Trade-offs between health and absenteeism in welfare states: striking the balance

Simen Markussen[*]

Ragnar Frisch Centre for Economic Research[†]

August 20, 2007

Abstract

Workers' absenteeism due to illness represents a major concern in several countries. Absenteeism are however not very well understood in economics. This paper presents a model where absenteeism is understood in relation to health. Its main predictions are (i) intermediate welfare state generosity lead to the lowest absence rates as (ii) generous regimes results in excess long-term absenteeism and (iii) strict regimes lead to excess short-term absenteeism. (iv) Maximizing health is not the same as minimizing absenteeism. Finally, these predictions are supported by aggregate data for 12 OECD countries.

JEL classification: C61; H53; H55; I31; J08

Keywords: Absenteeism; Health; Dynamic programming; Welfare state policies

1 Introduction

Is health important for understanding sickness absence? Staying home from work, claiming sick-leave, can be treated as an individual choice as well as a consequence of bad health.

1

When sickness absence is treated as a *choice* it is made synonymous to shirking. On the other hand, when treating sickness absence as a *consequence* one fails to consider individual decision making. This paper aspire to bridge the gap between these two strands of the literature, by assuming absence to be an individual choice taken conditional on health and labor market institutions. The research question follows directly; how are health and sickness absence affected by policy variables such as sick pay and employment protection legislation?
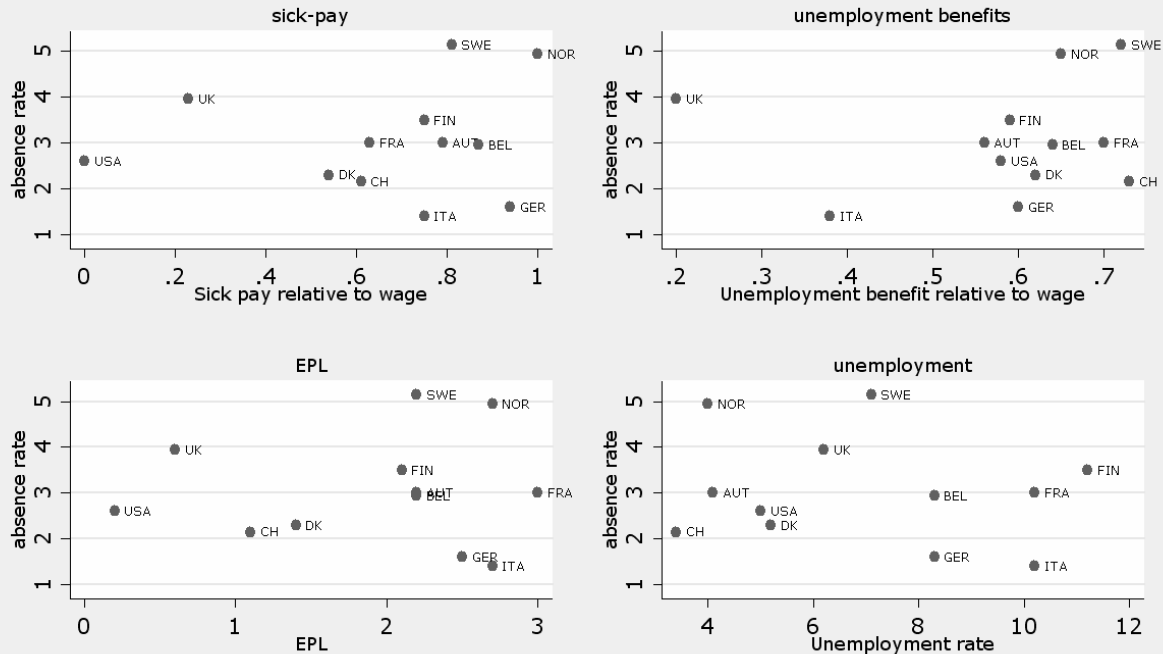
On a typical day, 2,8% of european workers stay home due to illness [3, Bonato and Lusinyan, 2004]. Absenteeism represents a major concern in several countries and much effort is spent on designing policies that reduce absence rates but still provide some sort of social insurance.

Sickness benefits serve as an insurance against income loss from illness. It is troubled by moral hazard problems as illness is hard to verify and because illness propensity is affected by behavior. In a world of complete information one could simply provide full insurance against illness for all workers without risking increased illness or shirking. In the real world, however, as absence becomes cheap - both the needy and the greedy may stay home - for the right or the wrong reasons.

Usually economists analyse absenteeism in the labor-supply framework. Absence is then synonymous to shirking. Many papers refer to Shapiro and Stiglitz' *disciplinary mechanisms* as determining the level of absenteeism [6, Shapiro and Stiglitz, 1984]. The fear of becoming unemployed as well as the difference between benefits and wages discipline workers not to shirk. Their framework is however not satisfactory for understanding absenteeism. It was never ment to be.

A different part of the litterature called *presenteeism* focus on the possible problems to health and productivity from workers being present at work when ill [2, Chatterji and Tilley (2002)]. Clearly, their concern mirrors the insurance problem mentioned. Shrinking benefits to reduce shirking also increases the problem of presenteeism. Consequently, finding optimal policy is a trade off between shirking and presenteeism. Or, is it? Is it obvious that less benefits and job-security leads to lower absence rates? Let us first consider figure 1.

Figure 1: Absenteeism and disciplinary mechanisms. The figure shows total absence rates together with four different "disciplinary mechanism"; sick-pay (as a fraction of wage), unemployment benefits (as a fraction of wage), employment protection legislation (EPL) and unemployment. Data for absenteeism is provided by Eurostat, collected from national Labor Force Surveys and are found in Bonato and Lusinyan (2004). Data for sick-pay and unemployment benefits are provided by Scruggs (2004). Data for EPL and unemployment are provided by OECD. The figure shows no obvious relationship between the disciplinary mechanism and sickness absence.

Figure 1 plots total absence rate together with four different "disciplinary mechanism"; sick-pay (as a fraction of wage), unemployment benefits (as a fraction of wage), employment protection legislation (EPL) and unemployment. From standard economic theory we should expect a positive relationship in all but the plot in the south-east corner, which should be negative. Just by looking at the figure we can see that this is not very clear. When calculating the correlation coefficient between sickness absence and sick-pay (.123), EPL (.055), unemployment benefits (.109) and unemployment (-.175), suspicions of a weak relationship are confirmed.

Hence, the labor-supply model have problems accounting for these observations. The purpose of this paper is to construct a theoretical model suitable for understanding absenteeism and see whether this model can explain the data better. This model is built on an idea that sickness absence should be treated as an individual choice, taken conditional on health. For a given level of health a worker can choose to go to work or to stay home. His decision have consequences both for his health, income and labor market status. The degree to which income and labor market status are affected by absenteeism depends on policies such as sick pay and employment protection legislation (EPL). Consequently, these policies also influence the worker's decision of for which levels of health he should stay home and for which levels he should go to work. Furthermore, whether the worker stay home or goes to work will have an impact on his future health as well as his labor market status. If he goes to work when ill, his health may worsen. If he stays home this may reduce his job-security or his chances of being promoted.

A dynamic model is built to keep this dynamic story tractable as well as to obtain sharp predictions. Intuitively one can think of the model as a worker that gets out of bed in the morning, observes his health and labor market status, and then decides whether or not to go to work that period. The worker cares for health, leisure and income and when deciding whether or not to go to work he takes into account both present and future periods. The modelling of health is essential in the analysis. Health is modelled as a continuous variable rather than just "good" and "bad". For simplicity it is kept unidimensional. Health is a state variable for the worker which is exposed to health shocks, making health stochastic. At the very heart of the model is the relationship between work, leisure and health. Working, when ill - i.e. health below a certain level - is assumed to have a negative impact on next period's health status. Working otherwise - when above the same threshold - is good for health. Mirroring this, staying home when ill is considered as restitution and is assumed to have a positive impact on next period's health. Finally, staying home when well leads to passivity and decay and will to some extent be harmful to health. These assumptions are somewhat hard to test since health in the model is collapsed into a unidimensional variable. I do however believe these assumptions reflect something real, captured in sayings of common sense, such as "rest when ill" and "idleness is the root of all evil".

The solution of this model will be a threshold for health, such that the worker chooses to work if health is above this threshold and stay home if health is below it. This threshold will again depend on the policy variables. Three exogenous policy variables are included; employment protection, sickness benefits and unemployment benefits. In general, this threshold will increase as policy becomes more generous and decrease as policy becomes stricter. Hence, a worker in a strict welfare regime will choose to work also for lower health levels at which a worker in a more generous regime would choose to stay home.

By exposing the worker to an exogenous distribution of health shocks, the framework allows us to obtain predictions for frequencies and durations of absence spells as well as distributions of health.

The model predicts an U-shaped relationship between welfare state generosity and sickness absence. In strict regimes workers will return to work too early - when the probability of catching an illness is higher. Hence, strict regimes are predicted to experience short and frequent absence spells among their workers. In generous regimes workers tend to stay home for a long time once ill, leading to more long-term absenteeism.

