TALLINN UNIVERSITY OF TECHNOLOGY
DOCTORAL THESIS
40/2020

Working Schedules and Efficient Time-Use in R&D Work

RAUL RUUBEL

TAL TECH PRESS

TALLINN UNIVERSITY OF TECHNOLOGY
School of Business and Governance
Department of Economics and Finance
This dissertation was accepted for the defence of the degree 05/10/2020

Supervisor: Professor Aaro Hazak, PhD
Department of Economics and Finance
Tallinn University of Technology
Tallinn, Estonia

Co-supervisor: Professor Kadri Männasoo, PhD
Department of Economics and Finance
Tallinn University of Technology
Tallinn, Estonia

Opponents: Professor Michael C. Burda, PhD
Chair for Macroeconomics and Labor Economics
Humboldt-Universität zu Berlin
Berlin, Germany

Associate Professor Michiru Nagatsu, PhD
Faculty of Social Sciences
University of Helsinki
Helsinki, Finland

Defence of the thesis: 23/11/2020, Tallinn

Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for doctoral or equivalent academic degree.

Raul Ruubel

---
signature

European Union
European Regional
Development Fund

Investing
in your future

ISSN 2585-6898 (publication)
ISBN 978-9949-83-615-4 (publication)
ISSN 2585-6901 (PDF)
ISBN 978-9949-83-616-1 (PDF)
Printed by Koopia Niini & Rauam

TALLINNA TEHNIKAÜLIKOOL
DOKTORITÖÖ
40/2020

Tööajakorraldus ning efektiivne ajakasutus teadus- ja arendustegevuses

RAUL RUUBEL

TAL TECH
KIRJASTUS

Contents

List of Publications

The list of author's publications, on the basis of which the thesis has been prepared:

I Hazak, A., Ruubel, R. and Virkebau, M., 2019. When would creative R&D employees like to work? *International Journal of Organizational Analysis*, 27 (3), 596−612. DOI: 10.1108/IJOA-04-2018-1409. (ETIS 1.1).

II Ruubel, R. and Hazak, A., 2018. Disparities in Knowledge Employees' Actual, Contractual and Desired Working Schedules. *Knowledge Management: An International Journal*, 18 (1), 17−30. DOI: 10.18848/2327-7998/CGP/v18i01/17-30. (ETIS 1.1).

III Ruubel, R., 2020. Time dimensions of job autonomy in Estonian R&D institutions. *Journal of the Knowledge Economy*. DOI: 10.1007/s13132-020-00633-5. (ETIS 1.1).

Please see the Curriculum Vitae for other publications relating to this thesis.

Author's Contribution to the Publications

The contribution of the author to the papers in this thesis is:

I The author of the thesis had a leading role in reviewing the literature, contributed to the data analysis and econometric estimations, and co-wrote the article, including the explanation of the research problem, the literature review, the discussion of the results, and the conclusion of the paper.

II The author of the thesis had a leading role in preparing a specific data subset for the paper, reviewing the literature, and running the econometric estimations. The author of the thesis co-wrote the article, including the explanation of the research problem, the literature review, the discussion of the results, and the conclusion of the paper.

III The author of the thesis is the sole author of the paper.

Introduction

How time can be appreciated and used as a resource has become an increasing concern, especially for the millennial and post-millennial generations. Mainstream economics suggests that individuals seek an optimal balance between work and leisure by rationally assessing the returns and disutilities of work. Finance theory suggests that individuals rationally evaluate the returns on their investment of time as a resource by considering the opportunity costs and risks of investing their time in alternative ways. In perfect markets, time as a resource should be channelled into the uses that generate the highest returns given the opportunity costs and related risks. In reality, decisions about investing time are more complex than the classical concepts of economics and finance would suggest, as individuals have different preferences and face different constraints in the process of maximising utility. These individual heterogeneities and how they interact with social norms for work, income, wealth, leisure and the use of time appear to cause various behavioural divergences from the general understanding of financial and economic rationality when decisions are made about working time. A key challenge for organisations is to reconcile the behaviours of employees that maximise utility with behaviour by employers that maximises efficiency (Freeman, 1999), where generational differences in behaviours and in the values that motivate and drive individuals (Smola and Suton, 2002; Lester et al., 2012; Güngör and Alp, 2019) need to be considered. Moreover, work schedules as contractual contingencies agreed between the employer and the employee add another important institutional dimension to how efficiently time is used from the perspective of both employees and employers.

