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Pfeifer, Christian

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Effective working hours and wages: the case of downward adjustment via paid absenteeism

Christian Pfeifer
Leuphana University Lueneburg

Abstract

This paper compares contractual with effective working hours and wages, respectively. Effective working hours are defined as contractual working hours minus absent working hours. This approach takes into account workers' downward adjustment of working time via paid absenteeism if working time constraints are present, which induce workers to accept contracts with larger than their optimal choice of working hours. A German personnel data set, which contains precise information on wages as well as working and absence hours, is used to assess the impact of such downward adjustment on wage inequality and wage differentials by gender, schooling, and age. The main results are: (1) Wage inequality is lower for effective than for contractual wages. (2) The gender gap in effective hourly wages is more than one percentage point smaller than the gender gap in contractual wages, because women are on average more absent than men. (3) Workers with lower schooling are more absent, which leads to an upward bias in estimates for rates of return to schooling when contractual instead of effective wages are used. (4) Older workers are more absent so that contractual age-earnings profiles are significantly flatter than effective age-earnings profiles.

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Contact: Christian Pfeifer - pfeifer@leuphana.de.
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1. Introduction

One of the most frequently used application in labour economics and econometrics as a whole is the estimation of earnings functions to assess wage differentials and wage inequality. The dependent variable is usually the log of earnings and measured on the basis of year, month, week, day, or hour. Most economic models rely on the hourly wage rate. In empirical practice, several hourly wage measures can be computed from the data and the question is which one is preferable. Contractual hourly wages (total income divided by contractual working hours) are normally used because they can be easily computed in most data sets. This might however be problematic in an economic interpretation because a worker's utility does not depend on contractual working hours but on effective working hours and his perceived wage rate is not the contractual but the effective hourly wage (total income divided by effective working hours). Moreover, firms are interested in effective wages and not in contractual wages when making employment decisions. Thus, it is of central importance to define effective working hours and to assess the empirical importance of different hourly wage measures.

A number of previous studies has taken into account overtime work when defining effective working hours and computing hourly wages (e.g., Bell and Hart, 1999; Bell *et al.*, 2000; Pannenberg and Wagner, 2001; Hübler, 2002; Wolf, 2002; Anger, 2011). But overtime is only one form of working time adjustment, which is upward orientated. In the presence of fixed contractual working hours, a worker might choose overtime work if his utility maximizing working hours are larger than contractual working hours. The important case of downward adjustment of working time via paid absenteeism has been however largely ignored.[1] If working time constraints are present that induce a worker to accept a contract with larger than his optimal working hours, a worker can use work absence to approach his optimal level of working hours (Allen, 1981; Brown and Sessions, 1996; Dunn and Youngblood, 1986). As such behaviour might occur more strongly among low wage workers, a systematic bias might arise if contractual instead of effective wages are used to study wage differentials and inequality.

The aim of this paper is to compare estimated wage differentials by gender, schooling, and age groups between contractual and effective wages. For this purpose, I use a personnel data set of a German company that is perfectly suitable to study the above issue, because it comprises exact information without measurements errors or censoring about contractual, absent, and effective working hours as well as about wages. Such data quality is necessary to correctly analyze potential systematic biases. One caveat of such insider econometric studies with personnel data of a single company is however that the results are not representative and cannot always be generalized. In order to illustrate potential systematic biases in wage differential estimates, such a quantitative case study can nevertheless give valuable insights. The German case is of special interest for a first study due to its very generous institutional sickness benefits (Osterkamp and Röhn, 2007; Frick and Malo, 2008). Sick pay in Germany is regulated in the Act on Continued Payment of Remuneration ("*Lohnfortzahlungsgesetz*"). An employee who is sick for more than three days has to present a medical certificate of sickness from his physician. Sick employees have a legitimate claim of 100 percent wage replacement paid by the firm from the

[1] Absenteeism refers to reported sickness related work absence of employees. Such sickness reports need not to be true. Even if an employee is really sick, he can choose to some degree how long he stays away from work to recover from a disease or injury. Worker absenteeism is hence often used as a proxy for work effort, which is justified because absenteeism can to some degree be interpreted as shirking behaviour as well as a signal for work attachment (Barmby *et al.*, 1994; Brown and Sessions, 1996; Ichino and Moretti, 2009).

first absent day and for a period up to six weeks. In case of longer sickness absence due to the same disease, the wage replacement rate decreases to 70 percent and is paid by the health insurance up to 78 weeks. The issue of effective wages is, however, not only relevant for Germany but to some degree for every institutional setting in which workers receive sickness benefits when absent from work.

The next section illustrates the basic theoretical context, which is based on the static labour supply and demand models, and the relevance of effective hourly wages. Section 3 informs about the data set, basic descriptive statistics for hours and earnings, and different inequality measures for contractual and effective wages. The regression results for hours and wages are presented in Section 4. The paper concludes with a summary and discussion of the results.

2. Theoretical Framework

A worker's decision to be absent from work can be modelled in the framework of the static neo-classical labour supply model (Allen, 1981; Brown and Sessions, 1996). Let a worker's utility U in equation (1) depend positively on total consumption and total leisure. Leisure L is a fixed amount of time T minus the time spent at work H as depicted in equation (2). Consumption is generated from total income, which is for simplicity only labour income. Total labour income Y in equation (3) is constrained by the product of hourly wages w and the total number of working hours H.

$$U = U(Y, L) \quad \text{with} \quad \frac{\partial U}{\partial Y} > 0, \frac{\partial U}{\partial L} > 0 \tag{1}$$

$$L = T - H \tag{2}$$

$$Y = wH \tag{3}$$

The worker's problem is to maximize his utility in equation (1) under the time constraint in equation (2) and the budget constraint in equation (3). The standard textbook solution is that a worker chooses to work as many hours until his marginal rate of substitution between leisure and consumption equals the hourly wage rate ($\frac{\partial U/\partial L}{\partial U/\partial Y} = w$). In the graphical solution in Figure 1, the worker's optimal working hours choice H^* is the tangential point of the indifference curve (U^*) and the budget constraint with the slope $-w = -w_C$.

