institution (county)	-0.107**	0.045	0.025	-0.077	1.001**	-0.446*
	(0.037)	(0.035)	(0.051)	(0.106)	(0.092)	(0.185)
Hospital (county)	-0.330**	0.065*	-0.303**	-0.317**	0.171	-0.605**
	(0.033)	(0.032)	(0.048)	(0.100)	(0.087)	(0.162)
Working time pattern						
≤ 50%	-0.478**	0.066**	0.159**	0.639**	0.327**	-0.511**
	(0.014)	(0.014)	(0.021)	(0.036)	(0.037)	(0.070)
(50,80)%	-0.263**	0.092**	-0.043*	-0.063	0.095**	-0.348**
	(0.012)	(0.012)	(0.020)	(0.039)	(0.035)	(0.064)
≥ 80%	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Working shift	0.122**	-0.004	-0.084**	-0.060	-0.186**	0.288*
	(0.018)	(0.019)	(0.025)	(0.058)	(0.045)	(0.113)
Family situation						
Having a child 0-6	0.060**	-0.011	-0.144**	-0.335**	0.333**	0.029
	(0.017)	(0.019)	(0.024)	(0.053)	(0.040)	(0.079)
Having a child 7-12	0.040**	-0.006	-0.063**	-0.125**	-0.033	-0.050
	(0.014)	(0.015)	(0.022)	(0.044)	(0.041)	(0.075)
Being a lone parent	0.148**	0.092*	0.153*	-0.057	0.450**	-0.080
	(0.041)	(0.042)	(0.064)	(0.097)	(0.087)	(0.217)
Change in effect of pregnancy from the beginning to the end of the obser-vation period (calculated from linear trend)	0.182**	0.008	0.580	-0.814	0.032	
	(0.057)	(0.103)	(0.415)	(0.580)	(0.213)	

Note: *(**) indicates significance at the 5(1) per cent level.

Table 5
Correlation coefficients in the estimated unobserved heterogeneity distribution
$corr(\exp(v_{ki}), \exp(v_{ji})),\ k \neq j$

	To sickness absence (v_{k1})	To work resumption (v_{k2})	To a new job (v_{k3})	To other benefit (v_{k4})	To non-employment (v_{k5})	Sickness absence in first month (v_{k0})
To sickness absence (v_{k1})	-	-0.369	0.107	0.229	0.123	0.268
To work resumption (v_{k2})		-	0.064	-0.224	-0.004	-0.178
To a new job (v_{k3})			-	0.065	0.484	0.138
To other benefit (v_{k4})				-	0.371	0.119
To non-employment (v_{k5})					-	0.091