The assumptions regarding health, work and leisure are crucial when obtaining these predictions. However, not all assumptions are crucial for all the predictions. In general, the assumption that work is harmful for health when ill is important for the predicted outcome in strict welfare states. The assumption that passivity is harmful when well is important for predictions regarding the most generous welfare states.

Finally, these predictions, together with the predicted health distributions, are evaluated on data for absenteeism and health in 12 OECD countries. Despite its simplicity and partial structure, the model's predictions fit the data quite well.

2   A simple model for sickness absence

Consider a worker maximizing utility over two periods. His utility is given by (1), where l_t denotes leisure and takes the value one if he is home in periode t and zero if he goes to work. c_t and h_t denotes consumption and health.

$$u\left(c, l, h\right) = \sum_{t=1}^{2} \delta^{t-1} \left[u\left(c_t\right) + \eta l_t + \theta h_t\right] \tag{1}$$

Health evolves in accordance with the law of motion in (2)[1].

$$h_{t+1} = h_t + \begin{cases} \alpha \left(h_t - h^W \right) : \text{if working} \\ \alpha \left(h^P - h_t \right) : \text{if at home} \end{cases} \tag{2}$$

Assume there is an upper and lower limit of health, denoted h_H and h_L. Let h^W be a critical level for health such that if $h_t > h^W$ working improves health. If $h_t < h^W$ working harms health. Let h^P be the level of health when absent (not working) such that, for a non-working person, h approaches h^P regardless. If $h_t < h^P$ this process is restitution. If $h_t > h^P$ it is decay caused by inactivity.

The state space of health can then be divided into three intervals. (i) For levels of health between h_L and h^W health will improve from staying home - restitution - and worsen from working - exhaustion. (ii) For levels of health between h^W and h^P health will improve anyhow. From the symmetry of (2) health will improve faster if he stays home when h_t is closer to h^W and works if h_t is closer to h^P. (iii) For levels of health between h^P and h_H health will improve from working and worsen if he stays home.

Standing in period 1, the worker's problem is whether to work or stay home this period. If he chooses to work he receives wage W. If he stays home he receives benefits B. When making up his mind, he must also take the future consequences of his actions into consideration. Health in period 2 will be determined of his decision in period 1. The object of interest is a decision rule, denoted $\hat{h}$, saying for which levels of health the agent chooses to work and for which levels of health he chooses to stay home. The law of motion for health is illustrated in figure (2) below.

---

[1] To simplify the parameter α governs both health evolvement when working and staying at home. This make the problem symmetric and the results simpler. No results rest on this assumption.
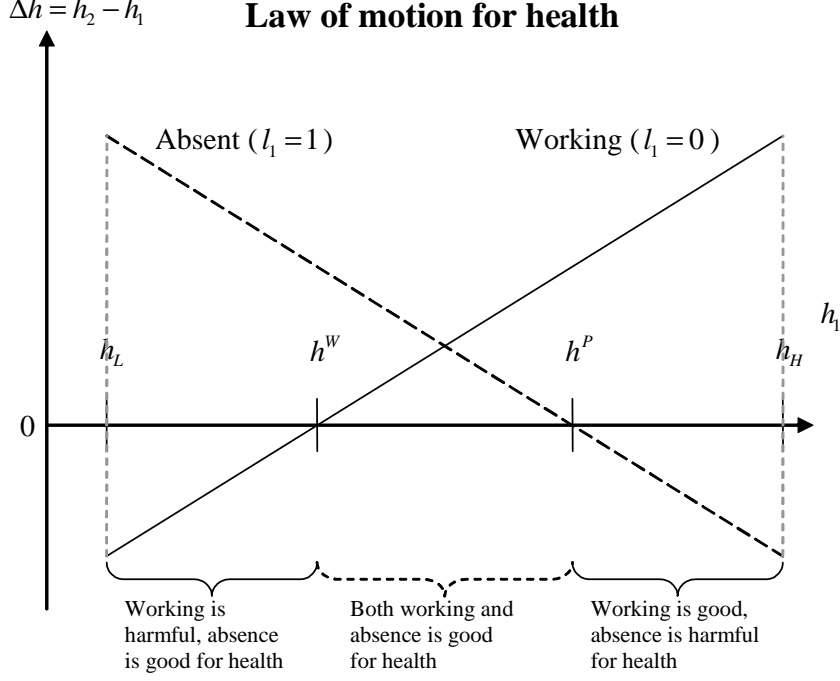
Figure 2: Law of motion for health. The figure illustrates the law of motion for health and the assumptions made regarding the health effects from working and leisure. The state space for health can be divided into three regions. For low levels of health $(h < h^W)$, working is harmful while absence is good for health. For intermediate levels of health $(h^W < h < h^P)$, both working and absence is good for health. For high levels of health $(h > h^P)$, working is good while absence is harmful for health.

Full job-security Full job-security implies that the decision in period 1 has no impact on employment in period 2. To solve the worker's problem we start in period 2. Utility in period 2 is given by (3).

$$
\begin{aligned}
v_2\left(h_2\right) &= \max\left[u\left(W\right), u\left(B\right) + \eta\right] + \theta h_2 \\
&= \tilde{u}_2 + \theta h_2
\end{aligned}
\tag{3}
$$

The decision in period 2 is independent of health since there is no third period. If the worker chooses to work in period 1 his utility is given by (4). If he chooses to stay home his utility is given by (5).

$$
u_1^W = u\left(W\right) + \theta h_1 + \delta\left(\tilde{u}_2 + \theta\left[h_1 + \alpha\left(h_1 - h^W\right)\right]\right)
\tag{4}
$$

$$
u_1^A = u\left(B\right) + \eta + \theta h_1 + \delta\left(\tilde{u}_2 + \theta\left[h_1 + \alpha\left(h^P - h_1\right)\right]\right)
\tag{5}
$$

The decision rule $\hat{h}$ is to stay home whenever $h_1 < \hat{h}$ and work whenever $h_1 > \hat{h}$. Formally, $\hat{h}$ is a mapping $h_1 \to l_1$ such that $u_1^W - u_1^A = 0$. Let $G \equiv u(W) - u(B) - \eta$, to simplify notation. The decision rule is given by (6).

$$\hat{h}_1 = \frac{h^W + h^P}{2} - \frac{G}{2\delta\theta\alpha} \tag{6}$$

Consider first the case when $G = 0$. The optimal decision rule is simply the average of h^W and h^P, due to the symmetry of (2). When the agent is indifferent between the wage from working and the benefit together with the leisure from staying home he will choose to stay home when this is best for his health and work otherwise.

In some countries workers have full wage compensation -$B = W$ - when ill. In this setup this implies that $G = -\eta$, such that the worker chooses to stay for health levels at which his health would benefit from working. Another extreme is the case with no sickness benefits at all. When $B = 0$ it may be the case that the worker chooses to work for health levels at which working is harmful for his health.

No job-security   Let us consider another extreme case. No job-security implies that a worker staying home in the first period has no job in the second period. When unemployed he will receive a benefit B, equal to the amount he receives when ill. This is clearly a simplification as unemployment benefits in most countries are slightly lower than sickness benefits. However, this is of little importance for the argument made.

Again we start in period 2 to solve the worker's problem. utility in period 2 is given by (7).

$$v_2(h_2|l_1) = \begin{cases} \max[u(W), u(B) + \eta] + \theta h_2 & \text{if } l_1 = 0 \\ u(B) + \eta + \theta h_2 & \text{if } l_1 = 1 \end{cases} \tag{7}$$

$$= \begin{cases} \tilde{u}_2 + \theta h_2 & \text{if } l_1 = 0 \\ u(B) + \eta + \theta h_2 & \text{if } l_1 = 1 \end{cases}$$

Utility in period 2 is conditional on the decision made in period 1. Staying home in period 1 results in a loss of opportunities in period 2. Whether this loss of opportunities comes with a reduction in utility depends on G - the in-period valuation of income, benefits and leisure. Let the additional utility of having a job in period 2 be denoted by $\tilde{u}_2^O(G) = \tilde{u}_2 - u(B) - \eta$. Note that $\tilde{u}_2^O(G) > 0$ if $G > 0$, $\tilde{u}_2^O(G) = 0$ if $G \leq 0$ and $\frac{\partial \tilde{u}_2^O(G)}{\partial G} > 0$ if $G \geq 0$.

If the worker chooses to work in period 1 his utility is given by (8). If he chooses to stay home his utility is given by (9).

$$u_1^W = u(W) + \theta h_1 + \delta \left[\tilde{u}_2 + \theta \left[h_1 + \alpha \left(h_1 - h^W \right) \right] \right] \tag{8}$$

$$u_1^A = u(B) + \eta + \theta h_1 + \delta \left[u(B) + \eta + \theta \left[h_1 + \alpha \left(h^P - h_1 \right) \right] \right] \tag{9}$$

Following the same procedure as in the case with full job-security the decision rule is now given by (10).

$$\hat{h}_1 = \frac{h^w + h^P}{2} - \frac{G}{2\theta\delta\alpha} - \frac{\tilde{u}_2^O}{2\theta\alpha} \tag{10}$$

As in the case with full job-security, the worker chooses what is optimal for his health if $G = 0$. Also if $G < 0$ the case with full job-security and no job-security are identical. The reason is simple: if $G < 0$ the agent will never prefer to work in period 2 anyhow, such that there is no loss in utility from losing this opportunity. If $G > 0$ the two cases differ. In the case of no job-security, the worker will go to work for even poorer health in order to keep his job in the next period.