In the next step, the distinction between contractual and effective working hours and wages is made and illustrated in Figure 1. If the worker has to decide about accepting a job, firms offer him a fixed contractual number of working hours H_C and fixed contractual hourly wages w_C (e.g., due to collective contracts or inflexible work and pay schedules). The worker might have to accept a contract with larger than his optimal working hours ($H_C > H^*$ and $U_C < U^*$) because of such working hours constraints and a lack of better job opportunities. As a worker cares only about the working hours actually being at work, which are effective working hours H_E, he might deviate from contractual working hours. The difference between H_C and H_E can in principle be negative, i.e., the worker makes an upward adjustment of working time via overtime hours (Bell and Hart, 1999) which is not subject of this analysis, or positive, i.e., the worker makes a downward adjustment of working time via (fully) paid absent working hours H_A, which are valued by the worker as leisure hours.[2] The latter is possible as workers in Germany receive a 100 percent wage replacement rate in case of - sickness related - absenteeism. As total income Y_C is, at least if long-term career aspects are not taken into account (Brown, 1994)[3], independent of effective working hours, the worker perceives his effective hourly wage w_E as different from the contractual wage w_C. The new time and budget constraints are as in equations (4) and (5) and the effective hourly wage is then calculated following equation (6).

$$L = T - H_C + H_A = T - H_E \tag{4}$$

$$Y_C = w_C H_C = w_E (H_C - H_A) = w_E H_E \tag{5}$$

$$w_E = \frac{Y_C}{(H_C - H_A)} = \frac{Y_C}{H_E} \tag{6}$$

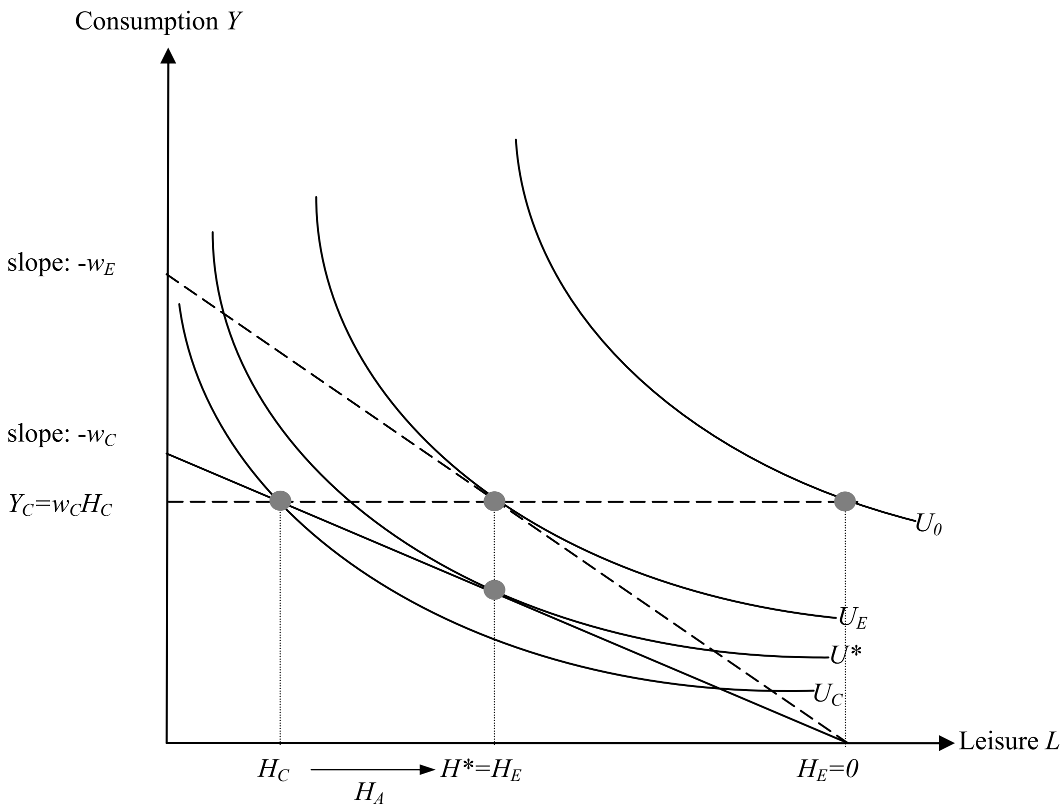

Figure 1: Effective Working Hours and Wages in the Labour Supply Model

[2] The assumption that all reported sickness absence is leisure increasing shirking behaviour of workers is quite strong. But it is useful in order to illustrate the issues of interest.

[3] That working time adjustments can have career consequences is shown for unpaid overtime by Anger (2005) for the risk of unemployment and by Pannenberg (2005) and Anger (2008) for future income.

