Absenteeism, efficiency wages and economic incentives

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Abstract
Norwegian panel register data on 170 000 jobs in over 800 workplaces during the period 2000-2004 are used to study the impact of tax legislation changes on worker physician-certified absence behaviour and workers' pay. Evidence is found in accordance with the notion that increased marginal earnings taxes decrease the return on effort, and thus cause increased absenteeism. Controlled for fixed job effects, a higher anticipated marginal tax rate increases the absence rate, overall and with respect to muscular-skeletal illnesses, but this is neither observed for injuries nor in fixed pay workplaces providing full compensation for absent workers.

Key words: Absenteeism, wages, tax reforms, GMM, conditional Probit, conditional Poisson

JEL-code: H24, I12, J22, J28, J32, M52

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1. Introduction

In modern welfare states, earnings and pay-roll taxes are important for financing public welfare, including sick pay. In this paper we argue that the same tax system financing public sick pay, may paradoxically also affect workers' sickness behaviour. The reason is that the tax system affects workers' return on effort, and thus may be considered to provide negative financial incentives.

While negative financial incentives impact on absence has been studied for decades (see next section), the importance of the earning tax system as a potential source for negative financial incentives affecting absence is largely ignored. Studies of behavioural changes following tax reforms have previously primarily focused on earnings and labour supply responses.[1] The study of Johansson and Palme (2002) is to our knowledge the sole exception to this. It analyses the joint effect on absenteeism of changes in both sick pay and marginal taxes in Sweden. The idea of Johansson and Palme (2002) is that changes in the tax system over time in a country provide variation in the price of leisure (alternatively interpreted as the return on effort) of the worker. In a fixed person effect duration approach they find that the cost of absence for the workers clearly affects work absence behaviour.

Johansson and Palme (2002) are, however, unable to deal with the influence an employer cause on pay and absence. Firstly, wages are set by employers to take into account how costly absence is for them (Barmby, Sessions and Treble, 1994; Engström and Holmlund, 2007). If the marginal tax changes, and thus also the return on worker's effort, employers may respond by adjusting their wage policies. Secondly, the quality of the match between a firm and its employees affects worker absence behaviour. Workers in good matches are less likely to become absent than workers in bad matches. When Johansson and Palme find no significant impact of the virtual income on absence, this can be explained by

[1] See for example Feldstein (1995a, 1995b), Aaberge et al. (1995) and Blundell et al. (1998) for important contributions identifying strong labour supply responses following tax reforms.

workers in bad matches having lower virtual income. Similarly, a failure to take into account the job-specific match quality may overestimate the negative effect of the absence cost on absence if workers in bad matches have lower absence costs. Finally, Johansson and Palme's analyses rest on the assumption that an absence is completely at the discretion of the worker, and for certain illnesses at least this is hard to believe.

Our paper wants to remedy this, by studying the impact of changes in the marginal earnings tax for the individual worker on his or hers sickness absence behaviour, where we take into account unobserved job heterogeneity as well as study how this relate to different kinds of illnesses.

While we neither observe the introduction of a specific bonus scheme nor observe what can be defined as an experiment with respect to wages, we argue that by observing exogenous variation in the return on workers' effort (in line with the notion of Johansson and Palme), we are able to study how this affect the sickness absence decisions of workers. If one embeds taxes into the theoretical model of Barmby et al. (1994), this simple agency model predicts increased absence probability when reduced return on effort follows from increased marginal taxes. Increasing the earnings tax rate makes leisure becomes relatively cheaper, thus causing workers to become more absent. Since increased pay-roll tax affects both wages and sick pay, theoretically such an increase makes shirking more costly, thus employers respond to pay-roll tax hikes by increasing wages to offset costly shirking. In the appendix we elaborate briefly the background for these predictions.

From an empirical point of view these predictions have two important consequences. First, since earnings tax changes are exogenous to the workers and affect workers absence behaviour directly, variables expressing the marginal earning tax can be introduced in absence regressions as exogenous variables.

Second, since variation in the pay-roll tax legislation is equally exogenous to the workers as changes in the marginal earning tax, but should not affect worker behaviour directly (only through employers' adjustment of pay policies), pay-roll tax variation provides the necessary variation for us to measure the impact of wages on absence behaviour.

This idea is very simple, and should be easily adaptable to other countries than Norway and Sweden. On the other hand, the progressive and geographically differentiated earning and pay-roll tax systems of Norway and the timing of events here seem ideally suited for our purpose. The timing is beneficial for our purpose, since the tax legislation for the next year is made public at the end of the previous year, before workers make their absence decisions. The progressive tax system is beneficial, since as the marginal earnings tax and pay-roll tax in this system increases as earnings grow, the relationships are strongly non-monotonic. For earnings levels relevant for the workers in our study the marginal earnings tax jumps at certain earnings thresholds levels. These threshold levels divide the tax rate for the majority of our workers into three categories, low, middle and high. For workers located in the earnings distribution close to these threshold levels, a change in the tax system will have much stronger impact on the return to effort, than for the average worker. It is this discontinuity we will explore in our empirical analyses.

Finally, while we analyse workers absence behaviour motivated by an efficiency wage mechanism, another strand of thinking about absence following injuries is the literature on compensating wage differentials. This framework is based on the assumption that employees have preferences for certain (different) bundles of wage-risk-combinations, while firms, which are taking into account the costs of providing safety, offer job contracts consisting of different combinations of wages and risk.[2] While the efficiency wage framework implies a negative relationship between wages and absence for a given utility level, compensating wage

[2] Compensating wage differentials were introduced formally by Rosen (1974), which introduced the concept of hedonic prices. It has been addressed in a multitude of studies (Viscusi, 1978; Duncan and Holmlund, 1983; Garen, 1994, Gronberg and Reed, 1994, Dale-Olsen, 2006).

setting implies a positive relationship between wages and risk, and thus absences (due to injuries). Since both efficiency wage mechanisms and compensating wages are present in the Norwegian economy, we expect our empirical analysis to reveal that the relationship between wages and absences is contingent on illness diagnosis.

The structure of the remainder of the paper is as follows: Section 2 presents briefly central findings in the literature on financial incentives and absences besides Johansson and Palme (2002). Section 3 describes the tax reforms and pay compensation system in Norway. Section 4 presents our empirical strategy. Data is presented in Section 5. The impact of the earning tax system on absences is the topic of Section 6. Section 7 focuses on other explanations for our empirical results. Section 8 briefly concludes. In the appendix we present an axiomatic illustration and auxiliary regressions.

2. How do negative financial incentives affect workers' absence behavior?

In the economic literature negative financial incentives are usually associated with reduced absence. Negative financial incentives come in many different shapes.

First, there is the direct effect of reduced public sick pay. Barmby, Orme and Treble (1995), Johansson and Palme (1996) and Henrekson and Persson (2004) find that when wages are cut whenever a worker is absent, then the absence rate drop. The two latter studies utilise public variation in the sick pay legislation in Sweden and thus exploit what may be considered a natural experiment.

Second, we have seen the last 10 year studies of worker absence behaviour focussing on firms' incentive aspect of worker payment. Particularly three studies should be noticed. Motivated by the same theoretical model as our paper, Brown, Fakhfakh and Sessions (1999) studying profit-sharing, employee share ownership and absenteeism based on French Panel data on 127 firms from 1981 to 1991, find that both profit-sharing and shared ownership significantly reduced the absence rate, but ownership shares more so.

Engellandt and Riphahn (2004), on the other hand, use panel data on 6500 workers in a large international company to study the incentive effects of two different remuneration schemes on different effort indicators, whereof absence is one. The first remuneration scheme is an individual surprise bonus, while the other is more structured determining (part of) the pay following individual performance evaluations. They find that when worker evaluation is more dispersed, absence is lower.

