Temporal and locational flexibility of work and absenteeism

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Abstract: The effects of temporal and locational flexibility on the frequency and length of sickness absenteeism are analysed in this study. Using a Dutch survey of public sector employees, I show that increased temporal and locational flexibility is negatively associated with sickness absenteeism in general. Especially flexi-time, i.e. quickly adjustable temporal flexibility, reduces both the frequency and in particular the duration of absences. Telehomework or locational flexibility on the other hand seems to mainly affect absence frequency but not absence duration. Long-term temporal flexibility in the form of part-time work finally does not appear to have a significant impact on absenteeism.

Keywords: absenteeism; flexible work arrangements; flexi-time; locational flexibility; part-time work; telehomework; temporal flexibility

JEL-codes: J22; J;28; J32; M52; M54

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1 Introduction

The timing and setting of work has received surprisingly little attention among labour economists.[1] Most of the time it is implicitly assumed that employees work together simultaneously and at the same location in order to produce goods and services. This does not always have to be the case, of course. An interesting new development in this respect refers to temporal and locational flexibility (TLF). An increasing number of establishments experiment with a new organisation of work and working time in which employees perform their tasks remotely and outside regular office hours (Messenger, 2010). The share of establishments in 21 EU-countries which offered some type of flexibility regarding the beginning and end of daily working time for example rose from 48% to 57% between 2005 and 2009 alone (Riedmann et al., 2010). In the EU the share of employees involved in telework increased from 4.5% to 7% from 2000 to 2005 (Welz and Wolf, 2010).

Facilitated by new, output-oriented management styles and modern ICT technologies, employees can exert more control over the timing and setting of work, which becomes much more individualised under TLF. The extent to which TLF can be incorporated into different jobs and task profiles certainly varies as the importance of simultaneity differs between production processes (cf. Owen, 1977). Compare for example the type of work in an operating room or on an assembly line on the one hand with the type of work of knowledge or web workers on the other. Yet, modern technology reduces the importance of synchrony in timing and location, allowing for new possibilities in the organisation of work and working time.

It may be presumed that increased TLF is beneficial for employees and in line with the preferences of modern knowledge workers. Employees demand flexible working schedules in order to suit their preferred life styles and to strike a balance between work and personal life. TLF caters this demand by giving employees more control over duration, scheduling and setting of work (Lewis, 2003; Plantenga, 2003; Rau, 2003). As a result, TLF allows employees to work during times more suited to their personal needs and circadian rhythm. TLF also reduces time spent commuting or sometimes eliminates commuting altogether. Previous research indicates accordingly that TLF improves the fit between paid work and private life and increases job satisfaction (Possenriede and Plantenga, 2011).

Implementing TLF and giving employees more control over time and place of work is not without cost for the employer though. There is less opportunity for direct interaction between employees when they do not work simultaneously at the same place. This makes it more complicated to instruct and monitor employees, possibly resulting in a more distant employer-employee relationship. Productivity may also depend on synchrony of activities, because employees need to perform

[1] The most notable exception probably being Daniel Hamermesh (e.g. Hamermesh, 1998, 1999, 2002; Hamermesh and Pfann, 2005)

time-critical tasks, interact directly with clients or complement each other in the production process (Heywood and Jirjahn, 2009; Kremer, 1993). Employers may also benefit from increased TLF for employees however (Anxo et al., 2006; Chung, 2009; Reilly, 2001). It can save costs because turnover and travel expenses are reduced and less office space is needed. Furthermore, employees' attitudes and morale are improved, leading to more dedicated employees(T. D. Allen, 2001; Kelliher and Anderson, 2010).

Another important issue is the reduction of absenteeism rates through increased TLF. Across Europe, average rates of absence are between 3% and 6% of working time with estimated costs amounting to 2.5% of GDP (Edwards and Greasley, 2010). In the Netherlands, with average absence rates of around 4.3% in recent years, yearly wage costs of sickness absenteeism are estimated to be 7.5 billion EUR (Hartman et al., 2010). TLF may reduce absenteeism because employees can flexibly respond to minor sicknesses or private 'emergencies'. Furthermore it may improve worker's health, through reduced stress and increased job satisfaction, for example.

