Sick of Taxes? Sick Leave, Effort, and Taxes

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Abstract

We estimate a compensated price elasticity of sickness absence. Sick leave is an intensive margin of labor supply where individuals are free to adjust. The elasticity tells us about the price responsiveness of effort and program participation. We exploit variation in tax rates over two decades, which provide thousands of differential incentives across time and space, to estimate the price responsiveness. High taxes provide an incentive to take more sick leave, as less after tax income is lost when taxes are high. The panel data allow for extensive controls, including unobserved individual characteristics, and the panel is representative of the full population. We find a substantial price elasticity of sick leave, -0.7, with respect to the net of tax rate. This indicates that high tax rates significantly reduce work effort and increase program participation.

JEL codes: H31, I31, J22

Key words: sick leave, work effort, taxes

1 Introduction

Employee absenteeism may represent several dimensions of behavior. Being absent may demonstrate low effort and dedication in the work place. Absenteeism and claiming social insurance benefits is a program participation decision. We study sick leave in Sweden, and estimate its price elasticity.[1]

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[1] Social insurance programs that cover lost earnings due to health shocks exist in most developed nations, see for example Bound and Burkhauser (1999) and Barmby, Ercolani and Tremble (2002).

We use variation in marginal tax rates to identify the price responsiveness of sick leave, where other papers have used changes in program rules. Our approach recovers the compensated price elasticity where other papers have focused on uncompensated treatment effects. The price elasticity sheds light on the responsiveness of worker effort and program participation to incentives.

Empirical studies of work effort are few since effort is hard to observe. As sick leave is very much at the individual's discretion, we argue it is an observable effort choice. For the first week of each spell the individual determines himself if he is fit to work or entitled to sick leave benefits.[2] The program provides a very flexible way for individuals with low motivation to not exert effort on the job. Our hypothesis is that such discretionary sick leave is related to the returns from working.

The fact that sick leave is at the individual's discretion provides a unique opportunity to estimate labor supply responses in a setting where workers are free to choose how much to work. The literature has mostly found small elasticities of intensive margin labor supply with respect to the returns to working, see for example Blundell and MaCurdy (1999), but these estimates may be severely biased due to employees limited scope for adapting to wage changes.[3] We avoid this challenge by looking at a margin where employees are free to adjust. The few studies that have analyzed labor supply where workers are free to adjust have relied on very select samples.[4] Our sample is representative of the full population.

Absenteeism as a measure of effort has been studied in a couple of papers. Ichino and

[2]The program replaces earnings due to any injury or illness. At the beginning of the second week a physician needs to validate the condition.

[3]See for example Kahn and Lang (1991) and Dickens and Lundberg (1993).

[4]For example Camerer et al (1997) and Farber (2005) study cab drivers in New York City, Fehr and Goette (2007) study bike messengers in Zurich, and Oettinger (1999) studies stadium vendors.

Maggi (2000) examine how absenteeism is influenced by regional background. Ichino and Riphahn (2005) studies how employment protection affects effort.[5] None of these papers study the price elasticity of effort, which we do.

The benefit of using tax rates to obtain the price elasticity is that there is a lot of variation in tax rates. Taxes rates vary across time, locations, and due to the progressivity of the tax code. This provides thousands of differential treatments across time and space from which we can obtain the price response. In contrast, the program participation literature has focused on evaluating changes in replacement rates within the program, frequently a change at one point in time with one treated group and one control group.

Several papers have studied how rule changes affect benefit use in Sweden.[6] Two papers study the effect of a reform of the corresponding program in Germany.[7] The Workers' Compensation program, which replaces earnings due to work related injuries, would be the most closely related program in the U.S., see Meyer, Viscusi, and Durbin (1995), Krueger (1990), and Curington (1994). The Swedish sick leave program does not impose a limit on the length of spells, hence making it comparable to disability insurance.[8, 9] Some papers focus on aspects other than replacement rates; de Jong, Lindeboom, and van der Klaauw (2011) studies effects of stricter screening in Holland and Hesselius, Johansson, and Larsson (2005) examines laxer screening in Sweden.[10]

Individuals forego some income if they claim sick leave benefits rather than work. The

[5] Mas and Moretti (2009) study how colleagues influence work effort.

[6] See Johansson and Palme (1996, 2002, 2005), Henrekson and Persson (2004), and Pettersson-Lidbom and Skogman-Thoursie (2008).

[7] See Ziebarth and Karlsson (2009) and Puhani and Sopnderhoff (2009).

[8] Disability insurance behavior has been studied in the U.S. and elsewhere. Studies include Bound (1989), Gruber (2000), Autor and Duggan (2003), Campolieti (2004), and Chen and van der Klaauw (2008).

[9] However, few individuals have long spells during the period we study. There is an early retirement program individuals can enter if permanently injured.

[10] Low and Pistaferri (2010) take a structural approach to evaluate the welfare effects of stricter screening.

forgone income after tax is less when marginal taxes are high, hence we'd expect sick leave to be higher when marginal tax rates are higher, ceteris paribus. In the data we find that sick leave is substantially higher when the opportunity cost is lower. We account for a large number of controls including individual fixed effects that capture unobserved heterogeneity. We use a random sample of the 1974 population in Sweden, about 162,000 individuals, who we follow during 17 years.

Our results show a sizable price elasticity of days of sick leave with respect to the net of tax rate. Our preferred estimate is -0.7. The price elasticity is a new contribution to the work effort literature. The finding is consistent with the program participation literature, absenteeism is higher when its price is lower, but the price variation and the data we used to obtain the estimate are new.

The next section describes the sick leave program in more detail, and section 3 presents the data. The following two sections discuss the economic and empirical models. The empirical results are presented in section 6. Section 7 concludes.

