Sick of Taxes? Sick Leave, Effort, Well-Being, and Taxes

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Abstract

We estimate a compensated price elasticity of sickness absence. It tells us about the price responsiveness of effort, program participation and well-being. 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. 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, increase program participation, and reduce well-being.

JEL codes: H31, I31, J22

Key words: sick leave, work effort, well-being, 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. Absenteeism may also be one manifestation of low subjective well-being. We study sick leave in Sweden, and estimate its price elasticity.¹

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¹Social insurance programs that cover lost earnings due to health shocks exist in most developed nations, see for example Bound and Burkhauser (1999) and Barnby, 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, program participation, and subjective well-being 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.

Absenceism as a measure of effort has been studied in a couple of papers. Ichino and Maggi (2000) examine how absenceism is influenced by regional background. Ichino and Riphahn (2005) studies how employment protection affects effort.3 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.

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 Mas and Moretti (2009) study how colleagues influence work effort.
Several papers have studied how rule changes affect benefit use in Sweden.\textsuperscript{4} Two recent papers study the effect of a reform of the corresponding program in Germany.\textsuperscript{5} 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.\textsuperscript{6, 7} Some papers focus on aspects other than replacement rates; de Jong, Lindeboom, and van der Klaauw (2010) studies effects of stricter screening in Holland and Hesselius, Johansson, and Larsson (2005) examines laxer screening in Sweden.\textsuperscript{8}

We argue that sick leave may also be an expression of well-being. The well-being literature has focused on subjective measures of well-being from surveys, and found subjective well-being to be highly correlated with health status.\textsuperscript{9} Based on this evidence we think sick leave contains information on individual well-being. By studying behavior we can avoid some of the issues that the self reported measures of well-being face, see for example Bertrand and Mullainathan (2001) and Ravallion and Lokshin (2001). Our measure contains a subjective component, individuals assess themselves if they are well enough to work, but also an observable behavioral outcome in the up take of sick leave benefits.\textsuperscript{10} We are able to compute

\textsuperscript{5}See Ziebarth and Karlsson (2009) and Puhani and Sopnderhoff (2009).
\textsuperscript{6}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).
\textsuperscript{7}However, few individuals have long spells during the period we study. There is an early retirement program individuals can enter if permanently injured.
\textsuperscript{8}Low and Pistaferri (2010) take a structural approach to evaluate the welfare effects of stricter screening.
\textsuperscript{9}See for example Graham (2009) for an extensive survey of the determinants of subjective well-being across the world. Other surveys include DiTella and MacCulloch (2006) and Frey and Stutzer (2002).
\textsuperscript{10}Daly and Wilson (2009) study suicides as a manifestation of low subjective well-being, which is similar to our argument regarding sick leave, but they don’t relate behavior to prices.
a price elasticity of one dimension of well-being, which is new to this literature.\textsuperscript{11}

Individuals forego some income if they claim sick leave benefits rather than work. The 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. The aggregate data is consistent with the hypothesis. The average days of sick leave, see figure 1, are higher when the average marginal tax rate is higher, see figure 2. These raw means could be influenced by a number of factors. 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 and well-being literatures. 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.

\textsuperscript{11}Subjective well-being and program participation have been studied in the context of unemployment by for example Stutzer and Lalive (2004) and Clark (2003).
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. 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. There is no fixed allocation of sick leave days, 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. In 1974 sick leave benefits became taxable income 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

\[12\text{In a comparison to the U.S. the program encompasses both 'personal days' provided in employment contracts (although restricted to sick leave) and the workers' compensation program.}\]
\[13\text{Benefits are paid by the social insurance office directly to the claimant.}\]
\[14\text{The sick leave program was passed into law in 1962 (SFS 1962:381) and it took effect in 1963.}\]
\[15\text{The updates to the program are detailed in law SFS 1973:465.}\]
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.\textsuperscript{16} This system was in place until 1987. From 1988 through 1990 the first day of no coverage was abolished.\textsuperscript{17} 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: 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.