In this article I analyse the effects of TLF on absenteeism. In particular, I use a cross-section survey of Dutch public sector employees to analyse the effects of TLF on the frequency and duration of sickness absenteeism. Unfortunately the statistical treatment of TLF is far from perfect yet. TLF in the strict sense refers to an individualized organisation of work and working times in which at least part of the work can be done outside the premises of the employer and outside regular work hours. In this study I presume that the organisational and agency aspects of TLF are best represented by flexible work arrangements (FWA) such as flexi-time, telehomework and part-time work (Lewis, 2003; Rau, 2003). Flexi-time gives employees (some) control over their work schedule and part-time work enables employees to adjust the weekly duration of work. Both are presumed to capture the individualised working times of TLF. Telehomework allows employees (some degree of) individual choice in the location of work and covers the possibility to work at different places.

Due to the prevalence of part-time work in the Dutch economy, it is particularly interesting to see whether alternative means to provide flexibility and autonomy to employees, namely flexibility in the timing and location of work, provide significant labour market effects.

2 TLF and absenteeism

There are several reasons why increased TLF may reduce absenteeism. First, there may be direct effects of increased control over working time and place on absenteeism. It has previously been argued that absenteeism is higher when there is a mismatch between preferred and actual working hours (Dunn and Youngblood, 1986) and that absenteeism serves as a coping mechanism against bad working conditions, such as low work-time control (Kristensen, 1991). It is therefore to be expected that the absence rate is lower if employees have a say over their working time and place.

Second, the timing of and the fit between work and non-work related activities may be improved under TLF. Emergencies and other non-work responsibilities that appear more or less unplanned may interfere with employee's ability to show up at work. Under a fixed working time regime only absenteeism permits an employee to undertake these activities and may therefore be used to obtain work schedule flexibility (S. G. Allen, 1981). An employee with TLF on the other hand experiences less time restrictions and can thus fit these activities flexibly into his or her schedule. So instead of using sick leave as a shortcut to be able to react to unforeseen emergencies or attend important non-work activities during scheduled working time – i.e. instead of 'shirking' – employees may make use of flexible work arrangements for this purpose (Kim and Campagna, 1981).[2]

TLF may in particular be relevant for young working parents struggling to resolve work-family conflict. Especially young children are likely to cause unexpected emergencies that interfere with work responsibilities (Greenhaus and Beutell, 1985). Here again, more control over the timing and location of work may reduce the need to 'shirk'. Two previous studies accordingly point towards a negative relationship of flexi-time on work-family conflict and subsequent absenteeism. Ralston and Flanagan (1985) found that flexi-time reduces absenteeism of both men and women by helping to cope with inter-role conflict. VandenHeuvel (1997) shows that family-related absence is reduced if (female) workers can flexibly reschedule their work hours due to family reasons. So, TLF may reduce absenteeism especially for employees with family responsibilities, due to a higher need for flexibility.

Increased control over working time and place may not only change the way in which employees reconcile emergencies and non-work activities with their work responsibilities, but also how they deal with (minor) sicknesses and sickness absenteeism. Employees, who are sick and have the opportunity to flexibly reschedule their work or to work at home, may not report sick or return to work more quickly than employees without these opportunities.[3]

Apart from these behavioural effects, TLF may have a positive effect on employees' health through various pathways as well. Work-time control is associated with positive health outcomes and has been shown to moderate adverse effects on health associated with work-related stress and employer-oriented flexibility, such as overtime and work at irregular hours (Ala-Mursula, Vahtera, Linna et al., 2005; Costa et al., 2006; Grzywacz et al., 2008; Olsen and Dahl, 2010). Temporal flexibility furthermore reduces the impact of long domestic and total working hours on absences and work-family interference (Ala-Mursula, Vahtera, Kouvonen et al., 2006; Ala-Mursula, Vahtera, Pentti et

[2] Of course, these two means of obtaining work schedule flexibility come at different (potential) costs to employees and employers. Increased absences may for example result in lower wages, a lower likelihood of promotion or even dismissal for the employee. With TLF the risk of these drawbacks should be smaller.

[3] This effect may be double-edged, though. If work pressure is high, more flexibility may lead to presenteeism, however, i.e. working on the job while being sick. Presenteeism has in general been shown to affect health negatively and is therefore detrimental to productivity and employees' well-being (Hansen and Andersen, 2009; Kivimäki et al., 2005).

al., 2004; Geurts et al., 2009). Commuters in particular experience a reduction of time available for domestic work, discretionary leisure activities, sleep, and recovery, which again can lead to health complaints and therefore higher sickness absence rates (Costal et al., 1988). Since TLF can reduce commuting times substantially, it may reduce absenteeism via this route as well (Ala-Mursula, Vahtera, Kouvonen et al., 2006). TLF finally increases job satisfaction (Possenriede and Plantenga, 2011; Scandura and Lankau, 1997) which again has been shown to improve health (Faragher et al., 2005; Fischer and Sousa-Poza, 2009).