2 The Sick Leave Program

Sweden has a publicly run sick leave insurance program that covers lost earnings in the case of basically any injury or illness.[11] It is very easy to claim the benefits. For the first week of each spell, the law gives the individual the discretion to determine if he is fit to work or not. If he wants to claim the sick leave benefits he makes two phone calls, one to the social insurance office and one to his employer.[12] There is no fixed allocation of sick leave days,

[11] In a comparison to the U.S. the program encompasses both 'personal days' provided in employment contracts (although restricted to sick leave) and the workers' compensation program.

[12] Benefits are paid by the social insurance office directly to the claimant.

you can use the insurance as long as your sickness requires and for as many spells as you like. For spells up to 7 days the individual himself determines if he is fit to work. For spells longer than 7 days it is required that a physician validates your condition. Monitoring of actual sickness is very light, at least in part due to the difficulty in verifying conditions like stomach ache and back pain.

The rules governing sick leave insurance have been remarkably constant over the 1974-1990 period.[13] In 1974 sick leave benefits became taxable income[14] and data on the benefits become available. The replacement rate for lost earnings due to sickness was set to 90%. The daily benefit is calculated as 90% of normal annual labor earnings divided by 365, up to a cap. The replacement cap is indexed to inflation. About 93 percent of the incomes are below the cap, and 6 percent of the sick leave observations are above the cap.

Benefits can be claimed from the second day of the sickness spell. The definition of the second day is, however, quite generous. It is sufficient to call in sick before midnight and that day counts as the first day of the spell. If you think you'll be sick tomorrow you can always call in sick today and the first unpaid day is of no consequence, and if it turns out that you're fit for work tomorrow you can change your mind.

If the sickness spell is shorter than 7 days there is no requirement that a physician validates your condition.[15] This system was in place until 1987. From 1988 through 1990 the first day of no coverage was abolished.[16] We can't extend the analysis further than 1990 since another reform makes the data from 1991 and on difficult to compare to previous years.

Most sick leave spells are short, about 95 percent are shorter than one month (Source:

[13]The sick leave program was passed into law in 1962 (SFS 1962:381) and it took effect in 1963.
[14]The updates to the program are detailed in law SFS 1973:465.
[15]Spells shorter than 7 days do not pay benefits on weekends.
[16]The updates to the program are detailed in law SFS 1987:223.

Försäkringskassan). You need to have earnings for six months in order to qualify for the sick leave benefits and be less than 65 years of age. The program is universal and it is administered by the central government and does not depend on your employer. Benefits are financed through a flat payroll tax.

3 The Data

We use registry data on individual panels over the period 1974 to 1990 (from 1973 for lagged income). The data draw information from several sources; demographic information from the population registry, income information from the tax authorities, and various public benefits from the social insurance administration. We use a random sample of the 1974 population who we follow for 17 years.[17] About 3 percent of the population is sampled. In addition, household members are included in the data. This allows us to control for the household composition as well as spousal income. We define four education groups; at least 3 years of college, less than 3 years of college, completed high school, and not completed high school.[18]

Individuals are included in the analysis from ages 22 to 60. The age restrictions are due to the looser connection to the labor market of individuals at the tails of the life cycle. The young may still be studying and may not have a firm foot in the labor market. At ages close to retirement individuals face a number of incentives to leave the labor force that we don't model here, and we choose to exclude those observations. We restrict the analysis to individuals who are labor force participants, which is defined as having positive labor earnings in that year. Since the sick leave program is designed to replace lost labor earnings this

[17]The only sampled individuals that disappear from the data are those who die or emigrate.

[18]The highest education level is observed in 1990 and we use this value for the whole time period.

should be the relevant sample. The typical regression has just short of 2 million observations, which breaks down to about 162,000 individuals who are in the sample on average 12 years. Summary statistics are presented in Table 1.

3.1 Days of Sick Leave

The data contains direct information on claimed sick leave benefits by year and we want to transform it to days of sick leave. There are two reasons for this specification. First, economic models usually stipulate that agents choose days of sick leave so examining this measure is more in accordance with these theories. Second, examining days of sick leave makes it easier to interpret the estimated coefficients.[19]

Sick leave benefits for each individual are linear in the number of days claimed. Daily benefits are 90% of normal earnings up to a cap above which it is a flat amount per day. For individuals below the cap, days of sick leave are sick leave benefits divided by normal daily earnings qualifying for sick leave benefits. Normal earnings are according to the rules what you would have earned if you had worked, and may or may not correspond to actual earnings. We measure normal earnings based on a fixed effects regression. We regress real earned income on demographic interactions, a business cycle control, and an individual fixed effect for labor force participants over the sample period 1974-1990.[20] The fitted values of this regression including the individual fixed effect are the normal earnings for each individual. Normal annual earnings are divided by 365 to get daily earnings. For individuals above the replacement rate cap the procedure is simpler. The daily replacement benefit is the level

[19] Our results are robust to using the sick leave benefits directly rather than their transformation to days of sick leave.

[20] The demographic variables are full interactions of gender and education with age and age squared. The business cycle control is average regional employment rates.

of the annual cap divided by 365. Days of sick leave are then observed sick leave benefits divided by the maximum daily sick leave benefit. About 63% of the labor force participants claim some sick leave during the year.

3.2 Taxes

Income taxes in Sweden are levied at the national and municipal (kommun) levels. Municipal income tax rates are proportional to income and are set by each of the about 280 municipalities. There is a fair amount of variation in the cross-section of these taxes (the standard deviation in 1990 is 1.2 percentage points). Municipalities raise revenue through the income tax and service fees.[21] The proceeds are used to fund local public services like roads, sanitation, schools, and day care. National income taxes are progressive. During the whole period there is a basic tax. In 1983 a new tax base was introduced, called the additional amount. The additional amount is a separate tax base where some deductions, such as capital losses are cancelled.[22] The tax base for the national basic tax and the municipal taxes are virtually identical. Sweden has a single filer system, which makes it straightforward to compute marginal tax rates also for married couples. We observe taxable income as recorded by the tax authorities and we know the tax schedules for each year. Given this information we can compute marginal income taxes for each individual in the sample.