The new budget constraint is a horizontal line at $Y_C = w_C H_C$ due to the 100 percent wage replacement (see equation (5)). The worker has therefore an incentive to be as much absent as possible. In the extreme case, the worker would choose not to appear at work at all (H_E=0 and L=T). Such an behaviour is however unlikely to be tolerated by firms and likely to have negative career consequences (e.g., layoff, training, wage growth, promotion). Fairness and work group norms can also restrict such an extreme behaviour (e.g., unfair towards colleagues as they have to work more) (Bradley *et al.*, 2007). Thus, a worker might choose reference points to determine his amount of absent and effective working hours (Munro and Sugden, 2003). He could for example choose his original optimal working hours (H_E=H*) or his original optimal utility level ($U^* = U(Y_C, H_C > H_E > H^*)$) as reference points. The example with H_E=H* is used to briefly illustrate the effect of absenteeism on effective hourly wages and utility. The perceived effective hourly wage is total contractual income divided by effective working hours (see equation (6)) which results into a steeper hypothetical budget constraint because $w_E > w_C$. Furthermore, utility in case of absenteeism is larger than to adhere contractual working hours ($U_E(Y_C, H_E = H^*) > U_C(Y_C, H_C)$) because $H_E < H_C$.

Differences between workers' absence behaviour and consequently in effective wages can arise from heterogeneous preferences for leisure and consumption. Workers who differ in their optimal working hours are also likely to have different reference levels for effective working hours. A worker with lower optimal working hours is then likely to have more absent working hours and a higher effective wage compared to a worker whose optimal working hours do not deviate much from contractual working hours. Moreover, workers might be offered different contractual wages which also leads to different optimal working hours and reference levels. If workers with low contractual wages are more absent than workers with high contractual wages, the differences in effective wages between both groups would be lower than the differences in contractual wages.

Effective wages are furthermore crucial in the determination of labour demand, which is illustrated again in the static neo-classical model. A competitive firm maximizes its profits (∏) in equation (7) if the difference between the value of total output (pQ) and costs is maximised. We assume market output prices (p), a fixed production technology (Q), constant capital (K), market capital prices (r), and market contractual wages (w_C). Moreover, total labour input consists of the number of workers (N) times effective working hours (H_E), which are contractual working hours (H_C) minus absent working hours ($H_A \leq H_C$). As the firm has to pay the contractual wage regardless of absent working hours (100 percent wage replacement), total labour costs are independent of absent working hours. Following the above computation of effective wages in equations (5) and (6), contractual labour costs can be reformulated into effective labour costs. Because workers are for simplicity homogenous, all workers provide the same number of working hours. Furthermore, absent working hours are exogenously chosen by workers. Thus, the firm's only choice variable is total labour input. The standard first order condition in (8) yields that a firm hires workers up to the point in which effective wages equal the value of marginal product.

$$\begin{aligned} \max_{H_E N} \ \Pi &= pQ\left(\left(H_C - H_A\right)N, K\right) - w_C H_C N - rK \\ &= pQ\left(H_E N, K\right) - w_E H_E N - rK \end{aligned} \tag{7}$$

$$\text{with} \quad \frac{\partial Q}{\partial(H_E N)} > 0 \quad \text{and} \quad \frac{\partial^2 Q}{\partial(H_E N)^2} < 0$$

$$w_E = p\frac{\partial Q}{\partial(H_E N)} \tag{8}$$

The discrepancy between contractual and effective wages is obvious, because effective wages are larger than contractual wages in case of workers' downward adjustment of working time via paid absenteeism. Thus, labour demand would be too high if falsely contractual instead of effective wages are taken into account, which would result into a loss of profits. Furthermore, a firm might statistically discriminate against worker groups with higher absenteeism, which would result into lower employment chances for these workers (Aigner and Cain, 1977).

3. Data Set and Descriptive Statistics

The data set was extracted directly from computerized personnel records of a large German limited liability company that produces innovative products for the world market (for more details about the data see Pfeifer and Sohr (2009)). The company has a works council and is subject to an industry wide collective contract. The personnel records contain information about all employees in the company's headquarter on a monthly basis from January 1999 to December 2005. The subsequent empirical analysis includes all blue-collar and white-collar workers, who are neither apprentices nor trainees, who are not in early retirement schemes, and who are not absent on a permanent basis (e.g., parental leave, sabbaticals). Moreover, monthly observations are aggregated on the basis of calendar years because individual absenteeism is very volatile over the year. Therefore, workers who are not observed for all twelve months in a calendar year are excluded from the sample. In sum, the sample contains 9633 yearly observations of 1790 workers in an unbalanced panel design.

Table I presents descriptive statistics about working hours and nominal earnings. Workers have on average 1815.5 contractual working hours per year.[4] Because workers also have on average 58.4 absent working hours per year, which are officially sickness related and fully paid, effective working hours are only 1757.1 and hence significantly lower.[5] Workers are on average 3.25 percent of their contractual working time absent. The average probability that a worker reports an absence in a year is larger than 70 percent. Nominal yearly gross income is on average 36727.6 Euros. The contractual hourly wage is computed by dividing yearly income by contractual working hours, whereas the effective hourly wage takes into account effective working hours in the denominator. The mean contractual wage is 20.00 Euros and the mean effective wage is 20.63 Euros, which are about three percent higher hourly wages.

[4] Note that only 251 different values for contractual working hours can be observed in the seven year observation period (9633 yearly observations of 1790 workers) and that about 85 percent of the observations have only three unique working hours values, which are typical fulltime working hours schemes. This finding emphasizes the adjustment-to-equilibrium approach in case workers are confronted with take-it-or-leave-it contracts that leave few room for individual adjustments of contractual working time (see labor supply model in the previous section).

[5] Unfortunately the personnel data set does not contain reliable information about unpaid overtime, which would be the opposite of downward adjustment via paid absenteeism.