Finally, Hassink and Koning (2005) study a lottery set up in two plants with capital-intensive production technologies of a large Dutch manufacturer employing 481 workers using monthly data from the period 2001 to 2003. Participation in the lottery is contingent on not having been on sick leave for the last three months. Seven winners are picked randomly. Each winner receives 75€ in the form of coupons, and is made publicly known. Winners are then excluded from future lotteries. The lottery is found to be highly beneficial for the firm, in that the decrease in sick leave exceed the cost of setting up the lottery. Not only do Hassink and Koning find that the lottery reduces sick leave by 1.6 percentage points, they observe that after winning the lottery, the winners resume their previous absence behaviour (which should be expected if it was the prospect of winning the lottery which reduced their absence rate).

3. Tax reforms and pay compensation for absent workers

3.1 The Norwegian tax system

In this section we present some of the Norwegian tax reforms during the period 2000 to 2004. Table 1 shows the marginal earning tax rate for different earning levels. The marginal earning tax rates for low earning levels vary between 7.8 percent and 35.8 percent in a quite non-linear way. Consider for example the tax legislation for 2003. For earnings less than 23000

Nok the marginal tax is 0 percent. For earnings between 23000NOK and 33430NOK the marginal tax is 25 percent. Then for earnings between 33430NOK and 63400 NOK the marginal tax drops to 7.8 percent. For earnings between 63400NOK and 132500 NOK it jumps to 35.8 percent. Then for earnings between 132500 and 190400NOK it drops to 29.1. For earnings between 190400NOK and the first threshold for the top tax, i.e., 347000 NOK in 2003, the marginal tax then stays at 35.8 percent. While the marginal tax rate vary quite a lot for low earnings, the tax level are quite stable for average earnings levels. The median worker faces a marginal earnings tax rate of 35.8 percent. As the earning levels increase, then the marginal tax rate increases by jumps to first 49.3 and to 55.3 percent. Consider year 2003 once more as an example. If the worker earns less than 346 999 NOK as described above, then the worker faces a marginal earning tax rate of 35.8 percent. If the worker earns 347001 NOK he or she faces a marginal tax rate of 49.3 percent. Finally, if she earns at least 872001 NOK then she faces a marginal tax rate of 55.3.

[Insert Table 1 around here]

The discussion above and Table 1 reveal two facts. First, it is mainly the threshold levels for the top taxes that changes during our period of observation. Second, small changes in earnings may yield quite strong impact on the marginal tax rate.

Next we look closer on the pay-roll tax rate during our period of observation. Table 2 presents the pay-roll tax rate in the 5 pay-roll tax zones of Norway, and reveals two important characteristics during our period of observations.

[Insert Table 2 around here]

Firstly, we see that the pay-roll tax rate is unchanged in all zones during the period 2000-2003. Then in 2004 it increases weakly in 3 of the zones. Secondly, we see that the pay-roll tax rate is dependent on worker earnings. For high earners the employers face an additional pay-roll tax rate on the earning exceeding the threshold. For example, a worker earning

1500000 Nok in 2000 employed by an employer located in the capital Oslo (zone 1) costs the employer first 14.1 percent in earnings-independent pay-roll tax rate and then an additional 12.5 percent on the 726000 Nok exceeding the threshold. Thus the employer ends up paying roughly a pay-roll tax rate of 20 percent. Similarly, for an employer located in the northernmost county in Norway, Finmark, the total pay-roll tax rate is 12.5, which is completely determined by the pay-roll tax rate related to high earnings.

3.2 The sick pay system in Norway

The sick pay system in Norway is prototypical of a generous Scandinavian welfare state. Workers are provided complete compensation for 1 year if earnings are less than 6G (G=baseline level public social insurance system, roughly 48 377 Nok in 2000 and increasing to 58 139 Nok in 2004). The employers are free to offer top-up compensation for workers earning more than 6G (in our data 40% of the private sector workplaces offer top-up in 2003). In 2004 45 percent of all private sector (excluded public administration, health care and education) workers earned more than 6G. The employer-provision of top-up sick pay compensation is a practice that is not particular to Norway, but is seen in other welfare countries as well (Barmby et al., 2002).

While one uses the phrase “complete compensation”, it is important to note that this does not mean that all pay is compensated fully. First, for workers operating under a performance pay regime based on individual performance, bonuses will often not be compensated. If the absence is detrimental to team performance, then bonuses can be lost also under a regime with team incentive devices. Thus under performance-pay it is hard to talk about full compensation. Close to 50% of Norwegian private sector workers operate in 2003 under a regime of performance pay (Barth et al., 2005), thus a substantial proportion of Norwegian workers cannot be said to experience complete compensation. Furthermore, when you are absent from work you loose out on opportunities at work providing other extra pay, for instance overtime payment. Finally, certain non-wage elements are not compensated fully.

Usually each worker have up to 4 periods of 3 absence days based on own declaration of illness. After that all absences regardless of longevity have to be physician-certified. The firms are free to extend the number of absence periods and/or absence lengths (in our data 26% of the workplaces provide such extensions in 2003). As is described in the data section, our data comprise information on physician-certified absences only, so workers' short-term self-certified absence behaviour is not analysed empirically.

The first 16 days of the absence spell are covered or paid by the employer. The remaining spell is covered by the public authorities.

4. Empirical strategy

We are to study the relationship between tax reforms, wages and sickness absence. Since firms optimize wages w.r.t. worker turnover and absenteeism, and workers sort into firms depending on pay and work environment, wages and absences are endogenous variables in most absence regressions. To a certain extent we are able to deal with this endogeneity problem by applying a fixed job effect approach. This implies that our identification of the relationship between wages and absence rests on variation only within the job but over time. We need exogenous variation in wages, however, to identify absence behaviour across jobs.

From the discussion in Section 1 we know that changes in the pay-roll tax do not affect worker utility directly but through wages only. So if pay-roll tax changes affect wages, it has to be because employers due to changed profitability bargain or set wages differently. Thus in this case, it appears we have a valid instrument for wages. Earnings tax variables, on the other hand, affect absence directly and thus can apparently be incorporated in the absence regressions as exogenous variables.

Unfortunately, this is even more complicated. Firstly, the marginal earnings tax and the pay-roll tax are determined contingent on workers' earning. So apparently the causation goes the other way around. But the rules for taxation a specific year are published at the end of the year before, and it is these rules that determine behaviour. So while the realised marginal tax rate for worker i in job j at year t-1 is given by $MT_{ijt-1}=margtaxt(\sum_j W_{ijt-1})$, we define the anticipated marginal tax rate for worker i in job j at year t as $EMT_{ijt}=margtax_t(g_{ent-1}\sum_j W_{ijt-1})$, where g_{ent-1} expresses the average wage growth for workers with educational qualification e employed in industry n at year t-1. Thus we assume that the workers observe the wage growth of comparable workers (i.e., those with similar educational qualification defined on a 3-digit level and employed in the same 3-digit industry) last period and assume that this wage growth will be realised the following period as well.[3]

It is the anticipated marginal tax rate we use to represent the marginal earnings tax rate. Therefore it is important to realise that in the empirical analyses we are to study the impact of changes in the *anticipated* or expected marginal tax on absence behaviour, and not the impact of realised marginal tax changes on absence behaviour.

In a similar way we define the earning-sensitive part of the pay-roll tax rate – the anticipated pay-roll tax rate: $EPT_{ijt}=pay\text{-}roll\_tax\_rate_t(g_{ent-1}W_{ijt-1})$, i.e., the pay-roll tax for a worker a specific year is determined by the tax rules for that year conditioned on the previous year's earnings in the job.

