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ICT and Actual Working Time in Germany **

Abstract

This study investigates the impact of information and communication technology (ICT) on actual weekly working hours using the second wave of the German Linked Personnel Panel, a unique employer-employee dataset. ICT usage is widespread among employees in the private sector. Half of the establishments equip all managerial employees with mobile devices. We confirm the findings of previous studies that show a positive correlation between ICT usage and working times. Employees work approximately 30 minutes longer per week if they use modern digital technologies for work. Furthermore, our multivariate analyses reveal that this correlation is especially strong for managers and in establishments that equip all of their employees in leading positions with mobile devices.

Key words: **ICT, working time, work-life balance** (JEL Codes: J21, J22, O33)

Introduction

The use of information and communication technologies (henceforth: ICT) has increased rapidly in recent years, both in households and firms. On one hand, more than 85% of all households in Germany own a computer, tablet, or laptop, and 85% have internet access at home (Statistisches Bundesamt, 2015). On the other hand, half of German establishments implement modern digital technologies, e.g. production plants are organized as smart factories or service firms use cloud computing (Arntz, Gregory, Lehmer, Matthes, & Zierahn, 2016). Across the private sector, currently more than 80% of employees use ICT in their everyday work (Arnold, Butschek, Steffes, & Müller, 2016).

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Since the beginning of the 1990 s, the influence of computer technology on labor market outcomes has been a research focus. Krueger (1993) was the first to analyze the impact of computers on (US) wages, unveiling a wage premium for workers who use a computer at their job. However, DiNardo and Pischke (1997) argue that the observed wage premium of computer use is mainly due to unobserved worker heterogeneity, a conclusion that has been confirmed for Germany (Anger & Schwarze, 2003). Freeman (2002) has shown a positive correlation between ICT and both hours worked and wages. These studies argue that this wage premium is a short-run phenomenon that will disappear as computer technology spreads. That said, these studies were published more than ten years ago, and they are unable to capture the rapid technological change and the increasing relevance of ICT in firms.

Therefore, based on the previous research, we address the question of whether ICT usage influences actual working time, and if so, how. Access to smartphones and laptops fosters self-managed work, allowing for the response to emails or calls from home or outside of contractual weekly working hours. Therefore, while holding contractual working hours fixed, we assume an increase in actual working hours, especially for employees in managerial positions. We hence expand the existing literature on ICT and working hours by quantifying the difference between actual and contractual working time and the use of ICT in general as well as for managers in particular.

We employ the Linked Personnel Panel (LPP), a unique German linked employer-employee dataset. It consists of an establishment survey in private sector firms with at least 50 employees and an associated survey of employees of these establishments (Broszeit & Wolter, 2015; Kampkötter, Mohrenweiser, Sliwka, Steffes, & Wolter, 2016). From the two waves available to date, we use the second wave, including 771 establishments and more than 7,100 employees, as information on digitalization and mobile work are only included from that wave on.

This paper proceeds as follows. In section 2, we summarize the previous literature and empirical research on this topic. Section 3 explains the data, as well as the variables, and provides descriptive results. In section 4, we turn to our core analysis and present our multivariate results on the effect of work-related ICT, controlling for a large set of individual and establishment level variables. Section 5 concludes.

Previous Research

To date, various studies have addressed the use of ICT. These technologies change work organization and facilitate "telecommuting where workers perform some or all of their work outside of a traditional office setting" (Boswell & Olson-Buchanan, 2007, p. 592). Arnold, Butschek, Steffes and Müller (2016) find that 83% of all employees in establishments with at least 50 employees in the private sector use ICT. These analyses also reveal differences among employees with respect to their qualification, occupational position and employment in different economic sectors:

Only 60% of all employees without vocational training use ICT at work in comparison to 90% of all academics. Especially in functional areas such as sales and administration, the proportion of employees working with ICT is higher than in areas like production or personal services. Professions in sectors such as accommodation, food services or construction show a lower usage of ICT compared to business-related professions. However, the use of mobile ICT (smart devices) such as smartphones or laptops mainly depends on the job position: 64% of employees in managerial positions use smart devices, as opposed to 14% of employees without managerial responsibility. As the costly endowment with technical communication equipment is an important prerequisite for mobile work, managers are more able to work outside the office than employees without managerial responsibility. Kirchner (2015) finds that employees with university degrees use computers more often than those without formal qualifications. However, the author shows that job-related criteria such as fixed-term contracts and job tasks dominate the results, e.g. service jobs use computers less often than managers but office workers on the contrary use computers more often than managers. The study measures computer usage on a seven-point scale ranging from never to all the time, thus measuring intensity for computer and internet usage within working time rather than the influence of ICT on working times itself.