To build some intuition we can investigate the impact of letting $\delta \to \infty$. This will loosely correspond to an infinite horizon problem with a (very) patient agent. Period 2 should then be interpreted as the rest of his life. In the case of full job-security $\lim_{\delta\to\infty} \hat{h}_1 = \frac{h^W + h^P}{2}$. Hence, G has no impact on the decision rule. The economic cost of staying home one period last only that period while the consequences for health last for all future periods, so he follows the decision rule that maximizes health. In the case of no job-security $\lim_{\delta\to\infty} \hat{h}_1 = \frac{h^W + h^P}{2} - \frac{\tilde{u}_2^O}{2\theta\alpha}$. Here G has an impact on the decision rule. The reason is that the economic cost of staying home last forever, since he looses his job. From this we should expect job-security and the threat of being unemployed to have a larger impact on the decision rule than the level of benefits received when ill.

3 The stochastic model in infinite horizon

3.1 Baseline model

Let us now extend the model to the case of infinitely many periods. This will give room for much more nuances than the stylized two-period model from above. This extension will also make it possible to obtain precise empirical implications of the model that can be tested.

Let the worker's parameterized utility function be given by (11) and the law of motion for health be given by (12). The log utility function is chosen for convenience. The results do not hinge on this assumption.

$$U\left(C, l, h\right) = \sum_{t=0}^{\infty} \delta^t \left[\ln\left(C_t\right) + v \ln\left(h_t\right) + \eta l_t\right] \tag{11}$$

$$h_{t+1} = h_t + \begin{cases} \alpha\left(h_t - h^W\right) + \varepsilon_{t+1} : \text{if working} \\ \alpha\left(h^P - h_t\right) + \varepsilon_{t+1} : \text{if at home} \end{cases} \tag{12}$$

ε_t is an idenpendent identically distributed health shock with zero mean. ε_t takes only three values;

$$P\left(\varepsilon = \begin{matrix} -\phi \\ 0 \\ \phi \end{matrix}\right) = \begin{pmatrix} \frac{1}{4} \\ \frac{1}{2} \\ \frac{1}{4} \end{pmatrix}$$

Down to ε the worker can perfectly predict next period's health. If the worker (at least) rest when $h < h^W$ and work (at least) when $h > h^P$ he will always recover perfectly from any health problem - at least in expected terms. Hence, this model is neither suited for analysing the effect of permanent health shocks as there are no permanent shocks here, nor the situation for workers with chronic health problems as workers here always fully recover. The temporary shocks - ε - introduce some uncertainty about the consequences of work and rest. This reflects something real - that health tomorrow is partly predictable and partly uncertain. It will also turn out to smooth the problem around the critical thresholds h^W and h^P.

Ignoring for a moment the stochastic term ε we can draw the implications of (12) in a figure. In figure (3) the effect of working on health is illustrated. The figure shows

how health evolves conditionally on the intial health level for a working agent. The parameterization of (12) used to draw figure (3) is listed in table 2.
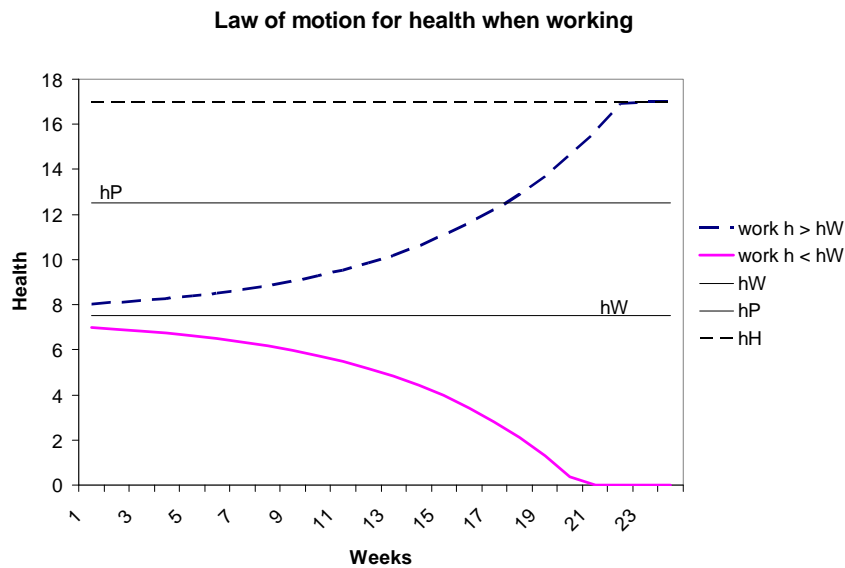
Law of motion for health when working

Figure 3: Law of motion for health (working). The figure illustrates how health is expected to evolve for a working agent. If he chooses to work when $h < h^W$ he must expect health to worsen. Starting out at $h = 7$ he can expect $h = h_L$ after 21 weeks. If he choose to work when $h > h^W$ health will (in expected terms) gradually improve. Starting out at $h = 8$ he can expect $h = h_H$ after 23 weeks.

In figure (4) the law of motion is illustrated for a non-working agent. If not working, health will approach h^P regardless.

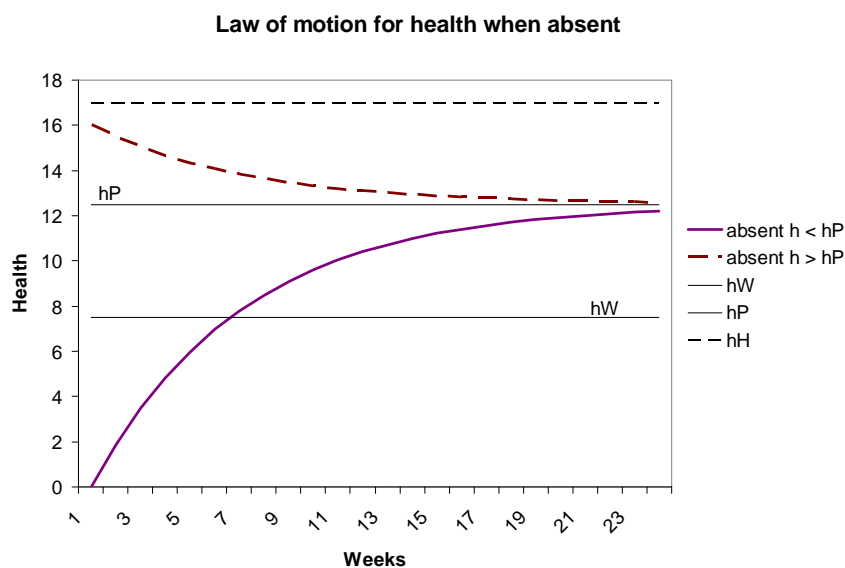**Law of motion for health when absent**

Figure 4: Law of motion for health (absent). The figure illustrates how health is expected to evolve for a non-working agent. Regardless of initial health his health level will approach h^P.

The problem of when to work can be solved numerically using dynamic programming. The Bellman equation in (13) is then solved subject to (14). For an infinite horizon problem of this type, calendar time is of no importance. Following standard convention, primes are used to denote future periods.

$$V\left(h\right) \quad = \quad \max_{l \in \{0,1\}} \ln\left(c\right) + v \ln\left(h\right) + \eta l + \delta EV\left(h'\right) \tag{13}$$

$$s.t. \quad : \quad h' = h + \begin{cases} \alpha\left(h - h^W\right) + \varepsilon' : \text{if working} \\ \alpha\left(h^P - h\right) + \varepsilon' : \text{if at home} \end{cases} \tag{14}$$

The model is parameterized such that one period corresponds to one week's length. All parameters used when solving the model in (13) is listed in table 2. The key is the relationship between the discount rate δ and the health effects from work and leisure, controlled by the parameter α. The weekly discount factor implies a yearly discounting of 0.9. The implications of the size of α is illustrated in figures (3) and (4). The fastest possible recovery from h_L to h_H is made in approximately 20 weeks. The worker will easier deviate from what is best for his health either if discounting is higher (lower δ) or if recovery is slower (lower α).

Table 2

Parameters used when solving the model

h_L	0	h^W	7.5	W	16
h_H	17	α	0.15	η	0.55
h^P	12.5	δ	0.997976	v	0.8
		ϕ	1		

The decision rule is a threshold for health, denoted $\hat{h}$, which is the lowest level of health at which the worker chooses to work. This threshold is drawn in figure (5), marked with "full job-security". It is increasing in the level of benefits. For high benefit levels the agent prefer not to work at all, since he obtains additional utility from leisure. Even without benefits the worker will not choose to work if health is below h^W.