Secondly, our panel setting creates additional demands on the instruments. The tax parameters are obviously set by the public authorities, and are thus easily interpreted as exogenous. But public authorities may determine future tax parameters on basis of current behaviour. Thus the marginal earnings tax can only be considered predetermined and weakly

[3] If the number of comparable workers within the same educationXindustry-category is less than 5, then we assume that the average wage growth within the economy provides a better measure of the anticipated wage growth. This approach was chosen to reduce the sensitivity to and importance of outliers in calculations of the anticipated wage growth.

exogenous. This assertion is further enforced since future marginal earnings tax depend on previous earning levels and absence behaviour. The reason is quite simple that if the marginal earnings tax increased previously and thus reduced the rate of return on effort, and consequently lowered wages and increased absence, then this will affect future earnings as well. This implies that the within-transformation cannot be used, but estimation of wages on taxes should be based on first-differenced regressions.[4] These first-differenced wage regressions may then be used to predict wages, thus allowing the pay-roll tax variables to act as instruments for wages in absence regressions. Our empirical strategy is therefore:

1. Step 1: First-differenced linear panel regressions of wages on tax variables and controls (these results are presented in the appendix).
2. Step 2A: First-differenced linear panel regressions of the relative number of sick days on earnings tax, predicted wages and controls.
3. Step 2B: Conditional Logit regressions of the occurrence of absence on earnings tax, wages (instrumented and not) and controls.
4. Step 2C: Conditional Poisson regressions of the absence spell length on earnings tax, wages (instrumented and not) and controls.

4.1 Linear wage regressions

Let log wages for worker i employed in job j at time t ($\ln W_{ijt}$) be expressed by:

$$1) \qquad \ln W_{ijt} = \gamma_{T1} EMT_{ijt} + \gamma_{T2} EPT_{ijt} + \gamma_x ' X_{ijt} + \theta_j + \upsilon_{ijt} ,$$

where EMT_{ijt} and EPT_{ijt} express the anticipated marginal earnings tax rate and the pay-roll tax rate, respectively, X_{ijt} expresses a vector of control variables, while θ_j and ν_{ijt} express a job specific fixed effect and a white noise error term, respectively.

[4] The classical "within-transformation can only be used if the instruments are actually strongly exogenous"(Cameron and Trivedi [2005:758]).

4.2 Linear absence regressions (the relative number of sick days)

Following the linear first-difference wage regressions of 4.1, the linear absence regressions follow directly using STATAs XTIVREG2-procedure. We measure absence as the number of absence days relative to the number of work days. For worker i employed in job j at year t, let A_{ijt} and D_{ijt} express the number of absence days and the number of work days, respectively. Then our regressions can be expressed by:

$$2) \qquad \frac{A_{ijt}}{D_{ijt}} = \beta_w \ln W_{ijt} + \beta_T EMT_{ijt} + \beta_x' X_{ijt} + \alpha_j + \varepsilon_{ijt},$$

where lnW, EMT, and X are as defined previously, while α_j and ε_{ijt} express a job specific fixed effect and a white noise error term, respectively. Equation 2) is estimated using first-difference linear regression to take care of the fixed job effect. Log daily wage is instrumented by the pay-roll tax rate variables as presented in Sub-Section 4.1.

However, these regressions ignore the fact that A_{ijt}/D_{ijt} can be understood as a censored variable, with an inflation of zeroes. Since the degree of censoring is considerable (40% of the workers do not experience an absence during our observation period), this will clearly affect our estimates. This can be appropriately treated by two fixed job effect approaches: Conditional Logit and Conditional Poisson regressions. The drawback is that these methods yield a considerable loss of observations, since only workers experiencing at least one absence spell identify the model. In our regressions we introduce the number of working days as an offset variable, i.e., the parameter associated with the variable is kept restricted to 1. We conduct regressions where we treat wages both as an exogenous variable and as an endogenous variable. In the latter case we use the linear prediction from 4.1 as our measure of the instrumented wages.

4.3 Conditional Logit regressions of the occurrence of absence

In this section we focus on the probability of experiencing an absence due to illness.

Define $Y_{ijt} = \begin{cases} 1, & if \quad A_{ijt} > 0, \\ 0, & if \quad A_{ijt} = 0, \end{cases}$ and let $Z_{ijt} = (\ln W_{ijt}, EMT_{ijt}, X_{ijt})$. In this case the joint density of the Y-s can be written:

$$3) \qquad f(Y_{ijt} \mid \alpha_j, Z_{ijt}, \beta) = \frac{\exp(\alpha_j \sum_t Y_{ijt}) \exp(\sum_t Y_{ijt} Z_{ijt}')\beta)}{\prod_t \left[1 + \exp(\alpha_j + Z_{ijt}'\beta)\right]}.$$

Elimination of the fixed job effect α_j is eliminated by conditioning on $\sum_t y_{ijt}=c$, and the following density is consistently estimated using ML.

4.4 Conditional Poisson regressions of the absence spell length

Finally we want to study the absence days relative to working days. The tax structure may not only affect the absence decision, but also affect the length of the absence. Let once again $Z_{ijt} = (\ln W_{ijt}, EMT_{ijt}, X_{ijt})$. The joint density of the job-specific fixed effect Poisson-model can be expressed

$$4) \qquad f(A_{ijt} \mid \alpha_j, Z_{ijt}, \beta) = \prod_{t=1}^{t} \exp\left[-\alpha_j \exp(Z_{ijt}'\beta)\right]\left[-\alpha_j \exp(Z_{ijt}'\beta)\right]^{A_{ijt}} / A_{ijt}!.$$

Elimination of the fixed job effect α_j is eliminated by conditioning on $\sum_t A_{ijt}=c$, and the following density is consistently estimated using ML.

5. Data

Our analyses are based on the linking of two kinds of data sets. The *first* two data sets comprise questionnaires, the Norwegian Workplace and Employment Relationship Survey 1997 and 2003 (NWERS1997, NWERS2003), answered early winter 1997/2003 by the daily manager or personnel manager of roughly 2300 Norwegian establishments from both public and private sectors. These establishments are sampled from establishments with more than 10 employees. Furthermore, the sample is constructed so that large establishments are over-sampled (for example, all establishments with more than 300 employees are included in the sample). The NWERS-establishments employ over 350 000 workers, i.e., nearly a fifth of the Norwegian workforce. The sampling procedure and the questionnaire (NWERS2003) are described in Holth (2003) and Torp (2005). The questionnaire covers topics such as compensation, work practices and organisation issues. It is quite similar to questionnaires found in many countries, e.g., United Kingdom (work and employment relation surveys (WERS)) and United States (EQW-NES).

For our purpose, the questions regarding worker pay determination and pay compensation related to absences are particularly interesting. Thus the questionnaire provides information on whether workers' wages are performance related, e.g., by a surplus sharing regime, or if they are fixed. It also provides information on whether top-up compensation is provided to absent workers (ensuring full pay compensation for absent workers).

The *second* data set, or more precisely, data system, is based on public administrative register data. It comprises *all* firms, workplaces and employees (incl. executives) in Norway 2000–2004 (roughly 140000 firms, 180000 workplaces and 2000000 employees each year) employed May 15th each year. This data set is a similar to an integrated register based data system, Current System for Social Data (CSSD), linked by Statistics Norway, comprising information from public administrative registers (except CSSD is not restricted to employment spells active on May 15th). This linked employer-employee data set provide information on workers (incl. executives) (absence spells[5], physician-certified illness diagnosis[6], gender,

[5] We know the start and stop date of an absence spell. Similarly, we know the start and stop date of a job spell. Thus when we later measure absence days relative to the number of work days this implies a certain degree of measurement errors. Both job spells and absence spells contain weekends and public holidays. We have chosen this approach since we do not know if a worker really works on weekends and public holidays, or if he or she is off work.

[6] These diagnoses allow us to define an injury, but we cannot identify work accidents or work-related injuries. Our injury measure will include i) work related injuries which are treated by physicians, but not reported to the authorities as work place accidents, ii) work related injuries which are treated by physicians and reported to the authorities as

educational qualifications, income, occupation (2003)), jobs (for example spell length in days and thus seniority, spell-specific earnings and thus combined with spell length daily wage, weekly working hours (intervals, exact hours 2002-2004), hourly wage (only 2002-2004, calculated from earnings, spell length and exact weekly working hours), and firm-and establishment identifying numbers, industry (5-digit NACE), sector and municipality.

