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Self-Managed Working Time and Employee Effort:

Microeconometric Evidence

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Abstract

Based on German individual-level panel data, this paper empirically examines the impact of self-managed working time (SMWT) on employee effort. Theoretically, workers may respond positively or negatively to having control over their own working hours, depending on whether SMWT increases work morale, induces reciprocal work intensification, or encourages employee shirking. We find that SMWT employees exert higher effort levels than employees with fixed working hours, but after accounting for observed and unobserved characteristics and for endogeneity, there remains only a modest positive effect. This effect is mainly driven by employees who have a strong work ethic, suggesting that intrinsic motivation is complementary to SMWT. Moreover, reciprocal work intensification does not seem to be an important channel of providing extra effort. Finally, we find no SMWT effect among women with children in need of parental care indicating that these workers primarily choose SMWT to accommodate family obligations.

JEL Classification: J24; J81; M50
Keywords: Self-managed working time, employee effort, reciprocity, work ethic, intrinsic motivation, family obligations, complementarity

1. Introduction

Today, flexible working hours belong to the standard practices of human resource management. In the United States, 79% of employers offer some degree of flexible working hours to their employees (Shockley and Allen 2012). In Europe, at least 55% of EU27 firms with 10 or more employees use policies with flexible starting and ending times, and these practices are most common in Scandinavian countries (about 70-80%) and least widespread in the South East of Europe, where only about a third of the firms offer such practices (Riedmann et al. 2010). Furthermore, in the United States about 40% of workers can vary the distribution of their working hours within certain limits (Golden 2012). While the aggregate percentage for the EU27 countries is very similar, the dispersion among the EU27 countries is relatively large ranging from below 30% in the southern and eastern countries to about 45-50% in Finland, Denmark, the Netherlands and the United Kingdom (Goudswaard et al. 2012).[1]

In practice, working time arrangements are quite heterogeneous and differ along two dimensions: the degree of working time flexibility and the degree of an employee's autonomy over her working time schedule. Fixed working hours by definition imply low degrees of both working time flexibility and worker autonomy. At the other end of the spectrum, the arrangement of self-managed working time (SMWT) gives workers extensive control over their daily working hours.[2] Often these workers can even decide upon their place of work (at work, at home or elsewhere). Other regimes such as flextime or shift work can be settled somewhere in between fixed working hours and SMWT. Today, SMWT is quite widespread. For example, in the United States about 15% of employees are able to completely determine working hours on their own (Golden 2012), while the corresponding percentage is about 17% for EU27 employees (Goudswaard et al. 2012).

Given the high adoption rates of SMWT as a policy of flexible working hours, a natural follow-up question is: What are its effects on worker performance? Theoretical predictions about the answer to this question are ambiguous. On the one hand, due to high working time autonomy and reduced employer control, there might be a worry that SMWT encourages shirking, especially when workers are additionally allowed to work from home. On the other hand, there are reasons to believe that SMWT might induce workers to provide extra effort due to increased self-motivation or an urge to reciprocate the employer's goodwill in granting them SMWT. Practitioners, such as employer and employee representatives, also seem to be split on this question, as evidenced by an ongoing political debate about SMWT (e.g.,

[1] This country-specific information is provided by the European Foundation for the Improvement of Living and Working Conditions. Additional Excel sheets can be accessed at http://www.eurofound.europa.eu/surveys/smt/ewcs/ewcs2010_12_02.htm.

[2] There are some alternative expressions for SMWT in the literature, e.g., work time control, schedule control, trust hours, trust-based working time or boundary-less work (Beckers et al. 2012, Kelly and Moen 2007, Singe and Croucher 2003).

Lehndorff 2007, Singe and Croucher 2003). Unions often seem to oppose SMWT, because this arrangement implies the omission of working hours registration, so employers are able to deprive their employees of paying overtime premiums. Moreover, unions sometimes criticize the work intensification that follows the implementation of SMWT, especially when this arrangement is combined with a goal-setting policy.[3] Employer representatives, on the other hand, typically deny any workload increase and, instead, emphasize the positive effect that SMWT is expected to have on the employees' work-life balance. SMWT is also controversially discussed by managers, as was recently demonstrated by the cancelation of work-from-home arrangements at Yahoo enacted by CEO Marissa Mayer who raised concerns that work from home would undermine the employees' work morale (Miller and Perlroth 2013).

Against this backdrop, the objective of the present paper is to shed light on the effects of SMWT on worker performance by conducting an empirical analysis based on a large representative individual-level panel data set, the German Socio-Economic Panel (SOEP). We measure worker performance by the amount of extra effort that workers typically exert, where extra effort is defined as the difference between workers' actual working time inputs and their contractual obligations, and we carefully assess the robustness of our results against alternative effort measures. Besides investigating the overall SMWT effect, we conduct a number of subgroup analyses in order to refine the management implications that we can draw from the analysis. More precisely, we examine whether complementary relationships can be found between SMWT, personality traits and other human resource policies. In particular, we look at complementarity with worker reciprocity, work ethic, and the presence of performance evaluation. Finally, we ask whether the SMWT effect also depends on the family background of workers.

Our empirical investigation is closely related to studies which examine the impact of working time flexibility and autonomy on performance variables measured at the individual level, such as organizational commitment, perceived productivity or longer working hours. For example, Eaton (2003) and Lyness et al. (2012) find that employee control over time, pace and place of work has a positive impact on perceived productivity and organizational commitment as defined by measures such as loyalty and the willingness to exert effort. Kelliher and Anderson (2010) additionally find evidence for increased work intensification and conclude that employees reciprocate when given the opportunity to work flexibly by exerting additional effort. Moreover, Eldridge and Pabilonia (2009, 2010) find that employees who bring work home report longer working hours than their counterparts who work exclusively at the firm's premises. Finally, using personnel records of call center employees from a large Chinese multinational firm, Bloom et al. (2013) conduct an intervention study on the effects of work from home on individual worker per-

[3] In line with this reasoning, Lister and Harnish (2011) find that in the United States working from home arrangements are five times more common in non-union firms than in those with unions.

formance. Apart from a 13% productivity increase, the authors find an additional performance effect caused by employee self-selection.

On the other hand, based on experimental evidence and distinguishing between dull and creative tasks, Dutcher (2012) draws mixed conclusions. The author finds that while work from home is associated with an 11-20% productivity increase when workers deal with creative tasks, individual productivity declines by 6-10% when workers deal with dull tasks. This mixed evidence is confirmed by the field- and laboratory-based analyses of Leslie et al. (2012) who find that flexible work practices (including flexible schedules and occasional work from home) are associated with career premiums when managers interpret the employees' choice of flexible work practices as a signal of high organizational commitment. However, employees are also found to experience career penalties, if management interprets their choice to work flexibly as a signal of low organizational commitment, suggesting that some workers may use flexible work practices mostly to accommodate their personal life at the expense of organizational commitment. As a result, existing empirical evidence on the impact of working time flexibility and autonomy on employee performance is quite inconclusive.

The present paper adds to the empirical literature on the performance effects of working time flexibility and autonomy in various ways. First, while previous studies have often relied on non-random or non-representative samples,[4] we conduct a representative analysis based on one of the most extensive household survey panel datasets in Europe, the SOEP. Results obtained from these data should allow us to draw generalizable conclusions, the more so as the SOEP includes not only worker characteristics, but also some firm-level information such as firm size or sector affiliation.

Second, existing studies often do not distinguish very clearly between different forms of flexible working time arrangements, by either aggregating various measures of flexible working hours into whole bundles of flexible working time regimes (e.g., Leslie et al. 2012), or by using a single one-dimensional measure of working time autonomy ranging from employer-controlled to employee-controlled working time (e.g., Eaton 2003, Lyness et al. 2012). These approaches generally do not allow the performance effects of specific working time arrangements to be isolated. In contrast, we explicitly focus on one of these working time practices, SMWT, while not ignoring other working time arrangements. This allows us to estimate a specific SMWT effect, while simultaneously controlling for alternative working time arrangements.

Third, previous studies predominantly apply self-reported, subjective measures of worker performance such as organizational commitment, perceived productivity or work-family conflict as their out-

[4] For example, Eaton (2003), Kelliher and Anderson (2010) as well as Bloom et al. (2013) base their analyses on data that are restricted to certain occupational groups and/or to a limited number of firms.

come variable (e.g., Eaton 2003, Kelliher and Anderson 2010, Lyness et al. 2012). In contrast, we examine the impact of SMWT on more objective (though still self-reported) and continuous measures of employee effort (i.e., extra effort defined as actual minus contractual working time or overtime worked during the previous month) as well as discrete measures (i.e., presence of non-standard working hours in the evenings, at night and at weekends).

Fourth, the vast majority of the empirical literature in this field is based on cross-sectional data and does not address problems of endogeneity. Hence, management implications cannot be drawn from the results of these studies. The recent studies by Bloom et al. (2013), Dutcher (2012) and Leslie et al. (2012), who conduct intervention or experimental studies, are rare exceptions in this respect. Similar to these studies, we aim at estimating causal effects, which allows us to derive managerial implications with regard to an effective use of SMWT. We do so by implementing a fixed effects instrumental variables estimation strategy that explicitly accounts for unobserved time-constant worker characteristics and potential biases caused by time-varying selectivity or reverse causality.

Finally, by investigating whether SMWT is complementary to employee attitudes to reciprocity and work ethic, we also contribute to the small but growing literature that asks for the role of certain personality traits in determining employee performance (e.g., Kelliher and Anderson 2010, Lambert 2000).

The remainder of this paper is organized as follows. Section 2 contains the theoretical background and derives the rival hypotheses to be examined in this study. Section 3 describes the data, key variables and introduces some descriptive statistics. Section 4 is devoted to our econometric model and the estimation strategy. In Section 5, we display and discuss the results of our empirical analysis. Finally, Section 6 concludes.

2. Theoretical Background and Hypotheses

In this section, we discuss several theories on the performance effects of SMWT, starting with theories implying negative performance effects, followed by theories predicting positive performance effects.

Granting flexible working hours or increased job autonomy has much in common with the delegation of decision rights, and it is therefore likely to share some of the same benefits and pitfalls. In particular, the theory of decentralization points to the risk that delegating decision rights may involve unintended worker responses (e.g., Lazear and Gibbs 2009). In the present context, providing employees with SMWT carries the risk that these employees exploit their discretion and behave opportunistically by reducing individual effort, because under SMWT no monitoring by means of working hours registration takes place. This reasoning is in line with agency theory according to which the delegation of decision rights

from the principal to the agent involves a serious moral hazard problem unless the agent's actions are sufficiently monitored or alternatively incentivized. The shirking risk is especially high when SMWT is accompanied by the freedom to work from home, because usually this makes employee monitoring much more difficult, which in turn lowers the employees' shirking costs (Dutcher 2012, Felstead et al. 2003).