Employers in the private sector seek to gain competitive advantage with their products and services on the global market. As relatively high labour costs are generally a disadvantage for developed economies that are competing with emerging and developing countries, the advantages of those countries in how they use human capital need to stem from either higher labour productivity or innovation that lets them escape the competition and provide a novel product or service. The efficient creation and use of knowledge is key in both cases. This means that research and development (R&D) has a crucial role in achieving competitive advantages, and in driving socio-economic development in general.

Working arrangements that improve efficiency in R&D jobs may be an important factor in shaping competitive advantages. Well-designed working arrangements help make the best use of the intellectual capacity of knowledge employees and so to help achieve productivity gains and spur innovation. Employers often have standard homogeneous work schedules, as this appears to reduce the transaction costs of monitoring and controlling work processes, including measuring working time, which is the main unit of labour cost accounting. However, measured working time may be a signal of unobserved work effort. Since work effort is predominantly unobserved in R&D, there is asymmetry in the information available to the employer remunerating the work effort and the employee exerting that effort. The argument against rigid work schedules is that employees have different preferences for work schedules and work arrangements in general, and if their preferences are incompatible with the homogenous standard work schedules and work arrangements, work outcomes or work commitment may be impaired. If knowledge employees are required to work hours that they would prefer not to allocate for work, there is evident inefficiency in how time as a resource is used from the individual perspective, and so employees may wish to get compensation for disutility

or for related risks, which will give rise to compensating wage differentials. Freeman (1999) finds that the connections between individuals, decisions and information within an organisation are necessarily imperfect. Depending on how wide the information asymmetries are, the employee may be able to hide their true productivity, leaving their work effort below the optimal level. As a consequence, work schedules could have potentially large financial implications for companies, on both the revenue side and the cost side.

Another important source of disutility of work on top of the mismatch between desired and actual working time is the mismatch with contractual working time. These discrepancies may lead to R&D employees not being able or willing to devote as much of their intellectual capacity as they could with the schedules they actually want. The sources of the differences between desired, actual and contractual work schedules may not be entirely rational but may rather be behavioural and institutional in nature. There has been a huge change in the nature and type of work over the past century, with knowledge work becoming increasingly important, but social norms for working arrangements take a long time to change. The enforced requirement for distance work in knowledge work and other jobs during the Covid-19 pandemic has made flexible working arrangements a highly topical issue, and may lead to the regulations and social norms for work arrangements being revised. Inherent differences between individuals mean that uniform principles for working arrangements, including work schedules, may not be ideal. This suggests we need to acknowledge differences in preferences for work schedules and how different jobs and employees with different work-time preferences are affected by different working time arrangements. That knowledge is an unavoidable requirement for companies to understand the financial and economic implications of their work schedules and take measures to address inefficiencies in time use that arise from those work schedules. Given the large financial losses that could arise from misaligned work schedules impacting productivity and innovation, employers should be interested in how work schedules suit the heterogeneous preferences of knowledge employees and in allowing them more autonomy at work in their use of time and in decisions about it. This may help them find and retain valuable employees and help to improve the individual wellbeing of those employees, while also reducing the cost base and increasing productivity, resulting in positive financial returns for the company and reduction of public health costs, which benefits society. Remuneration schemes need to be rethought and detached from the measurement of work effort using the standard work hour.