Freeman (2002) quantifies the effects of computer and internet usage on hours worked. Using US data, he detects a 5-6% increase in working hours for computer users and a 5% increase for internet users. The combined effect of the joint usage of computer and the internet amounts to a 4% increase in hours.

In a study for Italy, Lucchetti, Staffolani and Sterlacchini (2005) investigate the impact of ICT on working hours and wages simultaneously. They find a substantial wage premium for white-collar workers. The effect on hours worked, however, is small and counteracted by a negative effect of higher wages on hours worked. As access to ICT has spread considerably since 2005, it is questionable whether these results are also valid for the current situation in Germany.

ICT offers both firms and workers unprecedented opportunities to make working time more flexible. By means of the German Socio-Economic Panel 2003 to 2011, Beckmann, Cornilessen and Kräkel (2017) discover that self-managed working time significantly increases employee performance. However, additional analyses provided by these authors reveal that strong work ethics and intrinsic motivation mainly drive this positive effect. Shirking, on the other hand, seems not to be a consequence of self-managed working time.

Beyond the German case, similar results have been found internationally. For instance, Bloom, Lian, Roberts and Ying (2015) conducted a field experiment within a Chinese NASDAQ-listed travel agency, where call center employees were randomly assigned to work either from home or in the office for 9 months. The obtained results indicate that working from home increased performance by 13%, of which

approximately 9 percentage points came from working more minutes per shift because the employees started working more punctually, could schedule personal matters in the time they saved by not commuting and took shorter breaks during the day and reported fewer sick-days. The remaining 4 percentage points resulted from more calls per minute, which could be attributed to a quieter work environment. After the experiment was considered successful, the travel agency rolled out the option to work from home to all employees and allowed those who participated in the experiment to reselect themselves between home or office work. This learning and re-selection increased the employees' performance by an additional 22%. Moshiri and Simpson (2011) provide an overview of studies that address ICT and productivity.

This finding is also corroborated by Anger and Schwarze (2003), who confirm that there is a positive self-selection of workers into jobs requiring the use of computers, which they attribute to differences in ability and other unobserved heterogeneity components such as motivation. Therefore, it seems that employees with access to ICT both are more productive and work longer hours, potentially due to a higher motivation of such workers. However, an alternative explanation for the longer hours despite the possibility to actually reduce working time due to higher individual productivity is delivered by an extensive literature that shows how ICT increasingly blurs the boundaries between work and private life. Towers, Duxbury, Higgins and Thomas (2006) find that ICT allows handling work and private matters more flexibly but raises employers' expectations regarding their employees' availability. This is supported by Noonan and Glass (2012), who argue that the biggest issue with telecommuting is that it allows employers to raise expectations for work availability during evenings and weekends, thus fostering longer workdays and workweeks. A field study by Karlson, Meyers, Jacobs, Johns and Kayne (2009) provides evidence that especially mobile devices such as smartphones and tablets turn recreational time into working time. The participants of their study felt the need to control work life during personal time. Moreover, approximately one-third of participants in a study by BAuA (2016) reported that they are contacted on business matters during their private life, which in turn has been found to have a negative impact on health and work-life balance (Pangert, Pauls, & Schüpback, 2016). Finally, yet importantly, if ICT usage causes interruptions of the workflow by distraction, this may hamper individual productivity (Jett & George, 2003).

Regardless of the mechanism that potentially drives working hours up – be it a higher motivation due to self-selection or the blurring of boundaries between work and private life – we assume the following:

Hypothesis 1: Employees who use ICT have a higher actual working time than employees who do not use ICT.

In his paper, Kirchner (2015) shows that computer and internet usage for work purposes depends highly on the occupational tasks. It is – not surprisingly – consid-

erably higher for white-collar jobs than it is for blue-collar jobs. Therefore, if hypothesis 1 can be confirmed, we also expect to find a stronger correlation between ICT usage and actual working hours for white-collar workers:

Hypothesis 2: White-collar workers respond more strongly to the use of ICT with respect to actual working time than blue-collar workers.