Decision rule (h-hat)
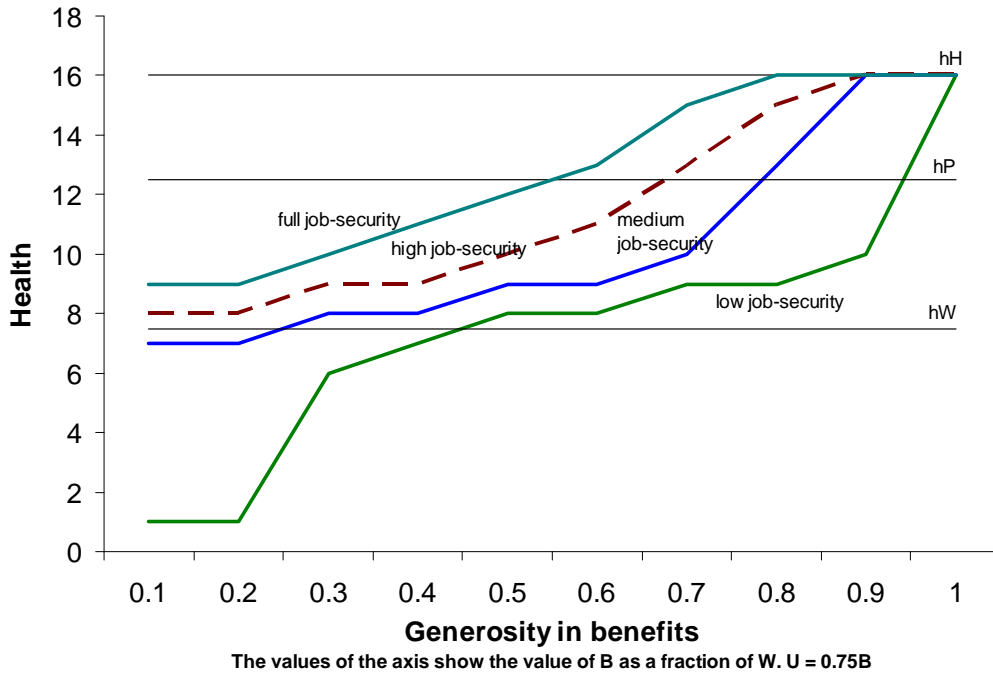## work when health is above the line

Figure 5: The decision rule. The figure shows the decicision rule as a function of the amount paid in benefits. Generosity in benefits equal to 0.5 implies that B = 0.5W (half the wage) and that U = 0.75B (37,5% of the wage). The agent chooses to work when health is above the line. The four decision rules differ in the parameter γ, i.e. how sensitive are job-security to work and absence.

Proposition 1 *There exists a set of parameters $\left\{\bar{\delta}, \bar{\alpha}\right\}$ such that for $\delta > \bar{\delta}$ and $\alpha > \bar{\alpha}$ the worker will never choose to work if $h < h^W$.*

For any combinations of δ and α that corresponds to $\delta > 0,8$ and reasonably fast recovery from illness, i.e. within one year, $\hat{h} > h^W$.

For high benefit levels - i.e. replacement rates close to one - the worker may choose never to work if utility from leisure exceeds the health problems caused by inactivity. This is contrary to what we observe in the real world. One explanation is that even in generous regimes, absence has a cost in the long run.

3.2 Long-run costs of absenteeism

In the real world, the decision of labor or leisure may have an impact in the long run. It seems reasonable that workers with high absence rates are less likely to be promoted and more likely to be fired than others. By introducing such a mechanism, staying home from work will have an economic cost in the long run - at least in expected terms. To keep the model as simple as possible I will only model the possibillity of being fired. The probability of having a job next period will be denoted by π.

If the agent stays home, the risk of being fired increases. The law of motion for job-security is given by (15).

$$\pi_{t+1} = \pi_t \begin{cases} +\gamma \left(\pi_H - \pi_t \right) : \text{if working} \\ -\gamma \left(\pi_H - \pi_t \right) : \text{if at home} \end{cases} \tag{15}$$

π_H is a the maximum level of job-security. The change in job-security from either working or staying home increases in the distance between π_t and π_H. Figure (6) illustrates the law of motion of job-security. In the model, π is the probability of being fired next week. In order to make the figure easier to interpret, these weekly probabilities are rescaled such that the figure illustrates the probability of still being employed one year from now.
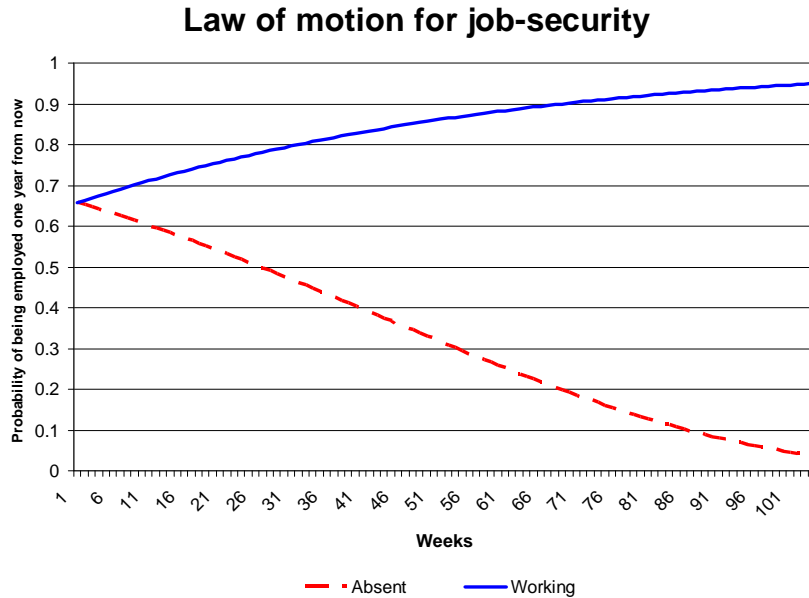

Law of motion for job-security

Figure 6: **Law of motion for job-security.** The figure illustrates the probability π of having a job one year from now. Starting out with $\pi = \frac{2}{3}$ the figure shows that after being absent from work for 21 weeks this probabilitys is reduced to $\approx 0,55$. After 21

weeks of "continuous work" $\pi \approx 0,75$. The parameters used are the same as for the "medium" regime in table 3.

Starting out with probability 2/3 of having a job one year from now, the figure illustrates how these probabilities change weekly given that the agent either works or stays home[2]. γ should be thought of as employment protection legislation as it determines how responsive job-security are to both work and absence. In a world of full job-security $\gamma = 0$. This corresponds to the model solved above. To show the effect of job-security when $\gamma > 0$, three regimes which only differ in the parameter γ are constructed. These regimes are illustrated in table 3.

Table 3
Job security

	Low	Medium	High
γ	.1	.02	.005
π_H	.999	.999	.999
Yearly job-risk			
start	$0,66^3$	0,66	0,66
6 mth work	0,97	0,72	0,69
12 mth work	$\approx \pi^H$	0,78	0,72
6 mth no work	0,01	0,58	0,62
12 mth no work	0,00	0,50	0,58
Unemployment benefits	$U = 0,75B$	$U = 0,75B$	$U = 0,75B$

If fired, the worker becomes unemployed. Unemployment is assumed to be an absorbing state, such that once an agent becomes unemployed he will remain unemployed forever. When unemployed he receives a benefit U for all future periods. Hence, being unemployed leads to an income loss of $W - U$ each and every period. Several studies [4, Raaum and Røed, 2006] have shown that workers with an unemployment history earn less than others. Hence, in a model without wage growth, absorbing unemployment is

---

[2]It turns out that it is the change in employment protection, i.e. γ, and not the level that has an impact on the workers decision.

[3]Note that this is the weekly probability transformed into yearly probabilities of being unemployed. Hence, 0.66 on a yearly basis, equals $(0,66)^{\frac{1}{52}} = 0.992$ on a weekly basis.

an acceptable assumption. Unemployment benefits U is indexed to the sick-leave benefit B such that $U = 0,75B$. Since the unemployed is not working, his health will follow the same path as it would if he stayed home from work. Utility from unemployment, conditional on health h, is given by (16).

$$V_U\left(h_t\right) = \sum_{t=1}^{\infty} \delta^{t-1} \left[\ln\left(U_t\right) + v\ln\left(h_t\right) + \eta\right] \tag{16}$$

The aim of the analysis is to find a relation (mapping) from the state variables health and job-security to the decision variable l. The Bellman equation in (17) is solved subject to (18) and (19).

$$\begin{aligned} V\left(h, \pi\right) &= \max_{l \in \{0,1\}} \ln\left(c\right) + v\ln\left(h\right) + \eta l \\ &\quad + \delta\left[\pi EV\left(h', \pi'\right) + \left(1 - \pi\right) EV_U\left(h'\right)\right] \end{aligned} \tag{17}$$

$$s.t. \quad : \quad h' = h + \begin{cases} \alpha\left(h - h^W\right) + \varepsilon' : \text{if working} \\ \alpha\left(h^P - h\right) + \varepsilon' : \text{if at home} \end{cases} \tag{18}$$

$$s.t. \quad : \quad \pi' = \pi \begin{cases} +\gamma\left(\pi_H - \pi\right) : \text{if working} \\ -\gamma\left(\pi_H - \pi\right) : \text{if at home} \end{cases} \tag{19}$$

The decision rule will again form a threshold $\hat{h}$ such that the worker chooses to work if $h \geq \hat{h}$ and stays home if $h < \hat{h}$. In figure (5) this threshold is drawn over different benefit levels and for three different levels of job-security. For the highest benefit level, the agent prefers to stay home for all levels of job-security. The benefits, combined with the utility from leisure is simply such that even unemployment is preferred to working. However, as benefits are reduced, the worker prefers to work for lower levels of health. If the risk of being fired increases rapidly when absent - the low job-security case - the worker prefers to work, even if this is harmful to his health. The worker faces an unpleasant trade-off between staying in good shape and staying employed. As unemployment becomes less attractive and more probable, i.e. low benefits and low job-security, the agent may prefer to work and suffer from health problems.