Until now we considered TLF and its potential to reduce absenteeism in rather general terms. Yet there may be differences between arrangements such as flexi-time and telehomework on the one hand and part-time work on the other. Most of the obstacles to work attendance, sickness-related or otherwise, come at short notice. Flexi-time and telehomework make it possible to adjust working schedule and place on a relatively short notice and I consequently assume that these arrangements have a significant impact on absenteeism. Part-time work is different in this respect because adjustments of the length of work are not so quickly made. It seems unlikely then that part-time work will have the same short-term behavioural effects on absenteeism. Nevertheless, as has already been mentioned above, some long-term indirect effects may exist, via health, stress, job satisfaction, etc. Part-time employment may therefore have an effect in this domain.

Part-time workers report for example to be less exposed to work-related health and safety risks, such as hazards and poor ergonomic conditions, and to experience lower work intensity. They also report fewer work-related health symptoms, such as backache, muscular pain, stress and fatigue. This may partly be due to sorting into particular sectors and task profiles, but may also be caused by a shorter exposure to adverse working conditions due to shorter work hours (Burchell et al., 2007; Fagan and Burchell, 2002; Isusi and Corral, 2004).

Shorter work hours also improve the combination of paid work and private life. Part-time employment gives more room for flexible scheduling, because the smaller the number of working hours of an employee, the smaller their fraction relative to a given amount of business hours and therefore the more room to schedule these hours into the roster. More part-time than full-time workers indeed report to have at least some control over the scheduling of their working hours. Part-time employees accordingly report more often that their work lives are compatible with other commitments (Burchell et al., 2007; Fagan and Burchell, 2002). Furthermore, the opportunity costs of work increase under the assumption of decreasing marginal utility from work. More working hours would therefore lead to an increase in absenteeism (S. G. Allen, 1981, p. 79).[4]

In summary there are several ways how TLF influences absenteeism. It may change the way em-

[4] Increased hours may theoretically lead to a *decrease* in absences as well, because the cost of a potential job loss increases with working hours (Drago and Wooden, 1992). Empirically, Drago and Wooden (ibid.) also find a positive (composite) effect, however.

ployees directly deal with emergencies and (minor) sickness and may improve health, for example by reducing stress and increasing job satisfaction. Part-time work is different from flexi-time and telehomework in that it usually cannot be adapted as quickly to changing circumstances as the latter two. Part-time work may nevertheless have positive longer-term effects on health and work-life fit and may therefore reduce absenteeism as well. These considerations lead to the following hypotheses:

Hypothesis 1: *Increased temporal and locational flexibility through the use of flexible work arrangement (flexi-time, telehomework, part-time work) will be negatively associated with sickness absenteeism.*

Hypothesis 2: *The association will be stronger for flexi-time and telehomework than for part-time work, because the former make it possible to adjust the timing and location of work at short notice.*

Hypothesis 3: *The association between temporal and locational flexibility and sickness absenteeism will be stronger for employees with family responsibilities than for those without, due to a higher demand for flexibility for the former group of employees.*

3 Methodology

3.1 Data

The Dutch Public Sector Employee Survey 2004 (*Personeelsonderzoek Overheidspersoneel*, PO 2004) by the Dutch Ministry of the Interior and Kingdom Relations (MinBZK, 2005) is used for the analysis.[5] This survey is conducted bi-annually to study the satisfaction, motivation, profile and labour market behaviour of the public sector employees in the Netherlands. The PO 2004 edition is unique in that it includes data on the preference for and the availability of flexible work arrangements and other working conditions. It contains data on 24,414 employees from all public sectors, like state government, municipalities, police, defence, schools, universities, and academic hospitals and provides detailed information on work organisation, fringe benefits, and other work-related factors, as well as socio-economic and household characteristics of the surveyed employees. All respondents were employed with the same employer for the whole year 2003 (ibid., p. 63).[6] Data from individuals working in the defence sector as well as from all individuals with missing information on one of the variables used was excluded from the analysis. Table 1 presents an overview

[5] The PO datasets are available for scientific research upon request at the Dutch Ministry of the Interior and Kingdom Relations.

[6] This includes employees who changed jobs or had multiple contracts with the same employer, who stopped working for not more than three months and resumed afterwards, or whose number of working hours changed. It does not include employees who entered and left the public sector or changed employers within the public sector (e.g. from one police corps to another) in 2003 (MinBZK, 2005, p. 69). For a description of the sample design see MinBZK (ibid., p. 64 et sqq.).