For research purposes, it is a nice feature of the Norwegian public administrative registers that each individual, each establishment and each firm are identified by unique identifying codes (separate number series). In our data, these original numbers are replaced by encrypted numbers.

When we link the questionnaires and the register data, we end up with 820 workplaces and 167 168 workers, 171 136 jobs and 496 006 observations covering the period 2000-2004. Does our final data set provide a different picture of absenteeism than what we generally observe in the Norwegian economy? Table 3 shows the average absence days relative to work days in Norway for workers employed the whole year, overall and for specific illnesses. On average 5-7 percent of the work days in Norway are lost due to physician-certified sickness absence. We do observe a weak drop in 2004 overall, but injuries show a stable development while pregnancy-related absences increase. In 2004, after pressure from the public authorities physicians change their sick leave certifying practice by becoming more restrictive. The aggregate absence rates in Norway then consequently dropped markedly. As seen in Table 3 the overall aggregate relative number of sick days drop markedly in 2004, but since we focus on those workers that are employed the whole year, our aggregate figures refer to a selected group of workers which will be less affected by the new practice of physicians.

[Insert Table 3 around here]

work place accidents, and iii) non-work related injuries, since it is not know where and on what occasion, the worker's injury was acquired.

Next the table shows the similar figures for our sample of workers. We observe a weak decrease from 2000 to 2001 compared to that of all workers. Otherwise the similarities between our sample of workers and for the economy in general are evident.

6. Sickness absence, wages and tax reforms

Following our empirical predictions from Section 1 we expect to find a positive relationship between the pay-roll tax and wages and a negative relationship between wages and the earnings tax rate. In this section we set forth to study the relationship between absences, wages and taxes empirically. To avoid complications regarding retirement decisions, special tax rules for elderly workers and the drastically increasing illness probability associated with elderly workers, we discard observations of workers older than 60 years of age. We also discard observations of workers less than 20 years of age to avoid complications associated with school children.

6.1 Wages and tax reforms

In this sub-section we briefly describe how the changes in the tax legislation affect empirically the marginal tax of the workers. Table 4 presents relevant yearly descriptive statistics.

[Insert Table 4 around here]

Table 4 clearly reveals that the changes in the tax legislation do not affect the majority of the workers. Less than 8 percent of the workers experience a discrepancy between the observed marginal earning tax rate for previous period earnings and the anticipated marginal tax rate for previous period earnings contingent on the average earnings growth and the tax legislation for next year. However, each year roughly 1–3 percent of the workers anticipate increased marginal earning tax rate, while 1 – 5 percent of the workers anticipate a tax rate reduction.

While on average, this discrepancy between observed and anticipated marginal tax rate is virtually zero (0.02 percentage points), the maximum positive and negative discrepancy is -28 and 28 percentage points, respectively. Thus for some workers the impact of changed tax legislation on the marginal tax rate has be defined as considerable.

We then run as a first step a set of 6 linear regressions of log daily wages or log yearly earnings on the anticipated marginal earnings tax rate, the anticipated pay-roll tax rate and the fixed pay-roll tax rate, as well as some other controls, which later will be used to predict wages for the second step absence regressions. The anticipated pay-roll tax rate captures the earnings-related part of the pay-roll tax. We present our results in Appendix A2 Table A. In Models 1-4 and Model 6 we estimate the regressions using OLS on first-differenced observations. This takes care of the fixed job effect. In Model 5 we estimate the regression based on the within-job transformation. Model 5 should econometrically provide biased estimates, and is just presented as a contrast.

Both pay-roll tax variables are highly significant. Growth in the fixed pay-roll tax part, which is relevant for the majority of workers, cause wage growth. Growth in the earning sensitive part of the pay-roll tax, the anticipated marginal pay-roll tax rate, which is relevant for the top wage earners, reduces wages. However, the combined effect of two the pay-roll tax variables for the top wage earners is positive, implying 0.5 percent higher wages after 1 percentage point pay-roll tax increase.

6.2 The number of sick days, wages and earning tax reforms

In this sub-section we estimate absence regressions using GMM in first-difference form (eliminating fixed job effects), using the same set of controls as in the wage regressions of sub-section 6.1 (except the pay-roll tax variables that are used as instruments). Table 5 presents the results from the absence regressions. Absence in these regressions is measured by the number of sick days relative to the number of work days.

[Insert Table 5 around here]

First, note that we also in Table 5 present some evidence on the strength and appropriateness of pay-roll tax variables as instruments. Firstly, no evidence is found to support the notion that our instruments are weak. We present the F-value of excluding the pay-roll tax variables from the regressions based on the partial R-square-values. We see in all the regressions these F-values are exceeding 10, which is a rule-of-thumb threshold for this test. We also provide Cragg-Donald minEval/L2 F-values indicating strong instruments. Secondly, with one exception only, the Hansen J-tests for over-identifying restrictions do not indicate that the pay-roll tax variables should have been included in the absence regression. The exception is found in one of the robustness checks regressions, Model 5.

The evidence presented in Table 5 is very robust, and only minor changes are observed between the models. Two important observations are found in all the regressions. Firstly, we identify a significant positive impact of the anticipated marginal earnings tax rate on the absence rate. Increasing the anticipated marginal tax rate by 10 percentage points increases the absence rate by 0.5-0.6 percentage points. Since the average absence rate is roughly 6 percentage points, this implies an increase of 10 percent. Secondly, rather surprisingly no significant relationship is found between wages and absence. This implies that no evidence is found supporting the notion that as one moves between jobs providing higher wage levels, the absence rate should drop.

6.3 Sickness absence, wages, earning tax reforms and censoring

As is pointed out in Section 4, in the regressions in 6.2 one ignores the fact that many workers are observed with zero absences. Thus the absence ratio is censored. To take account of the non-continues nature of the occurrence of absences and the number of absence days, we estimate Conditional Logit – and Conditional Poisson-regressions instead (these conditional approaches eliminate the fixed job effect). However, the drawback is that these methods yield a considerable loss of observations, since only workers experiencing at least one absence spell during our five years of observations identify the models. We conduct regressions for absences related to all kinds of illnesses, for absences related to muscular-skeletal diseases, and for absences related to injuries.

In Table 6 we present the results from the Conditional Logit-regressions. An indicator variable expressing absence (=1) or not (=0) is our dependent variable. In addition to the anticipated marginal tax rate and log daily wages (observed and predicted[7]), we use the same set of controls as Model 3 of Table 5. The number of work days is used as an offset variable, i.e., its parameter is restricted to 1 a priori. This let us interpret the estimates as expressing the impact on the absence incidence rate.

[Insert Table 6 around here]

In Models 1 and 2 we study absences related to all kinds of illnesses. Firstly, we see that anticipated marginal tax rate affects the incidence rate positively and significantly. Increasing the tax rate by 1 percentage points, increases the incidence rate by nearly 0.6 percentage points, i. e., the impact is 10-times as strong as the one revealed by the regressions of Table 5. Secondly, in Model 1 we identify a strong negative relationship between wages and the absence incidence rate. Higher wages within a job implies lower absence incidence rate. In Model 2, when wages are instrumented, a positive but not significant relationship is found (albeit it is close). So for wages Table 5 and Table 6 present a similar picture.

In Models 3 and 4 we focus on absences related to muscular/skeletal illnesses. This is a family of diagnoses where we expect that workers can make individual absence decisions

[7] We use the predicted wage values based on the estimates of Appendix A2 Table A, which are also used in Table 5.

and thus affect the absence incidence rates. Once again we find strongly significant and positive impact on the incidence rate from the anticipated marginal tax rate. As for wages, within a job we find a strong negative relationship between wages and absences. When wages are instrumented, this relationship becomes significantly positive.