Claim 2 *If the economic consequences of absence last for all future periods, i.e. increased risk of unemployment, reduced risk of promotions etc., the agent faces a trade-off between health and income and may choose to work even if $h < h^W$.*

4 Aggregate predictions from the model

Having established a relationship between $\hat{h}$ - the lowest level of health at which the worker chooses to work - and labor market regime, it is time to investigate such a model's aggregate predicitions. $\hat{h}$ is increasing in the level of sickness and unemployment benefits (B and U) as well as in the level of employment protection (γ). From now on regimes will be ranked along a one-dimensional scale - from strict to generous - such that $\hat{h}^{STRICT} < \hat{h}^{GENEROUS}$. The model is thus simulatated for different levels of $\hat{h}$ to build some intuition on its implications.

Catching an illness To get the simulations going there is necessary to expose each worker to an additional health shock ν. Every period each worker faces a small probability of catching an illness. This "illness shock" is drawn from a highly left skewed distribution with approximately zero mean. The weekly probability of receiving a health shock is such that on average $\approx 1\%$ of the workers each week is hit by a negative shock of more than -5 while $\approx 0,2\%$ of the workers are hit by a shock of -16. The shock is temporary and not autocorrelated (iid). This implies roughly that in a year 41% of the workers are hit at least once by a shock of less that -5 while 10% are hit at least once by a shock of -16[4].

This health shock v could have been included also when solving the model for the decision rule in the previous section. Excluding v implies that the agent, when deciding whether he should go to work or not, do not take the possibility of catching a non-predictable illness into consideration. He base his decision solely on his observed health status and the consequences of working and staying home. As the shock v is independent of health status and the probabilities of being hit by a substantial shock are fairly small each period, including it in the dynamic programming problem would not make much difference for the results.

Results Figure (7) summarizes the main results of this model. The model predicts an U-shaped relationship between the decision rule, i.e. strictness, and sickness absence. Absence rates is lowest for a decision rule close to h^W. In the strict regimes, on the left

---

[4]The probability of being hit at least once by a shock of -5 or less can (roughly) calculated as $1 - (1-0,01)^{52} = 0,407$. The probability of being hit at least once by a shock of -16 is then $1-(1-0,002)^{52} = 0,099$.

"hand" of the U, there is mostly short term absence. In the generous regimes, on the right "hand" of the U, there is mostly long term absence.

Claim 3 *We should expect to find an U-shaped relationship between total absence and welfare state generosity..*

Claim 4 *Strict regimes should experience more short-term absence, generous regimes should experience more long-term absence.*
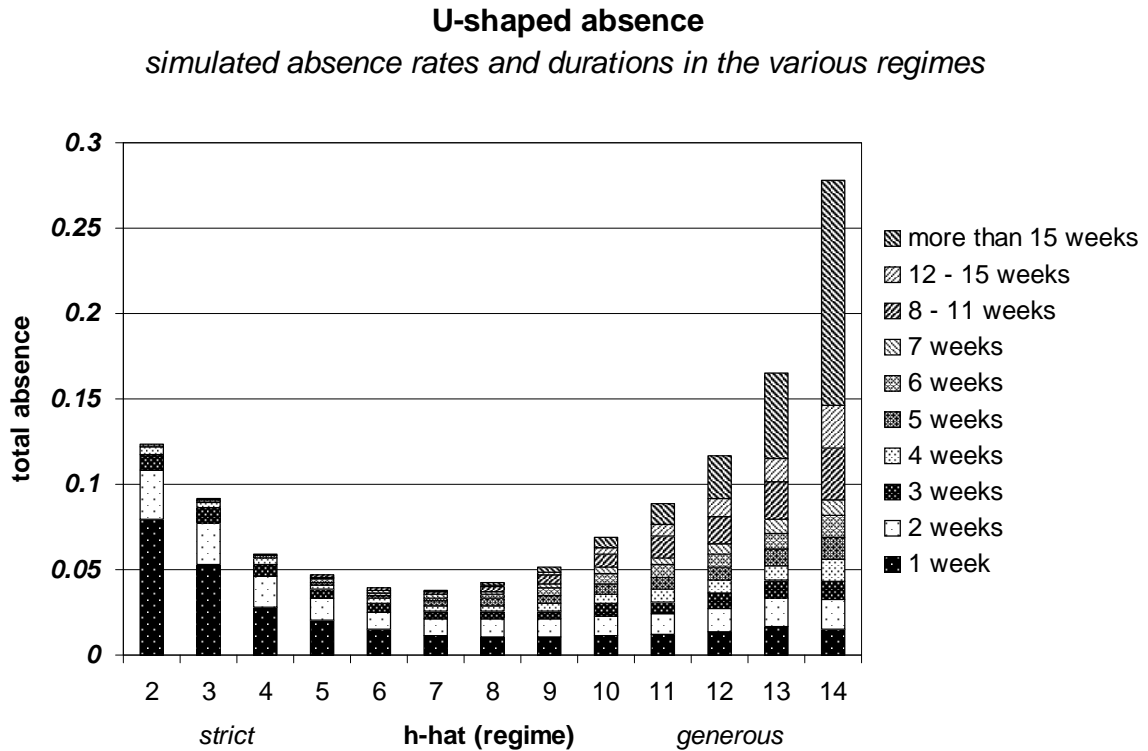
U-shaped absence

simulated absence rates and durations in the various regimes

Figure 7: **U-shaped absence.** The figure shows the simulated absence rates for different levels of the decision rule h-hat. Hence, h-hat = 2 is the result of a very strict regime with low benefits and low job-security. h-hat = 14 is the result of a very generous regime.

The reason why the model predicts a U-shaped relationship between absence and strictness is simple. Consider first a worker in a strict regime with $\hat{h} < h^W$. Assume he is hit by a large negative health shock ν and stays home because $h < \hat{h}$. His health improves from restitution and he returns to work when $\hat{h} < h < h^W$. Since $h < h^W$ working is bad for his health and there is probable that $h < \hat{h}$ the next period. Hence,

if $h < \hat{h}$ we will observe frequent and short absence spells before he, at some point due to the stochastic term ε, recovers sufficiently and $h > h^W$. Consider then a worker in a more generous regime with $\hat{h} = 10$. If hit by a large negative shock ν, this worker will not return to work before working is good for his health. Hence, when hit by a large shock he will experience one, longer absence spell. However, when hit by a small shock ν he may also get below $\hat{h}$. He will then have a short - but usually not repeated - absence spell. Hence, shocks that would not result in any absence in a strict regime may lead to short-term absence in a more generous regime. At some point in between these two we find the absence minimizing decision rule. If $\hat{h} > h^P$ we may get long term absence also from small shocks hitting people with good health. Think of a worker with $\hat{h} = 14$ and prima health, $h = 16$. At some point he is hit by a small shock of -2,5, such that $h = 13, 5 < \hat{h}$. Next period he stays home and - since inactivity is assumed to be bad for healthy people - his health is worse next period. Hence, if $\hat{h} > h^P$ we get a long-term absence trap.
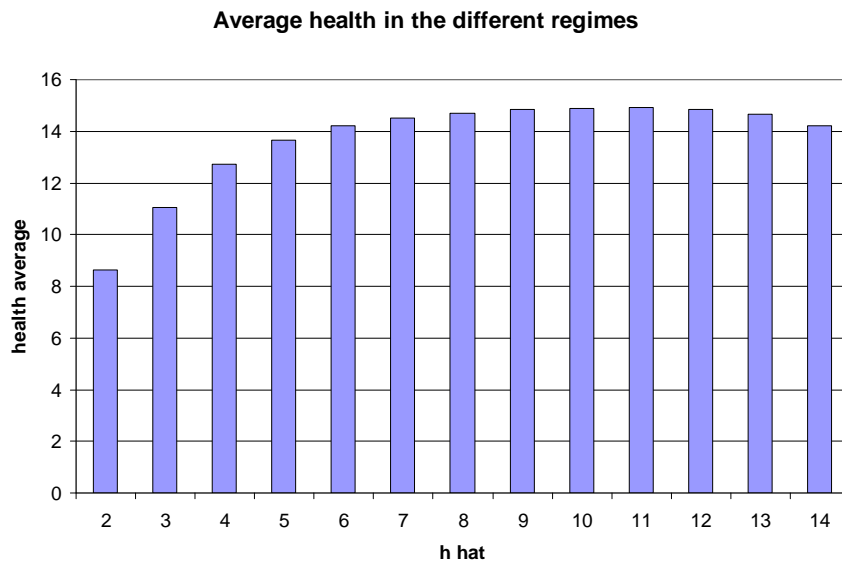
Average health in the different regimes

Figure 8: Hump-shaped health. The figure illustrates how average health depends on the decision rule h-hat. Health is maximized for h-hat equal to 11.