As stated before, ICT leads to a digital divide between educational degrees. On one hand, employees with higher computer skills select themselves into jobs with higher ICT usage (Anger & Schwarze, 2003), while on the other hand, education serves as a signal when employers have to decide whom to equip with digital devices (Kirchner, 2015). Moreover, considering that managers frequently work longer hours, which should tend to occur during evenings and weekends, we expect employees in managerial positions to respond more strongly to ICT usage in terms of increasing their working time. To the best of our knowledge, the only paper addressing the impact of ICT usage on actual working hours for managers is Hübler (2002), who unearths a positive correlation between computer use and unpaid overtime hours.

ICT technology increases productivity as stated above, but it is also often misused for private purposes. This results in longer but not more productive working hours. So-called cyberslacking seems to be more common among higher-status employees (Garrett & Danziger, 2008). Hence the following:

Hypothesis 3: The link between ICT usage and actual working hours is stronger for employees in managerial positions.

This correlation should be especially strong in establishments where a high proportion of managers is equipped with mobile devices. Owning a mobile device facilitates working outside regular office hours for every manager individually, but it also sends a signal that working outside office spaces and after regular working times is accepted if not even demanded.

Data

We use the second wave of the innovative LPP. The linked employer-employee dataset consists of both a survey of establishments with more than 50 employees and a survey of employees of these establishments (Broszeit & Wolter, 2015; Kampkötter, et al., 2016). The first wave of the LPP was conducted with 1,219 establishments in 2012. The second wave of 771 remaining establishments was administered in 2014. The survey is representative of the German private sector and provides detailed information on a variety of HR management practices along the dimensions recruitment and selection, performance management, talent management and employee development, retention management and corporate culture. The sample for the establishment survey has been drawn from the IAB Establishment Panel 2011. Therefore, all information from the IAB Establishment Panel is available for these firms, including a wide range of structural information on work-

ing time arrangements or works councils (Fischer, Janik, Müller, & Schmucker, 2009; Ellguth, Kohaut, & Möller, 2014).

The second part of the LPP consists of an employee survey in the interviewed establishments. In 2012/13, a total of 7,508 employees from these establishments were interviewed. The follow-up survey in 2015 included 7,109 individuals from three groups: employees who had given an interview in the first wave and still worked for the same employer in 2015, individuals who have been interviewed in 2012/13 and no longer worked for the former employer, and employees of the interviewed firms who had been contacted in 2015 for the first time. The individuals were interviewed via telephone (CATI). The employee survey covers extensive characteristics of the current working conditions in the areas of working contract and hours, further training and development, remuneration, company culture and socio-demographics. The second wave of the employee survey focused on digitalization and mobile work. For this reason, we restrict our analyses to the second wave.