On a positive note, flexible work schedules have become more common in recent years in most European Union countries, including Estonia (Figures 1 and 2, based on the European Company Survey). However, many of those who have the option of flexible working schedules might be prevented from using them by social norms, family commitments, the attitudes and behaviour of other employees, or other factors. Furthermore, even when companies provide flexible working options, they do not necessarily do so to all employees on an equal basis. Although flexible work schedules have become more common in recent years, they have not yet become the prevailing norm. This could be because introducing flexible schedules and remote work needs multi-faceted changes in management practices, including potential revision of how work tasks are allocated, work processes and teamwork are monitored, and remuneration and reward schemes operated. Furthermore, employers may see flexitime and remote working options as an additional benefit that they may be reluctant to grant without

negotiation or bargaining. On top of all this, flexibility may extend actual working hours beyond standard hours to the detriment of employees who do not receive proportional compensation for the overtime worked.

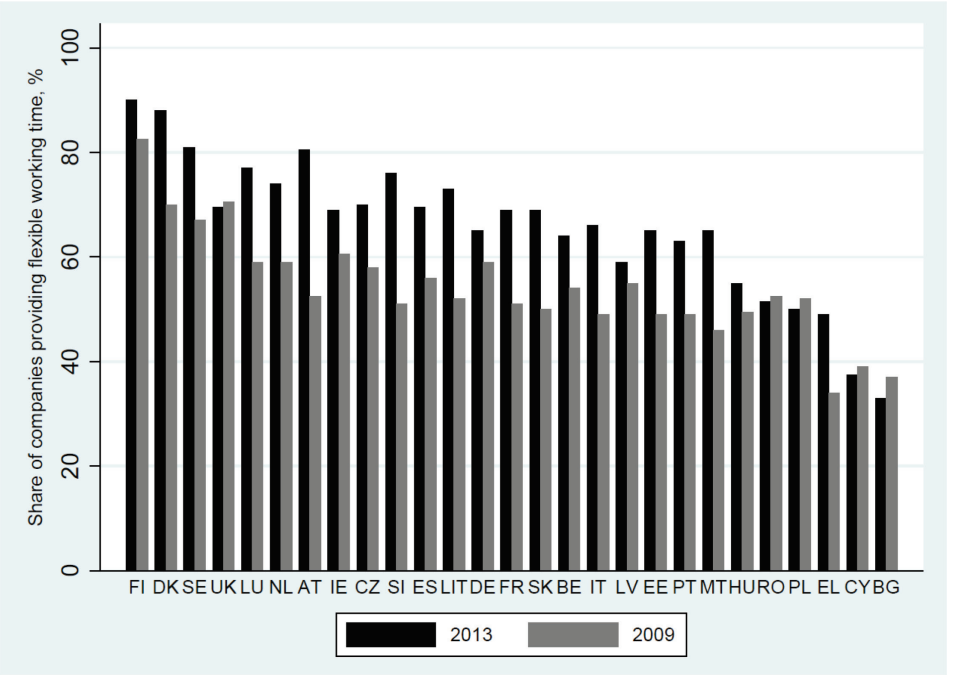

Figure 1: Share of companies providing flexible working time in the European Union countries in 2009 and 2013. Source: Chung (2018) based on the 2009 and 2013 European Company Survey