The literature analyzing the reasons behind employers' decisions to introduce practices of flexible working hours or increased job autonomy maintains that employers do so to respond to a growing need of employees to balance their work and family lives, which in turn is at least partially driven by a rise in female labor market participation (Golden 2009, Ortega 2009, Shockley and Allen 2012). If this is indeed the primary reason for their implementation, employees might exploit these flexible practices to accommodate family rather than work obligations. By combining attribution theory with signaling theory, similar considerations have recently been developed by Leslie et al. (2012). The authors argue that an employee's choice of flexible work practices can either signal high or low organizational commitment, depending on the employer's perception about the employee's intentions for choosing a certain flexible work practice. If managers interpret the employees' demands for flexible work practices as being motivated by the desire to increase individual productivity, they will evaluate each petition as signaling that the individual is a highly committed worker who deserves career premiums in return. If, however, managers assume that the employees' demands are motivated by a self-interested desire to accommodate their personal lives, they will interpret each petition as signaling that the individual has a low level of commitment towards the firm, which involves career penalties (signal of low commitment hypothesis). This implies that, if the choice of SMWT (as a measure of flexible work practices) is indeed motivated by the self-interest of employees who seek to accommodate their personal lives at the expense of organizational duties, these employees are unlikely to increase their effort level in response to the introduction of SMWT. This reasoning as well as the shirking argument discussed above is summarized in Hypothesis 1.

HYPOTHESIS 1. *Employees with SMWT are less likely to exert extra effort than employees with fixed working hours*.

In contrast, other theoretical considerations come to the conclusion that SMWT may induce employees to exert extra effort. In fact, employers may wish to adopt the practices of flexible working hours or increased job autonomy, because they expect this to have a positive effect on worker performance (Golden 2009, Ortega 2009, Shockley and Allen 2012). For example, according to the theory of decentralization, SMWT may encourage employees to provide extra effort for at least two reasons. First, SMWT enriches an employee's job and may therefore have a positive impact on work motivation and employee effort (Askenazy and Caroli 2010). Second, SMWT allows workers to exploit their private information about how to distribute individual working hours most efficiently. For example, workers can adapt to

their individual circadian rhythms and are thus likely to work more effectively (Pierce and Newstrom 1980). Moreover, they are able to reduce commuting time, because they can freely choose to commute outside of rush hours (Lucas and Heady 2002). This holds especially if SMWT includes working from home, which additionally allows employees to work more effectively by reducing work interruptions (e.g., Venkatesh and Vitalari 1992). Similarly, SMWT allows employees to make use of their informational advantage regarding an effective coordination of work and family obligations, which contributes to improving the employees' work-life balance. As a result, job satisfaction and work morale are likely to improve (MacEachen et al. 2008, Singe and Croucher 2003).

In line with this reasoning, the job characteristics model of Hackman and Oldham (1976, 1980) finds that work motivation can be increased by improving job design. One of the core characteristics of a motivating job design is job autonomy. Since SMWT is a facet of job autonomy, it is likely to have a positive impact on both work motivation and job performance. A similar explanation of why SMWT may contribute to increasing employee effort can be derived from self-determination theory developed by Deci and Ryan (1985, 2000). A key concept of self-determination theory is the perceived locus of causality, which measures the degree of perceived autonomy associated with individual behaviors. The perceived locus of causality is assumed to range along a continuum between self-motivated and externally motivated behavior. A main conclusion of self-determination theory is that employees will exert greater effort when they perceive a more internal locus of causality compared to employees who perceive a more external locus of causality (Turban et al. 2007). Since SMWT is likely to strengthen the worker's perception of an internal locus of causality, it is also likely to increase worker effort.

A final explanation for a positive relationship between SMWT and employee effort is provided by social exchange theory, which was originally introduced by Blau (1964) and Homans (1958). According to this approach, workers may feel obliged to reciprocate in a positive way to benefits provided by their employer. Employees interpret these benefits as signals of recognition for past performance, trust in their work morale or consideration for their work-life balance, and thus respond by exerting additional effort. In the present context, reciprocating workers may exert extra effort in return for receiving decision rights over the choice of their working hours.[5] Assuming that employees value the same benefit (i.e., SMWT) differently, the degree of their sense of obligation to reciprocate will be different. Employees are thus more likely to increase their effort level, the more useful they assess the benefit received from their employer to be (Lambert 2000). Hypothesis 2 summarizes the predictions of the theory of decentralization, the job characteristics model, self-determination theory and social exchange theory.

[5] The similarities between social exchange theory and the gift exchange approach introduced by Akerlof (1982) are obvious. In our case, SMWT (instead of an efficiency wage) is the employer's gift for the employee who responds by donating extra effort.

HYPOTHESIS 2. *Employees with SMWT are more likely to exert extra effort than employees with fixed working hours.*

All in all, therefore, from a theoretical perspective the impact of SMWT on employee effort is heterogeneous and the net effect is ex ante unclear. Consequently, there is a clear need for empirical studies to shed light on this unanswered theoretical question.

3. Data, Variables and Descriptive Statistics

Our empirical analysis is based on data from the German Socio-Economic Panel (SOEP). Starting in 1984, the SOEP is an annual longitudinal survey of about 22,000 individuals living in about 12,000 private households. The questionnaires cover a wide range of individual and job-related characteristics. Job-related characteristics, for example, include employment and occupational status, type of work contract, training, working conditions and working time arrangements, professional mobility, earnings, and job satisfaction. In addition, the SOEP contains a number of individual characteristics such as education, personality traits, living circumstances, health and individual well-being, family biographies, career history and household composition. The SOEP even includes some characteristics at the firm level, such as firm size, sector affiliation and works council presence. Some of the items are surveyed annually, while others are captured at more or less regular time intervals.[6] All in all, the SOEP is probably the most established and representative survey data set at the individual level in Germany, and one of the largest and longest running household panel studies in Europe.

In order to examine the relationship between SMWT and employee effort, we utilize the SOEP waves of 2003, 2005, 2007, 2009 and 2011. These five panel waves contain information about both the different forms of working time arrangements and measures of employee effort. We restrict the analysis to private and public sector employees and exclude self-employed persons, civil servants and apprentices.[7] Workers in the sample are aged between 17 and 65.

Workers are assigned to the respective working time regimes according to their answers to the following survey question: "*Which of the following working hours arrangements is most applicable to your work?*" Respondents could choose between four items.

[6] For more comprehensive information about the SOEP, see Wagner et al. (2007).

[7] Self-employed individuals are excluded, because they are their own boss by definition. Thus, they are able to choose their working hours freely and may also lack a clear workplace definition (Eldridge and Pabilonia 2010, Golden 2009). In addition, we remove obvious outliers from our sample. Specifically, we eliminate individuals who reported unrealistically low monthly gross wages. Consequently, our sample includes workers who earn at least 400 euros per month. In Germany, workers with a monthly gross wage of up to 400 euros are often called 'mini-jobbers'.

- *Fixed working time*: In this regime, employees face a regular time schedule determined by the employer. For example, the schedule may foresee a daily working time from 9 a.m. to 5 p.m., five days a week, which sums up to a 40-hours work week. Fixed working time does not allow either variation in the time schedule or employee participation in determining working hours.
- *Flexible working time determined by employer*: In this regime, workers have flexible working hours that can freely be chosen by the employer in order to match firm requirements. This also includes changing the number of days worked from one week to another (Askenazy and Caroli 2010). This working time arrangement involves a low degree of worker autonomy and a medium or high degree of working time flexibility. Examples are shift work, on-call time, emergency services and stand-by duty.
- *Flextime*: This regime allows employees to vary their daily starting and finishing times requiring compulsory attendance only within a certain daily core time. Typically, flextime is accompanied by working hours accounts which allow employees to accumulate hours by working longer on some days and compensate this later by working less on other days. In this way, employees can even accumulate full days off. Since individual working time can to some extent be flexibly adjusted according to the employees' personal needs, flextime implies a medium degree of both work time flexibility and employee autonomy.
- *SMWT*: In this regime, employees have control over the duration, position, and distribution of their working time (Kelly and Moen 2007, Nijp et al. 2012, Shockley and Allen 2012). First, SMWT typically includes the employees' control over the starting and finishing times of their workday without being restricted to certain core times. Second, employees can set their breaks, vacation days and days off. Third, employees can freely distribute their workdays over the working week and decide whether they wish to exert extra effort (overtime). Fourth, there is usually no obligation to balance hours worked within a given time horizon. Finally, employees can typically even decide, where to work, i.e., they are allowed to work, at least occasionally, from home.[8] Consequently, this working time regime allows the employee a high degree of flexibility and autonomy over her individual working times.[9]

A visual summary of these working time arrangements can be found in Figure 1. Table 1 displays the incidence of the different working hours regimes between 2003 and 2011.

[Insert Figure 1 and Table 1 about here]

[8] There are synonym expressions for work from home such as telecommuting, remote working or home-based work (e.g., Eldridge and Pabilonia 2009, 2010, Oettinger 2011, Dutcher, 2012). In our sample (year 2009), about 50% of the SMWT-employees reported that they (partially) work from home.

[9] In addition, SMWT may involve the replacement of input control by output control, where actual working hours are no longer recorded. Instead, work is defined in terms of results (Moen et al. 2011a, 2011b). We address this in our empirical analysis by controlling for performance evaluations.

The table demonstrates that fixed daily working time is still the most common form of working hours arrangements. It applies to about 43% of the employees in Germany. About 20% of the workers make use of flextime within a working hours account. Furthermore, about 22.5% of employees work flexible hours that are determined by the employer. Finally, about 14.5% of employees report having the freedom to determine working time at their own discretion.[10] Table 1 also indicates that the percentages for each of the working time regimes remained quite stable over the past decade.

Table 2 provides some information about work effort in each of the four working time regimes. As a measure of extra effort, we use the difference between average actual working hours (WH^a) and contractual working hours (WH^c) per week, labeled $\Delta WH = WH^a - WH^c$. The first striking result is that workers provide some extra effort in each of the four working time arrangements, i.e., ΔWH is always positive. However, there are substantial differences between the categories with respect to the extent of extra effort. While on average ΔWH is relatively small in the fixed working time regime (2.2-2.7 hours per week), the largest amount of extra effort can be ascertained for employees with SMWT (6.9-8.1 hours per week). According to this finding, employees with SMWT provide, on average, an extra effort of up to one additional working day per week (in fulltime equivalents), which is about five hours more than workers in a fixed working time regime deliver.

[Insert Table 2 about here]

Note that these descriptive statistics only provide some first insights about average effort differences between the working time regimes, and cannot be interpreted as causal. Meaningful conclusions regarding a causal effort effect of SMWT (and other working time arrangements) can only be drawn from multiple regression analyses that explicitly account for potential endogeneity biases.