Figure (8) shows average health in the different regimes/decision rules. Health drawn over $\hat{h}$ has a hump-shape with a maximum somwhere between 10 and 11. The differences in health for $\hat{h} = [9, 11]$ are however rather small. The reason why get a hump-shape mirrors the reasoning above. If $\hat{h}$ is low, workers get caught in a short-term absence trap.

A substantial fraction of the workers will go in and out of work with low health. If $\hat{h}$ is high a substantial fraction of the workers will have $h = h^P$.

It should be noticed that these results are not independent of the speficiations. The distribution of ν are important for the result. For the model to predict a U-shape the distribution of ν must contain sufficiently many large negative shocks relative to smaller negative shocks.

Claim 5 *Maximizing health is not equivalent to minimizing absence.*

To further investigate the predicted distributions of health we can plot the cumulative health distributions following various $\hat{h}$ levels. In figure (9) these cumulative distributions are shown for $\hat{h} = [2, 4, 6, 8, 10, 12, 14, 16]$. The graph shows clearly that health is maximized for intermediate levels of $\hat{h}$. In the case of $\hat{h} = 2$ we see that a large share of the population have health below h^W while in the case of $\hat{h} = 16$ the majority have health levels around h^P.

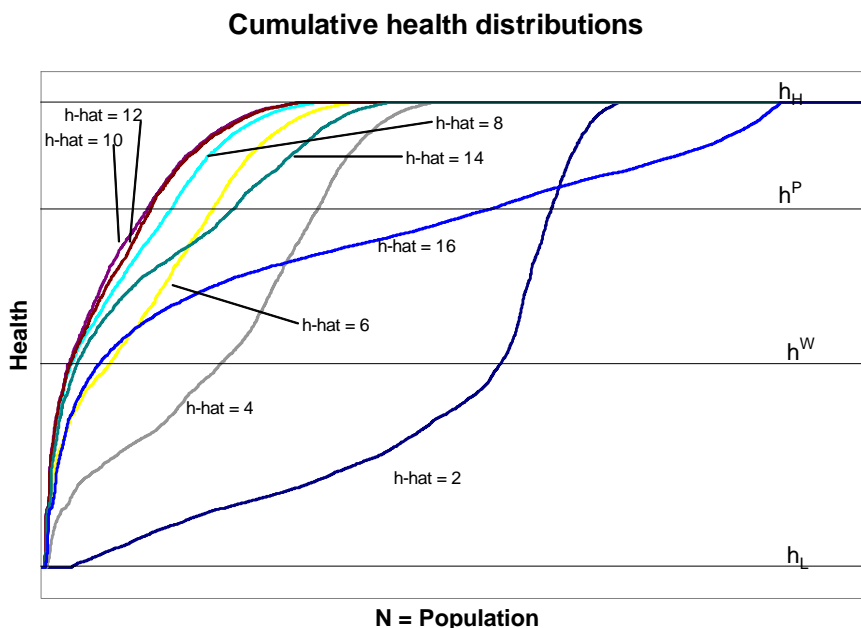**Cumulative health distributions**

Figure 9: Cummulative health distributions. The figure shows the simulated cummulative health distributions for several regimes. Health is best for $\hat{h} = [10, 12]$.

20

5 Comparing the predictions with data

By using the data shown in figure 1 we can litterally bring the sample of countries into the model. In table 4 the data used for figure (1) are presented. The data is gathered from different sources and averaged country wise for the period 1995-2003, with a few exceptions. Data for absenteeism is found in Bonato and Luisnyan (2004) and originates from Labor Force Survey conducted separately in each European country and put together by Eurostat. Data for US come from Bureau of Labor Statistics. Sickness replacement rates (B) and unemployment replacement rates (U) is provided by Scruggs (2004) and are averaged over the period 1995-2002. U and B shows the replacement rate for an average production worker. In many countries replacement rates are decreasing in wage such that for high income earners these figures will tend to be to high. Employment protection legislation (EPL) is an index provided by OECD for "late 1990s". Unemployment u is also provided by OECD and averaged for 1995-2003 for each country. Life expectancy is provided yearly by OECD and is averaged for 1995-2003 for each the whole population in each country.

Table 4

Data

Country averages for 1995-2003

| | Absenteeism | | | | | | | Life- | |
	<1 week	>1 week	Total	B	U	EPL	u	exp.	$\hat{h}$
AUT	.9	2.1	3.0	.79	.56	2.2	4.1	77.84	13.0
BEL	.5	2.45	2.95	.87	.64	2.2	8.3	78.12	13.0
CH	.8	1.35	2.15	.61	.73	1.1	3.4	79.64	11.4
DK	.95	1.35	2.3	.54	.62	1.4	5.2	76.51	10.3
FIN	1.15	2.35	3.5	.75	.59	2.1	11.2	77.48	11.0
FRA	.55	2.45	3.0	.63	.7	3	10.2	78.77	11.5
GER	.25	1.35	1.6	.94	.6	2.5	8.3	77.68	13.6
ITA	.35	1.05	1.4	.75	.38	2.7	10.2	79.13	10.9
NOR	1.55	3.4	4.95	1	.65	2.7	4	78.6	15.3
SWE	2.1	3.05	5.15	.81	.72	2.2	7.1	79.52	13.0
UK	2.0	1.95	3.95	.23	.2	.6	6.2	77.56	4.3
US	..	..	2.6	0	.58	.2	5	76.7	4.8

Sources: Data for absenteeism are averaged for 1995-2003 found in Bonato and Lusinyan (2004), B is sick-pay

and U is unemployment benefits (both relative to wages) averaged for 1995-2002 and are found in Scruggs dataset

(see references), EPL is for "late 1990s" from OECD, u is the average unemployment rate for 1995-2003

provided by OECD, Life expectancy is expected years of life at birth for men and women 1995-2003 from OECD..

From proposition 1 we know that the decision rule $\hat{h} > h^W$ as long as we have full job-security. Assuming full job-security we can thus assign a decision rule to each country by using the following function: $\hat{h}^{FULL} = h^W + \beta B$. There are no exact empirical counterpart to γ - the parameter governing the speed at which job-security are reduced when absent. In order to obtain a good measure of job-security the following procedure are carried out: (1) Let ΔEPL and Δu denote percentage deviation from sample mean of EPL and unemployment. (2) Let $\tilde{\gamma}$ be the empirical counterpart to γ, take values between zero and one, and be constructed as: $\tilde{\gamma} = \varphi \left(\Delta EPL - \Delta u \right)$. (3) Let $\hat{h} = h^W + \beta B - \alpha \left(1 - \tilde{\gamma} \right) \left(1 - U \right)$ where U is unemployment benefits as a fraction of wages. Note that this formulation ensures three favorable properties: In the case of no benefits and full job-security i.e.

$\tilde{\gamma} = 1$, $\hat{h} = h^W$. The marginal derivatives of B, U and $\tilde{\gamma}$ are all positive. The marginal derivative of U is decreasing in $\tilde{\gamma}$, and vice versa, such that job-security and unemployment benefits are substitutes. In order to plot these empirical counterparts to the decision rule shown in figure 4 the parameters β, φ and α need to given values. The parameterized equations used to create figure (10) below are given in (20), (21) and (22).