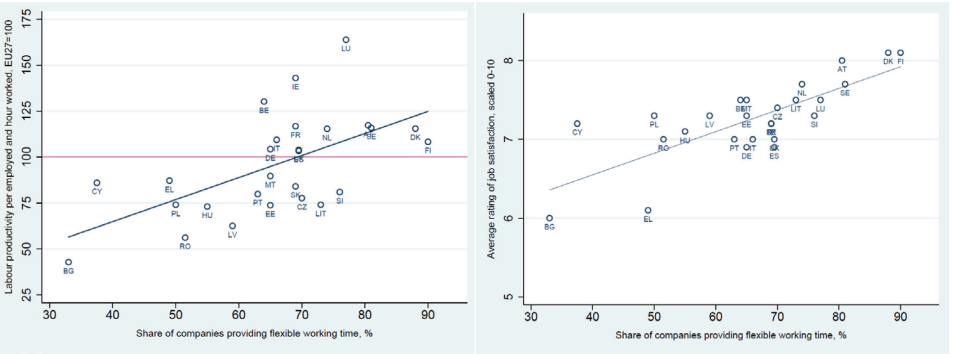

Figure 2: Share of companies providing flexible working time in the European Union countries, labour productivity and job satisfaction in 2013. Source: Chung (2018) based on 2013 European Company Survey, Eurostat.

This background leads to the aim of this thesis, which is to seek new empirical evidence on the following research questions about the economic efficiency of work schedules in R&D jobs:

- what type of employee prefers the different alternatives of daily and weekly working schedules;

- what are the drivers and extent of disparities between actual, contractual and desired working schedules; and
- what type of employee is more likely to be satisfied with flexible working time and what type with fixed time, and what drives other aspects of job autonomy that relate to time, such as how working time arrangements affect creativity, how free the employee is to decide upon their speed of work and when they take breaks, what the nature of work implies for working time, and what discontent and potential jealousy from colleagues might imply for working hours.

This thesis is built on three publications that provide empirical evidence of the heterogeneous preferences of Estonian creative R&D employees for daily and weekly working schedules (Paper I); evidence of the disparities between their actual, contractual and desired working schedules (Paper II); and an insight into what type of employee is more likely to be satisfied with flexible working time and what type will prefer fixed schedules, and what drives some other time-related aspects of job autonomy (Paper III). The contribution of the thesis lies in providing novel empirical evidence for these research questions using data from a pilot questionnaire study among Estonian R&D employees that provides unique information on their time use, organisation of work, compensation, health and sleep; and in providing a discussion of the background and results in the papers and thesis that helps give a better understanding of the potential linkages between the working time schedules of R&D employees and the financial performance and economic efficiency of companies. The empirical results and discussions in this thesis are of considerable practical use for employers and employees in creative knowledge jobs and for regulators, as carefully designed working time arrangements may contribute a lot to how efficiently the intellectual capital of R&D employees is used, and how the consequent productivity gains, enhanced innovation and reduced costs support the competitiveness and financial performance of companies, and thereby economic development in general.

Paper I, "When would creative R&D employees like to work?", uses maximum likelihood as one of the most popular econometric estimators in a multinomial logit regression model to reveal how individual characteristics are connected significantly to the heterogeneous preferences of employees for daily and weekly working schedules. The paper has been published in the International Journal of Organizational Analysis (indexed in the Web of Science and Scopus databases), and a draft of the paper was presented at the Doctoral Summer School in Economics, Management, Governments and Politics, Political Science, Law and Public Administration (Kohtla Parish, Estonia, 2017).

Paper II studies the considerable disparities between the actual and contractually agreed working schedules of creative R&D employees and those that they desire, using ordinary least squares (OLS) regression analysis as the econometric methodology. The paper, titled "Disparities in Knowledge Employees' Actual, Contractual and Desired Working Schedules", has been published in the journal Knowledge Management (indexed in the Scopus database), and a draft of the paper was presented at the Eighteenth International Conference on Knowledge, Culture, and Change in Organizations (University of Konstanz, Germany, 2018).

Paper III reveals some important company-level and individual-level predictors of whether an R&D employee will be better satisfied with flexible or fixed working schedules. The paper also provides insight into what types of employee perceive more constraints on the timing of their work because of jealousy of colleagues and other

factors. The paper, titled “Time dimensions of job autonomy in Estonian R&D institutions”, has been published in the Journal of the Knowledge Economy (indexed in the Web of Science and Scopus databases), and a draft of the paper was presented at the 10th International Conference “Economic Challenges in Enlarged Europe” (Tallinn, Estonia, 2018).