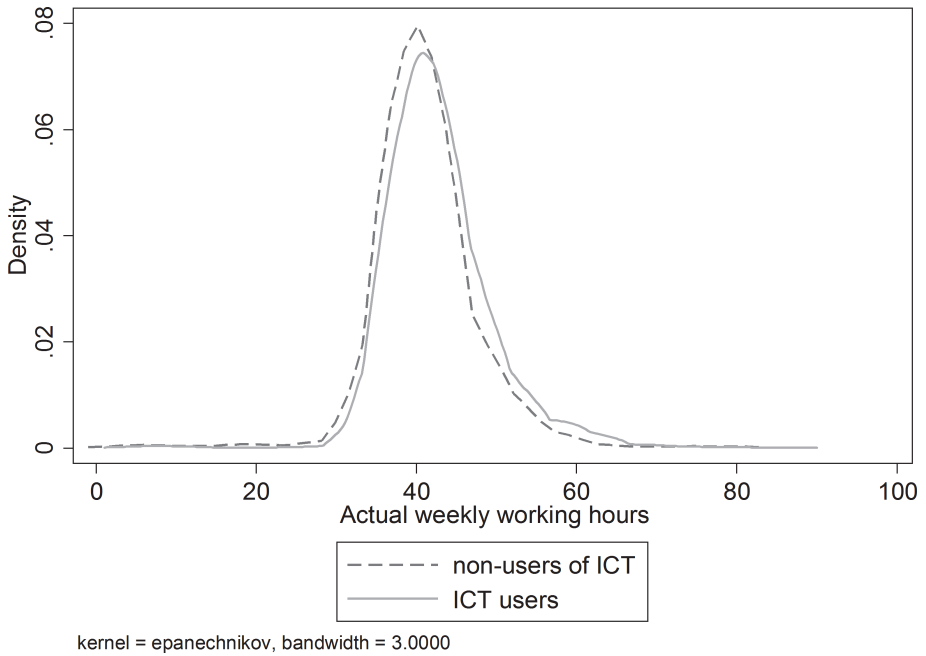
Variables and Descriptive Statistics

All of our models use actual working time as a dependent variable. Working time is measured in a common way by asking *"How many hours a week do you normally work, including overtime and long hours?".* The mean working time is 40.5 hours a week (*SD* = 8.1). Answers are right censored at 60 hours a week. The survey also includes information on the contractual working hours, which we use as a control variable for different working time regimes. The average contractual working time per week is 36.7 hours a week (*SD* = 5.7).

Our main explanatory variable is the use of ICT that is defined in a broad context. Participants were asked the filter question *"Do you use digital information or communication technologies such as a computer, the internet, a laptop, a tablet computer or a smartphone for business purposes?".* In our analysis sample, a majority of 78% reported using ICT for work purposes, which corresponds to a weighted 82% of all workers in Germany employed in a private sector establishment with at least 50 employees.

The unconditional kernel density estimates displayed in Figure 1 show that those who use computers, laptops, smartphones, or the internet, work longer hours than workers without access to ICT. Employees who use ICT for work purposes, on average, work 41 hours per week, compared to 39 hours for non-users. This difference is statistically significant.

Figure 1: Distribution of actual weekly working hours for ICT users and non-users



Data source: Linked Personnel Panel employee survey 2015.

Working time, however, is not solely driven by ICT usage. Henceforth, we use several explanatory variables from the employee survey such as sex, managerial position or use of home office to consider their interrelation with working times and ICT usage. Table 1 (in the appendix) presents descriptive statistics of these potentially confounding factors separately for users and non-users of ICT. More than two-thirds of the sample population are male, which is supposedly due to the focus on the private sector. Those who use ICT for work purposes are more likely to be white-collar, managers, and better educated, on average, than those who do not use ICT. Moreover, they work approximately 2 hours more per week.

It is noteworthy that more than half of our interviewed establishments equip all their managers with mobile devices. These employers on average also equip a greater share of their non-managerial employees with this technology (18.1% vs. 7.7%). However, even in these ICT-affine establishments, the spread of mobile devices among employees is relatively small. In establishments particularly fostering a mobile culture by means of providing mobile devices for all their managers, the individual use of ICT for work purposes is 4 percentage points higher than in firms where not all managers use mobile devices. These differences are statistically significant.

Multivariate Results

Looking beyond the descriptive relationship between actual working hours and the work-related use of ICT that has been addressed in the course of the preceding chapter, now we extend our analysis by incorporating important structural variables that potentially bias our coefficient of interest. Correspondingly, we control for basic socio-demographics such as sex, age, and age squared, as well as highest attained schooling certificate and highest vocational degree. We also consider household structure in terms of its number of members, whether there is a child, and whether the interviewee is currently in a relationship. Furthermore, we take into account crucial job characteristics, such as part-time and fixed-term contracts, and managerial positions. We also control for differences in working time regimes by introducing variables indicating the absence of fixed working hours, the application of weekend shifts, shift work, and flextime[1]. Because ICT may be more likely to be available in establishments with more flexible working time arrangements, neglecting these different regimes may bias our coefficients. Moreover, as we want to account for differences in stipulated working time between contracts, we control for contractual working hours.

Since individuals select themselves into sectors and establishments, we additionally consider establishment-level characteristics. To control for the stratification of the survey, we include 17 sector dummies, 4 region dummies (North, East, West, and South Germany), and 4 establishment size dummies. We also control for the existence of works councils and collective bargaining both at the industry and firm levels, as well as for whether the establishment offers flexible pay components because it may influence an individual's decision to work extra hours.

Judging from the coefficients from the OLS estimation in Table 2, we can infer that the use of ICT (i.e. computers, laptops, tablets or smartphones) is accompanied by longer actual working hours. Holding fixed their contractual working time, employees – on average – work approximately 30 minutes more per week than those without access to ICT.

Concerning the control variables, it is certainly worth noting that the variables indicating the working time regime also exert a substantial impact on actual working hours themselves. While weekend shifts and shift work are accompanied by fewer overtime hours, workers who work in regimes that aim to improve the flexibility of working hours, such as flexible working time patterns and flextime, actually work longer hours. However, as we control for these differences in working time regimes, our results for ICT usage can be interpreted independently of those factors.