4. Econometric Model and Estimation Strategy

In order to measure the impact of SMWT on worker effort, we specify the following fixed effects model:

$$\Delta WH_{it} = \alpha_1 SM_{it} + \alpha_2 ED_{it} + \alpha_3 FT_{it} + X_{it}\beta + \mu_{i,o(it)} + u_{it} \,. \qquad (1)$$

The dependent variable ΔWH measures the amount of extra effort (as defined above) of employee i at time t. Our main explanatory variables are dummy variables for three of the four working hours regimes,

[10] The definitions of the working hours arrangements are partially different in the European Working Conditions Survey (EWCS). However, the definitions regarding flextime and SMWT are equivalent, so that the corresponding percentages in the EWCS and the SOEP are comparable. According to additional Excel sheets provided by the European Foundation for the Improvement of Living and Working Conditions (see http://www.eurofound.europa.eu/surveys/smt/ewcs/ewcs2010_12_02.htm) the percentages calculated from the SOEP are in line with the German information obtained from the EWCS.

i.e., SMWT (SM), flexible working time determined by the employer (ED), and flextime (FT). The coefficients α_1, α_2 and α_3 must be interpreted relative to the excluded reference group of the fixed working time regime, where for our purpose α_1 is of particular interest. Furthermore, u is an idiosyncratic error term with zero mean and finite variance, and $\mu_{i,o(it)}$ is a worker-occupation specific spell fixed effect, where the index $o(it)$ stands for the occupation in which worker i is employed at time t. This is equivalent to the inclusion of dummy variables for all unique worker-occupation combinations, and it controls for worker fixed effects and occupation effects as well as their combination.[11]

Equation (1) contains a rich set of socio-economic control variables included in the vector X to ensure that our parameter estimates for α_1, α_2 and α_3 are not biased by factors that intrinsically must be attributed to other potential determinants of extra working time. In this regard, we assume that extra working time may additionally be affected by individual characteristics such as years of schooling, gender, nationality, marital status, the existence of children in the household, health status, satisfaction with health and household income, as well as the number of hours devoted to leisure-time activities.[12] Furthermore, various job characteristics may influence a worker's extra effort, i.e., wage level, job tenure, job satisfaction, occupation, occupational status, employment status (full-time or part-time, permanent or fixed-term), employer changes, perceived job security, and previous experiences with full-time and part-time jobs as well as unemployment. We also add firm-level information (firm size class and sector affiliation of the respondent's company) to the vector of control variables. Moreover, X also includes a set of time dummies. Finally, in addition to the information provided by the survey, we match average annual unemployment rates of the different German Federal States as published by the German Federal Statistical Office to our data. Table A2 in the Appendix provides the definitions and descriptive statistics of the complete set of variables used in this study.

Estimated by conventional OLS, α_1 can only be interpreted as a causal effect, if our focus variable SM is strictly exogenous, i.e., uncorrelated with both the unobserved individual effect, $\mu_{i,o(it)}$, and the idiosyncratic error term, u_{it}. However, if this exogeneity assumption does not hold, then α_1, estimated

[11] The advantage of including worker-occupation spell fixed effects is twofold. First, as we have more than 10,000 workers and 1,000 occupations, this is a computationally simple way to control for two types of fixed effects when the number of units for each fixed effect is too high to generate and include dummy variables (Andrews et al. 2006). Second, this controls for unobserved heterogeneity even more flexibly than just including the worker and occupation effects separately. By including them in a combined way, we allow for unobserved worker heterogeneity that is constant as long as a worker is employed in the same occupation, but that is allowed to change when a worker switches her occupation. This controls not only for a worker's overall time-constant unobserved characteristics but also for some time-variant unobserved characteristics.

[12] The time-invariant variables, years of schooling, gender and nationality, are only included when we estimate (1) by OLS, but dropped from the model when we implement the fixed effects estimator.

by OLS, is biased and inconsistent due to time-invariant or time-varying unobserved individual characteristics. Equation (1) explicitly addresses the case of time-invariant unobserved factors by including occupation-specific worker fixed effects $\mu_{i,o(it)}$ that may be correlated with both the explanatory variables (including the working time arrangements) and the worker's propensity to provide extra effort. Individual (occupation-specific) ability is a typical example of a factor that may influence the choice of a certain working hours arrangement as well as employee effort. The bias of these unobserved characteristics on employee effort can be eliminated by applying the fixed effects within-estimator to equation (1).

After controlling for fixed effects, there may be additional bias due to a potential correlation between SM and u_{it}, which may result from the omission of time-varying characteristics that drive selection into a particular work time regime, or from reverse causality. In the latter case, an employee's decision in favor of SMWT may depend on her actual working hours. Moreover, employees may sort into different working time regimes based on time-varying unobserved characteristics which also affect their effort choices. Examples include personality traits that may change over time, or unobserved changes to an individual's life circumstances. If not addressed, both reverse causality and selection based on time-varying unobservable characteristics might cause estimation biases.

To address these issues, we combine equation (1) with instrumental variables (IV) approaches. Specifically, we use two related two-step identification strategies, where the first is based on predictor substitution and the second relies on residual inclusion. Both approaches require the estimation of reduced form equations for each of the three flexible working time regimes in the first stage. For the first approach these equations are

$$SM_{it} = \gamma_{11} ED_{it} + \gamma_{12} FT_{it} + X_{it}\delta_1 + Z_{1it-2}\omega_{11} + \omega_{12} Z_{2it} + \nu^{SM}_{i,o(it)} + \varepsilon_{1it} \tag{2}$$

$$ED_{it} = \gamma_{21} SM_{it} + \gamma_{22} FT_{it} + X_{it}\delta_2 + Z_{1it-2}\omega_{21} + \omega_{22} Z_{2it} + \nu^{ED}_{i,o(it)} + \varepsilon_{2it} \tag{3}$$

$$FT_{it} = \gamma_{31} SM_{it} + \gamma_{32} ED_{it} + X_{it}\delta_3 + Z_{1it-2}\omega_{31} + \omega_{32} Z_{2it} + \nu^{FT}_{i,o(it)} + \varepsilon_{3it}\ . \tag{4}$$

Here, $\nu_{i,o(it)}$ and ε_{it} represent the occupation-specific worker effects and the idiosyncratic error terms. The vector X contains the same control variables as in equation (1). Altogether, Z_1 and Z_2 comprise four identifying instrumental variables that are excluded from the primary equation (1). For instrumental variables to be valid, they must be relevant, i.e., significant predictors of the working time arrangements in the first stage, and exogenous, i.e., uncorrelated with the idiosyncratic error term u_{it} in equation (1).

Our first three exclusion restrictions, included in Z_1, follow a standard procedure of IV estimations with panel data (e.g., Fernandez-Val and Vella 2011, Vella and Verbeek 1998). Specifically, we instrument each of the working hours arrangements with its corresponding lagged variable, i.e., SM_{it} is instrumented by SM_{it-2}, ED_{it} is instrumented by ED_{it-2}, and FT_{it} is instrumented by FT_{it-2}. These instruments are relevant, because a worker's past choices are likely to affect her current choice. At first glance, it appears natural that the experience of previous work under a certain working time regime increases the likelihood of future work under that regime; therefore, we would expect positive coefficients ω_{j1}, ($j = 1,2,3$), on the corresponding lagged working time regime variables. Note, however, that in a fixed effects within-estimation also negative coefficients on the lagged working time regime variables can occur, if changes between regimes are relatively frequent and the observation period is relatively short.[13] As our panel is relatively short and changes between working time regimes may be caused by a number of events such as employer changes, promotions, relocations or management policy changes, negative signs of the coefficients on the lagged variables would not be surprising. With respect to the exogeneity requirement, we have to assume that a worker's working time regime in the past (lagged by two periods) has no direct effect on a worker's current work effort; i.e., that it is uncorrelated with the idiosyncratic error u_{it} in equation (1). In our application, this assumption seems credible, the more so as it only needs to hold conditional on our large set of covariates, which includes the contemporary working time regime, a large set of observed characteristics, and the worker's unobserved time-constant propensity to provide extra effort (the fixed effect). After holding all these factors constant, it is hard to see how the lagged working time regime could have a direct effect on the worker's current effort.

As a further instrument for our focus variable, SM_{it}, Z_2 represents the share of workers with SMWT among all workers in the same occupational status group, firm-size category, sector, region, and

[13] The reason for a potential negative sign when introducing fixed effects is the following. The positive correlation in a regression without fixed effects can be largely driven by two groups of workers. Workers who always stay in SMWT exhibit $SM_{it} = SM_{it-2} = 1$, and workers who always stay out of SMWT exhibit $SM_{it} = SM_{it-2} = 0$. Across these groups of workers, SM_{it} and SM_{it-2} are hence positively correlated. In a fixed effects regression, workers who do not change state do not contribute to the identification of the coefficient, so one important source of a positive correlation is eliminated. Instead, periods in which switches occur gain weight in the estimation, and these switches contribute to a negative sign, because in the periods just after a switch SM_{it} and SM_{it-2} take opposite values. The weight of these switches is stronger the more switches occur in a given observation period or the shorter the observation period is for a given number of switches. One way to assess the importance of switches is to look at the ratios of the within-worker standard deviation to the overall standard deviation of SM, ED, and FT. These ratios are 55%, 61%, and 50%, suggesting that switches between working-time regimes are not extremely rare, so that a negative sign of the lagged working-time-regime variables might be expected.

time period.[14] This group-specific mean is positively correlated with the SMWT dummy SM by construction and should consequently be negatively correlated with the remaining working hours arrangement dummies ED and FT. On the other hand, there is no reason to expect that the average demand for SMWT employees within each of these cells has an influence on an employee's propensity to provide extra effort in any other way than through its effect on the individual choice of SMWT.[15] This should especially hold true, because we group the observations mainly according to firm characteristics rather than employee characteristics.

In our first approach, we estimate the parameters of the triangular four-equation structure (1)-(4) by the two-stage least squares (2SLS) within estimator, where at the second stage SM, ED and FT in the primary equation (1) are replaced by their predicted values. In Section 5, we refer to this estimator as the fixed effects IV estimator (FEIV). Since the model (1)-(4) is over-identified with four instruments for three endogenous explanatory variables, we can test the exogeneity of the overidentifying restrictions, conditional on the validity of at least as many instruments as are required for exact identification.

The 2SLS approach has the strength that it allows the inclusion of fixed effects, because the first stages are estimated as linear probability models. It has the drawback, however, that the binary nature of the endogenous regressors is not explicitly accounted for. We therefore implement a second IV approach to address this issue by estimating the first-stage equations (2)-(4) as probit models. Since the fixed effects probit model leads to inconsistent parameter estimates (e.g., Baltagi 2008), we estimate random effects probit models, but proxy for time-constant occupation-specific unobserved worker heterogeneity that may be correlated with the error term by additionally including the person-occupation mean values of all the time-varying covariates of (2), (3), and (4), respectively. This proceeding is also known as Mundlak's approach (e.g., Greene 2008). The first-stage equations (2)-(4) can then be written as

$$D_{it}^{*} = W_{it}^{D}\eta_{1}^{D} + \overline{W_{i,o(it)}^{D}}\eta_{2}^{D} + \theta_{i,o(it)}^{D} + \varepsilon_{it}^{D} \tag{5}$$

$$D_{it} = \begin{cases} 1 & \text{if } D_{it}^{*} > 0 \\ 0 & \text{otherwise}, \end{cases} \tag{6}$$

[14] For each of the five years we defined two groups of occupational status (jobs with managerial or non-managerial tasks), four firm sizes classes, 10 industries and the 16 federal states of Germany. Cells with just one observation do not provide real means and are therefore merged. By proceeding in this way, we prevent the instrument for these observations being identical to the endogenous SMWT variable and thus avoid potential endogeneity of the instrument.