Average marginal tax rates for each year are plotted in figure 2. Marginal income taxes exhibit substantial variation over time and at different points of the income distribution, which is illustrated by the marginal tax rate schedules in figure 3. There are both increases

[21] Property taxes as well as the value added tax are levied by the national government.

[22] The tax base is similar to the alternative minimum tax in the U.S., although the tax is additional rather than alternative.

and decreases in tax rates across the whole income distribution, which is helpful in identifying the price response.[23] The tax schedules are based on a person living in Stockholm. For individuals in different locations the schedules have the same shape but if the municipal tax rate is higher their tax schedule would be shifted up correspondingly.[24]

When analyzing the tax rate variation we find that the time variation is the most important factor. In particular, accounting for changes over time at different income levels account for a majority of the variation. The variation in taxes across locations over time is also a factor, but it is relatively less important. The price variation we use has wide support, marginal tax rates vary between 25 and 90 percent.

4 Economic Model

In this section we present a simple economic model for sick leave. Consider an economy where agents have utility over consumption C and sick leave S,

$$U\left(C,S\right) \tag{1}$$

with utility increasing and concave in both arguments, that is, individuals enjoy both consumption and leisure from sick leave but at a diminishing rate. Decisions, which are made under certainty, are subject to the budget constraint

$$C = w\left(\bar{H} - S\right) + \delta w S + Y \tag{2}$$

[23] In comparison, program evaluations frequently look at one increase or one decrease in prices.

[24] Average taxable income is 134,000 SEK. It may also be noted that for 1983-1990 there is an additional source of tax variation introduced by the division of the tax base into the basic and additional amounts. In plotting the 1986 line we have assumed that the basic and additional amounts are equal. However, given the same basic amount taxable income some individuals face higher marginal tax rates if their additional amount exceeds their basic amount taxable income (for example due to capital losses). The tax rate schedule could be thought of as a correspondence rather than a step function.

The net of tax wage rate is w, δ is the sick leave replacement rate, and Y is non-labor income. $\bar{H}$ is a given labor contract that stipulates the number of work days. The choice of sick leave is a marginal decision while labor contracts are much less flexible. S is required to be no greater than $\bar{H}$. The first order conditions for this problem are

$$\begin{aligned} U_C &= \lambda \\ U_S &\leq \lambda w (1-\delta) \quad for\ S < \bar{H}. \end{aligned} \tag{3}$$

λ is the multiplier on the budget constraint and subscripts denote partial derivatives. We assume that consumption and sick leave are additively separable in the utility function and consider a exponential utility function for sick leave such that

$$U_S = \exp\left(-\frac{1}{b}(S+f)\right) \tag{4}$$

where both $b > 0$ and f are parameters. The parameter b determines how responsive marginal utility is to additional sick leave and f shifts the curve. Some individuals have f -parameters such that they will choose no sick leave, and others may find it optimal to choose $S = \bar{H}$. We substitute the parametric utility function into the first order condition at interior points and use the after tax wage $w = (1-\tau) W$, where τ is the marginal tax rate and W is the gross wage, to get

$$\begin{aligned} -\frac{1}{b}(S+f) &= \log(1-\tau) + \log W + \log(1-\delta) + \log\lambda \ \Leftrightarrow \\ S &= -b\left[\log(1-\tau) + \log W + \log(1-\delta) + \log\lambda\right] - f. \end{aligned} \tag{5}$$

The marginal effect of the log net of tax rate on sick leave is $\frac{dS}{d\log(1-\tau)} = -b < 0$. It is straightforward to allow the utility to depend on individual characteristics. The shifter f could be parameterized to consist of individual characteristics X, an individual specific component u and an idiosyncratic shock e such that $f = pX + u + e$. In the empirical analysis we allow f to depend on a number of individual and aggregate characteristics.

The model builds on the labor supply tradition. It is straightforward to think of S as days absent from work. We may also consider S as a measure of effort, where effort produces disutility that is traded off against consumption.

One obvious alternative to our story that taxes influence sick leave behavior is omitted health shocks. It turns out such shocks work opposite to our hypothesis that the log net of tax rate has a negative influence on sick leave. Consider a health shock, which would increase sick leave and in turn reduce income. As the tax rate is progressive the lower income would reduce the tax rate and increase the net of tax rate. The health shock produces a positive relationship between sick leave and net of taxes, which goes against our mechanism. Health shocks would produce a positive bias of our estimate.

5 Empirical Model

Consider an empirical model where days of sick leave for individual i at time t, denoted by $SL_{i,t}$, are chosen according to the following model.[25]

$$SL_{i,t} = \beta \log \left(1 - \tau_{i,t}\right) + \theta V_{i,t} + \pi X_{i,t} + u_i + e_{i,t} \tag{6}$$

where $\tau_{i,t}$ is the marginal tax rate, $V_{i,t}$ is the virtual income that captures income effects of tax changes, $X_{i,t}$ are individual characteristics, u_i is an individual effect, and $e_{i,t}$ is an unobserved i.i.d. shock. The individual effect is assumed to be fixed in the main specification. The choices of sick leave days per year are censored at 0 and 365. Since a substantial fraction

[25]Earlier work includes Allen (1981).

of individuals don't claim any sick leave during a year the censoring at 0 is particularly important. In the baseline regressions we use a linear fixed effects estimator with dummies at the two censoring points.

We choose to model taxes as the net of tax rate, since the net of tax rate is what an individual takes home on the margin. It is the relevant price facing the individual. Furthermore, the individual controls include an indicator of income above the replacement cap as these individuals face lower replacement rates than the stipulated rate.

The individual's budget set is linearized using virtual income.[26] Under the assumption that the tax rate was fixed at the same rate as the marginal tax rate he faces, the virtual income captures the net income an individual would have if he had zero taxable income.[27] The estimate of the coefficient θ is used to compute the income elasticity of sick leave with respect to tax changes.