1 Flextime represents a flexible schedule for working hours enabling employees to adjust the beginning and end of each workday to their individual needs or preferences and hence aims to improve work-life balance. It usually entails a core period of mostly 4 to 6 hours in which presence at work is mandatory.

Table 2: Determinants of actual working hours per week

	Dependent variable: Number of actual weekly working hours
Regressors	OLS
Number of contractual weekly working hours	.885***
	(.033)
Use of information & communication technology (D)	.506**
	(.222)
Sex (1=female)	-.507**
	(.208)
Age	.058
	(.059)
Age squared	-.001
	(.001)
White-collar worker (D)	.886***
	(.219)
Fixed-term contract (D)	.359
	(.433)
Managerial position (D)	1.665***
	(.199)
Part-time contract (D)	-1.915***
	(.454)
Flexible working time/no fixed working hours (D)	1.446***
	(.267)
Weekend shifts (D)	1.653***
	(.151)
Shift work (D)	-.943***
	(.218)
Flexitime (D)	.278
	(.205)
Number of people in household	.109
	(.077)
Child (D)	.008
	(.228)
Partner (D)	.081
	(.225)
Share of managers equipped with mobile devices (establ.)	-.002
	(.003)
Share of non-managerial workers equipped with mobile dev.	.006
	(.004)
Works council (D)	-.543*

	Dependent variable: Number of actual weekly working hours
Regressors	OLS
	(.294)
Collective bargaining: industry-level	.085
	(.270)
Collective bargaining: firm-level	-.191
	(.360)
Flexible pay components (D)	-.099
	(.228)
Number of observations	4,522
Number of establishments (clusters)	664
R-squared	0.61

Data source: Linked Personnel Panel employee survey 2015. Notes: Standard errors clustered at the establishment level. Apart from the variables displayed in the table, the specification also contains controls for highest schooling degree (5 dummies), highest vocational degree (5 dummies), establishment size (4 dummies), region (4 dummies), and sector (17 dummies). Significance is denoted as *** p<0.01, ** p<0.05, or * p<0.1.

Our main results from Table 2 suggest that white-collar workers work almost an hour longer per week than those with a predominantly blue-collar task profile. According to our considerations leading to hypothesis 2, we assume that the correlation between ICT and working hours should be larger for white-collar employees. Judging by the coefficients for the interaction term displayed in column (1) of Table 3 below, this is confirmed. The results even imply that this correlation is solely driven by white-collar workers, who appear to work, on average, approximately 100 minutes more per week when using ICT.

Table 3: Effect heterogeneities

Dependent variable: Number of actual weekly working hours	(1)	(2)	(3)
Regressors	Interaction with white-collar task profile	Interaction with managerial positions	Restricted to establishments that equip all their managers with mobile devices
ICT usage (D)	-.004	.220	.007
	(.239)	(.227)	(.294)
White-collar worker (D)	-.348		
	(.428)		
ICT * White-collar worker	1.662***		
	(.478)		
Managerial position (D)		.361	-.588
		(.482)	(.698)
ICT * Managerial position		1.534***	2.374***
		(.514)	(.734)
Number of observations	4,522	4,522	2,528
Number of establishments (clusters)	664	664	353
R-squared		0.61	

Data source: Linked Personnel Panel employee survey 2015. Notes: Standard errors clustered at the establishment level. Apart from the variables displayed in this table, each specification also contains the same variables used in Table 2. These are controls for the number of contractual working hours, dummy variables indicating fixed-term contracts, flexible working time, weekend shifts, the number of people in the household, whether there is a child or a partner, the highest schooling degree (6 dummies), highest vocational degree (7 dummies). Furthermore, it entails establishment-level controls for works councils, collective bargaining, flexible pay components, establishment size (4 dummies), region (4 dummies), and sector (17 dummies). Significance is denoted as *** p<0.01, ** p<0.05, or * p<0.1.