[15] The idea to use group-specific means as exclusion restrictions is not unusual and has been applied, for example, in Woessmann and West (2006).

where D represents SM, ED or FT, respectively. Here, D_{it}^{*} denotes the latent propensity to choose working time regime D_{it}, and ε_{it}^{D} is a normally distributed error term. The vector W^{D} includes each of the right-hand-side variables of equations (2), (3), and (4), while $\overline{W_{i,o(it)}^{D}}$ contains the person-occupation mean values of all time-varying covariates of (2), (3), and (4). Finally, $\theta_{i,o(it)}^{D}$ is that part of the original unobserved effect $\nu_{i,o(it)}^{D}$ which remains after controlling for the person-occupation means of the time-varying covariates, i.e., $\theta_{i,o(it)}^{D} = \nu_{i,o(it)}^{D} - \overline{W_{i,o(it)}^{D}}\eta_{2}^{D}$. Mundlak's approach relies on the assumption that after controlling for the person-occupation mean values, $\theta_{i,o(it)}^{D}$ is uncorrelated with the original regressors in W^{D} and can hence be treated as a random effect.

From the random effects probit estimates of (5) and (6), we extract the generalized residuals $s_{it}^{D} = \left(D_{it} - \Phi_{it}\right)\phi_{it} / \left[\Phi_{it}\left(1-\Phi_{it}\right)\right]$, where ϕ_{it} and Φ_{it} denote the PDF and CDF of the standard normal distribution evaluated at $W_{it}^{D}\eta_{1}^{D} + \overline{W_{i,o(it)}^{D}}\eta_{2}^{D} + \theta_{i,o(it)}^{D}$. In the second stage, these generalized residuals are added as correction terms to equation (1) in order to control for remaining time-varying unobserved heterogeneity, i.e.,

$$\Delta WH_{it} = \alpha_1 SM_{it} + \alpha_2 ED_{it} + \alpha_3 FT_{it} + X_{it}\beta + \kappa_1 s_{it}^{SM} + \kappa_2 s_{it}^{ED} + \kappa_3 s_{it}^{FT} + \mu_{i,o(it)} + u_{it} \,. \qquad (7)$$

Intuitively, the generalized residuals embody time-varying characteristics that drive the selection into the working time regimes, and explicitly controlling for them in the second stage removes the endogeneity bias from the coefficients of the working time regime variables. Just as for equation (1), equation (7) is estimated by the fixed effects estimator.[16] In Section 5, we refer to this second approach as the endogeneity-corrected fixed effects estimator (ECFE).

5. Empirical Results

In this section, we proceed in four steps. In Subsection 5.1, we present and discuss the estimation results of our main specification introduced in Section 4. Subsection 5.2 provides empirical results for other indicators of employee extra effort. Here, measures of unusual working hours, i.e., work in the evening or at night and work at weekends, serve as dependent variables. In Subsection 5.3, we check the robustness of our estimation results from the main specification to changes in the definition of the dependent variable.

[16] See Fernandez-Val and Vella (2011) for a similar two-step estimation strategy.

Finally, in Subsection 5.4, we conduct additional subgroup analyses to obtain further information about complementarities between SMWT and worker characteristics, which helps us to sharpen the management implications regarding an effective use of SMWT.

5.1. Effort Effects of Self-Managed Working Time

Table 3 displays the estimation results for the impact of SMWT on employee extra effort, where extra effort is defined as the average number of actual weekly working hours minus contractual weekly working time. Column (1) contains the ordinary least squares (OLS) estimates of an unconditional specification, where the dependent variable is solely regressed on the working time regime dummies and a constant. Column (2) describes the OLS estimates of the working time regime dummies conditional on the complete set of covariates. Column (3) displays the fixed effects (FE) estimates of α_1, α_2 and α_3 from equation (1). The coefficients resulting from our fixed effects instrumental variables (FEIV) estimation of equations (1)-(4) can be found in column (4). Finally, column (5) contains the results from our endogeneity-corrected fixed effects (ECFE) estimator according to (7).[17]

[Insert Table 3 about here]

The most striking result of our estimates is that throughout all specifications SMWT has a positive influence on employee extra effort, which confirms Hypothesis 2. However, the magnitude of the positive impact sharply declines when accounting for observed heterogeneity in column (2), for time-constant occupation-specific unobserved heterogeneity in column (3) and for time-constant and time-varying unobserved heterogeneity simultaneously in columns (4) and (5). Starting with an initial estimate of about 5.1 hours per week in the unconditioned specification, the effect on average extra effort reduces to 3.3 hours in the complete OLS model. It further declines to 1.4 hours in the FE model and finally ends up with estimates of 1.1 hours in our FEIV model (not statistically significant) and 1.0 hours in the ECFE model (statistically significant at the 5% level).

Table 3 also includes information about the validity of the exclusion restrictions applied in the FEIV and the ECFE approach. First, relevance of the instruments is indicated by F - or χ^2 -tests on joint significance in the respective first-stage regressions. Each of the test statistics by far exceeds the rule-of-thumb value of 10, indicating strong instruments. Instrument relevance is additionally confirmed by the corresponding parameter estimates of the first-stage equations, which are displayed in Table A1 in the Appendix. In each of the first-stage equations both the respective lagged working time variable and the

[17] All estimates that are not reported in the tables of this and the following subsections are available from the authors upon request.

group-specific mean variable are significant at the 5% or 1% level, respectively. The group-specific mean variable exhibits the expected positive sign in the SM equations and a likewise unsurprising negative sign in the ED and FT equations. Moreover, all lagged working time variables exhibit a negative sign in the corresponding reduced form equation. Finally, Hansen's J-test documents that the overidentification restrictions can be considered as exogenous ($p = 0.46$).[18] All in all, therefore, the diagnostic tests support the validity of the overidentifying restrictions and thus emphasize the confidence in our FEIV and ECFE approaches.

Note, however, that neither the C-test for endogeneity nor an F-test on joint significance of the endogeneity correction terms s^{SM}, s^{ED} and s^{FT} in equation (7), i.e., $\kappa_1 = \kappa_2 = \kappa_3 = 0$, rejects the null hypothesis of exogenous working time regime dummies ($p = 0.59$ or $p = 0.80$). This indicates that the FE estimates displayed in column (3) can already be interpreted as causal, and that there is no necessity to additionally account for unobserved time-varying heterogeneity. As a result, the FE, FEIV and ECFE models all provide consistent estimates for the SMWT effect, where the FE model is the most efficient of the three models, producing the smallest standard errors. Therefore, the FE model is our preferred model, but its results are confirmed by the FEIV and ECFE models.[19]

We find that from the initial 5.1 hours of extra effort obtained in the unconditional OLS estimation about 1.8 hours can be explained by observed individual, job or firm characteristics other than SMWT. From the remaining 3.3 hours, about 1.9 hours can be attributed to unobserved factors, leaving an effect of around 1.4 hours that can be ascribed to the policy of SMWT itself. This is only 27% of the initially estimated impact.

In sum, we conclude from these results that, although controlling for selection into SMWT reduces the positive effort effect of SMWT considerably, there remains a small positive and causal effect. The 95% confidence interval from our preferred FE estimate ranges between 0.9 and 1.8 hours. Most interestingly, this rules out any negative effort effects, meaning that we do not find any evidence for the hypothesis that SMWT encourages employee shirking. On the contrary, compared to the fixed working hours

[18] We conducted additional tests with regard to the exogeneity assumption of our exclusion restrictions. Specifically, we ran FEIV regressions, where only three of the four instrumental variables served as exclusion restrictions, while the remaining instrument was added to the vector of control variables in the primary equation. A simple t-test on significance of the estimated coefficient then provides information in terms of the exogeneity assumption of this particular instrument. Each of our instruments proved to be insignificant in the primary equation which is consistent with the result of Hansen's J-test of overidentification. Furthermore, we simply added the instruments to equation (1) in order to test the exogeneity assumption. Neither of the instruments turned out to be significant in this specification.

[19] Another way to verify that the FEIV and ECFE models confirm the estimates of the FE model is to note that its SMWT effect of 1.4 hours lies within the 95% confidence intervals for the SMWT effect resulting from the FEIV and ECFE models.

arrangement there seems to remain a positive regime effect of about 90 minutes of excess working time per week.

5.2. Self-Managed Working Time and Non-Standard Working Hours

This subsection extends our analysis by considering further measures of extra effort. Specifically, we investigate whether or not employees with SMWT work more non-standard hours than employees with fixed working hours. Non-standard working hours include work in the evening or at night as well as work at weekends. This investigation aims at expanding our previous insights with respect to the impact of SMWT on employee extra effort. The results are displayed in Table 4 and Table 5.

[Insert Table 4 and Table 5 about here]

Table 4 contains the estimates for evening work and night work. The original question in the questionnaire is "*Do you sometimes have to work in the evenings (after 7 p.m.) or at night (after 10 p.m.)?*" From the respondents' information we generate dummy variables indicating whether or not employees are used to working in the evenings or at night at least occasionally and use these dummies as dependent variables. We maintain our previous estimation strategies, focusing on the FEIV approach for the endogeneity correction, because this approach provides us with more detailed information about instrument validity (namely the overidentificaton test) than the ECFE estimation strategy. This implies that both the outcome and first-stage equations are linear probability models, which produce consistent estimates for our SMWT effect and the remaining covariates.[20]

The estimations in Table 4 show a quite uniform pattern. While the positive OLS estimate for SM is highly significant and quite substantial in terms of size, the corresponding FE estimate remains significant but the size of the coefficient declines considerably. Finally, in the FEIV specification, α_1 continues to decline in size and becomes insignificant. For example, in the model for evening work the FE estimate (0.078) declines by about 70% compared to the OLS estimate in a model without control variables (0.263). The coefficient continues to decline by an additional 19% in the FEIV specification.

Analogously, Table 5 displays the estimates for work on Saturdays and Sundays. Hence, our dependent variables in these cases are dummy variables that indicate whether or not an employee at least occasionally works on Saturdays or Sundays, respectively. The estimation results follow the same pattern as before. Starting with a highly significant positive coefficient in the unconditioned OLS model, the effect

[20] See Angrist and Pischke (2009, Section 3.4.2) for a justification of applying linear IV methods to limited dependent variables, and Angrist and Evans (1998) for a well-known application of linear IV estimation in a context where both the outcome and the endogenous variable are binary.

of SMWT on the propensity to work at weekends decreases substantially in size and significance when accounting for time-constant and time-varying unobserved characteristics in our FEIV specification.

The diagnostic tests again confirm the validity of our exclusion restrictions. Also, in three of four FEIV specifications, the C-test does not reject the exogeneity hypothesis. In these cases, as in our previous results, the point estimates resulting from the FE approach can already be interpreted as causal effects. In sum, our previously obtained main finding, according to which an employee's exertion of extra effort can only to a minor extent be attributed to the arrangement of SMWT, remains unchanged. For example, for the evening work specification we conclude that only about 30% of the original impact of SMWT on the probability of working in the evenings can be ascribed to this particular working time arrangement. In contrast, the predominant part of this positive impact can be explained by observed and unobserved time-invariant heterogeneity.