Table 1: Variable definitions and summary statistics

Variable	Definition	Mean	Std. Dev.	Min	Max
Absence frequency	Number of times reported sick in 2003	1.088	1.415	0	25
Absence duration	Total number of days reported sick in 2003	7.016	20.998	0	260
Flexi-time	Access to flexible working times	0.569	0.495	0	1
Telehomework	Access to work at home every now an then	0.519	0.500	0	1
Part-time	Part-time categories				
1	Small part-time job (1-11h)	0.023	0.150	0	1
2	Medium part-time job (12-19h)	0.080	0.272	0	1
3	Large part-time job (20-35h)	0.313	0.464	0	1
4	Full-time job (36+h)	0.583	0.493	0	1
Workdays	Usual number of workdays per week				
0	0 workdays per week	0.001	0.037	0	1
1	1 workday per week	0.012	0.109	0	1
2	2 workdays per week	0.051	0.220	0	1
3	3 workdays per week	0.150	0.357	0	1
4	4 workdays per week	0.283	0.450	0	1
5	5 workdays per week	0.496	0.500	0	1
6	6 workdays per week	0.007	0.082	0	1
Female	Female employee	0.452	0.498	0	1
Child 0-5	Child(ren) 0-5 years living at home	0.173	0.378	0	1
Child 6+	Child(ren) 6+ years living at home	0.476	0.499	0	1
Age	Age categories				
1	15-24 years	0.028	0.166	0	1
2	25-34 years	0.175	0.380	0	1
3	35-44 years	0.272	0.445	0	1
4	45-54 years	0.372	0.483	0	1
5	55+ years	0.153	0.360	0	1
Family status	Family status				
1	Single (incl. single parent)	0.024	0.152	0	1
2	Cohabiting or married	0.967	0.179	0	1
3	Living at parent's home	0.005	0.072	0	1
4	Other	0.005	0.067	0	1

Table 1: Variable definitions and summary statistics *(continued)*

Variable	Definition	Mean	Std. Dev.	Min	Max
Partner job	Does partner have a job?				
1	No	0.200	0.400	0	1
2	Yes. <= 20 hours per week	0.190	0.393	0	1
3	Yes. >= 21 hours per week	0.610	0.488	0	1
Education	Highest educational degree				
1	Primary school	0.004	0.065	0	1
2	Lower vocational training (e.g. lbo)	0.036	0.187	0	1
3	Lower secondary education (e.g. mavo)	0.074	0.262	0	1
4	Higher secondary education (e.g. vwo)	0.059	0.237	0	1
5	Medium vocational training (e.g. mbo)	0.154	0.361	0	1
6	Higher vocational training (e.g. hbo)	0.449	0.497	0	1
7	Academic (e.g. bachelor kandidaatsexamen)	0.036	0.185	0	1
8	Academic (e.g. master)	0.187	0.390	0	1
Experience	How many years did you perform paid work?	22.559	10.403	0	55
Wage	Gross wage category				
1	<= 1.250 EUR	0.087	0.281	0	1
2	1.251 - 1.500 EUR	0.073	0.259	0	1
3	1.501 - 1.750 EUR	0.068	0.252	0	1
4	1.751 - 2.000 EUR	0.082	0.274	0	1
5	2.001 - 2.500 EUR	0.170	0.376	0	1
6	2.501 - 3.000 EUR	0.135	0.342	0	1
7	3.001 - 3.500 EUR	0.146	0.353	0	1
8	3.501 - 4.000 EUR	0.102	0.302	0	1
9	4.001 - 4.500 EUR	0.064	0.245	0	1
10	4.501 - 5.000 EUR	0.036	0.186	0	1
11	> 5.000 EUR	0.038	0.191	0	1
Contract type	Type of contract				
1	Permanent contract	0.950	0.217	0	1
2	Temp. c. with prospects of permanent c.	0.024	0.154	0	1
3	Temp. c. without prospects of permanent c.	0.017	0.129	0	1
4	Contract based on special arrangement	0.004	0.064	0	1
5	Other	0.004	0.067	0	1