Then in Models 5 and 6 we study the relationship between the injury incidence rate, the anticipated marginal earnings tax and wages. Firstly, neither Model 5 nor Model 6 reveals any significant relationship between injuries and the marginal earnings tax. Thus our findings are being in accordance with the notion that the anticipated marginal earning tax rate should only affect workers absence decisions when they can be affected by individual choice. Secondly, in Model 5 we identify a positive relationship between injury incidence rate and the wage level within a job, i.e., a relationship which indicates compensating wages. When wages are instrumented, no significant relationship is found in Model 6.

Next we turn to the Conditional Poisson-regressions. The results from these regressions are presented in Table 7. Our dependent variable is now the number of sick days. We use the same set of controls as in Table 6 and the number of work days is still used as an offset variable. This let us interpret the estimates as expressing the impact on the absence rate.

[Insert Table 7 around here]

Note that even if we analyze physician-certified absences, these can possibly be influenced by workers' decisions in two different ways. First, the worker can influence if he or she will turn absent, then secondly he or she can influence when to return to work (i.e., the number of sick days). Thus, if anything, we expect that if the anticipated marginal earnings tax increases (and thus lowers the return to effort) then the impact on the absence rate should be stronger than on the incidence rate. Models 1 – 4 reveal that this is indeed so. The absence rate is twice as sensitive to changes in the anticipated marginal tax rate as the incidence rate. Increasing the anticipated marginal tax rate by 1 percentage point increases the absence rate (the relative number of lost work days) by 2.1 percentage points. This implies a 30 percent increase in the relative number of lost work days, and thus has to be considered substantial.

Models 5 and 6 then focus on the number of lost sick day due to injuries. While we in Table 6 observed that the injury incidence rate was unaffected by the anticipated marginal earnings tax rate, this is not so for the number of lost sick days. The impact is weaker than for lost sick days due to muscular-skeletal illnesses, but it is still significantly positive. This result is in accordance with the notion that while workers cannot affect the probability of injuries (and thus the incidence rate), they can influence the number of sick days following an injury.

7. Other explanations?

These analyses and their results present a rather calculating picture of workers' absence behaviour. Can financial incentives really be so important for workers when they determine whether they are to show up at work or report sick? As reported in the introduction, Hassink and Koning (2005) report a sharp drop in the absence rates following the introduction of a lottery where workers could win 75€ in the form of coupons. Thus workers apparently change behaviour even for measly gain. Is the incentive-story a plausible explanation in our case?

To address this question, we end this section by running a series of Conditional Probit (within job) regressions where we study what it takes to eliminate the observed positive relationship between absence and changes in the anticipated marginal tax rate. These regressions are presented in Table 8.

One possible conflicting explanation that would produce apparently identical empirical results in our regressions is that workers are less worried for their jobs and consequently about their performance during good times. At the same time during good times workers experience larger wage growth than in recessions. Thus on the margin, one would observe increased anticipated marginal tax rates in industries experiencing growth, at the same time as one would observe increased absence rates in these industries due to less concerned workers. These two relationships will then imply that we should observe a positive relationship between the anticipated marginal tax rate and the absence rate. To exclude this explanation we introduce the anticipated wage growth previous period as one of the controls in Model 1.[8] We see that the anticipated wage growth last period correlates significantly negatively with absences, thus rejecting our competing explanation. More importantly, however, this introduction cause only minor changes to occur with respect to the impact of the anticipated marginal tax on absences.

[Insert Table 8 around here]

Next in Model 2 we incorporate into the control vector a worker's total earnings previous year. One motivation for this inclusion is that if our results follow from some regression-towards-the-mean effect (high wage and few absences last period, lower wage and more absences next period) the inclusion of this variable would capture this effect. The explanation above, i.e., that good performance last year may make workers less worried about their job next year, also implies a positive relationship between payment last year and absences the following year. While the level of total earnings last period affects absences positively, a finding in line with explanations above, the inclusion of this control variable strongly reduces the impact of the anticipated marginal tax on absences. The impact is, however, still positive and significant at a 1 percent level of significance. So even after control for total earnings last period and anticipated wage growth last period we still observe a positive relationship between anticipated marginal earnings taxes and the relative number of absence days. All though we do not show this, we have also estimated regressions including log daily wage squared to eliminate the possibility that the observed impact of the anticipated marginal tax on absences follows a second order earnings effect. This has, however, negligible effect on the impact of the anticipated marginal tax.

[8] Remember that this variable is defined as the average wage growth from period t-2 to t-1 for workers employed within the same 3-digit industry having the same 4-digit educational qualification. We argue that this wage measure should capture changes in the workers outside options.

As is seen in Section 3 the marginal earnings tax rate vary quite irregularly at low earnings levels, and this observation may possibly be interpreted as evidence for the notion that workers would have no idea about which marginal earning tax rate level they actually face. Most workers, on the other hand, will due to media interest be aware of the top tax rates. Thus it is interesting to study the potential differential impact of the anticipated marginal tax rate on absences depending on the earning tax level. In Model 3 we split the anticipated marginal tax rate into two parts by splines. The first variable, called the anticipated marginal tax rate-basis, is defined equal to the anticipated marginal tax rate for earnings not invoking top tax, otherwise it is zero. The second variable, named the anticipated marginal tax rate-top, is defined equal to the anticipated marginal tax rate for earnings invoking top tax, otherwise it is zero. In Model 3 we see that *both* the anticipated marginal tax-variables are strongly significant and positive. The impact is actually stronger for the basis tax, i.e., we find support for a differential impact depending on the position in the wage distribution.

In Models 4-8 we conduct the same set of regressions on selected samples of workers. In Model 4 we focus on workers employed in workplaces where employers provide full compensation.[9] Thus we discard information on 20 000 jobs. Compared to the results of Model 2, this causes only minor changes.

In Model 5 we focus on full-compensation workplaces where neither stocks nor stock options were provided to employees. We expect stocks and stock options provided to the employees to reduce absenteeism and to increase performance by partly increasing the involvement of workers and partly introducing what can be considered an element of profit sharing or performance pay. Since a majority of employers providing full compensation also provide stocks and stock options this massively reduces the number of jobs included in the

[9] Public-financed sick pay provides full compensation for earnings less than 336000Nok. Average earnings for full-time workers employed the whole year across both public and private sector is 331000Nok. 45 percent of all private sector workers (excluded public administration, health care and education) earn more than 336000Nok, and thus need to receive additional sick pay from their employers to achieve full compensation.

analysis – we end up discarding information on 40000 jobs. The impact of the anticipated marginal tax rate on absences is cut in half, but is still significant.

In Model 6 we focus on workplaces where employers provide full compensation and fixed pay contracts only. Information on close to 30000 jobs is discarded. The impact of the anticipated marginal tax is still positive and significant.

Finally in Models 7 and 8 (equivalent to Models 2 and 3) we focus on jobs where employers provide full compensation, remuneration comprise neither stocks nor stock options, and workers are paid fixed pay. These workers receive the same pay from their employers whether they are absent or not and regardless of their performance, but their return on effort would drop whenever taxes are raised and consequently we would still expect that their absence behaviour would be affected. In both Models 7 and 8 we see a strong significant negative impact on absences from wages, so higher wages are correlated with fewer lost sick days. More importantly, the impact from the anticipated marginal tax rate drops to zero and is highly insignificant. Thus we conclude that when workers' absence behaviour cannot affect pay, changing tax rates leave workers' absence behaviour unaffected. This indicate that it is not enough that the return on effort is affected by changing marginal taxes, but workers have to be aware of that their remuneration depends on their effort (and thus indirectly on absences).

9. Conclusion

While negative financial incentives impact on absence has been studied in decades, the potential importance of the earning tax system has largely been ignored. Thus we supplement a scarce literature. During the period 2000-2004 several changes occur in the Norwegian tax system, particularly with respect to the earnings tax and the pay-roll tax. A majority of workers is not affected by the changes in the earnings tax legislation, but in our data for 2-8 percent of workers each year, at the margin, the changes are considerable.