Table I: Descriptive Statistics for Hours and Earnings

	Mean	Std. Dev.	Min.	Max.
Hours				
Contractual working hours	1815.5000	181.1042	207.8400	2088.6000
Absent working hours	58.3980	77.1738	0	658.0000
Absence rate	0.0325	0.0428	0	0.3602
Absence probability	0.7121	0.4528	0	1
Effective working hours	1757.1020	197.3925	207.8400	2088.6000
Earnings				
Yearly gross income in Euros	36727.58	14796.60	3855.14	157478.30
Log yearly income	10.4447	0.3538	8.2572	11.9670
Contractual hourly wage in Euros	19.9996	6.7531	9.5514	75.4206
Log contractual wage	2.9474	0.3018	2.2567	4.3231
Effective hourly wage in Euros	20.6326	6.7553	9.5514	76.8937
Log effective wage	2.9814	0.2928	2.2567	4.3424

Note: Number of yearly observations is 9633 of 1790 workers.

Figure 2 depicts the development of working hours and nominal wages from 1999 to 2005. It can be seen that differences between contractual and effective working hours are quite stable, although working hours vary over time. Wages are largely increasing due to their nominal character; but the differences between contractual and effective wages are again stable. Overall, the descriptive statistics indicate that downward adjustment of working time via paid absenteeism is a non negligible factor which has a significant impact on hourly wages.

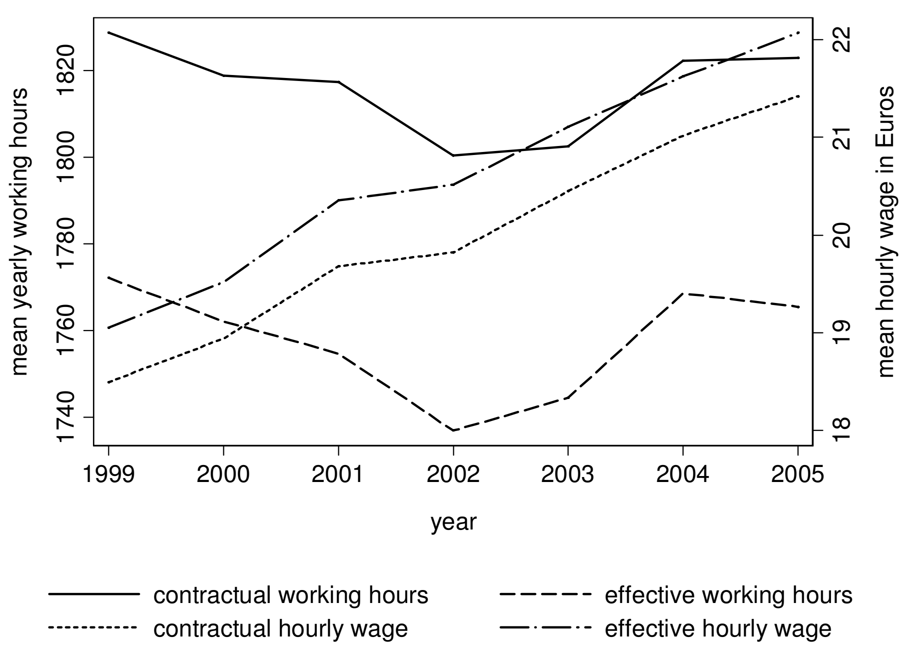

Figure 2: Time Trends of Hours and Wages

Figure 3 depicts the distribution (kernel density estimations using Epanechnikov kernel functions) of log contractual and effective hourly wages. It is not surprising that the distribution of effective wages is on the right hand side of the distribution of contractual wages. More interesting is, however, that especially workers at the lower tail of the wage distribution benefit if effective working hours are incorporated instead of contractual hours. The first picture, thus, suggests that inequality is lower for effective than for contractual wages because low wage workers might more frequently adjust their working time downwards via absenteeism to increase effective wages. This impression is supported by different inequality measures, which are summarized in Table II. Although the standard deviation of contractual wages is slightly lower than of effective wages, which is due to the higher mean of the latter, all other inequality measures show a reduction in inequality when taking into account effective working time and wages, respectively.