\section{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.\textsuperscript{18} 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

\textsuperscript{16} Spells shorter than 7 days do not pay benefits on weekends.

\textsuperscript{17} The updates to the program are detailed in law SFS 1987:223.

\textsuperscript{18} The only sampled individuals that disappear from the data are those who die or emigrate.
college, less than 3 years of college, completed high school, and not completed high school.\textsuperscript{19}

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 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 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.\textsuperscript{20} 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

\textsuperscript{19}The highest education level is observed in 1990 and we use this value for the whole time period.

\textsuperscript{20}Property taxes as well as the value added tax are levied by the national government.
as capital losses are cancelled.\textsuperscript{21} 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 and decreases in tax rates across the whole income distribution, which is helpful in identifying the price response.\textsuperscript{22} 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.\textsuperscript{23}

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.

\textsuperscript{21}The tax base is similar to the alternative minimum tax in the U.S., although the tax is additional rather than alternative.
\textsuperscript{22}In comparison, program evaluations frequently look at one increase or one decrease in prices.
\textsuperscript{23}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.
3.2 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.

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.\textsuperscript{24} 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 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.

\textsuperscript{24}The demographic variables are full interactions of gender and education with age and age squared. The business cycle control is average regional employment rates.
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 $S$,

$$U(C, S)$$  \hspace{1cm} (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

$$C = w(\bar{H} - S) + \delta w S + Y$$  \hspace{1cm} (2)

The net of tax wage rate is $w$, $\delta$ 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

$$U_C = \lambda$$

$$U_S \leq \lambda w (1 - \delta) \text{ for } S < \bar{H}.$$  \hspace{1cm} (3)

$\lambda$ 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

$$U_S = \exp \left( -\frac{1}{b} (S + f) \right)$$  \hspace{1cm} (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 $\tau$ is the marginal tax rate and $W$ is the gross wage, to get

$$-\frac{1}{b} (S + f) = \log (1 - \tau) + \log W + \log (1 - \delta) + \log \lambda \iff S = -b [\log (1 - \tau) + \log W + \log (1 - \delta) + \log \lambda] - f. \quad (5)$$

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 being days absent from work. We may also consider $S$ as a measure of effort, where effort produces disutility that is traded off against consumption.

## 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.\textsuperscript{25}

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

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

\textsuperscript{25}Earlier work includes Allen (1981).
i.i.d. shock. The individual effect is assumed to be fixed in the main specification, but it will be assumed to be random in some specifications.\textsuperscript{26} The choices of sick leave days per year are censored at 0 and 365. Since a substantial fraction 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 also use a random effects Tobit model that incorporates both the lower and upper 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.\textsuperscript{27} 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.\textsuperscript{28} The estimate of the coefficient $\theta$ 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 $\zeta_{SL,1-\tau}^C$ and $\zeta_{SL,1-\tau}^U$ denote the compensated and uncompensated elasticities of sick leave with respect to the net of tax rate, $1 - \tau$. Then,

$$\zeta_{SL,1-\tau}^C = \zeta_{SL,1-\tau}^U + \zeta_{SL,V} \frac{SL}{V}$$

\textsuperscript{26}In the Tobit specification we also assume that the shock $e_{i,t}$ is normally distributed.
\textsuperscript{27}The method is frequently used in labor economics, see for example Blundell and MaCurdy (1999).
\textsuperscript{28}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.
where $\zeta_{SL,V}$ is the elasticity of sick leave with respect to virtual income.\textsuperscript{29} It is the compensated elasticity that is important from a theoretical perspective to be able to assess the welfare cost of taxation.

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 $\tau(\cdot)$, then the tax rate we want in terms of the economic model is $\tau(WH)$. We observe marginal tax rates $\tau(W(H - S) + WS)$, 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,\textsuperscript{30} that is, we compute the tax rate $\tau(WH)$. 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

\textsuperscript{29}In terms of the empirical model, $\zeta^C = \beta/SL + \theta$.