We obtain the compensated elasticity of sick leave with respect to the net of marginal tax rate from the Slutsky relationship. Let $\zeta^C_{SL,1-\tau}$ and $\zeta^U_{SL,1-\tau}$ denote the compensated and uncompensated elasticities of sick leave with respect to the net of tax rate, $1-\tau$. Then,

$$\zeta^C_{SL,1-\tau} = \zeta^U_{SL,1-\tau} + \zeta_{SL,V}\frac{SL}{V}$$

where $\zeta_{SL,V}$ is the elasticity of sick leave with respect to virtual income.[28] It is the compensated elasticity that is important from a theoretical perspective to be able to assess the welfare cost of taxation.

[26]The method is frequently used in labor economics, see for example Blundell and MaCurdy (1999).

[27]The virtual income is computed as individual earnings, including capital income, minus income taxes paid minus the net of marginal tax rate times taxable income. In addition, spousal income is added when relevant.

[28]In terms of the empirical model, $\zeta^C = \beta/SL + \theta$.

5.1 Marginal Tax Rates

The marginal tax rate is a function of earnings. Since sick leave affects earnings there is a potential endogeneity bias in that tax rates are a function of sick leave, in particular if sick leave spells are long or frequent. If we denote the marginal tax rate function by $\tau(.)$, then the tax rate we want in terms of the economic model is $\tau\left(W\bar{H}\right)$. We observe marginal tax rates $\tau\left(W\left(\bar{H}-S\right)+\delta WS\right)$, which depend on sick leave choices. We observe sick leave benefits, and using the compensation rules we can compute taxable income if no sick leave would have been claimed by adding $(1-\delta)WS$ to observed taxable income. We apply the tax code to this adjusted taxable income and obtain marginal tax rates at zero sick leave days,[29] that is, we compute the tax rate $\tau\left(W\bar{H}\right)$. This is the relevant tax rate facing an individual before he decides whether to call in sick or not. This tax rate does not depend on sick leave choices. The marginal tax rate at zero days of sick leave is what we use in the analysis.

Virtual income is adjusted in a similar manner to capture the value at zero days of sick leave. This includes adjusting income to what it would have been if no sick leave had been claimed and increasing the tax bill based on the extra income (taxed at the marginal tax rate at zero days of sick leave). The adjustments make virtual income independent of current sick leave choices.

[29] For most individuals this means adding one ninth of sick leave benefits to taxable income. The approach is somewhat different in practice due to the replacement cap. The procedure assumes that these additional earnings would not have been subject to any additional deductions.

6 Results

We find that tax rates have a substantial effect on choices of days of sick leave. The point estimate has the expected sign and it is highly significant. Income effects are economically insignificant. The compensated price elasticities are substantial. The results are robust to controlling for a host of factors and using different estimators.

The basic empirical specification is a linear individual fixed effect estimator with dummies at the censoring points, that is, dummies for 0 and 365 days of sick leave. We only use variation from the interior days of sick leave to estimate the price elasticities. The main variable of interest is the log of the net of marginal tax rate. We also control for virtual income to account for income effects due to tax changes. The first specification in Table 2 includes no other controls. The estimated coefficient on the net of tax rate has the expected sign; a higher after tax cost of reporting sick is associated with fewer days of sick leave. The estimate is identified using only variation within individuals, that is, people take less sick leave during years when their net of tax rate is higher than their average level. The magnitude of the effect is that a 10% increase in the net of marginal tax rate, for example from 50% to 55%, leads to a one day reduction in sick days on average. To transform the estimate to an elasticity we evaluate it at the average number of sick days claimed, which produces a compensated elasticity of sick days to the net of marginal tax rate of -0.38.

As sick leave may be influenced by demographic and other factors, which may be correlated with marginal tax rates, we introduce a number of controls into the model. In the second specification we include a full set of interactions of age and age squared with gender and the four education categories. Including these variables increase the price responsiveness slightly. Including detailed controls for household composition[30] increase the price effects a little further.

Accounting for own income has little effect. We use a lag since current income may be endogenous. We also include an indicator if the normal income is above the replacement cap. Accounting for regional fixed effects and regional business cycles do not affect the analysis either. In specification 5 we add year fixed effects to account for aggregate shocks like productivity shocks or the uniform effect of tax reforms. Another concern could be that the marginal tax rate is a non-linear transformation of income. It may be that our tax price estimate just picks up non-linear effects across the income scale. To address this issue we make a 5 piece spline of the lagged earnings, with knots at quintiles. Including these controls produce a substantially higher net of tax estimate of -18 as seen in specification 5. The compensated sick leave elasticity now stands at -0.72. We can also transform the estimate to a labor supply elasticity.[31] The compensated labor supply elasticity is then about 0.09. It is similar to what is found for compensated labor supply elasticities on the intensive margin although we only consider one margin of adjustment.[32]

Our analysis thus far shows that the price responsiveness of sick leave does not rely on year to year tax reforms or differences in behavior across different income groups. What we exploit is the long time period where tax rates change differentially at different sections of the income distribution. Individuals tend to have higher sick leave during years when they face higher tax rates than they usually face. Since we apply the within estimator we identify the effect from deviations from individual means.

[30] We include the number of children of different ages as well as marital status.

[31] Here we assume that the average employment contract has 220 work days in a year.

[32] See for example Blundell and MacCurdy (1999).

The estimated income effects of tax changes are economically insignificant throughout, although they are statistically significant. The point estimate on virtual income is negative. From a labor supply perspective that indicates that sick leave is an inferior good, and not quite comparable to leisure. From the perspective of subjective well-being, a negative income effect is to be expected. Higher income is associated with higher well-being,[33] so in our context higher income would be expected to reduce sick leave.

We believe the estimates have a causal interpretation. Tax policy is exogenous to the individual. We believe it's a reasonable assumption that tax reforms are enacted independent of local health trends. The tax changes we exploit provide thousands of different incentives for individuals across time and locations. We show that these price changes have a significant impact on individual behavior. We explore the exogeneity of the price changes further below.