Table 1: Variable definitions and summary statistics *(continued)*

Variable	Definition	Mean	Std. Dev.	Min	Max
Executive position	Are you supervising colleagues?	0.285	0.451	0	1
Overtime	Regularly working overtime	0.476	0.499	0	1
Multiple jobs	Employee holding 2+ jobs	0.058	0.234	0	1
Hour satisfaction	Satisfaction with number of work hours				
1	I am satisfied	0.827	0.378	0	1
2	I would like to work more hours	0.053	0.224	0	1
3	I would like to work less hours	0.119	0.324	0	1
Sector	Sector				
1	State government	0.176	0.381	0	1
2	Municipalities	0.078	0.268	0	1
3	Primary school	0.174	0.379	0	1
4	Secondary school	0.172	0.377	0	1
5	Vocational training and further education	0.137	0.344	0	1
6	Judiciary	0.013	0.113	0	1
7	Police	0.085	0.279	0	1
8	Research institutes	0.014	0.118	0	1
9	Higher vocational training	0.029	0.168	0	1
10	Universities	0.037	0.189	0	1
11	Conservancies	0.019	0.137	0	1
12	Provinces	0.026	0.159	0	1
13	Academic hospitals	0.040	0.197	0	1
Firm size	Number of employees				
1	0-10 employees	0.008	0.087	0	1
2	11-20 employees	0.022	0.148	0	1
3	21-50 employees	0.059	0.235	0	1
4	51-100 employees	0.073	0.260	0	1
5	101-500 employees	0.315	0.464	0	1
6	501-1000 employees	0.131	0.337	0	1
7	1001-5000 employees	0.249	0.432	0	1
8	5000+ employees	0.144	0.351	0	1

The descriptive statistics are based on the same sample as the Absence duration: Full sample model below ($N = 15752$).

and descriptive statistics of the variables used in the analysis.

The dataset contains three variables relating to absenteeism; a binary variable for whether or not the respondent reported sick in the previous year, the total number of times the respondent was absent (frequency) and the total number of days the respondent was absent (duration). The latter two are used as the dependent variables. In 2003 57.0% of the employees reported sick at least once. On average, employees called in sick 1.09 times and 7.02 days.

The main independent variables are the opportunity to work at home every now and then (telehomework) and to have flexible working times (flexi-time), which are both dummy variables (0 = no/don't know; 1 = yes)[7], as well as three part-time work categories.

A large number of control variables that measure observable personal and household as well as job and employer characteristics are used. Many of these are likely to be correlated with FWA and to simultaneously affect the frequency and length of absences. Most control variables are measured as dummy or categorical variables.

3.2 Statistical model

Both dependent variables are count outcomes that exhibit significant overdispersion. The data was therefore fitted with a negative binomial regression model (NB).[8] The overdispersion parameter α, reported in the tables below, is significantly different from zero in all models. As a robustness check, the models were also estimated by Poisson quasi-MLE (Cameron and Trivedi, 2010, p. 577; Gourieroux et al., 1984). This alternative specification did not affect the results significantly. Fitting the data with a zero-inflated model was rejected in favour of the NB, due to the risk of overfitting the data (Long, 1997, p. 249).[9]

Two models for each of the two dependent variables were estimated. The first model includes all predictor variables with no interactions and the control variables.[10] In the second model I interact flexi-time and telehomework, respectively, with dummy variables indicating the presence of one or more children of different age categories. This will show us whether these work arrangements have an additional effect for employees with (small) children and reduce absenteeism by helping

[7] The "no" (arrangement not available) and the "don't know" categories are treated the same. For our analysis it is very unlikely that unknown policies affect absences. If an employee is not aware of whether or not she has access to an arrangement, she probably will not have made use of it.

[8] More specifically a mean-dispersion model was used (NB2 in the terminology of Cameron and Trivedi (1998, pp. 70-77)). See Cameron and Trivedi (1998), Long (1997), Long and Freese (2005) or Winkelmann (2008) for the statistical theory of count data models. The statistical analysis was carried out using Stata 11 (StataCorp, 2011) with user-written commands by Jann (2005; 2007) and Long and Freese (2005).

[9] In order to use zero-inflated models one basically has to assume that there is a two-stage process at work: The first process determines whether or not it is structurally possible for an employee to be absent, the second determines the extent of the absences, given that absences are possible. I cannot think of any reason why the structural probability of an employee to be absent should be zero, however, so the use of zero-inflated models is not justified here.

[10] Observations with missing values are excluded by listwise deletion.

them to combine paid work with private life. Both models were estimated for the full sample as well as for female and male employees separately in order to determine whether there are structural differences in the effect of FWA on the absence behaviour of men and women (VandenHeuvel and Wooden, 1995).

The usual limitations of cross-sectional data also apply to this empirical analysis. The analysis does not imply any statistical causality and despite the large number of control variables there may be potential biases due to unobservable heterogeneity at the employee, job, or firm level. Furthermore I have to rely on self-reported data, which means that measurement errors are possible, for example because employees may not fully recall the frequency and duration of absences in the previous year (Dionne and Dostie, 2007).