\textsuperscript{30}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.
leave choices.

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.

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 a number of 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 factors increase the price responsiveness slightly. Including detailed controls for household composition\(^{31}\) 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.\(^{32}\) 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.\(^ {33}\)

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

\(^{31}\)We include the number of children of different ages as well as marital status.
\(^{32}\)Here we assume that the average employment contract has 220 work days in a year.
\(^{33}\)See for example Blundell and MacCurdy (1999).
the effect from deviations from individual means.

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,\textsuperscript{34} 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.

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

\textsuperscript{34}Income is the second strongest correlate with subjective well-being, after health, according to Graham (2009).
separately from 1987. These definitional changes could affect the analysis. To examine the 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.

Our estimate is not influenced by individual shifting across programs. We exclude individuals who have taken up either unemployment benefits or welfare payments during the year. The responsiveness to the replacement 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. The estimated elasticity is similar to our baseline specification. It 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.

In Table 4 we explore some other estimators. In the first specification we use a random effects estimator rather than the within estimator used so far. In the specifications in Table 4 we also include a control for permanent income, which is splined in 5 pieces with knots at quintiles. The random effects specification also includes dummies for 0 and 365 days

35 For example, Larsson (2006) finds shifting between the unemployment and sick leave benefits.
36 Average virtual income is 120,000 SEK.
37 We run a fixed effect regression of earnings on demographic interactions and business cycle controls. The estimated individual fixed effect is our estimate of permanent income.
of sick leave. The estimated net of tax responsiveness is a little higher than the within estimate. Next we use a Tobit model for panel data with censoring at both the lower and upper censoring points.\textsuperscript{38} For interior points this model is similar to the random effects estimator but it also explicitly accounts for the observations with 0 and 365 days (under the assumption of normality). The marginal effects are reported in column 3, and they are higher than the linear random effects models in column 1. In column 4 we present the results from the between estimator. We compare the average days of sick leave between people and relate it to their average net of tax rate, taking into account their average incomes and other controls. Using the variation across individuals lead to much higher estimates than we found with the within estimator. This indicates that it is important to account for the unobserved heterogeneity the fixed effects capture, since the results are so different.

7 Conclusion

We estimate one price elasticity, days of sick leave with respect to the net of tax rate. We provide three interpretations of our estimate; first, that work effort is price elastic, second, that program participation is elastic, and third, that individual well-being is price elastic. We believe our estimate is a contribution to three distinct literatures. A price elasticity estimate is an innovation to the effort and well-being literatures. The well-being literature is focused on self-reported subjective measures, and one of our contributions is to bring a study of observable actions to this literature. Our contribution to the program participation literature is, first, to use tax rate variation, and second, to study a panel over a long time

\textsuperscript{38}There are about 700,000 observations with no up take, and less than 10,000 observations at the upper censoring point.
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.

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. There are certainly behaviors
other than sick leave that may carry information about subjective well-being. Some examples
would be demand for medical services and pharmaceuticals, as well as marriage and divorce.
These behaviors could be analyzed in the framework presented in this paper to shed further
light on the elasticity of other aspects of well-being.

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.

References


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8 Figures and Tables

Figure 1. Days of Sick Leave, 1974-1990

Sample: Labor force participants, ages 22-60.

Figure 2. Marginal tax rate, 1974-1990

Sample: Labor force participants, ages 22-60.
Figure 3. Marginal Tax Rate Schedules