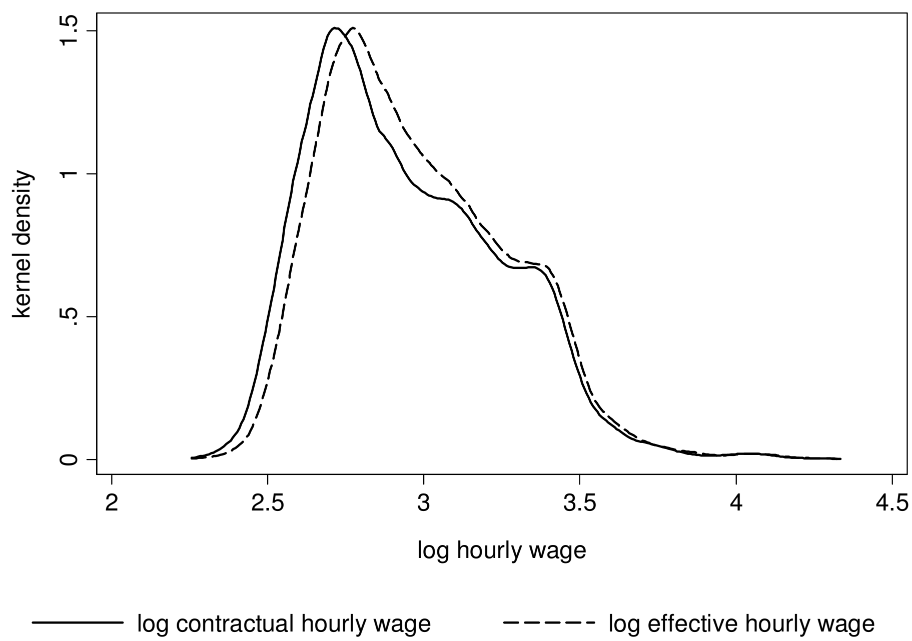

Figure 3: Distribution of Contractual and Effective Wages

Table II: Inequality of Earnings

	(1) Yearly income	(2) Contractual wage	(3) Effective wage	(2) - (3)
Mean	36727.58	19.9996	20.6326	-0.6330
Standard deviation	14796.60	6.7531	6.7553	-0.0022
Standard deviation of logs	0.3538	0.3018	0.2928	0.0090
Relative mean deviation	0.1500	0.1308	0.1259	0.0049
Coefficient of variation	0.4029	0.3377	0.3274	0.0103
Gini coefficient	0.2048	0.1766	0.1710	0.0056
Mehran measure	0.2775	0.2424	0.2351	0.0073
Piesch measure	0.1685	0.1436	0.1390	0.0047
Kakwani measure	0.0391	0.0289	0.0272	0.0017
Theil entropy measure	0.0708	0.0512	0.0482	0.0030
Theil mean log deviation measure	0.0665	0.0484	0.0455	0.0029
Atkinson measure	0.0644	0.0472	0.0445	0.0027

4. Regression Analyses

In this section, I estimate several regressions for hours and earnings using random effects GLS (generalized least squares) to exploit the panel nature of the data set. The Breusch and Pagan (1980) Lagrange multiplier test indicates that the random effects model is more appropriate than pooled cross sectional OLS (ordinary least squares), because the null hypothesis that the variance of the random effects equals zero is rejected at high significance levels in all regressions. Since most of our variables of interest (gender, schooling) are time invariant, fixed effects models are not very useful for the aim of this paper, which is to compare coefficients between different groups, namely by gender, highest schooling degree, and age categories.[6] In addition to these group indicating variables, all regressions include the observation years to control for aggregated influences and to deal with the nominal character of earnings, i.e., the year fixed effects account also for year specific inflation rates.

Two specifications are estimated for every outcome variable. The first specification does not control for job levels obtained from wage groups in the collective contract, because these levels are highly correlated with earnings as well as hours and can be interpreted as an outcome of other covariates.[7] Nevertheless, it might be interesting to see if effects can still be found within the job levels, so that a second specification is estimated which includes twelve job level dummies. As the dependent variables have already been discussed at length in the previous section, Table III contains a list of the explanatory variables, which are all specified as dummy variables, and their mean values in the pooled sample.

[6] A comparison between random effects and fixed effects models shows only small differences between the coefficients of time-variant variables, which are however significant in a Hausman (1978) specification test due to the large sample size and very small standard errors.

[7] See Pfeifer (2008) and Pfeifer and Sohr (2009) for a description and discussion of the job levels obtained from the collective contract, which is binding to the company. In the present paper, job levels fulfil only the purpose of an additional control variable.

Table III: Descriptive Statistics for Control Variables

	Mean
Female (dummy)	0.2363
Less than high school degree (dummy, reference)	0.6966
High school degree (dummy)	0.0969
College degree (dummy)	0.2066
Age <25 years (dummy, reference)	0.0225
Age 25-35 years (dummy)	0.1916
Age 35-45 years (dummy)	0.3920
Age 45-55 years (dummy)	0.3081
Age 55-65 years (dummy)	0.0857
Year 1999 (dummy, reference)	0.1285
Year 2000 (dummy)	0.1361
Year 2001 (dummy)	0.1445
Year 2002 (dummy)	0.1566
Year 2003 (dummy)	0.1522
Year 2004 (dummy)	0.1452
Year 2005 (dummy)	0.1368
Blue-collar level 1 (dummy, reference): unskilled work (instruction)	0.0339
Blue-collar level 2 (dummy): semi-skilled work (basic training)	0.0270
Blue-collar level 3 (dummy): semi-skilled work (two-year apprenticeship)	0.0396
Blue-collar level 4 (dummy): somewhat difficult skilled work (three-year apprenticeship)	0.1638
Blue-collar level 5 (dummy): moderately difficult skilled work (three-year apprenticeship)	0.0799
Blue-collar level 6 (dummy): difficult skilled work (three-year apprenticeship)	0.0470
Blue-collar level 7 (dummy): very difficult skilled work (three-year apprenticeship)	0.0195
White-collar level 1 (dummy): simple tasks (instruction or basic training)	0.0523
White-collar level 2 (dummy): somewhat difficult tasks (three-year apprenticeship)	0.1396
White-collar level 3 (dummy): moderately difficult tasks (university of applied science degree)	0.1478
White-collar level 4 (dummy): difficult tasks, making decisions of limited scope (university degree)	0.0910
White-collar level 5 (dummy): very difficult tasks, making decisions of broader scope (university degree)	0.0694
White-collar level 6 (dummy): upper management tasks, non-pay-scale (not subject to collective contract)	0.0890

Note: Number of yearly observations is 9633 of 1790 workers.