4 Results

Table 2 shows the incidence rate ratios for the model without interactions. Access to flexi-time and access to telehomework have a significant effect on the number of times absent according to the model. Both reduce the absence frequency by 5.3% or 0.06 absences per year holding all other variables in the model constant (Absence frequency: Full sample). Access to flexi-time furthermore reduces the length of absences significantly by 15.7% or 1.27 days per year (Absence duration: Full sample). Part-time work does not have a significant effect on both the absence frequency and duration. No single category of part-time workers is individually nor are they jointly significantly different compared to full-time workers (36+h) both with respect to the frequency and duration of absences. Note however that the regular weekly number of days at work was controlled for, in order to account for the fact that the absolute risk of absence is reduced for those who work fewer days.

As a next step I estimated the model separately by gender in order to determine whether there are significant differences in the effect of TLF on the absence behaviour of men and women. The estimation results from the separate regressions are combined by seemingly unrelated estimation (StataCorp, 2009; Weesie, 1999).[11] Subsequent Wald tests for differences in the coefficients do not reject the hypothesis of equal coefficients of the flexible work arrangements for male and female employees, both with respect to frequency and duration of absences (see Table 2).[12]

In order to analyse whether FWA have an additional effect for employees with family responsibilities, the flexi-time and telehomework variables are both interacted with dummy variables indicating the presence of one or more children of two different age categories (see Table 3). These

[11] Seemingly unrelated estimation combines the parameter estimates and associated variance-covariance matrices of two or more regression models in order to test cross-model hypotheses.

[12] There is one exception: Men working in large part-time jobs are roughly 15% more often absent than their full-time working (male) colleagues according to our model, but they are not significantly longer absent.

Table 2: Incidence rate ratios of flexible work arrangements on absence frequency and duration

Variables	Absence frequency			Absence duration		
	Full sample	Male only	Female only	Full sample	Male only	Female only
Flexi-time access	0.947*	0.948	0.939	0.843**	0.789***	0.871*
	(0.0238)	(0.0357)	(0.0305)	(0.0444)	(0.0550)	(0.0609)
Telehomework access	0.947*	0.927*	0.965	0.953	0.968	0.931
	(0.0217)	(0.0321)	(0.0289)	(0.0471)	(0.0649)	(0.0604)
Small part-time job (1-11h)	0.973	0.958	0.950	0.927	1.111	0.898
	(0.0854)	(0.143)	(0.105)	(0.184)	(0.360)	(0.219)
Medium part-time job (12-19h)	0.952	0.920	0.948	0.977	0.681	1.114
	(0.0522)	(0.0992)	(0.0638)	(0.119)	(0.163)	(0.154)
Large part-time job (20-35h)	1.037	1.149*	0.990	1.043	1.061	1.033
	(0.0377)	(0.0619)	(0.0466)	(0.0764)	(0.109)	(0.0964)
Female	1.156***			1.333***		
	(0.0315)			(0.0867)		
Children 0-5 years at home	1.071*	1.154***	1.023	0.981	1.000	1.034
	(0.0292)	(0.0449)	(0.0395)	(0.0604)	(0.0892)	(0.0845)
Children 6+ years at home	0.935**	1.000	0.878***	0.917	0.898	0.959
	(0.0221)	(0.0334)	(0.0287)	(0.0480)	(0.0609)	(0.0694)
0 workdays per week	0.540*	0.571	0.518	1.732	1.877	0.204***
	(0.146)	(0.211)	(0.176)	(1.123)	(1.122)	(0.0840)
1 workday per week	0.377***	0.208***	0.511**	0.308**	0.159***	0.384*
	(0.0676)	(0.0553)	(0.114)	(0.117)	(0.0808)	(0.169)
2 workdays per week	1.003	1.168	0.985	0.822	1.005	0.788
	(0.0617)	(0.146)	(0.0698)	(0.105)	(0.237)	(0.118)
3 workdays per week	0.978	1.125	0.982	0.822*	1.191	0.780*
	(0.0418)	(0.107)	(0.0490)	(0.0698)	(0.172)	(0.0793)
4 workdays per week	1.073*	1.054	1.077	1.066	1.020	1.109
	(0.0316)	(0.0416)	(0.0456)	(0.0673)	(0.0804)	(0.0936)
6 workdays per week	0.856	0.850	0.906	0.704	0.509***	1.490
	(0.103)	(0.125)	(0.190)	(0.165)	(0.0962)	(0.670)
α	0.443	0.544	0.331	3.743	4.255	3.125
	(0.0241)	(0.0386)	(0.0273)	(0.0662)	(0.102)	(0.0770)
Observations	15963	8724	7245	15752	8635	7123

Incidence rate ratios from negative binomial regression. Robust standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; α denotes the overdispersion parameter.