6.1 Alternative Specifications and Estimators

Our results are robust to several alternative specifications. We find that care for young children doesn't affect our finding. We exclude women with children between the ages 0 and 2 (only women since care of young children were mostly done by women during the period we study). Excluding this group does not affect the results, as seen in the first column of Table 3. Another concern may be the measurement of sick leave benefits. Up until 1983 maternity leave was included in sick leave benefits but starting in 1984 the parental leave in connection to the birth of a child was reported separately. In addition, care for sick child was reported separately from 1987. These definitional changes could affect the analysis. To examine the

[33] Income is the second strongest correlate with subjective well-being, after health, according to Graham (2009).

impact we redefine the sick leave variable as take up of any of the three programs (sick leave, parental leave, and care for sick child). Redefining the dependent variable does not affect the estimated coefficients much, as seen in specification 2.

There could be a bias from the fact that the data may not include the first uncompensated day of the spell, but we argue that such omissions would bias our estimate toward zero.[34] We are only concerned about the omission of the first day for spells that are correlated with tax rates. Such 'discretionary' sick leave could hence be underreported in the data. However, such underreports would make the estimated price response smaller than the true response since the price variation is related to the observed sick leave variation, which would be smaller than the true variation. The bias would hence be toward zero.

Our estimate is not influenced by individual shifting across programs.[35] We exclude individuals who have taken up either unemployment benefits or welfare payments during the year. The responsiveness to the net of tax rate is similar to the baseline specification.

We don't find that the composition of the labor force affects our results. It could be that unhealthy workers drop out of the labor force, which could affect our estimates if this tends to happen when they face relatively low (or high) tax rates. In the fourth specification we only include individuals aged 22-50, an age range with very little exit from the labor force. Estimates are somewhat lower in this group but still sizable and strongly significant.

We find that our results are not driven by individuals with very high or low incomes. In specification 5 we only include individuals whose virtual income is at least 30,000 and less than 3,000,000 SEK.[36] The estimated elasticity is similar to our baseline specification. It

[34] As argued above, the uncompensated day would be irrelevant for an individual who anticipates to be on sick leave tomorrow if you report sick today.

[35] For example, Larsson (2006) finds shifting between the unemployment and sick leave benefits.

[36] Average virtual income is 120,000 SEK.

may be noted that the income effect is an order of magnitude larger in this specification, although it does not have an economically significant effect on the compensated elasticity.

We get similar results if we split the sample into shorter periods. As we study a 17 year period we could be worried that some underlying factors have changed over the time period, which may affect our estimate. We have split the sample period in half, from 1974 to 1981 and from 1982 to 1990. Both periods experience both tax increases and decreases, and they produce similar results. Also other time period splits produce similar results. We conclude our results are not a result of the 17 year period we study, but the results are also present for shorter periods.

It could also be that there is some skill bias in sick leave, which is correlated with tax changes.[37] To address the concern of non-linear trends by skill group we include year fixed effects interacted with the four education groups in specification 6. Our estimates are virtually identical after adding these controls, and we conclude that skill bias is not an explanation of our results.

Omitted income shocks, over and above our income controls, would be a concern if they reduced the net of tax rate (by increasing the tax rate) and increased sick leave. First we may note that our estimate of the income effect, the virtual income term, is negative so we would expect a positive income shock to reduce sick leave, in contrast to the concern of sick leave increasing with income. Yet, we may account for omitted income shocks by including taxable income, the income the tax schedule is applied to, as a control.[38] Our estimated elasticity is still large and significant, although slightly smaller in magnitude compared to the baseline.

[37] Although it seems unlikely, a priori, that the skill bias would follow the non-linear pattern of tax rates.

[38] The taxable income has been adjusted to reflect income at zero days of sick leave, as before, in order to remove any direct relationship with the dependent variable.

Based on the distribution of sick leave in Figure 1 it may be interesting to examine a model where sick leave is distributed lognormally. We reformulate our basic model so that the independent variable is the natural logarithm of days of sick leave. In the following specifications we only include basic demographic controls, age and age squared interacted with gender and education, and year fixed effects. The purpose of these more limited controls is to further examine the exogeneity of the tax rate variation.

The logarithmic specification is first estimated in levels using the individual fixed effects estimator. The estimated coefficient, -0.49 in column 1 of Table 4, should be interpreted as the uncompensated price elasticity of sick leave. Not including the income effects would have a minor effect on the estimated elasticity as the income effects we estimated above are very small. The estimated elasticity is a bit larger than specification 2 in Table 2, which may be the closest comparison, but smaller than the baseline estimate in column 5 of Table 2.

We estimate the model in first differences in column 2 of Table 4.[39] This estimator differences out an individual specific effect in each time difference, and may be a more flexible method to account for unobserved heterogeneity compared to the fixed effects estimator. The estimated elasticity of -0.69 is larger than the fixed effects estimate in the previous column and similar in magnitude to the baseline elasticity in column 5 of Table 2. The result indicates that the first difference estimator removes some bias toward zero imposed by the assumption of the within estimator that the fixed effect is constant across time.

The individual tax rate is composed of a local tax rate and a national tax rate. The tax rate may hence depend on where the individual chooses to live, and we may be concerned

[39] We estimate the model $\Delta \log (SL_{i,t}) = \beta \Delta \log (1 - \tau_{i,t}) + \delta \Delta X_{i,t} + \Delta e_{i,t}$ where Δ denotes the first difference operator.

that individuals with a high demand for sick leave move to places with higher local tax rates, which would induce a negative correlation between tax rates and sick leave. To address concerns that mobility, or any factor correlated with changes in the local tax rate, would affect our estimate we instrument for the individual's total tax rate with the national tax rate, which is independent of location. The first stage in this regression is extremely strong, indicating that almost all the relevant tax rate variation comes from the national rate. The second stage estimate is very similar to the OLS estimate, as seen in specification 3 in Table 4, indicating that mobility does not explain our results.