Another example supporting our main finding is that, in the 'work on Sundays' specification only about 25% (0.044/0.177) of the original impact of SMWT on the probability of working on Sundays can be explained by this human resource practice. Presumably, the causal effect is even weaker because for this specification the C-test emphasizes the necessity to additionally account for time-varying unobserved heterogeneity, which in the end decreases the causal effect to zero. In both cases, we can thus conclude that the causal effect of SMWT on employee extra effort is rather small. Apart from other observed characteristics, the positive effect is largely driven by unobserved heterogeneity such as selection issues. Also, note that similar to the previous subsection, we find no evidence that SMWT encourages shirking.

5.3. Applying Alternative Measures for Employee Extra Effort

In this subsection we examine whether the result of a positive effort effect of SMWT, which declines when gradually controlling for observed and unobserved factors, also holds when we replace our dependent variable used in Subsection 5.1 by two alternatively defined measures of extra effort. The first variable measures the amount of self-reported overtime work in the respective month prior to the survey (OT). Just as with our dependent variable in Subsection 5.1, the second alternative variable is defined as actual minus contractual working time. The difference between these two variables, however, is the definition of actual working hours. While the dependent variable that we used in Subsection 5.1 is restricted to the average actual working hours that employees spend doing their main job, the alternative measure additionally includes commuting times as well as the number of working hours, if any, committed to a

second job ($\Delta WH2$).[21] As before, we focus on our OLS, FE and FEIV estimation strategies. Table 6 displays the corresponding estimation results.

[Insert Table 6 about here]

The results confirm our previous estimates. In both specifications, the unconditioned OLS effect is positive and highly significant. The coefficients resulting from the FE model are also significant, but decline substantially from about 2.3 to 0.7 hours or from about 2.7 to 0.7 hours, respectively. Again, the FEIV point estimates lose their significance. The validity of our exclusion restrictions is confirmed by the diagnostic test statistics. For both FEIV specifications, the C-test does not reject the hypothesis of exogenous working hours-arrangement variables, and we can again interpret the FE point estimates as causal effects. Based on the initial OLS effects, therefore, about 70% (or 1.6 weekly hours in absolute terms) in the OT-specification and 74% (or about 2 weekly hours in absolute terms) in the $\Delta WH2$-specification must be ascribed to (observed and time-constant unobserved) factors other than SMWT, which is very much in line with our estimates in Subsection 5.1.

5.4. Subgroup Analyses

In this subsection, we carry out a number of subgroup analyses to check whether the SMWT effect uncovered previously varies with certain worker characteristics. This allows us to detect potential complementarities. If SMWT has a stronger effort effect for workers with certain characteristics, then these worker characteristics and SMWT are complements in the effort production function. Identifying such complementarities allows us to refine the management implications to be drawn, because we can then establish under which circumstances the introduction of SMWT has the strongest effort effects.

There are two typical tests for complementarities (Aral et al. 2012, Tambe et al. 2012). First, complementary practices or characteristics are likely to coexist and should thus be *positively correlated*. Second, by definition, complementary items have a larger performance impact when utilized jointly rather than separately, and hence, their *interaction effect* on performance is positive. In this subsection, we therefore present correlations between SMWT and certain worker characteristics, and we test for interaction effects by augmenting our preferred FE model (1) with interaction terms of SMWT and these worker characteristics.

[21] In order to calculate the actual working hours in this case, we analyzed the responses to the following question: "*How many hours do you spend on job, apprenticeship, and second job on a typical weekday, Saturday, and Sunday (including commuting times)?*" Actual working hours are then calculated as the number of working hours on a typical workday times 5 plus the number of working hours on typical Saturdays and Sundays.

Recall first that according to social exchange theory, a worker may be encouraged to provide extra effort as an act of positive reciprocity in response to being granted SMWT. From this we would expect SMWT to be positively correlated with a worker's inclination to reciprocate. Furthermore, we would expect the SMWT effect to be stronger for workers who are inclined to reciprocate positively and weaker for workers who are unlikely to act reciprocally. We test this idea by interacting our SMWT variable with a binary measure R that distinguishes high-level from low-level reciprocators.[22] Consequently, equation (1) is extended to

$$\Delta WH_{it} = \alpha_{11} SM_{it} + \alpha_2 ED_{it} + \alpha_3 FT_{it} + \pi_1 R_{it} + \pi_2 R_{it} \times SM_{it} + X_{it}\beta + \mu_{i,o(it)} + u_{it} \,. \qquad (8)$$

Note that in this specification low-level reciprocators not working under SMWT serve as the reference group, so α_{11} has to be interpreted as the SMWT effect for low-level reciprocators, while $\alpha_{11} + \pi_2$ is the SMWT effect for high-level reciprocators. If the SMWT effect was driven by reciprocity, we would expect more reciprocal workers to respond more strongly to SMWT than less reciprocal workers, so $\alpha_{11} + \pi_2 > \alpha_{11}$, or equivalently, $\pi_2 > 0$. Put differently, $\pi_2 > 0$ would indicate a complementary association between SMWT and reciprocity, meaning that 'the whole is more than the sum of its parts', i.e., $\alpha_{11} + \pi_1 + \pi_2 > \alpha_{11} + \pi_1$. We can therefore state the following hypothesis:

HYPOTHESIS 3a. *Positive reciprocity and SMWT are positively correlated.*

HYPOTHESIS 3b. *Positive reciprocity amplifies the effort effect of SMWT and is therefore complementary to SMWT in producing worker effort.*

Furthermore, recall that according to self-determination theory employees who perceive a stronger internal locus of causality are likely to exert a higher effort level due to increased intrinsic motivation. Working under an SMWT arrangement should strengthen the perception of an internal locus of causality, and this might be the reason for the positive effort effect of SMWT that was identified previously. However, intrinsic motivation might not only be a possible channel of a positive SMWT effect, it might also be complementary to SMWT. Hence, the SMWT effect might be stronger among highly motivated work-

[22] The extent of positive reciprocity is obtained from the respondents' degree of approval to the following statements: (a) "*If someone does me a favor, I am prepared to return it.*" (b) "*I go out my way to help somebody who has been kind to me before.*" (c) "*I am ready to bear personal costs to help somebody who helped me before.*" All items were to be answered on a 7-point Likert scale ranging from 1 ("*does not apply to me at all*") to 7 ("*applies to me perfectly*"). The amount of positive reciprocity is then calculated by summing up the Likert scores and dividing the sum by 3. The median of this variable represents the splitting value for R, where individuals with scores lower than the median are assigned to the group with a low level of positive reciprocity. Information about reciprocity is originally surveyed only in 2005 and 2010. We therefore replaced the missing values by imputing the 2005 observations to the years 2003 and 2007, and by imputing the 2010 observations to the years 2009 and 2011. This procedure should not be problematic, because personality traits are unlikely to change very quickly over time. For a short summary of the debate on whether personality traits can be assumed to be time-constant or time-varying, see Heineck and Anger (2010).

ers than among less motivated workers. We test for such a complementary relationship by looking at the correlation between intrinsic motivation and SMWT[23] (to check whether workers who are more motivated are also more likely to work under SMWT), and by interacting our SMWT variable in the working hours regression with a measure for intrinsic motivation. For this purpose, we construct a binary measure of work ethic (WE) to distinguish between employees with high and low levels of intrinsic motivation.[24] We set $WE = 1$, if a worker's desired weekly working hours are equal or higher than her contractual weekly hours; and we set $WE = 0$, if the desired hours fall short of contractual working time. In order to ensure that WE can, in fact, be interpreted as a measure for work ethic or intrinsic motivation rather than a measure which simply reflects a worker's preferences for longer working hours, we restrict our sample to full-time workers. The intuition behind this procedure is that part-time workers who prefer longer working hours may primarily wish to be promoted to a full-time job in order to earn more money. In this case, $WE = 1$ would indicate involuntary part-timers who are extrinsically, rather than intrinsically motivated.

In addition, recall from agency theory the recommendation that the delegation of decision rights to the agent should be accompanied by managerial control in order to prevent the agent from shirking. In practice, the introduction of SMWT may therefore be accompanied by a measure for monitoring employee output as a substitute for the rescinded duty to register their working hours. We address this idea by including a human resource policy measure aimed at increasing extrinsic motivation. Specifically, we add a dummy variable for performance evaluation, PE, which indicates whether or not an employee's performance is regularly evaluated by a supervisor.[25]

As before, we first test the correlation between SM and PE to see whether these two policy measures are more likely to be introduced jointly rather than separately. In line with Aral et al. (2012) and Tambe et al. (2012), we then test the correlation between lagged work ethic (WE_{t-2}) and current performance evaluation (PE_t), separated for workers with and without SMWT. If SMWT was particularly effective when combined with both intrinsic and extrinsic motivation, we would expect WE_{t-2} and PE_t to be positively correlated under SMWT, but not necessarily in the absence of SMWT. To continue analyzing these complementarities, we then complete our estimation model by including all two-way interac-

[23] For the correlation, we choose a lagged measure for motivation, because a positive correlation between current motivation and SMWT might simply indicate that workers have become more motivated because of SMWT, while a positive correlation between lagged motivation and SMWT indicates that workers who were motivated prior to working under SMWT are more likely to choose to (or to be chosen to) work under an SMWT regime.

[24] This reasoning is related to the forms of intrinsic motivation modeled in James (2005), i.e., employee loyalty directed towards an employer and duty directed towards a social norm (e.g., the employee's aspiration level concerning her workload).