Note: Reference groups are employees with no access to flexi-time or telehomework, employees with full-time jobs (36+ hours), male employees, employees without children and employees with 5 workdays per week. Control variables include respondents' age, family status, whether partner holds a job, education, work experience, wage, contract type, executive position, overtime, multiple jobholdings, satisfaction with hours, (sub-)sector and firm size in all models.

interaction effects are not significantly different from zero for the full sample and for female employees, both with respect to the frequency and the duration of absences. For male employees without children and with small children up to 5 years of age, access to flexi-time is associated with a significant reduction in absence duration by about 31% or 3 days per year. The model does not show this effect however for male employees with children of six years and older and with flexi-time, i.e. male employees with older children do not seem to benefit from access to flexi-time regarding average absence duration. TLF therefore does not seem to have any additional effects for employees with children at home.

5 Discussion and conclusion

Our analysis shows that increased temporal and locational flexibility is negatively associated with sickness absenteeism in general. Especially flexi-time, i.e. quickly adjustable temporal flexibility, reduces both the frequency and – in particular – the duration of absences. Telehomework or locational flexibility seems to mainly affect absence frequency but not absence duration. Long-term temporal flexibility in the form of part-time work finally does not appear to have a significant impact on absenteeism at all. So even though part-time employees report more often that their work is compatible with other commitments (Burchell et al., 2007; Fagan and Burchell, 2002), this is not reflected in fewer and shorter absences.[13] Hypothesis 1 and 2 are therefore not rejected by the data.

TLF is especially relevant for employees with family responsibilities. This should be reflected in lower absenteeism for this group in particular because TLF offers an alternative to 'emergency-induced' absences, and because it may reduce work-life related stress in general. This reasoning is not supported by the data, however, neither with respect to gender differences in effects for flexi-time and telehomework nor regarding the interactions of flexi-time and telehomework with the presence of children. Hypothesis 3 is thus rejected by the data. This finding may seem puzzling at first glance. Employees with access to telehomework and especially flexi-time report significantly more often than their colleagues without access to these arrangements that their working times match well with their private life (Possenriede and Plantenga, 2011). This improved fit between work and private life may not translate into fewer and shorter absences, however, because alternative arrangements like short-term care leave are available to react to emergencies (Olsen and Dahl, 2010). It is also possible that voluntary or family-related absences were underreported in our data,

[13] This result also indicates the importance of distinguishing between the effects of increased flexibility of part-time work and the effects of less 'exposure' to work and adverse working conditions in empirical analysis. The long-term temporal flexibility of part-time work does not affect absenteeism, while the associated reduced exposure (i.e. the lower number of workdays) of part-time work reduces absences to some degree (see the incident rate ratios of the workdays variables in table 2 and table 3).

Table 3: Incidence rate ratios of flexible work arrangements on absence frequency and duration: Employees with children