The national tax rate is progressive across income, as illustrated in Figure 3. It would hence be a concern if the tax reforms we study induce labor supply responses which affect income and in turn sick leave. The labor supply responses would have to follow a particular pattern for this to be a concern for us. For example, a tax cut could increase labor supply and income that in turn would reduce sick leave, a negative relationship between sick leave and the net of tax rate, if sick leave is a normal good. Our estimate of the income effect above is, however, negative indicating that sick leave is an inferior good.

We may still be concerned that income responds to tax policy, which in turn influences sick leave.[40] To address this we construct a tax rate that isn't based on current income. We regress current taxable income based on taxable income lagged five years, demographic interactions (the age/gender/education interactions), and growth rates by education groups (year effects interacted with education groups). We apply the tax code to the predicted taxable income from that regression and compute the log net of national tax rate based on

[40]Most labor supply estimates consider adjustment periods longer than our 1 year window. We may also note that the Swedish labor market hardly was the most flexible during this time period, which made it harder to adjust labor contracts immediately following a tax reform.

the income prediction, which is differenced and used as an instrument for the difference of log net of total tax rate.[41] The first stage is not weak.

The point estimate of -0.69 from using the national tax rate based on projected income is similar to the previous IV estimate and the OLS estimate, as seen in the fourth column of Table 4. The estimate is strongly significant, although the standard errors are now larger. The results are similar if we use the sixth lag instead of the fifth lag in the income projection.[42] We conclude that our estimates are driven by exogenous tax rate variation and not income responses induced by the tax reforms.

In Table 5 we estimate the price elasticity of sick leave for different demographic groups. We use the first difference model estimated with OLS just like specification 2 in Table 4. We find that women are more elastic than men, and that married women are more elastic than the unmarried women, in line with the previous labor supply literature. These patterns may be explained by women being relatively more productive in the home sector and hence more marginal in the market sector compared to men, which may induce a higher price responsiveness to market sector returns. The same argument applies to married versus unmarried women. We also find that public sector employees are more elastic than the private sector employees, as seen in specifications 4 and 5 in Table 5. This difference may be understood as a response to an environment where public sector worker face less flexible labor contracts compared to the private sector, and public sector employees respond more to incentives on the margin they have access to, sick leave.

[41] We hence use the projected income to compute the tax rates used as instruments in both period t and t-1 in each time difference. Note also that we only use the variation from the national rate.

[42] The argument for not using the first lag is that temporary income shocks may correlate with the instrument and subsequent sick leave. By using longer lags we reduce such concerns. That the results using the fifth and sixth lags are similar also indicate that there is no remaining mean reversion from temporary shocks at these lag lengths.

7 Conclusion

Sick leave is one margin of labor supply where employees in Sweden are free to adjust. It provides a unique opportunity to study how price elastic labor supply is when the employee has the discretion to decide how much to work. Our data, a long individual panel, is representative of the population and it contains a lot of price variation, where others have examined very select samples or short time periods with very limited price variation.

We estimate a substantial price elasticity of sick leave, -0.7, on the intensive margin. We find similar estimates using several methods. We apply fixed effect and first difference estimators, and we use different approaches to account for potential endogeneities and omitted variables. Our results support the interpretation that it's the tax rate variation that causes the behavioral response; individuals claim more sick leave during years when they face relatively higher tax rates and, hence, lower returns to working on the margin.

Our interpretation of sick leave as a measure of work effort hinges on the large degree of individual discretion in claiming sick leave, in line with the previous literature. Estimating a price elasticity is, however, new to the effort literature. Since sick leave is a social insurance program, our study contributes to the program participation literature. Two novel contributions are, first, to use tax rate variation, and second, to study a panel over a long time period to estimate the price elasticity of program use. Using tax rate variation over a long time period complements the existing literature that has focused on relatively short run evaluations before and after reforms. Previous evaluations typically study one price change in the program, while our study based on tax rates provides thousands of differantial price changes, both increases and decreases, from which we estimate behavioral responses.

Our findings contrast with Camerer et al (1997) who find less labor supply among New York City cab drivers when returns are higher. They suggest that labor supply of individuals who are free to adjust choose to work until they have reached their income target. Our results that people who can adjust work more when returns are higher, based on a representative sample, fit well into a standard model of labor supply where individuals optimally choose to work more when returns are higher.

Using tax rate variation to estimate price elasticities could be applied to other programs and in other countries. The interpretation of sick leave as effort hinges on the large discretion the individual has in claiming the benefits, which is fairly unique to the sick leave program. It may be harder to interpret other behaviors in that vein.

The effects of taxes on health are typically studied within the context of sin taxes and specific consumption taxes. Here we show that income taxes may also have implications for health, as measured by sick leave. Our findings provide a new rationale for lower marginal income taxes. Not only do marginal tax rates drive a wedge between marginal products of labor and leisure, they may also reduce the returns to staying healthy.