Our analyses clearly show that when workers expect to be taxed harder, i.e., when their return to effort drops, then it seem that their probabilities to be absent from work increases. Thus our results are supportive of Johansson and Palme (2002). We find that both the incidence rate and the relative number of lost work days increase quite significant, and the latter increase more so. This is as anticipated since in this case, the tax increase not only affects the worker decision on if he or she will turn absent (by making it more likely), but also his or hers decision on when to return to work (i.e., by extending the number of sick days).

Our results are surprising since they depict workers as very informed and rational acting individuals. We think it is fair to assume that many workers, possibly even the majority, have no idea of the kinks and twist of the tax system. However, for the minority of workers on the margin, those that are affected by these changes in the marginal tax rate, it seems that they actually are informed, and they adapt and change their sickness behaviour in quite a rational way. On the other hand, in the economic literature on labour supply, on active labour market policies and on unemployment benefits, there is a long history in providing evidence of rational behaviour, so our surprise is possibly without merit.

It is, however, not reasonable that all kinds of absences can be understood in an efficiency wage framework. Some kinds of illnesses cannot be (or are less) affected by workers' decisions on absence. If for example a serious injury occurs, then most workers are unable to decide whether or not to turn absent.[10] Thus, in accordance with this notion, we observe that the marginal earnings tax does not affect the incidence rate of injuries. When to return to work after an injury is still at the discretion of the worker (not to be taken literally, it

[10] Of course workers still have the discretion to determine whether or not getting a physician certified sick leave when it comes to minor injuries.

will of course involve the counsel of the physician), and thus we observe a positive relationship between sick days and changes in the marginal tax rate.

Our findings also provide an important nuance to Johansson and Palme's results. For the tax changes to affect worker behaviour, workers' remuneration has in some ways to be sensitive to worker effort. If workers are fully compensated and are paid a fixed pay with no stocks or no stock options, the return on effort is fixed. Whether they show up at work or stay home, whether they put in a lot of effort or not, it does not matter for their payment. Changes in the tax system in this case, albeit causing variation in the return on effort but of an equal kind, should not matter. And this is actually confirmed by our analyses. For workers employed under fixed pay contracts providing full compensation for absence, no significant relationship between the earnings tax and absences is observed. The reader should however note a potential drawback related to our findings in this case. By focussing on this sample, we discard 90 percent of our jobs and observations, and clearly analyse a highly selected sample.

What can we learn from our study? Firstly, it clearly reveals that workers react to financial incentive, whether they are intended or not. Thus one should be aware that the structure of the tax system, influences workers return to effort, and thus directly influence workers' effort on the job and indirectly affect their absence behaviour. This again implies that some changes to the tax system are more costly than others, and that the progressive tax systems of the Scandinavian welfare countries have certain negative aspects associated with it. This does not imply that these systems, by ensuring a high degree of redistribution and financing public welfare, are not without merit, just that there exists some negative consequences that one either is not aware of or do not talk about. Since only a minority of the workers is affected by these changes, we have to refrain from drawing conclusion on the aggregate financial performance of public tax revenue versus publicly financed sick pay. However, our main results support Johansson and Palme (2002). One implication following these studies is the notion that whenever politicians and public authorities consider implementing tax reforms, the evaluation should extend beyond tax revenue, earnings- and labour supply-considerations, and take into account possible worker absence effects as well. Increasing the marginal earnings tax to increase tax revenue to cover public welfare will paradoxically also increase public expenditure on welfare though increased sick pay. From a public economy perspective future studies should clearly address this issue on a wider basis using more comprehensive data. Secondly, from the perspectives of the private firms, one should be aware of this phenomenon when they determine their policy with respect to pay and compensation. Future analyses should address whether this actually influence firms' decisions to implement certain remuneration and compensation regimes.

Appendix

A1 An axiomatic illustration

Our theoretical motivation is found in the efficiency wage model of Barmby, Sessions and Treble (1994). We introduce these taxes in the model in a way that will exaggerate the impact. Firstly, we assume that only wages are subject to earning taxes, not sick pay and unemployment insurance. This is assumed to account for the progressive element in the earning taxes. Secondly, we assume that wages and sick pay are subject to pay-roll taxes. Let t denote earning tax rate, while p denote the pay-roll tax.

Let δ represents and index of workers' general level of health, where δ in [0,1]. As a worker's health deteriorates, $\delta \rightarrow 1$, and he or she experiences a higher valuation of leisure. The firm offers a contract specifying a fixed number of work hours, denoted by h. For present workers the firm's pays wages w. Furthermore, the firm pays sick pay to absent workers, based on a notion of acceptable illness. The firm does not observe the true health of the worker. The sick pay is larger than workers outside options, which is basically governed by the unemployment insurance, i.e., sick pay=s>b=unemployment insurance.

For the workers this means that they face three utility alternatives:

A1) $U_{na}=(1-\delta)(1-t)w+\delta[T-h]$, $U_a=(1-\delta)s+\delta T$, $U_u==(1-\delta)b+\delta T$.

From A1) one can derive that a worker will never work if $\delta>\delta_b=((1-t)w-b)/((1-t)w-b+h)$, and that there exists an indifference limit $\delta_a=((1-t)w-s)/((1-t)w-s+h)$, making the worker indifferent between absence and non-absence. We assume that the acceptable illness level, denoted δ_z, for which sick pay, s, is correctly paid, is in $[\delta_b, 1)$. However, $\delta_a < \delta_b$, and thus the workers have incentives to overstate their true sickness and consequently to "shirk".

To discover workers true health the firm may pay k for each worker to achieve a positive probability α of discovering the workers' true state of health. So α expresses the probability of discover a worker shirking. A worker caught shirking is fired. Since unemployment insurance is assumed strictly less than the sick pay, the positive probability of being fired when shirking, alters the workers behaviour. The expected utility of shirking is a weighted sum of the utility as unemployed and the utility as absent with the probability of being caught/not caught shirking as weights. Thus there exists a reservation sickness level, $\delta_c=((1-t)w-\beta)/((1-t)w-\beta+h)$, where $\beta=\alpha b+(1-\alpha)s$, such that $U_{na}(\delta_c)=\alpha U_u(\delta_c)+(1-\alpha)U_a(\delta_c)$. δ_c will be in (δ_a, δ_b). In this setting we see that the probability of absence is expressed by:

A2) $\Pr(\text{absent})=1-\delta_c=1-((1-t)w-\beta)/((1-t)w-\beta+h)=h/((1-t)w-\beta+h)$,

where $\partial \Pr(\text{absent})/\partial w<0$ and $\partial \Pr(\text{absent})/\partial t>0$.

The profit maximising firm optimise by setting wages and by offering a number of employment contracts, while it takes into account the temptation for workers to shirk. Barmby, Sessions and Treble assume a simple expected revenue function, g(n), $g'(n)>0$ and $g''(n)<0$, where n denotes the number of present workers. The expected number of present workers is expressed by $\delta_c n$. The firm's maximising problem can thus be expressed:

A3) $\max_{(w,\tilde{n})} E[\Pi(w, \tilde{n})]=g(n)-[\delta_c (1+p)w+(1-\delta_c)k+(1+p)(1-\delta_z)s-(1+p)(1-\alpha)(\delta_z - \delta_c)s]\tilde{n}$.

The two first-order conditions can then be expressed as:

A4) $\delta_c^2= (\partial\delta_c/ \partial w)[(1+p)s(1-\alpha\delta_z)+k]$,

A5) $g'(n)=(1+p)w+(1/\delta_c)[(1-\delta_c)k+(1-(\alpha\delta_z +(1-\alpha)\delta_c))s]$.