[25] The information about performance evaluations were originally only surveyed in 2004, 2008 and 2011. In analogy to the reciprocity variable, we replaced the missing values by imputing the 2004 observations to 2003 and 2005, and by imputing the 2008 observations to 2007 and 2009.

tion terms between SMWT (SM), intrinsic motivation (WE), and extrinsic motivation (PE) as well as a three-way interaction term measuring the potential complementarity between intrinsic motivation, extrinsic motivation and SMWT. Hence, the corresponding regression model can be written as

$$\begin{aligned}\Delta WH_{it} &= \alpha_{12} SM_{it} + \alpha_2 ED_{it} + \alpha_3 FT_{it} + \lambda_1 WE_{it} + \lambda_2 PE_{it} \\ &+ \lambda_3 WE_{it} \times SM_{it} + \lambda_4 WE_{it} \times PE_{it} + \lambda_5 PE_{it} \times SM_{it} + \lambda_6 WE_{it} \times PE_{it} \times SM_{it} \\ &+ X_{it}\beta + \mu_{i,o(it)} + u_{it} \ .\end{aligned} \tag{9}$$

Here, $\lambda_3 > 0$ indicates complementarity between SMWT and work ethic, which would imply that SMWT is particularly effective when targeted towards intrinsically motivated workers. Moreover, $\lambda_4 > 0$ would indicate complementarity between SMWT and performance evaluations implying that it is more effective to introduce SMWT jointly with measures of output control. Finally, λ_6 indicates whether or not performance evaluations amplify a potentially complementary relationship between SMWT and work ethic. Hence, $\lambda_6 > 0$ would indicate that SMWT is particularly effective when targeted towards intrinsically motivated workers in combination with the introduction of performance evaluation. This leads to the following hypothesis:

HYPOTHESIS 4a. *Lagged work ethic is positively correlated with SMWT; performance evaluation is positively correlated with SMWT; and the correlation between lagged work ethic and performance evaluation is positive under SMWT.*

HYPOTHESIS 4b. *Work ethic amplifies the effort effect of SMWT; performance evaluation amplifies the effort effect of SMWT; and work ethic combined with performance evaluation additionally amplifies the effort effect of SMWT. Work ethic, performance evaluation, and the combination of work ethic and performance evaluation are therefore complementary to SMWT in producing worker effort.*

Finally, recall that according to the 'signal of low commitment hypothesis' an employee's choice in favor of SMWT may result from the desire to accommodate her personal life or family obligations rather than to increase her productivity. In this subsection, we test whether this desire is differently distributed between workers who have and do not have children in need of parental care in their households. Specifically, it can be assumed that workers without children in need of parental care mostly choose to work under SMWT in order to increase their personal performance, thereby signaling an interest to boost their career, while workers who have children in need of parental care tend to choose the SMWT regime in order to fulfill their parental obligations. Following this reasoning, workers with children in need of par-

enting are less likely to exert extra effort under SMWT conditions than workers without such children.[26] We measure the impact of family obligations using dummy variables indicating female and male workers who currently have children in need of parental care (FC and MC, respectively). Our estimation model is therefore

$$\begin{aligned}\Delta WH_{it} = {} & \alpha_{13} SM_{it} + \alpha_2 ED_{it} + \alpha_3 FT_{it} + \varphi_1 FC_{it} + \varphi_2 FC_{it} \times SM_{it} + \varphi_3 F_{it} \times SM_{it} \\ & + \varphi_4 MC_{it} \times SM_{it} + X_{it}\beta + \mu_{i,o(it)} + u_{it} \,,\end{aligned} \tag{10}$$

where F characterizes female workers without children in need of parental care in their households. Note that the reference group in this specification is composed of male employees without children in need of parental care, who face fixed working hours. The coefficient α_{13} captures the SMWT effect of male employees who do not have children in need of parental care. The coefficients for the interaction terms, i.e., φ_2, φ_3 and φ_4, indicate whether females with children (FC), females without children (F) and males with children (MC) react differently to SMWT than males without children. For example, $\varphi_2 < 0$ and $\varphi_4 < 0$ would indicate that women and men with children in need of parental care provide less extra effort under SMWT than men without such children. These considerations ultimately lead to Hypothesis 5:

HYPOTHESIS 5. *Workers with children in need of parental care in their households are likely to choose SMWT in order to accommodate family obligations at the expense of exerting extra effort.*

Table 7 displays the parameter estimates of the SMWT variable (SM) as well as the reciprocity (R), work ethic (WE), performance evaluation (PE) or family obligations (FC, MC) variables, and the corresponding interaction effects. Note that specification (1a) is restricted to a sample of full-time employees and extends equation (1) by R, WE, and PE. The primary aim of this specification is to check, whether our main results in Subsection 5.1 are substantially affected by restricting the sample and including additional covariates. Comparing the first column of Table 7 with our previous results demonstrates that this is not the case. Moreover, we find that both positive reciprocity and work ethic have a relatively small (reciprocity) or moderate (work ethic) influence on employee extra effort, while performance evaluations do not contribute to increased worker effort significantly. The finding that the main SMWT effect remains virtually unaffected by the inclusion of the performance pay variable is important, because it suggests that the SMWT effect is not simply driven by the fact that firms have replaced their previous input monitoring activities (recorded working hours) by output monitoring via performance evaluation.

[26] Note that this rationale does not imply that SMWT is expected to be more or less common among different groups of gender and family composition. Hence, this rationale will offer us no specific hypothesis about the correlation between SMWT and gender or the presence of children. Consequently, we refrain from examining correlations for these groups.

[Insert Table 7 about here]

Regarding the impact of positive worker reciprocity we find at first that Hypothesis 3a cannot be confirmed. While we observe a positive bivariate correlation between SM and R ($r = 0.015$, $p = 0.003$), this correlation becomes very small and insignificant ($r = 0.004$, $p = 0.529$) when we consider a partial correlation conditioning on the regressors ED, FT and X.[27] After controlling for observed characteristics, SMWT thus seems to be equally common between reciprocal and non-reciprocal workers. Turning to Hypothesis 3b, we note from Table 7 that the interaction effect $\pi_2 = 0.176$ is not significantly different from zero, suggesting that reciprocal employees who work with SMWT do not exert a greater amount of extra effort in response to SMWT than their less reciprocal counterparts. Furthermore, the SMWT effect for less-reciprocal workers ($\alpha_{11} = 1.330$) is very similar to the overall SMWT effect resulting from our previous estimates in Table 3. Hence, our SMWT effect of 1.38 hours is not reduced for less reciprocal workers. We conclude therefore that workers who are positively reciprocating are not more likely to work under SMWT. Moreover, contrary to Hypothesis 3b, positive reciprocity does not amplify the positive effort effect of SMWT, so reciprocity is not found to be complementary to SMWT. This finding is in line with Giardini and Kabst (2008) who argue that German employees might not perceive the employer's provision of work-family practices (such as SMWT) as a special benefit that would elicit a sense of obligation in them to reciprocate. Instead, due to Germany's long tradition as a social market economy, German employees are assumed to expect a lot from their employers, which explains their lack of reciprocity.

Second, our results demonstrate a distinct complementary relationship between intrinsic motivation and SMWT, but not between extrinsic motivation and SMWT, nor between a combination of intrinsic and extrinsic motivation and SMWT. The partial correlation (conditioning on the regressors ED, FT and X) between WE_{t-2} and SM is positive and significant ($r = 0.043$, $p = 0.000$), suggesting that more motivated workers are more likely to work under an SMWT regime. On the contrary, the partial correlation between PE and SM is insignificant ($r = -0.009$, $p = 0.183$), suggesting no substantial association between performance evaluations and SMWT. Moreover, the correlation between WE_{t-2} and PE is neither significant in the absence of SMWT ($r = 0.010$, $p = 0.265$) nor in the presence of SMWT ($r = 0.025$, $p = 0.303$). Hence, we can only confirm Hypothesis 4a with respect to work ethic, but not with respect to performance pay or performance pay combined with work ethic.

Turning to Hypothesis 4b tested by including two-way and three-way interaction terms into the regression model, Table 7 shows that the SMWT effect for less motivated workers is only $\alpha_{12} = 0.807$

[27] To save space, we did not compile a table for the correlations, but only report them in the text.

hours, while more motivated workers exhibit an SMWT effect of $\alpha_{12} + \lambda_3 = 0.807 + 1.231 = 2.038$ hours, with the difference of $\lambda_3 = 1.231$ extra working hours being significant at the 5% level. Performance evaluation, however, does not increase the SMWT effect, either on its own ($\lambda_5 = 0.245$ and insignificant) or in combination with work ethic ($\lambda_6 = -0.123$ and insignificant). Hence, we conclude that work ethic is strongly complementary to SMWT, but performance evaluations are not. From a management perspective, SMWT is therefore likely to boost worker effort the most if it is targeted towards highly self-motivated workers, whereas accompanying performance evaluations do not seem to be necessary to keep worker effort high.[28] Intrinsic motivation should therefore be a criterion for selecting employees into SMWT arrangements.

Finally, we find evidence consistent with Hypothesis 5. However, this result does only hold for female employees working under the conditions of SMWT. Neither φ_3 nor φ_4 are significantly different from zero, meaning that females without children in need of parental care and males with children who need parental care react to SMWT in a similar way to "childless" men who are found to exert extra effort of about 1.5 hours per week. However, as $\varphi_2 < 0$, we can conclude that female workers with children in need of parental care represent the only group with a reduced SMWT effect. The SMWT effect for this group is $\alpha_{13} + \varphi_2 = 1.588 - 1.425 = 0.163$ hours per week, which means that female workers who have children in their care hardly respond to SMWT by providing extra effort, as measured by their time input.[29] Women with children in need of parental care, therefore, appear to be particularly likely to choose SMWT in order to accommodate family obligations.

6. Conclusion

Using a large representative individual-level panel data set, the German Socio-Economic Panel (SOEP), we empirically examine the effect of self-managed working time (SMWT), which provides employees with extensive decision-making authority over the determination of their working hours, on employee effort, as measured by the difference of employees' actual working time and their contractual obligation.

[28] The negative sign of λ_6 on the three-way interaction term might even imply that additional output monitoring reduces the effectiveness of SMWT targeted towards self-motivated workers; i.e., extrinsic motivation may crowd out intrinsic motivation. However, given that this interaction term is not significant, we cannot affirm this conclusion.

[29] The fact that women with children under SMWT work about 1.4 hours less per week does not mean, of course, that these workers are less productive. Knowing that they are time-constrained due to their child-care obligations, they might increase their productivity per hour worked and thus produce the same output in less time. We also checked SMWT effects on the wage per actual hours worked as a proxy for productivity. For each of the subgroups we consider, we find no effect of SMWT on the wage per actual hours worked. This would suggest that SMWT does not change productivity per hour, so that work time differences can be interpreted as differences in overall output.

Without controlling for selection into SMWT based on observable and unobservable characteristics, we find a large and significant association between SMWT and employee extra effort, which sharply declines when accounting for observed and unobserved characteristics. Our preferred fixed effects estimates imply the following decomposition of the raw difference of five hours of extra work between workers with SMWT and workers with fixed working time. About one hour and 45 minutes of the initial five weekly hours of extra effort can be attributed to selection on observable individual, job or firm characteristics. Roughly another two hours can be attributed to unobserved factors, leaving an effect of less than 90 minutes that can be ascribed to the policy of SMWT itself. We find no evidence for negative effort effects; i.e., we can rule out employee shirking as a response to SMWT. Additional instrumental variables estimates produce very similar results, and the associated endogeneity tests show that after controlling for fixed effects, there remains no further endogeneity, so we can already interpret the fixed effects results as causal.

After showing that SMWT employees, on average, exert extra effort rather than reducing effort, we conduct additional subgroup analyses, based on predictions of the relevant theoretical approaches, in order to obtain some information about complementarities between SMWT and worker characteristics. We find that an employee's intrinsic work ethic amplifies the positive SMWT effect, which is approximately two hours of extra effort per week for this type of workers. Perhaps surprisingly, however, we find no complementarity between SMWT and performance evaluations. This suggests that it is particularly effective to select intrinsically motivated workers into SMWT, while additional performance evaluations as extrinsic motivators do not boost the effort effect of SMWT. Furthermore, we find no complementarity between SMWT and employee reciprocity, which rules out reciprocity as a potential channel of the SMWT effect. Finally, our results demonstrate that female SMWT employees with children in need of parental care in their households exert virtually no extra effort, while both their "childless" counterparts and male SMWT employees with and without children in need of parental care are found to provide extra effort of about 90 minutes per week. This finding suggests that female workers with children in need of parental care choose SMWT mostly for the purpose of accommodating their family obligations rather than in order to increase their working time input.