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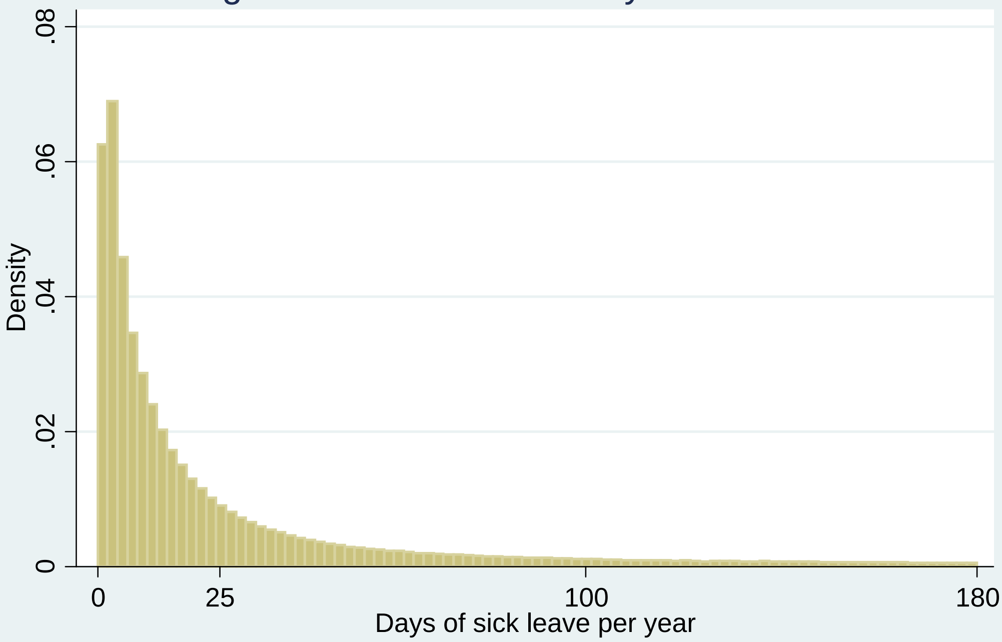
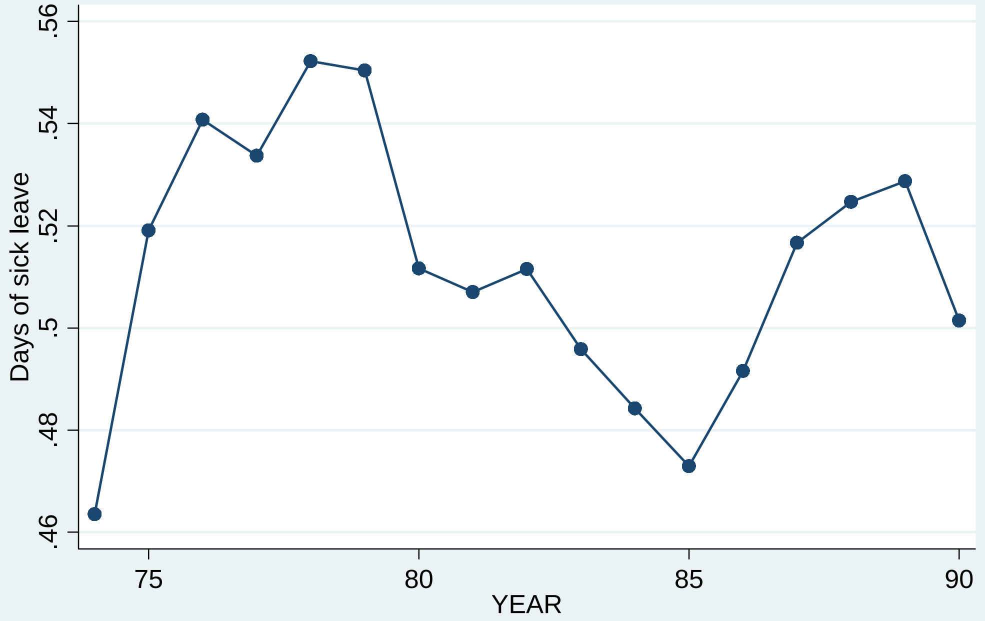
8 Figures and Tables

Figure 1. Distribution of days of sick leave.



Note: Only positive number of sick days are included. The graph is censored at 180 days.

Figure 2. Marginal tax rate, 1974-1990



Sample: Labor force participants, ages 22-60.

Figure 3. Marginal Tax Rate Schedules

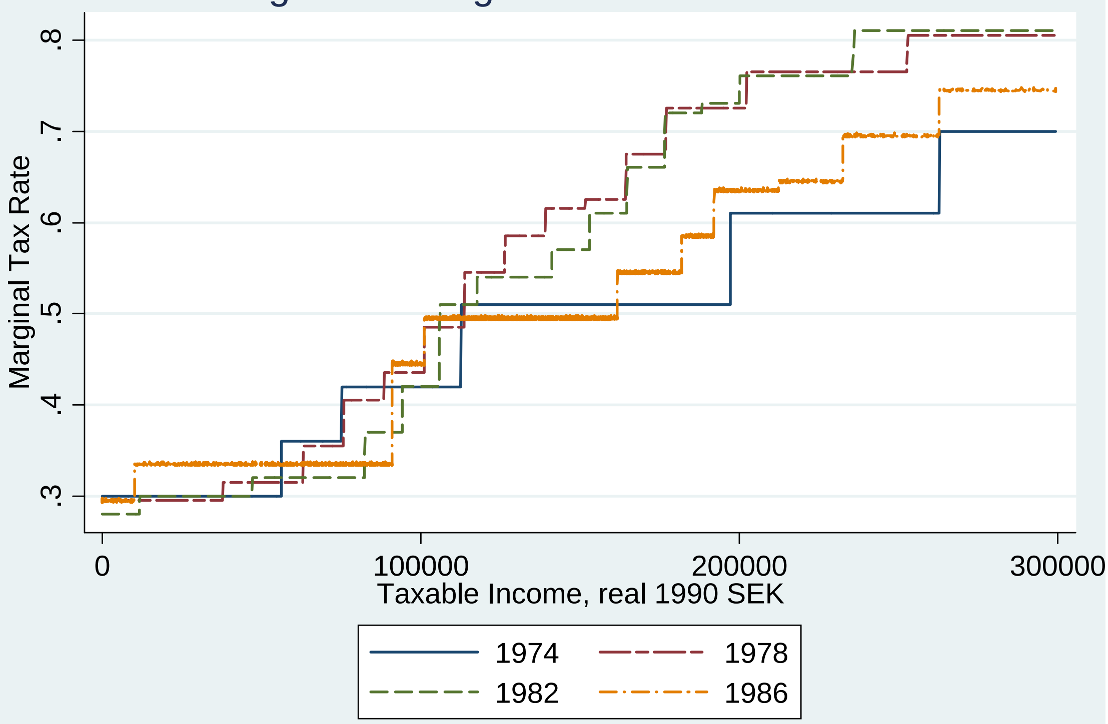


Table 1. Summary statistics

	Obs	Mean	Std. Dev.
Days of sick leave	1950473	25.0	57.6
Program participation rate	1950473	0.636	0.481
Marginal tax rate	1950267	0.498	0.130
Age	1950473	39.9	10.7
Man	1950473	0.523	0.499
Married	1950473	0.596	0.491
Earnings, 1990 SEK	1949142	126884	317706.8
< High school	1950473	0.412	0.492
High school	1950473	0.379	0.485
College, up to 2 years	1950473	0.093	0.290
College, 3+ years	1950473	0.116	0.320

Sample: Labor force participants, 22-60 years old, years 1974-1990.