From totally differentiating Equation A4), we find

A6) $$\frac{dw}{dp}=\frac{\frac{\partial\delta_c}{\partial w}s(1-\alpha\delta_z)}{\frac{\partial(\delta_c^2)}{\partial w}-\frac{\partial^2(\delta_c)}{\partial w^2}\left[(1+p)s(1-\alpha\delta_z)+k\right]}>0.$$

Note that if sick pay is not subject to the pay-roll tax or if sick pay is negligible, then firm wage setting is less or not at all affected by the pay-roll tax.

What happens with the firm's pay setting if the earnings tax changes? Unfortunately analytically this yield an ambiguous impact, but intuition implies that an increased earnings tax decreases labour demand and makes it more expensive to use pay to offset costly shirking.

A2 First step Wage regressions

[Insert Table A around here]

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Table 1 Marginal earnings tax during 2000-2004. Main area. Tax in percent.

Year	Tax free threshold	Low	Main	Top threshold 1	Top threshold 2	Tax 1	Tax 2
2000	3900	7.8<=29.1	<=35.8	277800	762700	49.3	55.3
2001	30600	7.8<=29.1	<=35.8	289000	793200	49.3	55.3
2002	31800	7.8<=29.1	<=35.8	320000	830000	49.3	55.3
2003	31800	7.8<=29.1	<=35.8	347000	872000	49.3	55.3
2004	31800	7.8<=29.1	<=35.8	354300	906900	49.3	55.3

Note: State tax is 7.8 of gross earnings. Municipality tax is usually 28.0, but dependent on deducts. Main area comprises all of Norway except the northernmost county and municipalities bordering to this county (this northernmost area is also characterised by having zero pay-roll tax). Threshold level figures expressed in NOK (1£=11NOK).

Table 2 Pay-roll tax during 2000-2004. Tax in percent.

	Pay-roll tax zones					Threshold level	Additional pay-roll tax
	1	2	3	4	5		
2000	14.1	10.6	6.4	5.6	0	774032	12.5
2001	14.1	10.6	6.4	5.6	0	809648	12.5
2002	14.1	10.6	6.4	5.6	0	851728	12.5
2003	14.1	10.6	6.4	5.6	0	853728	12.5
2004	14.1	14.1	8.3	7.3	0	930224	12.5

Note: The threshold level denotes workers' earnings level needed to invoke an additional pay-roll tax. Threshold level figures expressed in NOK (1£=11NOK).

Table 3 Sick days relative to working days. In percent.

Year	All	Muscles-Skeleton	Psych./Nervous syst.	Respiratory	Pregnancy	Others	Injuries
ALL							
2000	5.59	2.70	0.97	0.55	0.22	1.15	0.40
2001	6.27	2.94	1.26	0.52	0.20	1.36	0.42
2002	6.54	3.00	1.36	0.51	0.22	1.46	0.44
2003	6.72	3.11	1.43	0.50	0.27	1.41	0.45
2004	6.09	2.75	1.34	0.41	0.27	1.33	0.43
NWERS							
2000	6.34	3.23	1.09	0.57	0.18	1.28	0.48
2001	6.27	3.10	1.15	0.51	0.19	1.33	0.47
2002	6.54	3.23	1.19	0.52	0.19	1.42	0.51
2003	6.57	3.27	1.27	0.48	0.21	1.36	0.48
2004	5.81	2.79	1.12	0.39	0.23	1.28	0.43

Note: ALL: Based on 8277081 observations of the population of workers employed by the same employer during the whole year. NWERS: Based on observations of the population of workers employed by employers participating in the questionnaires NWERS1997 and NWERS2003.

Table 4 Descriptive statistics on workers affected by earning tax reforms. NWERS-panel. Workers 20 – 60 years of age. Strictly positive earnings last period.

Year	Statistic	Total earnings previous period	Anticipated marginal tax	Anticipated change in marginal tax	No changes in anticipated marginal tax	Increase in anticipated marginal tax	Reduction in anticipated in marginal tax
2000	Mean	291	41.8	0.4	97.5	1.3	1.2
	Max	2204	55.3	28.0	1	1	1
	Min	0.3	0	-28.0	0	0	0
2001	Mean	309	41.9	-0.3	97.5	1.3	1.2
	Max	3145	55.3	28.0	1	1	1
	Min	1.1	0	-28.0	0	0	0
2002	Mean	330	42.0	-12.2	91.8	3.4	4.8
	Max	2647	55.3	28.0	1	1	1
	Min	0.9	0	-28.0	0	0	0
2003	Mean	350	41.8	6.2	97.7	1.4	0.9
	Max	2611	55.3	28.0	1	1	1
	Min	0.3	0	-28.0	0	0	0
2004	Mean	363	41.8	5.2	97.8	1.3	0.9
	Max	3324	55.3	28.0	1	1	1
	Min	0.3	0	-28.0	0	0	0

Note: Earnings figures are reported in 1000 NOK, while all tax figures are reported in percent. The table is based on observations of the population of workers employed by employers participating in the questionnaires NWERS1997 and NWERS2003. The yearly distribution of workers is as follows: 85751(2000), 72402 (2001), 76427 (2002), 74113 (2003), and 71252 (2004).

Table 6 The impact of pay and tax reforms on absenteeism (proportion of work days absent). Fixed job effect.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Dep. Variable:	Proportion of work days absent t					
Anticipated marginal tax rate	0.0005**	0.0005**	0.0005**	0.0005**	0.0006**	0.0004**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Log daily wage	-0.0445	-0.0357	-0.0275		-0.0622	-0.0015
	(0.0653)	(0.0629)	(0.0669)		(0.0724)	(0.0783)
Log earnings				-0.0319		
				(0.0751)		
Full-time worker	0.0625**	0.0602**	0.0579**	0.0607**	0.0727**	0.0523*
	(0.0189)	(0.0183)	(0.0193)	(0.0253)	(0.0251)	(0.0200)
Experience (years) squared			0.0001**	0.0001**	0.0001	0.0001**
			(0.0000)	(0.0000)	(0.0001)	(0.0000)
Seniority (years) squared			-0.0001**	-0.0001**	-0.0001**	-0.0001**
			(0.0000)	(0.0000)	(0.0000)	(0.0000)
Employment spell (days) year		-0.0002**	-0.0002**	-0.0001	-0.0003**	
		(0.0001)	(0.0001)	(0.0002)	(0.0001)	
Controls for:						
Intercept, year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Method:						
First-difference (job) – IV	Yes	Yes	Yes	Yes		Yes
Fixed job effect – IV					Yes	
Sample:						
Employed whole year						Yes
Strength/appropriateness of instruments						
F-value excl. pay-roll tax var.	18.7	21.4	18.7	12.2	20.6	11.4
Cragg-Donald minEval/L2 F	25.7	26.7	24.4	17.9	18.4	23.3
Hansen J (p-value)	0.01(0.97)	0.01(0.91)	0.03(0.87)	0.02(0.89)	0.10(0.75)	0.48(0.49)

Anderson canon. Corr. LR	51.3(0.00)	54.0(0.00)	48.8(0.00)	35.7(0.00)	36.7(0.00)	46.6(0.00)
Jobs (IxE)	106591	106591	106591	106591	108551	89301
Observations (IxExT)	291444	291444	291444	291444	408399	257051

Note: Based on observations of jobs (combination of workerXworkplace) given by the population of workers employed by employers participating in the questionnaires NWERS1997 and NWERS2003. See Appendix A2 Table A for first step regression results. The pay-roll tax rate variables (anticipated pay-roll tax rate t, fixed pay-roll tax rate t) are used as instrument for wages (or earnings). ** and * denote 1 and 5 percent level of significance, respectively.

Table 7 The impact of pay and tax reforms on the probability of being absent.