The results of our study provide some important policy implications that are relevant for both management and employee representatives. While the latter may be concerned about a potential work intensification following the introduction of SMWT, managers may consider adopting SMWT (e.g., in the context of fringe benefits or work-life balance programs) and might wonder whether SMWT is associated with increased employee effort or shirking. According to our empirical results, the causal extra effort effect induced by SMWT is positive but modest, so both employers and employees should benefit from

the use of SMWT. Employers can benefit from introducing SMWT, because, on average, SMWT arrangements do not encourage employee shirking, but instead tend to elicit positive effort effects. The largest effort effect can be achieved, if managers select intrinsically motivated employees (i.e., employees with a strong work ethic) for working under SMWT. On the other hand, employees should also benefit from SMWT, because the modest effort effect could probably be compensated by the increased time autonomy coming along with SMWT. Consistent with this idea is our finding that the effort increasing effect caused by SMWT is more a matter of improved employee motivation than of reciprocal work intensification.

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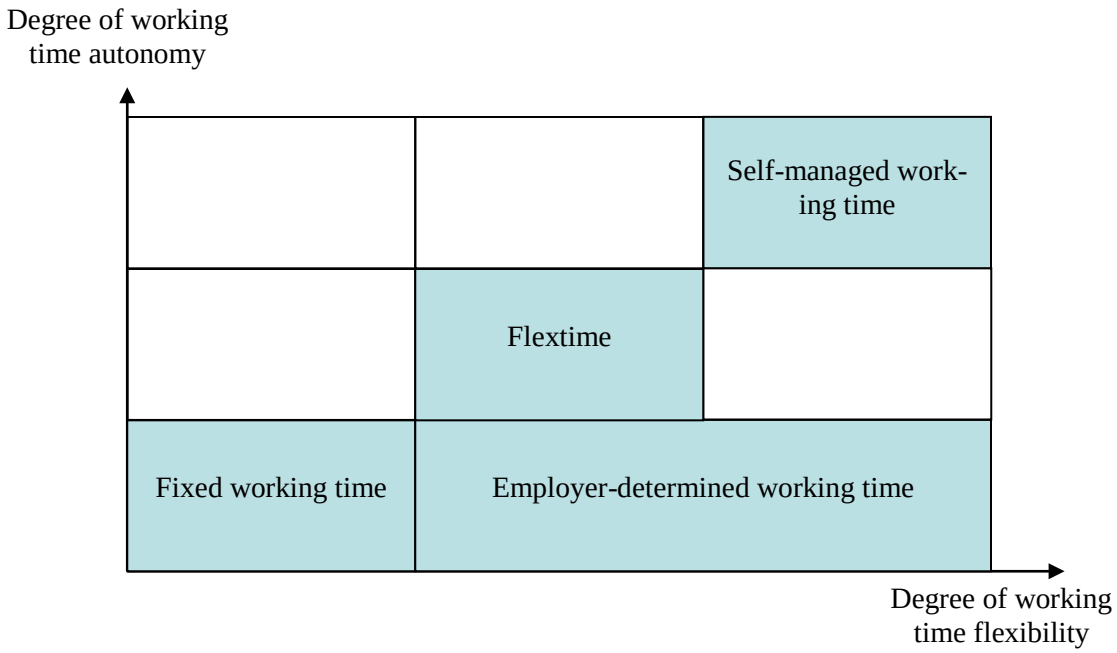
Figure 1: Practices of Working Time Arrangements



Note: An example for employer-determined working time with a medium degree of flexibility is shift work. Here, flexibility is typically restricted to planned changes between day-turn and night-shift that are fixed by the employer. The only competence of the employee in this respect is some kind of self-scheduling, meaning that employees may be allowed, to some extent, to coordinate the shift assignment with their co-workers (Nijp et al. 2012). Examples of employer-determined working time with a high degree of flexibility are emergency services, on-call time and standby duty.

Table 1: Incidence of Different Working Time Arrangements

Working time arrangement	2003	2005	2007	2009	2011	Total
Fixed working time	44.8	43.8	42.3	41.7	41.3	42.9
Flexible working time determined by employer	22.4	22.0	22.6	23.6	21.9	22.5
Flexible working time determined by employee (SMWT)	13.9	14.3	14.8	14.3	15.0	14.4
Flextime within a working hours account	18.9	19.9	20.3	20.4	21.8	20.2
N	9,583	8,755	8,785	8,752	6,915	42,790

Note: The means are displayed in percent. N is sample size.

Table 2: Actual and Contractual Working Hours per Week

Working time arrangement		2003	2005	2007	2009	2011	Total
Fixed working time	WH^a	35.8	35.9	36.5	35.9	35.9	36.0
	WH^c	33.6	33.6	33.8	33.5	33.3	33.6
	ΔWH	2.2	2.3	2.7	2.4	2.6	2.4
Flexible working time determined by employer	WH^a	37.6	37.9	37.9	37.6	38.0	37.8
	WH^c	33.7	33.7	33.5	33.3	33.5	33.5
	ΔWH	3.9	4.2	4.4	4.3	4.5	4.3
Flexible working time determined by employee (SMWT)	WH^a	38.2	40.2	41.1	41.0	39.1	39.9
	WH^c	31.1	33.0	33.0	33.3	32.2	32.5
	ΔWH	7.1	7.2	8.1	7.7	6.9	7.4
Flextime within a working hours account	WH^a	39.8	40.1	39.7	39.6	40.0	39.8
	WH^c	35.8	36.1	35.8	35.8	36.1	35.9
	ΔWH	4.0	4.0	3.9	3.8	3.9	3.9
Difference between the SMWT and the fixed working time arrangement	ΔWH^{SM}	4.9	4.9	5.4	5.3	4.3	5.0

Note: The displayed values are average weekly working hours. WH^a is average actual working hours per week, WH^c is contractual working hours per week and $\Delta WH = WH^a - WH^c$ is the difference between actual and contractual working hours per week. ΔWH^{SM} is the difference in ΔWH between workers with SMWT and workers with fixed working time. The calculations are based on 37,486 observations.

Table 3: Effects of Self-Managed Working Time on Employee Extra Effort

Estimation strategy	OLS	OLS	FE	FEIV	ECFE
	(1)	(2)	(3)	(4)	(5)
Self-managed working time (SM)	5.054***	3.320***	1.382***	1.146	1.029**
	(0.148)	(0.162)	(0.217)	(0.885)	(0.504)
Employer-determined working time (ED)	1.843***	1.402***	0.818***	0.520	0.748*
	(0.083)	(0.090)	(0.126)	(0.661)	(0.420)
Flextime (FT)	1.471***	0.748***	0.756***	1.574*	0.794
	(0.071)	(0.087)	(0.143)	(0.925)	(0.567)
Correction term s^{SM}					0.166
					(0.313)
Correction term s^{ED}					0.013
					(0.247)
Correction term s^{FT}					0.013
					(0.329)
Endogeneity test (p-value)				0.59	0.80
Test on instrument relevance (test statistic)					
SM equation				81.1***	454.8***
ED equation				70.0***	569.2***
FT equation				45.9***	331.9***
Hansen J-test (p-value)				0.46	
R^2 / R^2-within	0.080	0.306	0.025	0.024	0.027
N	37,486	30,699	31,367	19,824	19,504

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The dependent variable is the difference between average actual and contractual working time per week (ΔWH). The values in parentheses represent robust standard errors clustered at the individual level. The endogeneity test for the FEIV model is a C-test, while the endogeneity test for the ECFE model is an F-test on $\kappa_1 = \kappa_2 = \kappa_3 = 0$ in (7). Analogously, the test on instrument relevance for the FEIV (ECFE) model is an F-test (χ^2-test). The Hansen J-test is a test on overidentifying exclusion restrictions. The specification displayed in column (1) includes no control variables. The specifications in columns (2)-(5) contain a set of covariates described in Table A2 in the Appendix. Moreover, the specification in column (2) includes occupation and occupational status dummies, industry dummies, firm size dummies, and time dummies. The specifications in columns (3)-(5) also include all these dummies, except for the occupation dummies which are replaced by individual-occupation spell fixed effects.

Table 4: Effects of Self-Managed Working Time on Employee Effort (Evening and Night Work)

Estimation strategy	OLS	FE	FEIV	OLS	FE	FEIV
Dependent variable		Evening work			Night work	
Self-managed working time (SM)	0.263*** (0.009)	0.078*** (0.020)	0.029 (0.070)	0.058*** (0.009)	0.037** (0.019)	-0.006 (0.063)
Employer-determined working time (ED)	0.275*** (0.008)	0.076*** (0.013)	-0.023 (0.056)	0.154*** (0.008)	0.032*** (0.011)	-0.016 (0.048)
Flextime (FT)	0.037*** (0.009)	0.045** (0.018)	0.026 (0.088)	-0.076*** (0.007)	0.014 (0.014)	0.008 (0.080)
C -test on endogeneity (p -value)			0.35			0.65
F -test on instrument relevance (F -statistic)						
Equation (2)			99.9***			91.1***
Equation (3)			77.4***			70.9***
Equation (4)			49.8***			44.3***
Hansen J -test (p -value)			0.31			0.16
R^2 / R^2 -within	0.063	0.017	0.010	0.032	0.009	0.007
N	32,270	25,950	20,998	31,099	25,142	20,334

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The values in parentheses represent robust standard errors clustered at the individual level. The OLS models include no control variables. The FE and FEIV models contain a set of covariates described in Table A2 in the Appendix. Furthermore, the FE and FEIV models include occupational status dummies, industry dummies, firm size dummies, time dummies, and individual-occupation spell fixed effects.

Table 5: Effects of Self-Managed Working Time on Employee Effort (Work at Weekends)

Estimation strategy	OLS	FE	FEIV	OLS	FE	FEIV
Dependent variable	Work on Saturday			Work on Sunday		
Self-managed working time (*SM*)	0.148*** (0.009)	0.061*** (0.018)	0.027 (0.067)	0.177*** (0.010)	0.044** (0.021)	-0.108 (0.075)
Employer-determined working time (*ED*)	0.238*** (0.007)	0.074*** (0.012)	-0.035 (0.050)	0.210*** (0.008)	0.031*** (0.012)	-0.163*** (0.054)
Flextime (*FT*)	-0.083*** (0.009)	0.037** (0.017)	0.003 (0.093)	-0.043*** (0.008)	0.027* (0.016)	-0.027 (0.089)
C -test on endogeneity (p -value)			0.23			0.00
F -test on instrument relevance (F -statistic)						
Equation (2)			99.5***			93.1***
Equation (3)			74.6***			70.8***
Equation (4)			50.1***			45.0***
Hansen J -test (p -value)			0.37			0.68
R^2 / R^2 -within	0.059	0.014	0.008	0.047	0.009	-0.026
N	32,412	26,057	21,083	31,206	25,228	20,405

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The values in parentheses represent robust standard errors clustered at the individual level. The OLS models include no control variables. The FE and FEIV models contain a set of covariates described in Table A2 in the Appendix. Furthermore, the FE and FEIV models include occupational status dummies, industry dummies, firm size dummies, time dummies, and individual-occupation spell fixed effects.