Moreover, the results from our main specification from Table 2 also suggest that managerial positions generally entail longer working hours. Since overtime hours are likely to arise during evenings and weekends and considering that the application of home office mostly hinges on the availability of an ICT infrastructure, this implies that managers should extend their working time more strongly in response to ICT usage than those without managerial responsibilities the coefficients displayed in column (2) of Table 3 confirm this expectation, as we find a significant heterogeneity effect with respect to managerial positions. Similar to the interaction with a white-collar task profile, the positive correlation between ICT usage and actual working hours can be attributed to managers, at least for the most part. As the coefficient for the main effect of ICT usage is still sizeable but afflicted by a large standard error, we cannot rule out a possible impact of ICT on working hours for

non-managers. Nevertheless, within the group of managers, this effect turns out to be 1.5 hours and is thereby meaningful. As an extension to the manager specification displayed in column (2), column (3) shows that if we restrict the analysis to establishments that equip all their managers with digital devices, the correlation between ICT usage and actual working hours for managers is even higher than with the unrestricted analysis sample in column (2). Within this subgroup of establishments, using ICT increases the actual weekly working time of managers on average by approximately 2.4 hours. Overall, these findings add to the literature showing that managers take more overtime hours than regular workers (Bell & Hart, 1999; Bossler & Grunau, 2016) by providing further insights into how ICT usage may be considered one of the driving mechanisms of this conjuncture.

Conclusion and Discussion

In this paper, we examine the link between ICT usage and actual working hours, conditional upon contractual working hours. Digital devices such as computers, tablets, and smartphones are widespread in private households as well as in the business sector (Statistisches Bundesamt, 2015). For our analyses, we use the second wave of the LPP, which offers a unique data structure, combining longitudinal survey information from both employers and their employees. Among other important aspects, this dataset contains information on the use of ICT as well as contractual and actual working time.

We test three hypotheses using OLS regressions including a large set of control variables on both the employee and the employer level. The results show that on average, ICT users work approximately 30 minutes longer per week than those without access to ICT. An extended specification entailing interaction terms reveals that the link between ICT and actual working hours is mainly driven by both white-collar workers and managers rather than by regular employees. For white collars, we find an effect of ICT on the weekly working time of approximately 1.7 hours per week. Similarly, workers in a managerial position not only work longer hours in general but also respond stronger to ICT usage by 1.5 hours. Restricting our analysis sample to the group of workers from establishments that equip all of their managers with mobile devices in an attempt to focus on employers who are more likely to demand reachability beyond regular working hours confirms and strengthens the finding for managers even further.

Our results underline the advantages and disadvantages of ICT usage. Employees who work longer hours, especially managers, use the technical possibilities to increase working time even further. In this case, the benefit of making work more flexible may turn into a curse of blurring boundaries between work and free time. However, as is the main limitation of our analyses, we cannot empirically disentangle the reasons for the increase in actual working time. It could be caused by the increased speed and efficiency of decisions and coordination processes, which in

turn may lead to greater productivity. By contrast, working time could also be spent more inefficiently as multitasking comes at the expense of efficiency and smart devices also facilitate employees to handle private matters during working time (*cyberslacking*). For instance, Collins, Cartwright and Histop (2013) show that the increased autonomy in how time is organized can give the employees the opportunity to "snatch moments" of time and use them for personal purposes. Thus, it would be worthwhile for future research endeavors to further shed light on this matter.

Nevertheless, ICT gives employees and employers a powerful tool to achieve more flexible working time regimes. The use of corresponding instruments such as working time accounts, which allow for flexibility in a planned working time framework, has increased slightly in recent years (Bellmann & Hübler, 2015). However, additional institutional frameworks are needed to curtail negative effects such as the blurring of boundaries between work and private life.