Table IV informs about the results of the hours regressions. Five different outcome variables are used to get an impression of differences between gender, schooling degrees, and age categories: (1) number of contractual working hours, (2) number of absent working hours, (3) absence rate ((2)/(1)), (4) absence probability ((2)>0), and (5) number of effective working hours ((1)-(2)). Women have on average 137 contractual working hours less, are 14 hours more absent, have a higher absence rate of one percentage point, have a higher absence probability of nine percentage points, and work in total 150 effective working hours less than men. It can also be seen that higher schooling degrees are associated with more contractual working hours, fewer absent working hours, a lower absence rate and absence probability, and consequently with more effective working hours. When additionally controlling for job levels, the differences between the gender and schooling groups are reduced but remain largely significant. Overall the results on working hours and absenteeism are in line with previous research (e.g., Allen, 1981; Brown and Sessions, 1996; Dunn and Youngblood, 1986; Bradley *et al.*, 2007; Ichino and Moretti, 2009).

Table IV: Hours Regressions

	(1) Contractual working hours	(2) Absent working hours	(3) Absence rate	(4) Absence probability	(5) Effective working hours
Female (dummy)	-136.7559***	13.6377***	0.0099***	0.0910***	-150.2349***
	(8.1680)	(3.1904)	(0.0018)	(0.0170)	(8.5955)
High school degree (dummy)	-18.5385	-38.9132***	-0.0217***	-0.1056***	20.8897*
	(11.7859)	(4.6502)	(0.0026)	(0.0248)	(12.4295)
College degree (dummy)	103.5522***	-40.2240***	-0.0232***	-0.1673***	144.6246***
	(8.3267)	(3.2693)	(0.0018)	(0.0174)	(8.7699)
Age 25-35 years (dummy)	2.8233	9.5235*	0.0052*	0.0346	-7.2795
	(8.8006)	(5.6237)	(0.0031)	(0.0343)	(10.4785)
Age 35-45 years (dummy)	-7.4289	8.1959	0.0048	-0.0131	-16.1024
	(9.5165)	(5.8050)	(0.0032)	(0.0348)	(11.2200)
Age 45-55 years (dummy)	5.8924	10.4499*	0.0058*	-0.0209	-0.7777
	(10.1823)	(5.9971)	(0.0033)	(0.0357)	(11.9055)
Age 55-65 years (dummy)	16.5921	14.3830**	0.0075**	-0.0576	7.0986
	(11.5945)	(6.6653)	(0.0037)	(0.0394)	(13.4819)
Year (6 dummies)	Yes	Yes	Yes	Yes	Yes
Job level (12 dummies)	No	No	No	No	No
Mean dependent variable	1815.50	58.3980	0.0325	0.7121	1757.10
R squared (overall)	0.2128	0.0580	0.0645	0.0319	0.2282
Breusch Pagan test (χ^2)	14672.84***	3787.49***	3757.59***	2215.78***	12021.37***
Female (dummy)	-124.4736***	6.3345*	0.0056***	0.0663***	-134.0164***
	(8.3162)	(3.5604)	(0.0020)	(0.0198)	(8.8675)
High school degree (dummy)	-19.2151*	-17.8699***	-0.0102***	-0.0524**	1.9734
	(11.2615)	(4.7073)	(0.0026)	(0.0260)	(11.9217)
College degree (dummy)	37.5580***	-13.9547***	-0.0080***	-0.0772***	52.5169***
	(9.4073)	(4.0838)	(0.0023)	(0.0227)	(10.0737)
Age 25-35 years (dummy)	-5.3358	11.0182*	0.0064**	0.0385	-17.2298
	(8.8408)	(5.7020)	(0.0032)	(0.0352)	(10.5232)
Age 35-45 years (dummy)	-25.9359***	11.7586**	0.0073**	0.0016	-40.0274***
	(9.5633)	(5.9376)	(0.0033)	(0.0362)	(11.2827)
Age 45-55 years (dummy)	-18.7376*	17.0068***	0.0100***	0.0065	-34.5452***
	(10.1926)	(6.1528)	(0.0034)	(0.0373)	(11.9368)
Age 55-65 years (dummy)	-13.5386	23.4457***	0.0132***	-0.0186	-34.9853***
	(11.5292)	(6.7940)	(0.0038)	(0.0409)	(13.4231)
Year (6 dummies)	Yes	Yes	Yes	Yes	Yes
Job level (12 dummies)	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	1815.50	58.3980	0.0325	0.7121	1757.10
R squared (overall)	0.3226	0.1134	0.1190	0.0496	0.3277
Breusch Pagan test (χ^2)	12840.16***	3023.07***	3004.51***	2020.66***	10211.46***

Note: Number of yearly observations is 9633 of 1790 workers. Reference groups are men, have less than high school degree, and are younger than 25 years. Random effects GLS. Standard errors in brackets. Coefficients and test values are significant at *** p<.01, ** p<.05, and * p<.10.

Age has a more complex impact on hours. First, older workers have more absent hours and a higher absence rate, even though the absence probability is not significantly affected by age. These results are quite similar in both specifications with and without job levels. Working hours, however, give not a conclusive picture, because statistical significance is low and some age coefficients even change their signs if job levels are incorporated. Nevertheless, it seems as if older workers provide on average fewer effective hours since they are on average more hours absent.

The results of the earnings regressions are presented in Table V. The dependent variables are (1) log yearly income, (2) log contractual hourly wages, and (3) log effective hourly wages. All regressions reveal the usual findings that women earn significantly less than men, that more schooling is associated with significant higher earnings, that age-earnings profiles are upward sloping concave with slightly negative wage growth for the oldest workers, and that coefficients are smaller in the specifications with job levels as these absorb parts of the effects due to job assignment (Pfeifer, 2008). The aim of this paper is, however, to compare wage differential estimates between the different earnings measures with a special focus on differences between contractual and effective wages.[8] Hausman (1978) specification tests between the regressions for contractual and effective wages reject the null hypothesis of no systematic differences at high significance levels. Moreover, a fourth specification is estimated in which the dependent variable is the difference between log contractual wages and log effective wages. The significance of the estimated coefficients indicates that the estimated wage differentials differ significantly between contractual and effective wages.