Variables	Absence frequency			Absence duration		
	Full sample	Male only	Female only	Full sample	Male only	Female only
Flexi-time access	0.929*	0.930	0.931	0.795**	0.685***	0.914
	(0.0326)	(0.0433)	(0.0386)	(0.0566)	(0.0553)	(0.0675)
Telehomework access	0.942	0.941	0.946	1.013	1.052	0.933
	(0.0319)	(0.0425)	(0.0381)	(0.0704)	(0.0814)	(0.0676)
Children 0-5 years at home	1.061	1.124	1.034	1.029	0.920	1.224*
	(0.0461)	(0.0770)	(0.0577)	(0.102)	(0.114)	(0.122)
Children 6+ years at home	0.911*	1.002	0.839***	0.900	0.853	0.940
	(0.0339)	(0.0502)	(0.0398)	(0.0739)	(0.0758)	(0.0755)
Flexi-time*Children 0-5	0.999	0.976	1.007	0.979	1.003	0.849
	(0.0492)	(0.0766)	(0.0647)	(0.104)	(0.146)	(0.0985)
Flexi-time*Children 6+	1.044	1.047	1.019	1.141	1.315**	0.966
	(0.0451)	(0.0608)	(0.0561)	(0.108)	(0.133)	(0.0917)
Telehomework*Children 0-5	1.023	1.089	0.968	0.941	1.186	0.839
	(0.0487)	(0.0830)	(0.0621)	(0.0965)	(0.168)	(0.0968)
Telehomework*Children 6+	1.003	0.944	1.075	0.900	0.809*	1.079
	(0.0430)	(0.0539)	(0.0592)	(0.0862)	(0.0790)	(0.101)
Small part-time job (1-11h)	0.972	0.951	0.950	0.922	1.095	0.880
	(0.0852)	(0.144)	(0.0929)	(0.182)	(0.320)	(0.153)
Medium part-time job (12-19h)	0.952	0.918	0.947	0.972	0.674*	1.109
	(0.0522)	(0.0994)	(0.0586)	(0.118)	(0.123)	(0.118)
Large part-time job (20-35h)	1.037	1.148**	0.988	1.040	1.046	1.031
	(0.0376)	(0.0508)	(0.0414)	(0.0759)	(0.0787)	(0.0749)
Female	1.156***			1.341***		
	(0.0316)			(0.0861)		
0 workdays per week	0.540*	0.574	0.516	1.816	2.035	0.200*
	(0.146)	(0.248)	(0.243)	(1.207)	(1.289)	(0.146)
1 workday per week	0.377***	0.209***	0.511***	0.309**	0.164***	0.375***
	(0.0678)	(0.0599)	(0.0837)	(0.116)	(0.0547)	(0.0899)
2 workdays per week	1.004	1.168	0.989	0.821	0.982	0.784*
	(0.0617)	(0.126)	(0.0649)	(0.104)	(0.185)	(0.0870)
3 workdays per week	0.978	1.124	0.985	0.822*	1.173	0.786**
	(0.0417)	(0.0802)	(0.0459)	(0.0693)	(0.147)	(0.0629)
4 workdays per week	1.072*	1.053	1.078	1.069	1.014	1.105
	(0.0316)	(0.0364)	(0.0420)	(0.0669)	(0.0590)	(0.0770)
6 workdays per week	0.856	0.851	0.905	0.711	0.512**	1.457
	(0.103)	(0.134)	(0.222)	(0.169)	(0.124)	(0.609)
α	0.443	0.544	0.331	3.741	4.247	3.121
	(0.0241)	(0.0265)	(0.0200)	(0.0661)	(0.0798)	(0.0606)
Observations	15963	8724	7245	15752	8635	7123

Incidence rate ratios from negative binomial regression. Robust standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; α denotes the overdispersion parameter.

Note: Reference groups are employees with no access to flexi-time or telehomework, employees with full-time jobs (36+ hours), male employees, employees without children and employees with 5 workdays per week. Control variables include respondents' age, family status, whether partner holds a job, education, work experience, wage, contract type, executive position, overtime, multiple jobholdings, satisfaction with hours, (sub-)sector and firm size in all models.

though, since the dependent variables explicitly measure the frequency and length of *sickness* absence. Employees may thus be reluctant to report family-related absences in this category (Drago and Wooden, 1992; VandenHeuvel, 1997).[14]

Even though the data does not allow for firm conclusions on whether TLF mainly affects absenteeism because it lifts time-restrictions and changes employees' behaviour or because it improves employees' health, an educated guess is still possible. The behavioural effects of increased TLF on absenteeism should mainly concern and become apparent in short-term absences, since emergencies and minor indispositions by their very nature come at short notice and last shortly. Health-related effects of TLF on the other hand should be reflected in reductions in medium- and long-term absence. If the effect of TLF is relatively larger with respect to the frequency of absences than with respect to their duration, it can be interpreted as a short-term behavioural effect. If the relative effect is larger with respect to the length than to the frequency, however, it is likely to be a health-related effect. The analysis indicates that especially telehomework is associated with fewer but not with significantly shorter absences. This suggests that telehomework only reduces short-term absences and has an effect on employees' behaviour. Flexi-time reduces the frequency of absences similarly, but also has a considerable and highly significant effect on absence duration. Flexi-time therefore not only appears to affect the behaviour of employees but seems to have a positive influence on health as well.

The results of this study are certainly not a full cost-benefit analysis of TLF for employers. The costs of implementing TLF as well as the costs of absenteeism differ between sectors, firms and even types and groups of employees (Heywood and Jirjahn, 2004), which makes such an analysis extremely difficult. Other advantages of TLF, such as increases in productivity and organisational commitment, would have to be considered as well. The markedly negative association between TLF and absenteeism nevertheless support the case for TLF and should further increase the interest of employers in TLF. It is therefore not only valuable for employees and in line with the preferences of modern knowledge workers. Increased TLF can be quite beneficial for employers as well.

[14] On the reliability of self-reported data on sick leave in general, see van Poppel et al. (2002), Ferrie et al. (2005) and Voss et al. (2008).

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