Table 2. Price Elasticity of Days of Sick Leave.

Dependent Variable: Days of Sick Leave
Individual fixed effect regressions

Variable	(1)	(2)	(3)	(4)	(5)
log(1-t)	**-9.44**	**-10.68**	**-11.24**	**-11.31**	**-18.02**
	(.201)	(.206)	(.198)	(.2)	(.237)
Virtual Income	**-0.00063**	**-0.00052**	**-0.00056**	**-0.00056**	**-0.00070**
	(.0002)	(.00017)	(.00018)	(.00018)	(.00022)
Dummies for 0 and 365 days of sick leave	Yes	Yes	Yes	Yes	Yes
Age, age sq interacted with gender and education		Yes	Yes	Yes	Yes
Months with Infant x Female			Yes	Yes	Yes
Child 7 months-2 years			Yes	Yes	Yes
Child 3-6, Child 7-15 years			Yes	Yes	Yes
Marital status			Yes	Yes	Yes
Income lag				Yes	Yes
Income above cap indicator				Yes	Yes
Business Cycle control				Yes	Yes
Regional fixed effects				Yes	Yes
Year fixed effects					Yes
Income lag Spline					Yes
Compensated elasticity with respect to 1-t:					
Sick Leave Elasticity	**-0.38**	**-0.43**	**-0.45**	**-0.45**	**-0.72**
Observations	1948943	1948943	1948943	1948943	1948943

Notes: The marginal tax rate is denoted by t. Virtual income measured in 1000's of 1994 SEK.
Months with infant counts the number of months there is a child of up to 7 months of age in the household.
Education is gouped into 3+ years of college, <3 years of college, high school, <high school.
Business Cycle (BC) control is average regional employment rates.
Permanent income is an estimated individual fixed effect of earnings on demographic interactions and BC controls. Spline is 5 piece with knots at quintiles. Elasticities evaluated at sample means.
Individual panel data from 1974-1990, annually. Estimates of the within estimator.
Standard errors, clustered by individual, in parenthesis. Sample: Labor force participants, 22-60 years old.

Table 3. Alternative specifications.

Dependent Variable: Days of Sick Leave
Individual fixed effect regressions

Alternative explanation:	Fertility	Program definition	Use of other programs	Composition of labor force	Income restrictions	Skill biased time trends	Omitted income shocks
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(1-t)	**-16.76**	**-17.63**	**-17.30**	**-14.21**	**-16.48**	**-17.88**	**-14.65**
	(.233)	(.243)	(.237)	(.258)	(.269)	(.233)	(.425)
Virtual Income	**-0.00053**	**-0.00059**	**-0.00067**	**-0.00059**	**-0.00818**	**-0.00068**	**-0.00096**
	(.00019)	(.0002)	(.00021)	(.00023)	(.00075)	(.00021)	(.0003)
Additional controls or sample restrictions	Exclude women with children 0-2 years old	Broader sick leave measure	Exclude people with UI benefits, welfare.	Include only ages 22-50	Include only virtual income 30-3000 ksek	Year effects interacted with education	Taxable income at 0 days of sick leave
Compensated elasticity with respect to 1-t:							
Sick Leave Elasticity	**-0.77**	**-0.65**	**-0.73**	**-0.55**	**-0.78**	**-0.72**	**-0.59**
Observations	1865059	1948943	1835898	1414035	1523760	1948956	1948956

Notes: All controls used in Table 2, column (5), are included if applicable.
Individual panel data from 1974-1990, annually. Estimates of the within estimator.
Standard errors, clustered by individual, in parenthesis. Sample: Labor force participants, 22-60 years old.

Table 4. Logarithmic specifications estimated in first differences.

Dependent Variable:	log(Sick Leave)	∆log(Sick Leave)	∆log(Sick Leave)	∆log(Sick Leave)
Estimator:	Individual fixed effects (levels)	First differences OLS	First differences IV	First differences IV
Specification	(1)	(2)	(3)	(4)
log(1-t)	**-0.485**			
	(.009)			
∆log(1-t)		**-0.683**	**-0.716**	**-0.690**
		(.011)	(.011)	(.243)
Instrument:			National tax rate	National tax rate based on projected income
Observations	1231509	929929	929929	670968

Notes: Controls included in all specifications are age and age squared fully interacted with gender and education, as well as year fixed effects. ∆ is the first time difference operator.
The dependent variable in columns 2-4 is ∆log(Sick Leave).
Individual panel data from 1974-1990, annually. Column 4 includes data from 1979-1990.
Standard errors, clustered by individual, in parenthesis.
Sample: Labor force participants, 22-60 years old.

Table 5. Heterogeneity across demographic groups.

Dependent Variable: ∆log(Sick Leave)
First differences regressions

Sample	Men	Women, Married	Women, Unmarried	Public sector employees	Private sector employees
Specification	(1)	(2)	(3)	(4)	(5)
∆log(1-t)	**-0.54**	**-0.99**	**-0.80**	**-0.67**	**-0.59**
	(.014)	(.026)	(.027)	(.021)	(.017)
Observations	453427	282359	194143	308739	359020

Notes: Controls included in all specifications are age and age squared fully interacted with gender and education, as well as year fixed effects. ∆ is the first time difference operator.
Individual panel data from 1974-1990, annually. The models are estimated with OLS.
Standard errors, clustered by individual, in parenthesis. Sample: Labor force participants, 22-60 years old.