Fixed job effect.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Indicator if being absent at least once (=1) during year t					
	All kinds of absences		Muscles-skeletal		Injuries	
Anticipated marginal tax rate	0.0058**	0.0056**	0.0054**	0.0050**	-0.0011	-0.0009
	(0.0011)	(0.0011)	(0.0006)	(0.0006)	(0.0009)	(0.0009)
Log daily wage	-0.1091**		-0.2995**		0.2827**	
	(0.0307)		(0.0332)		(0.0538)	
Predicted log daily wage		0.0100		0.0303**		0.0158
		(0.0059)		(0.0094)		(0.0151)
Full-time worker	0.7034**	0.6600**	0.5833**	0.4740**	0.1920*	0.2738**
	(0.0508)	(0.0496)	(0.0564)	(0.0553)	(0.0978)	(0.0961)
Experience (years) squared	0.0011**	0.0012**	0.0005**	0.0006*	0.0007*	0.0006
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)
Seniority (years) squared	-0.0014**	-0.0014**	-0.0015**	-0.0015**	0.0008	0.0008
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0005)
Employment spell (days)	Offset	Offset	Offset	Offset	Offset	Offset
Controls for:						
Intercept, year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Method:						
Conditional logit	Yes	Yes	Yes	Yes	Yes	Yes
IV for daily wage		Yes		Yes		Yes
Jobs (IxE)	54636	54636	38463	38463	16659	16659
Observations (IxExT)	222218	222218	156847	156847	67835	67835

Note: The pay-roll tax rate variables (anticipated pay-roll tax rate , fixed pay-roll tax rate) are used as instrument for wages. See tables 5 and 6 for information on instruments. Regression Model 3 in Table 5 is used for predicting log daily wage. ** and * denote 1 and 5 percent level of significance, respectively.

Table 8 The impact of pay and tax reforms on the proportion of work days lost due to absenteeism. Fixed job effect.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Dep. variable: the number of work days absent during year t					
	All kinds of absences		Muscles-skeletal		Injuries	
Anticipated marginal tax rate	0.0213**	0.0205**	0.0222**	0.0214**	0.0183**	0.0187**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0004)	(0.0004)
Log daily wage	-1.0187**		-1.2567**		-1.2638**	
	(0.0021)		(0.0030)		(0.0087)	
Predicted log daily wage		0.0602**		0.0825**		0.0232**
		(0.0009)		(0.0015)		(0.0151)
Full-time worker	1.0722**	0.6681**	1.1506**	0.6615**	0.6500**	0.3797**
	(0.0044)	(0.0043)	(0.0064)	(0.0047)	(0.0197)	(0.0191)
Experience (years) squared	0.0008**	0.0012**	0.0009**	0.0014**	0.0010**	0.0012**
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Seniority (years) squared	-0.0034**	-0.0037**	-0.0037**	-0.0041**	-0.0028**	-0.0028**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Employment spell (days)	Offset	Offset	Offset	Offset	Offset	Offset
Controls for:						
Intercept, year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Method:						
Conditional Poisson	Yes	Yes	Yes	Yes	Yes	Yes
IV for daily wage		Yes		Yes		Yes
Jobs (IxE)	54219	54219	32282	32282	11522	11522
Observations (IxExT)	182466	182466	110114	110114	39846	39846

Note: The pay-roll tax rate variables (anticipated pay-roll tax rate t, fixed pay-roll tax rate t) are used as instrument for wages. See tables 5 and 6 for information on instruments. Regression Model 3 in Table 5 is used for predicting log daily wage. ** and * denote 1 and 5 percent level of significance, respectively.

Table 9 The impact of pay and tax reforms on the number of work days lost due to absenteeism. Fixed job effect. All kinds of absences

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Dep. variable: the number of work days absent during year t							
Antici.marginal tax rate	0.0231**	0.0036**		0.0043**	0.0018**	0.0030**	-0.0001	
	(0.0001)	(0.0001)		(0.0002)	(0.0003)	(0.0003)	(0.0004)	
Antici. marg. tax rate			0.0047**					-0.0005
basis			(0.0001)					(0.0005)
Antici. marg. tax rate			0.0035**					-0.0001
top			(0.0001)					(0.0004)
Log daily wage	-1.0199**	-1.0306**	-1.030**	-0.5559**	-0.5856**	-0.9365**	-0.738**	-0.739**
	(0.0022)	(0.0022)	(0.0022)	(0.0029)	(0.0049)	(0.0042)	(0.0071)	(0.0071)
Full-time worker	1.0690**	0.9473**	0.9457**	0.8626**	1.0393**	0.9498**	1.1048**	1.1081**
	(0.0045)	(0.0045)	(0.0045)	(0.0057)	(0.0096)	(0.0042)	(0.0160)	(0.0160)
Experience (years)	0.0009**	0.0012**	0.0012**	0.0016**	0.0014**	0.0013**	0.0014**	0.0014**
squared	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Seniority (years)	-0.0035**	-0.0036**	-0.0036**	-0.0034**	-0.0025**	-0.0027**	-0.003**	-0.0025**
squared	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Anticipated wage	-0.4761**	-0.2927**	-0.305**	-0.3724**	-0.4819**	-0.2152**	-0.258**	0.266**
growth year t-1	(0.0089)	(0.0090)	(0.0090)	(0.0106)	(0.0173)	(0.0163)	(0.0284)	(0.0285)
Total earnings year		0.0042**	0.0047**	0.0034**	0.0042**	0.0040**	0.0043**	0.0043**
t-1/1000		(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Employment spell (days)	Offset	Offset	Offset	Offset	Offset	Offset	Offset	Offset
Restrictions on workplace population								
No restrictions	Yes	Yes	Yes					
Employer ensure full compensation				Yes	Yes	Yes	Yes	Yes
Stocks/stock options not provided to employees					Yes		Yes	Yes
Fixed pay only						Yes	Yes	Yes

Controls for:								
Intercept, year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Method:								
Conditional Poisson	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Jobs (IxE)	54219	54219	54219	35542	10911	16062	5153	5153
Observations (IxExT)	182466	182466	182466	120316	36584	53940	17367	17367

Note: ** and * denote 1 and 5 percent level of significance, respectively.

Table A2 The impact of tax reforms on wages. Fixed job effect.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Dep. Variable:	Ln W	Ln W	Ln W	Ln E	Ln W	Ln W	Ln W
Anticipated marginal tax rate	0.0002**	0.0003**	-2.5e-6	-0.0006**	0.0009**	-0.0004**	-0.0027**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Anticipated pay-roll tax rate	-0.0012**	-0.0013**	-0.0012**	-0.0010**	0.0014**	-0.0009**	0.0001
	(0.0003)	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Fixed pay-roll tax rate	0.0062**	0.0062**	0.0059**	0.0057**	0.0041**	0.0069**	0.0057**
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0011)	(0.0024)	(0.0015)
Full-time worker	0.2860**	0.2869**	0.2852**	0.3345**	0.3436**	0.2503**	0.2691**
	(0.0070)	(0.0070)	(0.0070)	(0.0091)	(0.0059)	(0.0071)	(0.0073)
Experience (years) squared			-0.0005**	-0.0005**	-0.0003**	-0.0004**	-0.0003**
			(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Seniority (years) squared			-0.0003**	-0.0005**	-0.0003**	-0.0002**	0.0001**
			(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
Employment spell (days)		-0.0009**	-0.0009**	0.0030**	-0.0007**		-0.0009**
		(0.0002)	(0.0001)	(0.0001)	(0.0002)		(0.0001)
Method: First-difference	Yes	Yes	Yes	Yes		Yes	Yes
Method: Fixed effect					Yes		
Sample: Employed whole year						Yes	
Sample: Earnings above tax-free limit							Yes
R^2	0.051	0.066	0.069	0.164	0.131	0.049	0.067
Jobs (IxE)	106591	106591	106591	106591	106603	92347	89301
Observations (IxExT)	291444	291444	291444	291444	401526	257051	252413

Note: Based on observations of jobs (combination of workerXworkplace) given by the population of workers employed by employers participating in the questionnaires NWERS1997 and NWERS2003. LnW and lnE denote log daily wage and log yearly earnings, respectively. All regressions comprise an intercept and year dummies. ** and * denote 1 and 5 percent level of significance, respectively.