$$\hat{h}^{FULL} = h^W + 8B \tag{20}$$

$$\tilde{\gamma} = .5\left(\Delta EPL - \Delta u\right) \tag{21}$$

$$\hat{h} = h^W + 8B - 10\left(1 - \tilde{\gamma}\right)\left(1 - U\right) \tag{22}$$
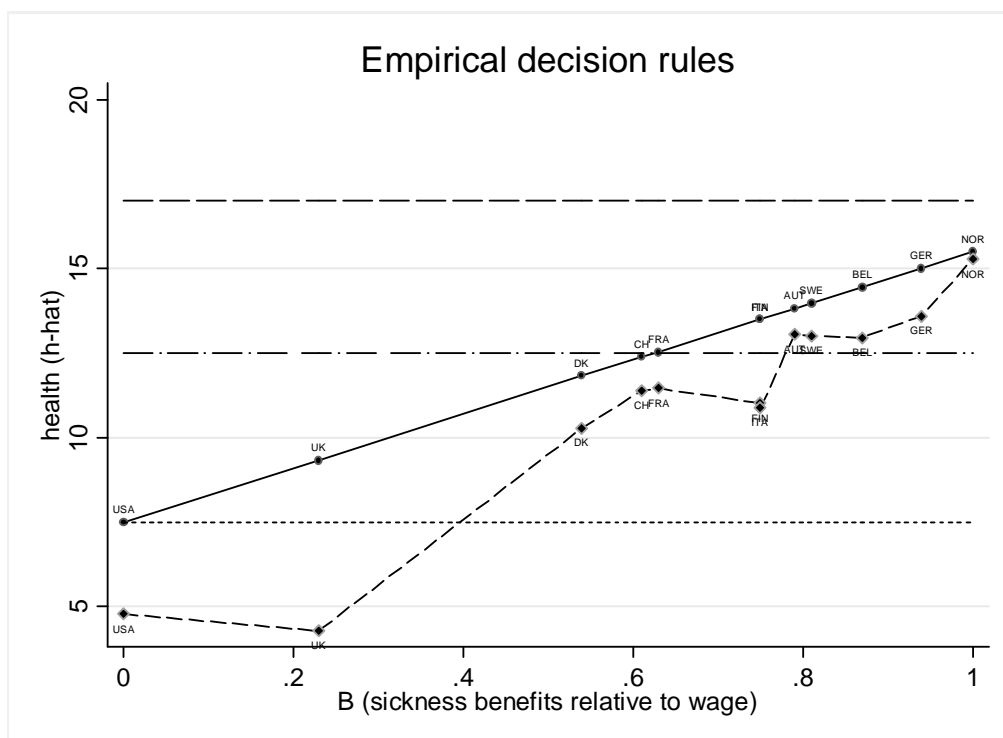

Figure 10: The empirical decision rules. The figure shows the empirical counterparts of the decision rules shown in figure 4. The solid line is the case with full job-security and is solely a function of B - sickness benefits. The dashed line shows how the county specific levels of $\hat{h}$ change as we include job-security (EPL and unemployment rate) and unemployment benefits.

Figure (10) illustrates the empirical counterparts of the decision rules derived from theory. We see that the main picture - ranking of countries - remains after introducing imperfect job-security, but there are some small changes. Notably, $\hat{h}^{UK} < \hat{h}^{US}$ - in other

words - UK are considered less "generous" than the US. The reason is that unemployment benefits are lower and unemployment rates higher in the UK than in the US.

In order to compare the model's predictions with the data we can now rank the countries according to $\hat{h}$ and plot data for absenteeism and health. Figure (11) is a scatter plot of $\hat{h}$ and total absence rate.The line is fitted from a quadratic regression:

$$absencerate_i = \underset{(2.5)}{6.9} - \underset{(.58)}{1.06\hat{h}_i} + \underset{(.03)}{0.06\hat{h}_i^2}.$$
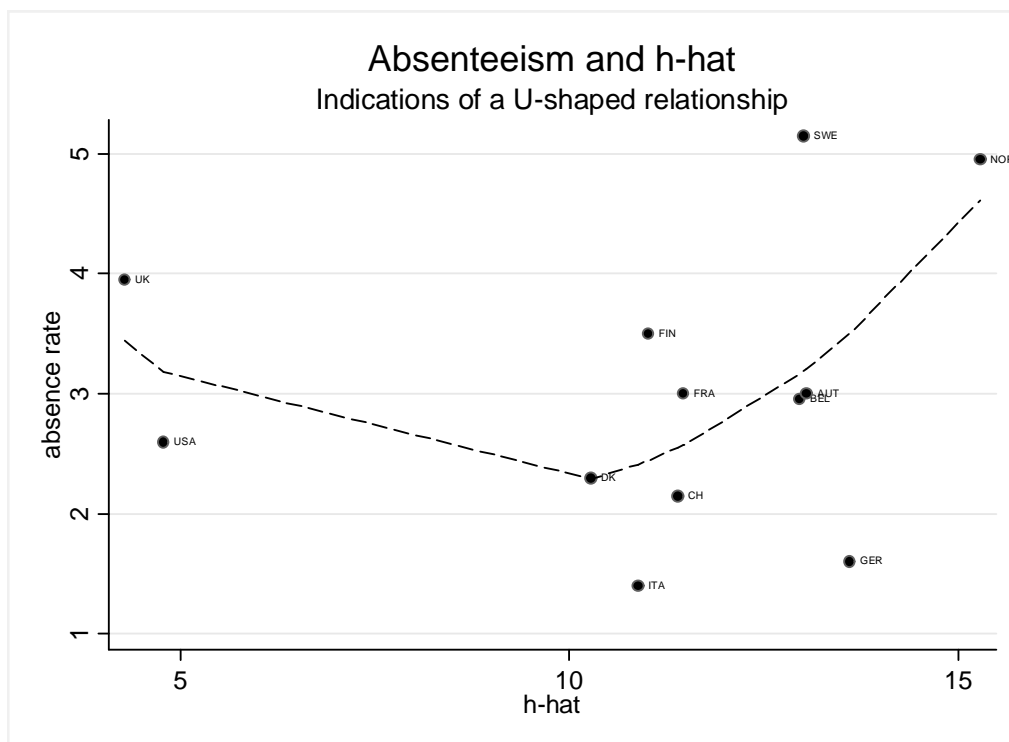

Figure 11: Indications of a U-shape? The figure shows absence rates and $\hat{h}$ for the sample of countries. The line is fitted from a quadratic regression. From the figure it is hard to reject the theoretical prediction that the relationship between the decision rule $\hat{h}$ and absenteeism is U-shaped.

The figure shows a possible U-shaped relationship between the decision rule - capturing strictness or generosity - and absenteeism. There are however few data points and large variation such that one should be careful in regarding this as more than weak support of the theoretical predictions. Nevertheless, the theoretical claims are not rejected by the data.

The theory predicts that short-term absenteeism should be the highest in the strictest regimes and long-term absenteeism the highest in the generous regimes. In figure (12)

data for short-term and long-term absence are plotted together with the decision rule $\hat{h}$. The figure illustrates - if anything - that these predictions cannot be rejected.
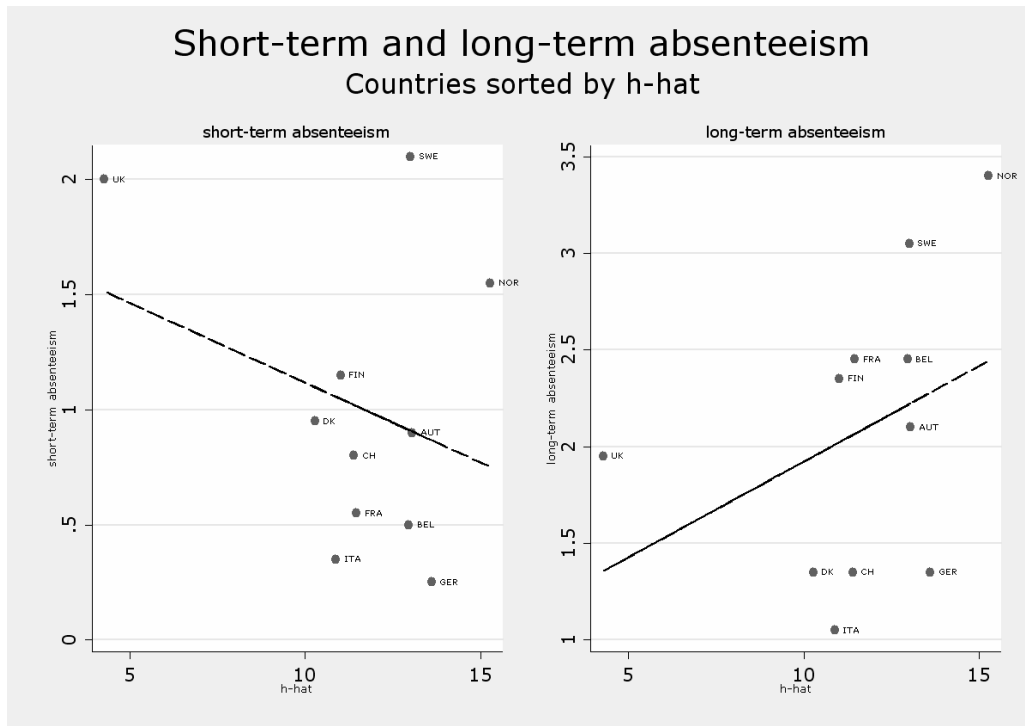

Figure 12: Short-term and long-term absenteeism. The figure plots short-term (<1 week) and long-term (>1 week) together with the decision rule $\hat{h}$. The lines are fitted from a linear regression with parameters: $short\_term_i = \underset{(.85)}{1.81} - \underset{(.07)}{.069}\hat{h}_i$ and $long\_term_i = \underset{(.98)}{.93} + \underset{(.08)}{.1}\;\hat{h}_i.$