Table 6: Effects of Self-Managed Working Time on Employee Effort (Sensitivity Check)

Estimation strategy	OLS	FE	FEIV	OLS	FE	FEIV
Dependent variable	Overtime last month (OT)			$\Delta WH2$		
Self-managed working time (SM)	2.311*** (0.085)	0.704*** (0.150)	0.511 (0.616)	2.693*** (0.204)	0.711** (0.336)	1.022 (1.381)
Employer-determined working time (ED)	0.732*** (0.047)	0.192** (0.081)	0.049 (0.416)	2.754*** (0.160)	0.260 (0.224)	1.633 (1.200)
Flextime (FT)	1.063*** (0.048)	0.341*** (0.110)	1.136 (0.736)	0.813*** (0.136)	0.193 (0.255)	-0.104 (1.435)
C-test on endogeneity (p-value)			0.54			0.56
F-test on instrument relevance (F-statistic)						
Equation (2)			100.1***			80.1***
Equation (3)			76.2***			66.7***
Equation (4)			51.2***			48.3***
Hansen J-test (p-value)			0.60			0.79
R^2 / R^2-within	0.046	0.019	0.016	0.016	0.020	0.019
N	40,637	32,948	20,762	35,012	30,050	19,024

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. $\Delta WH2$ is defined as total working hours in a typical week (including commuting times and working hours devoted to a potential second job) minus contractual working time. The values in parentheses represent robust standard errors clustered at the individual level. The OLS models include no control variables. The FE and FEIV models contain a set of covariates described in Table A2 in the Appendix. Furthermore, the FE and FEIV models include occupational status dummies, industry dummies, firm size dummies, time dummies, and individual-occupation spell fixed effects.

Table 7: Subgroup Analyses

Estimation strategy	FE	FE	FE	FE
Specification	(1a)	(8)	(9)	(10)
Self-managed working time (SM)	1.752***	1.330***	0.807*	1.588***
	(0.271)	(0.238)	(0.456)	(0.332)
Positive reciprocity (R)	0.225*	0.205*		
	(0.131)	(0.110)		
Interaction ($R \times SM$)		0.176		
		(0.358)		
Work ethic (WE)	0.707***		0.689***	
	(0.114)		(0.136)	
Performance evaluation (PE)	0.114		0.104	
	(0.139)		(0.182)	
Interaction ($WE \times SM$)			1.231**	
			(0.521)	
Interaction ($WE \times PE$)			-0.070	
			(0.197)	
Interaction ($PE \times SM$)			0.245	
			(0.663)	
Interaction ($WE \times PE \times SM$)			-0.123	
			(0.748)	
Females with children in need of parental care (FC)				-0.088
				(0.255)
Interaction ($FC \times SM$)				-1.425***
				(0.567)
Interaction ($F \times SM$)				-0.012
				(0.483)
Interaction ($MC \times SM$)				-0.036
				(0.412)
R^2 -within	0.037	0.027	0.037	0.026
N	20,490	28,906	21,960	31,367

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The dependent variable is ΔWH . The values in parentheses represent robust standard errors clustered at the individual level. Specification (1a) is restricted to a sample of full-time employees and extends equation (1) by the covariates displayed. Specification (9) is also restricted to a sample of full-time employees. All FE models additionally contain a set of covariates described in Table A2 in the Appendix as well as a set of occupational status dummies, industry dummies, firm size dummies, time dummies, and individual-occupation spell fixed effects.

Appendix

Table A1: First-Stage Estimates of the Exclusion Restrictions According to Equations (2)-(5)

Estimation strategy	FEIV			ECFE		
Explanatory variable to be instrumented	*SM*	*ED*	*FT*	*SM*	*ED*	*FT*
SM_{t-2}	-0.224*** (0.022)	0.004 (0.017)	0.021 (0.019)	-1.403*** (0.110)	0.127 (0.107)	0.014 (0.109)
ED_{t-2}	0.003 (0.006)	-0.243*** (0.015)	0.022** (0.009)	0.169 (0.119)	-1.285*** (0.057)	0.149 (0.094)
FT_{t-2}	-0.006 (0.012)	0.002 (0.014)	-0.184*** (0.018)	-0.090 (0.119)	0.094 (0.096)	-1.126*** (0.084)
Group-specific mean for employees with SMWT	0.426*** (0.031)	-0.068** (0.031)	-0.195*** (0.030)	3.359*** (0.226)	-0.558*** (0.190)	-1.469*** (0.204)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The values in parentheses represent robust standard errors clustered at the individual level. The same sets of control variables as in columns (4) and (5) of Table 3 are included, but not reported to save space.

Table A2: Definition and Descriptive Statistics of the Variables

Variable	Definition	*N*	Mean	Std	Min-Max
Dependent variables					
ΔWH	Difference between average actual and contractual working time per week	38,312	3.68	5.44	-38-42
Evening work	Dummy variable indicating whether or not an employee at least occasionally works in the evening	32,750	0.52	0.50	0-1
Night work	Dummy variable indicating whether or not an employee at least occasionally works at night	31,551	0.26	0.44	0-1
Work on Saturday	Dummy variable indicating whether or not an employee at least occasionally works on Saturdays	32,896	0.61	0.49	0-1
Work on Sunday	Dummy variable indicating whether or not an employee at least occasionally works on Sundays	31,649	0.36	0.48	0-1
OT	Number of overtime hours an employee has executed in the recent month before the survey	41.642	2.21	3.60	0-22.8
$\Delta WH2$	Difference between the number of working hours in a typical week (including commuting times as well as working hours devoted to a potential second job, as well as work at Saturdays and Sundays) and the weekly contractual working hours	35,728	10.51	9.49	-59.5-108
Main explanatory variables					
Self-managed working time (SM)	Dummy variable indicating whether or not an employee has extensive decision-making authority in terms of scheduling individual working hours (reference group: fixed working time)	42,790	0.14	0.35	0-1
Employer-determined working time (ED)	Dummy variable indicating whether or not an employee faces flexible working hours determined by the employer (reference group: fixed working time)	42,790	0.23	0.42	0-1
Flextime within a working hours account (FT)	Dummy variable indicating whether or not an employee is allowed to vary daily working hours, where daily attendance is restricted to a defined time interval (working hours account) (reference group: fixed working time)	42,790	0.20	0.40	0-1
Positive reciprocity (R)	See footnote 22.	38,890	0.41	0.49	0-1
Work ethic (WE)	Dummy variable indicating whether the difference between desired and contractual working time per week is ≥ 0	27,659	0.68	0.46	0-1
Performance evaluation (PE)	Dummy variable indicating whether or not an employee's performance is regularly evaluated by a supervisor	37,276	0.30	0.46	0-1
Control variables					
Monthly gross wage	Gross wage of the employee in the month before the survey (in 1,000 euros)	42,790	2.42	1.85	0.40-80.0

Variable	Definition	*N*	Mean	Std	Min-Max
Satisfaction with household income	Ordinal variable ranging from 0 to 10, indicating an employee's satisfaction with household income (0: completely unsatisfied, 10: completely satisfied)	42,411	6.41	2.12	0-10
Living with partner	Dummy variable indicating whether or not an employee has a settled living partner	42,568	0.84	0.37	0-1
Children aged under 16	Dummy variable indicating whether or not an employee has one or more children aged under 16 who currently live in the household	42,751	0.36	0.48	0-1
Full-time employed	Dummy variable indicating whether or not an employee is employed full-time	39,274	0.77	0.42	0-1
Fixed-term contract	Dummy variable indicating whether or not an employee has a fixed-term contract	40,317	0.09	0.29	0-1
Employer change	Dummy variable indicating whether or not an employee has changed their employer in the year before the survey	42,790	0.09	0.28	0-1
Male	Dummy variable indicating whether or not an employee is male	42,790	0.50	0.50	0-1
Foreign nationality	Dummy variable indicating whether or not an employee is of non-German nationality	42,790	0.07	0.25	0-1
Job tenure	Years of an employee's job tenure	42,733	10.51	9.64	0-50.9
Schooling	Years of schooling an employee has had	41,516	12.41	2.55	7-18
Full-time experience	Years of an employee's experience in a full-time job	42,403	15.61	11.38	0-49
Part-time experience	Years of an employee's experience in a part-time job	42,403	3.01	5.51	0-45
Unemployment experience	Years of a worker's unemployment experience	42,403	0.62	1.58	0-24.1
Hobbies and other leisure activities	Number of hours devoted to hobbies and other leisure activities on a typical working day	41,356	1.60	1.40	0-15
Satisfaction with health	Ordinal variable ranging from 0 to 10 that indicates the degree of satisfaction with an employee's health (0: completely unsatisfied, 10: completely satisfied)	42,714	6.93	1.98	0-10
Current health: good	Dummy variable indicating whether or not an employee assesses her current health status as good (reference group: very good)	42,720	0.48	0.50	0-1
Current health: satisfactory	Dummy variable indicating whether or not an employee assesses her current health status as satisfactory (reference group: very good)	42,720	0.32	0.47	0-1
Current health: poor	Dummy variable indicating whether or not an employee assesses her current health status as poor (reference group: very good)	42,720	0.10	0.30	0-1
Current health: bad	Dummy variable indicating whether or not an employee assesses her current health status as bad (reference group: very good)	42,720	0.01	0.11	0-1

Variable	Definition	*N*	Mean	Std	Min-Max
Strong worries about job security	Dummy variable indicating whether or not an employee is strongly concerned about her job security (reference group: no worries)	41,544	0.16	0.37	0-1
Some worries about job security	Dummy variable indicating whether or not an employee is somewhat concerned about her job security (reference group: no worries)	41,544	0.43	0.50	0-1
Firm size 20-200	Dummy variable indicating whether or not an employee works in a firm that employs between 20 and 200 employees (reference group: < 20)	41,453	0.30	0.46	0-1
Firm size 201-2000	Dummy variable indicating whether or not an employee works in a firm that employs between 201 and 2000 employees (reference group: < 20)	41,453	0.22	0.42	0-1
Firm size >2000	Dummy variable indicating whether or not an employee works in a firm that employs more than 2000 employees (reference group: < 20)	41,453	0.22	0.41	0-1
Regional unemployment rate	Average unemployment rate of the German federal state, where the employee lives (%)	42,751	10.75	4.49	4.3-22.1
Exclusion restrictions					
SM_{t-2}	Two years lagged observations of SM	25,494	0.14	0.34	0-1
ED_{t-2}	Two years lagged observations of ED	25,494	0.22	0.41	0-1
FT_{t-2}	Two years lagged observations of FT	25,494	0.21	0.41	0-1
Group-specific mean for employees with SMWT	Average share of SM in groups separated by 2 occupational status classes, 4 firm size classes, 10 industry classes, 16 regional classes, and 5 time periods	40,541	0.14	0.18	0-1

Note: N is the number of observations. Std is standard deviation. In order to save space the information for 11 occupational status dummies, 62 industry dummies, 16 regional dummies and five time dummies are not displayed.