Wage differentials between men and women as well as between schooling degrees are smaller in effective wage regressions than in contractual wage regressions. The gender gap in hourly wages is reduced by more than one percentage point if effective instead of contractual working hours are taken into account. The wage premiums of workers with high school and college degrees are about two percentage points smaller for effective than for contractual hourly wages. Furthermore, the effects of age on wages are larger in effective wage regressions than in contractual wage regressions. Figure 4 illustrates the predicted age-earnings profiles of average workers for contractual and effective hourly wages from the specifications without job levels and Figure 5 illustrates the same from the specifications in which job levels are incorporated. It can be seen that age-earnings profiles are steeper and that wages of older workers do not decrease as much for effective hourly wages compared to contractual hourly wages.

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[8] Bell and Hart (1999) perform a quite similar exercise for unpaid overtime.

Table V: Earnings Regressions

	(1) Log yearly income	(2) Log contractual wage	(3) Log effective wage	(4) (Log w_C) – (Log w_E)
Female (dummy)	-0.2411***	-0.1516***	-0.1402***	-0.0105***
	(0.0143)	(0.0125)	(0.0121)	(0.0019)
High school degree (dummy)	0.1297***	0.1416***	0.1223***	0.0232***
	(0.0204)	(0.0178)	(0.0173)	(0.0028)
College degree (dummy)	0.4644***	0.4084***	0.3838***	0.0247***
	(0.0145)	(0.0127)	(0.0123)	(0.0020)
Age 25-35 years (dummy)	0.0743***	0.0611***	0.0700***	-0.0057*
	(0.0089)	(0.0049)	(0.0066)	(0.0034)
Age 35-45 years (dummy)	0.1061***	0.0923***	0.1077***	-0.0053
	(0.0099)	(0.0055)	(0.0073)	(0.0035)
Age 45-55 years (dummy)	0.1172***	0.0862***	0.1060***	-0.0063*
	(0.0109)	(0.0062)	(0.0081)	(0.0036)
Age 55-65 years (dummy)	0.1119***	0.0659***	0.0932***	-0.0082**
	(0.0126)	(0.0072)	(0.0094)	(0.0040)
Year (6 dummies)	Yes	Yes	Yes	Yes
Job level (12 dummies)	No	No	No	No
Mean dependent variable	10.4447	2.9474	2.9814	-0.0340
R squared (overall)	0.4274	0.3944	0.3854	0.0625
Breusch Pagan test (χ^2)	19975.58***	22346.56***	20892.66***	3670.24***
Female (dummy)	-0.1363***	-0.0588***	-0.0425***	-0.0059***
	(0.0082)	(0.0057)	(0.0061)	(0.0021)
High school degree (dummy)	-0.0214*	0.0045	-0.0179**	0.0109***
	(0.0111)	(0.0079)	(0.0083)	(0.0028)
College degree (dummy)	0.0640***	0.0742***	0.0326***	0.0085***
	(0.0092)	(0.0064)	(0.0069)	(0.0025)
Age 25-35 years (dummy)	0.0423***	0.0448***	0.0505***	-0.0069**
	(0.0081)	(0.0043)	(0.0059)	(0.0034)
Age 35-45 years (dummy)	0.0602***	0.0722***	0.0831***	-0.0080**
	(0.0088)	(0.0048)	(0.0064)	(0.0036)
Age 45-55 years (dummy)	0.0738***	0.0746***	0.0903***	-0.0109***
	(0.0095)	(0.0052)	(0.0069)	(0.0037)
Age 55-65 years (dummy)	0.0748***	0.0675***	0.0902***	-0.0144***
	(0.0107)	(0.0060)	(0.0079)	(0.0041)
Year (6 dummies)	Yes	Yes	Yes	Yes
Job level (12 dummies)	Yes	Yes	Yes	Yes
Mean dependent variable	10.4447	2.9474	2.9814	-0.0340
R squared (overall)	0.8375	0.8951	0.8769	0.1158
Breusch Pagan test (χ^2)	12409.31***	13606.85***	10772.14***	2939.20***

Note: Number of yearly observations is 9633 of 1790 workers. Reference groups are men, have less than high school degree, and are younger than 25 years. Random effects GLS. Standard errors in brackets. Coefficients and test values are significant at *** p<.01, ** p<.05, and * p<.10.