Table 1. Summary statistics

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<td>Days of sick leave</td>
<td>1950473</td>
<td>25.0</td>
<td>57.6</td>
</tr>
<tr>
<td>Program participation rate</td>
<td>1950473</td>
<td>0.636</td>
<td>0.481</td>
</tr>
<tr>
<td>Marginal tax rate</td>
<td>1950267</td>
<td>0.498</td>
<td>0.130</td>
</tr>
<tr>
<td>Age</td>
<td>1950473</td>
<td>39.9</td>
<td>10.7</td>
</tr>
<tr>
<td>Man</td>
<td>1950473</td>
<td>0.523</td>
<td>0.499</td>
</tr>
<tr>
<td>Married</td>
<td>1950473</td>
<td>0.596</td>
<td>0.491</td>
</tr>
<tr>
<td>Earnings, 1990 SEK</td>
<td>1949142</td>
<td>126884</td>
<td>317706.8</td>
</tr>
<tr>
<td>&lt; High school</td>
<td>1950473</td>
<td>0.412</td>
<td>0.492</td>
</tr>
<tr>
<td>High school</td>
<td>1950473</td>
<td>0.379</td>
<td>0.485</td>
</tr>
<tr>
<td>College, up to 2 years</td>
<td>1950473</td>
<td>0.093</td>
<td>0.290</td>
</tr>
<tr>
<td>College, 3+ years</td>
<td>1950473</td>
<td>0.116</td>
<td>0.320</td>
</tr>
</tbody>
</table>

Sample: Labor force participants, 22-60 years old, years 1974-1990.
Table 2. Price Elasticity of Days of Sick Leave.

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

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 grouped 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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Fertility</th>
<th>Program definition</th>
<th>Use of other programs</th>
<th>Composition of labor force</th>
<th>Income restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(1-t)</td>
<td>-16.76</td>
<td>-17.63</td>
<td>-17.30</td>
<td>-14.21</td>
<td>-16.48</td>
</tr>
<tr>
<td></td>
<td>(.233)</td>
<td>(.243)</td>
<td>(.237)</td>
<td>(.258)</td>
<td>(.269)</td>
</tr>
<tr>
<td>Virtual Income</td>
<td>-0.00053</td>
<td>-0.00059</td>
<td>-0.00067</td>
<td>-0.00059</td>
<td>-0.00818</td>
</tr>
<tr>
<td></td>
<td>(.00019)</td>
<td>(.0002)</td>
<td>(.00021)</td>
<td>(.00023)</td>
<td>(.00075)</td>
</tr>
</tbody>
</table>

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

Compensated elasticity with respect to 1-t:
- Sick Leave Elasticity: 
  - -0.77
  - -0.65
  - -0.73
  - -0.55
  - -0.78

Observations: 1865059 1948943 1835898 1414035 1523760

Notes: All controls used in Table 2, column (5), are included if applicable.
Standard errors, clustered by individual, in parenthesis. Sample: Labor force participants, 22-60 years old.
Table 4. Alternative estimators.

<table>
<thead>
<tr>
<th>Estimator</th>
<th>Linear Random Effects (1)</th>
<th>Tobit Random Effects (2)</th>
<th>Marginal Effects (3)</th>
<th>Between estimator (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(1-t)</td>
<td>-23.05 (.245)</td>
<td>-43.48 (.314)</td>
<td>-27.43 (.198)</td>
<td>-58.12 (.627)</td>
</tr>
<tr>
<td>Virtual Income</td>
<td>-0.00105 (.0003)</td>
<td>-0.00152 (.00051)</td>
<td>-0.00096 (.00032)</td>
<td>-0.00478 (.0004)</td>
</tr>
<tr>
<td>Controls as in Table 2, specification (5)</td>
<td>Yes</td>
<td>Yes, except dummies for 0 and 365 days</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Permanent income spline, 5 piece</td>
<td>Yes</td>
<td>Yes</td>
<td>With censoring at 0 and 365 days</td>
<td></td>
</tr>
<tr>
<td>Notes:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>1948943</td>
<td>1948943</td>
<td>1948943</td>
<td></td>
</tr>
</tbody>
</table>

Notes: All controls used in Table 2, column (5), are included if applicable. Permanent income is an estimated individual fixed effect of earnings on demographic interactions and BC controls. Spline is 5 piece with knots at quintiles. Individual panel data from 1974-1990, annually. Standard errors in parenthesis. Sample: Labor force participants, 22-60 years old.