The model has also predictions for health. To compare these with the data we can plot the decision rule against a rough measure of general health. In figure (13) this is done by using life-expectancy at birth for males.
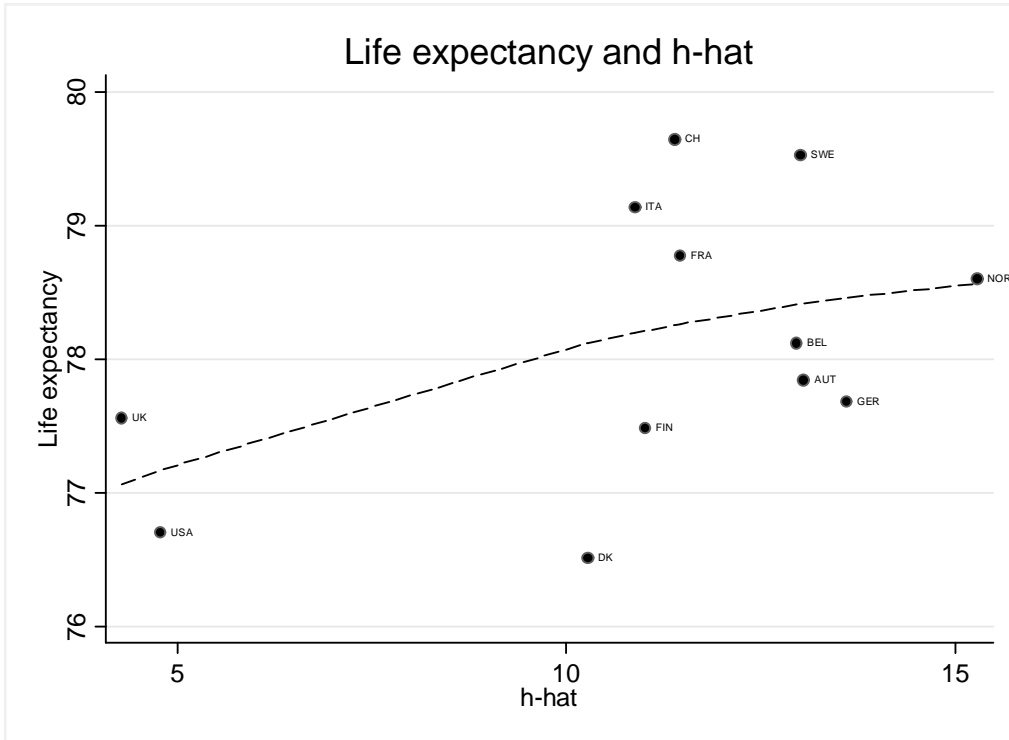
Figure 13: Health and $\hat{h}$. The figure plots life expectancy at birth for males agains the decision rule $\hat{h}$. The line is fitted from a quadratic regression with parameters

$$life\_ex_i = \underset{(2.29)}{75.95} + \underset{(.52)}{.29}\hat{h}_i - \underset{(.03)}{.008}\hat{h}_i^2.$$

The theory predicts a hump-shaped relationship between health and $\hat{h}$. Fom figure 13 it is neither strong support for nor evidence against this. However, it seems to be a positive relationship between health and welfare state generosity captured by the decision rule $\hat{h}$.

Despite the number of observations are scarce and the measures rough, it seems like the model captures something real. At least, it should be object for more robust empirical testing. Taking the model seriously implies several policy implications. Strict welfare regimes like the UK and the US could benefit from making their labor market institutions relevant for sickness absence more generous, implying higher benefits and improved employment protection legislation. This could possibly reduce absenteeism as well as improve general health. Generous regimes like Norway and Sweden could benefit from making their labor market institutions less generous in order to reduce absenteeism.

6 Concluding remarks

Labor market policies such as sick pay, unemployment benefits and employment protection legislation, matter both for health and absence rates. By including health and health effects from labor and leisure, it is possible to explain the observed indications of a U-shaped relationship between sickness absence and welfare state generosity in Europe. This is contrary to the standard economic framework. The intuition behind the results is simple: In very generous regimes there is a risk of staying home too long when ill, since the incentive to come back to work is quite weak. This leads to long absence spells, which is what we observe in Norway. In less generous regimes it is costly to stay home when ill. When this cost is sufficiently high, and increasing as the home period extends in time, agents may return to work too early. For these agents there is a risk of becoming ill again, since they were not restituted. This leads to short and frequent absence spells, which is what we observe in the UK. If the welfare arrangements are between these two extremes, agents choose to stay at home when ill, but prefer to work when they are well. This lead to low absent rates.

This paper has a clear message: strict welfare regimes could benefit from making their labor market institutions more generous. The model, as well as the empirical findings, also indicate that there is a trade-off between better health and less absenteeism for more generous regimes.

Several strong assumptions are made in order to obtain these results. One crucial assumption is that there are no savings. With savings, workers could save a "buffer stock" of endowments in order to smooth consumption between work and absence. However, savings would not alter the result from the proposition 1; that workers will full job-security never work when $h < h^W$. Savings would however weaken the threat of unemployment, but only to some extent. Even with savings workers often would be unable to smooth consumption between two different income-streams lasting all their lifetime. Hence, savings may change the results quantitatively but not qualitatively.

Another strong assumption is that unemployment is an absorbing state. In the real world it is of course possible to get a new job if you are unemployed. With no unemployment, such that workers get a new job at once, we could imagine that being fired is no threat at all. Then we would be in the full job-security case. A positive probability

of getting a new job, will give us something in between these extremes. However, making it possible to get out of unemployment would not alter the results qualitatively, only quantitatively.

Allowing savings without any credit constraints together with non-absorbing unemployment would probably make a change. Hence, the results hinge on at least one of these assumptions.

A much used benchmark is the friction-free "laissez-faire" economy, with perfect information and no unemployment. This benchmark would loosely correspond to the case with perfect job-security - because there are no unemployment - and no benefits. In the model, the regime with full job-security and no benefits is also the regime that has the lowest absence rates. However, in many european countries unemployment is high, and even worse, long-term unemployment is substantial. European labor markets are far from friction-free and there is no reason to believe that the medicine prescribed for the friction-free economy also is optimal for Europe.

7 Appendix

7.1 Numerical procedure in section 3

In order to solve the models in section 3 I have evaluated the value function on all integers in the interval between h_L and h_H. I have used linear interpoloation between these points. The problem is iterated until the value function for two preceding periods R and $R+1$ is equal for all levels of health, such that: $V^R(h, \pi) \approx V^{R+1}(h, \pi) \ \forall h, \pi$.

I have made health next period stochastic but expected health next period is given by the law of motion for health in (2). Figure (7.1) illustrates the way I have introduced stochastic health to get the problem somewhat smoother. If $E[h'|h, l] = k$, there is a probability q that $h' = k$. With probability $\frac{1-q}{2}$ $h' = k + 1$ and with probability $\frac{1-q}{2}$ $h' = k - 1$.

Stochastic health

$$\frac{1-q}{2}$$

h'+1

$$P(h'=[h'|h]|l)=q$$

h

E[h']

$$\frac{1-q}{2}$$

h'-1
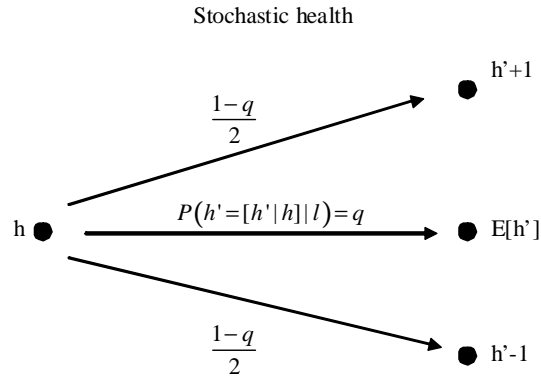
7.2   Simulation procedure in section 4

Adding the weekly health shock ad described in section 4, the stochastics are otherwise exactly the same as in section 3. The simulations are made with 6000 "agents" over 500 periods. It turns out that the initial distribution of health is of no importance. Hence, the distribution of health are ergodic. The stochastics are controlled by setting a seed such that the same draws are made for all decision rules.

All results, codes etc. are of course available on request. The simulations and the optimizations are all carried out using STATA.

References

[1] Eurostat, 2005. Health in Europe, data 1998-2003.

[2] Chatterji, M., Tilley, C. J., 2002. Sickness, absenteeism, presenteeism, and sick pay, Oxford Economic Papers, Volume 54, 669-687.

[3] Bonato, L., Lusinyan, L., 2004. Work Absence in Europe, IMF Working Paper, WP/04/193.

[4] Raaum, O., Røed, K., 2006. Do Business Cycle Conditions at the Time of Labor Market Entry Affect Future Employment Prospects?, The Review of Economics and Statistics, 88(2), 193-210.

[5] Scruggs, L., 2004. Welfare State Entitlements Data Set: A Comparative Institutional Analysis of Eighteen Welfare States, Version 1.1.

[6] Shapiro, C., Stiglitz, J., 1984. Equilibrium Unemployment as a Worker Disciplin Device, The American Economic Review Vol 74, 433-444.