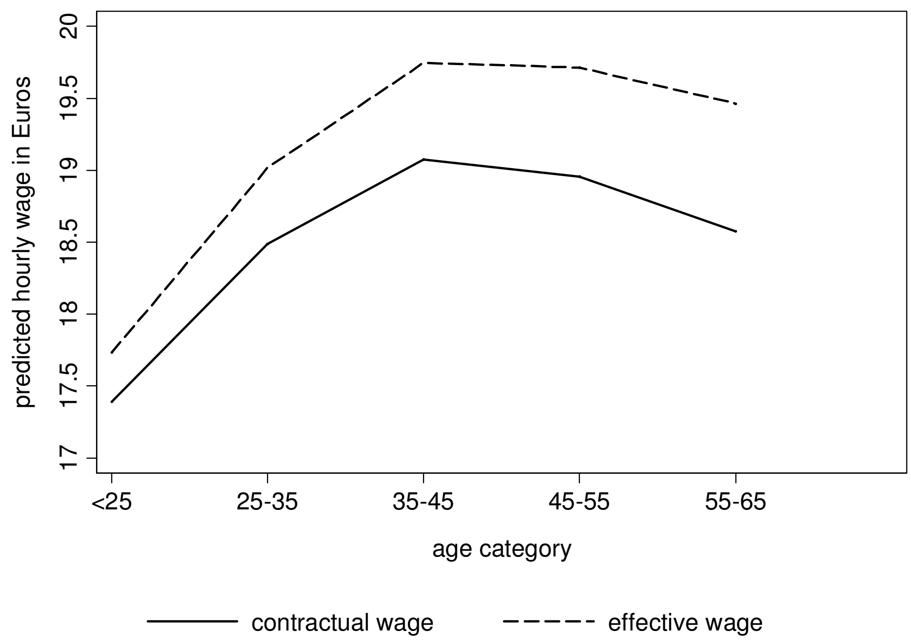

Figure 4: Age-Earnings Profiles for Contractual and Effective Wages (without Control for Job Levels)

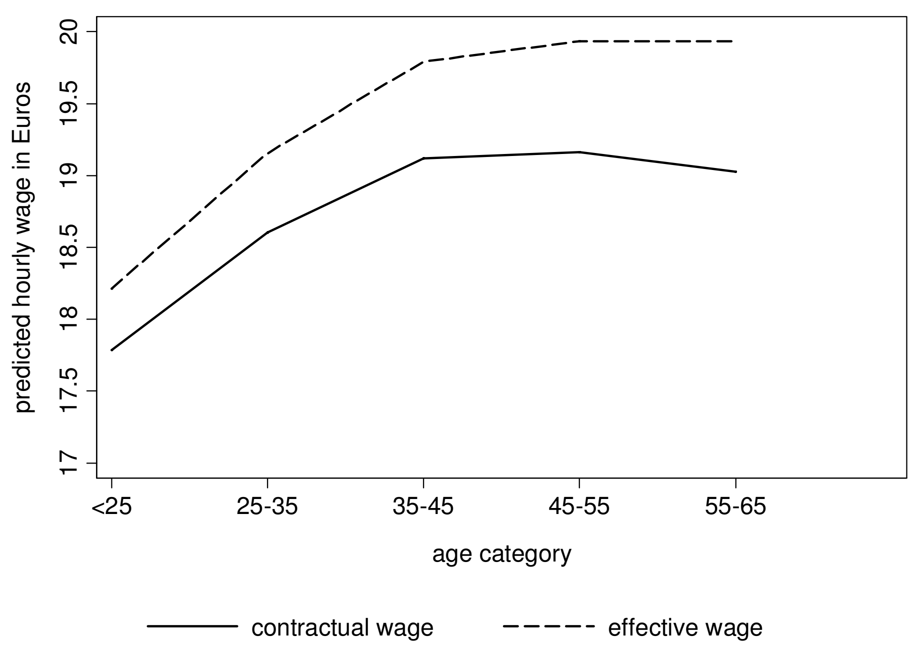

Figure 5: Age-Earnings Profiles for Contractual and Effective Wages (with Control for Job Levels)

5. Discussion and Concluding Remarks

The main result of this paper is that wage differential estimates are systematically biased if the compared groups differ in work absence. The gender gap in effective hourly wages is more than one percentage point smaller than the gender gap in contractual wages, because women are on average more absent than men. Moreover, workers with lower schooling are more absent, which leads to an upward bias in estimates for rates of return to schooling when contractual instead of effective wages are used. Older workers are also more absent so that contractual age-earnings profiles are significantly flatter than effective age-earnings profiles. Since workers at the lower tail of the wage distribution (e.g., women, low schooling) have higher absenteeism rates, the concept of effective wages reduces wage inequality compared to contractual wages. Bell and Hart (1999) report quite similar findings for unpaid overtime. Worker groups with more unpaid overtime have lower effective wages and hence wage differences are smaller than for contractual wages (e.g., men, higher schooling). A complete assessment of effective wages has therefore to account for paid and unpaid as well as for upward and downward adjustments of working hours. Moreover, the systematic pattern in absenteeism and wages in the reduced regression approach, which has been applied in this paper, indicates possible simultaneity between wages, working hours, and work absence that has to be addressed in future research. The general implication of my results is that researchers should be aware of potential biases in wage differential estimates and hourly wage inequality measures, if they are interested in the effective wage rate, which is the core of most economic models, and if absenteeism and other working time adjustments are not observed in the data, which is unfortunately the case for most data sets.

As firms are primarily interested in effective wages paid for effective labour supply, differences in effective working hours and wages are also likely to affect firms' employment decisions. If two groups differ on average in their effective wages, firms might statistically discriminate against workers from a group with on average higher absenteeism (women, low skilled, older workers) and hence prefer to recruit workers from a group with higher effective working hours (men, high skilled, younger workers). In a dynamic context, less employment chances for high absent workers might lead to a reduction of reservation wages and consequently to contractual wage differentials between low and high absent workers.

Some general implications on wage inequality and institutional sickness benefit systems can also be drawn. Sickness benefits are likely to reduce effective wage inequality because low wage workers are on average more absent than high wage workers. Therefore, sickness benefits, which are often financed by taxes or insurance premiums, lead to redistribution from high wage (low absent) workers to low wage (high absent) workers. If taxes and premiums are progressive, as in most countries, this redistribution effect is even larger. It might be worthwhile for future research to test relationships between the design of sickness benefit and health insurance systems on the one hand and inequality measures on the other hand. For this purpose, between and within country comparisons as well as natural experiments in micro data sets are possible empirical strategies. Such results would also help to improve our understanding of the political economy of sickness benefits and health insurances.

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