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Appendix

Table 1: Summary statistics by ICT usage status

	ICT users					Non-users of ICT				
	N	mean	sd	min	Max	N	Mean	sd	min	max
Actual Working hours	3,546	40.78	7.908	1	90	976	38.72	8.040	2	80
Contractual Working hours	3,546	36.89	5.325	4	60	976	36.12	6.776	3	60
Socio-economic characteristics										
Sex (1=Male, 2=Female)	3,546	1.283	0.450	1	2	976	1.311	0.463	1	2
Age	3,546	44.61	10.27	16	67	976	44.81	10.27	17.25	63
Age squared	3,546	2,095	855.4	256	4,456	976	2,113	858.3	297.6	3,958
Number of people in household	3,546	2.807	1.199	1	13	976	2.633	1.191	1	8
Child	3,546	0.243	0.429	0	1	976	0.198	0.399	0	1
Partner	3,546	0.868	0.339	0	1	976	0.786	0.410	0	1
Secondary & tertiary education										
No schooling degree	3,546	0.009	0.093	0	1	976	0.024	0.152	0	1
Lower secondary school leav. cert.	3,546	0.190	0.392	0	1	976	0.340	0.474	0	1
Higher secondary school leav. cert.	3,546	0.417	0.493	0	1	976	0.546	0.498	0	1
Univ. of appl. sciences entrance cert.	3,546	0.126	0.332	0	1	976	0.037	0.189	0	1
A-levels	3,546	0.258	0.438	0	1	976	0.053	0.225	0	1
No vocational degree	3,546	0.010	0.102	0	1	976	0.053	0.225	0	1
Apprenticeship training certificate	3,546	0.511	0.500	0	1	976	0.818	0.386	0	1
Meister/Technician	3,546	0.239	0.427	0	1	976	0.089	0.285	0	1
University/college degree	3,546	0.237	0.425	0	1	976	0.034	0.181	0	1
Other vocational degree	3,546	0.002	0.047	0	1	976	0.006	0.078	0	1
Job characteristics										
White-collar worker	3,546	0.722	0.448	0	1	976	0.248	0.432	0	1
Fixed-term contract	3,546	0.032	0.176	0	1	976	0.054	0.227	0	1
Managerial position	3,546	0.342	0.474	0	1	976	0.163	0.369	0	1
Part-time	3,546	0.128	0.334	0	1	976	0.163	0.369	0	1
Flexible working time	3,546	0.171	0.377	0	1	976	0.072	0.258	0	1
Weekend shifts	3,546	0.530	0.499	0	1	976	0.689	0.463	0	1
Shift work	3,546	0.252	0.434	0	1	976	0.525	0.500	0	1
Flexitime	3,546	0.569	0.495	0	1	976	0.183	0.387	0	1
Establishment-level characteristics										
Share of managers equipped with mobile devices	3,546	74.00	37.70	0	100	976	64.45	42.77	0	100
Share of non-managerial workers equipped with mobile devices	3,546	14.11	20.68	0	100	976	9.49	18.32	0	100
Works council	3,546	0.854	0.353	0	1	976	0.695	0.461	0	1
No collective bargaining	3,546	0.270	0.444	0	1	976	0.319	0.466	0	1
Industry-level collective bargaining	3,546	0.597	0.491	0	1	976	0.529	0.499	0	1
Company-level collective bargaining	3,546	0.133	0.340	0	1	976	0.153	0.360	0	1

	ICT users					Non-users of ICT				
	N	mean	sd	min	Max	N	Mean	sd	min	max
Flexible pay components	3,546	0.728	0.445	0	1	976	0.609	0.488	0	1
Region										
North Germany	3,546	0.154	0.361	0	1	976	0.160	0.367	0	1
East Germany	3,546	0.235	0.424	0	1	976	0.413	0.493	0	1
South Germany	3,546	0.277	0.447	0	1	976	0.171	0.377	0	1
West Germany	3,546	0.334	0.472	0	1	976	0.256	0.437	0	1
Industry										
Mining, Energy, sewage/waste	3,546	0.030	0.170	0	1	976	0.016	0.127	0	1
Food, drink and tobacco	3,546	0.031	0.173	0	1	976	0.079	0.270	0	1
Commodities	3,546	0.032	0.177	0	1	976	0.027	0.161	0	1
Industrial goods	3,546	0.194	0.396	0	1	976	0.179	0.384	0	1
Investment/consumer goods	3,546	0.385	0.487	0	1	976	0.329	0.470	0	1
Construction	3,546	0.015	0.121	0	1	976	0.064	0.244	0	1
Wholesale/automobiles trade & repair	3,546	0.044	0.204	0	1	976	0.018	0.135	0	1
Retail	3,546	0.021	0.142	0	1	976	0.035	0.183	0	1
Transportation and storage	3,546	0.042	0.201	0	1	976	0.074	0.262	0	1
Information/communication	3,546	0.028	0.166	0	1	976	0.001	0.032	0	1
Hospitality	3,546	0.003	0.056	0	1	976	0.004	0.064	0	1
Financial/insurance services	3,546	0.07	0.256	0	1	976	0.004	0.064	0	1
Economic, scientific, and freelance services	3,546	0.056	0.230	0	1	976	0.135	0.342	0	1
Health and social work	3,546	0.034	0.182	0	1	976	0.028	0.164	0	1
Other services	3,546	0.016	0.124	0	1	976	0.007	0.084	0	1

Data source: Linked Personnel Panel employee survey 2015. Main analysis sample as used in Table 2.