The main part of the thesis is structured as follows. Section 1 provides an overview of the related literature, after which Section 2 outlines the research questions and hypotheses for the thesis. The data and methodology are presented in Section 3 and the key results and conclusion are in Section 4.

Abbreviations

OLS	Ordinary Least Squares
rMEQ	Reduced Morningness-Eveningness Questionnaire
R&D	Research and Development
TFP	Total Factor Productivity

1 Overview of the Literature

The importance of R&D as a source of economic development has been stressed by both economists and politicians. As the source of success for R&D is knowledge employees, it is crucial that their intellectual potential and time be used as efficiently as possible. While only a few studies focus on R&D employees (e.g. Shalley et al., 2000; Eaton, 2003; Goswami et al., 2007; Kelliher and Anderson, 2008; Wang and Cheng, 2010; Hazak et al., 2017), those studies have found that increasing job autonomy by giving employees freedom in setting their work schedules and procedures has a positive impact on R&D work, while some past studies have demonstrated that a significant number of employees feel a mismatch between their actual and preferred work time, indicating that they are often unable to choose the working hours they desire (Reynolds, 2003; Böheim and Taylor, 2004; Barnay, 2016). This conflicts with the neoclassical theory of labour supply, which proposes that employees should not be restricted in their choice of working hours. If they are, they should be paid a premium as compensation for working under unfavourable conditions, as suggested by the theory of compensating differentials.

Flexible working time is a policy that is frequently used to increase the job autonomy of employees, and it has become more common in recent years to offer flexitime (Figures 1 and 2 in the Introduction). Numerous studies outline the benefits of flexible working time arrangements, but it has not yet become the prevailing norm to offer substantial working time flexibility, if any at all, and studies have shown that flexitime options are not offered on an equal and fair basis to all employees (Golden 2001). Moreover, the formal availability of flexible work schedules does not yet mean that employees actually take up the option, because of social norms, scheduling conflicts or other reasons, and so the effect on the financial performance of companies may be limited. The contrast between the conceptual arguments in favour of flexible work schedules and the limited actual use of these schedules in R&D work may arise from some rational cost-benefit considerations, market frictions and institutional constraints, or behavioural features, and these elements are also addressed in the following literature review in order to provide background for the research questions, hypothesis and empirical studies that underlie the thesis. The research in this thesis is largely placed at the intersection of literature on the economics of organisation and that on organisational analysis in the context of R&D work, with a discussion of the implications for the financial performance of companies and knowledge intensive economic development.

1.1 The Importance of Human Capital and Tacit Knowledge for R&D and for Building Absorptive Capacity

Many governments have set R&D policies in recent decades that aim to promote innovation and economic growth. Cohen and Levinthal (1989) propose that in addition to creating innovation, R&D also makes companies better able to assimilate and utilise existing information and knowledge from the environment, and they call this absorptive capacity. They argue that absorptive capacity enables companies to exploit first mover advantage in employing new technologies generated by others like government or universities, or to act as a prompt second mover by utilising spillovers from competitors, and so it explains why companies invest in basic R&D even though a large amount of the findings spill out to the public arena. Cohen and Levinthal (1990) elaborate further in their finding that spillovers have traditionally been considered a downside to R&D

activity, since the incentive for companies to invest in R&D is diminished if the findings are utilised by competitors who thus reduce the innovator's own profits. The authors argue that the potential negative impact of spillovers is offset by the positive incentive offered by absorptive capacity, as the more spillovers there are from competitors, the more motivated the company is to invest in its own R&D, as this enables it to make use of the spillovers. The crucial role of tacit knowledge in R&D is another factor that increases the incentives for R&D, since tacit knowledge is not easily transferable and so the inventor appropriates a significant share of benefits from the new knowledge and innovation provided by the R&D. Griffith et al. (2003) indicated that R&D has an important role in determining the pace of innovation and technology transfer, which are among the key sources of productivity growth, for economies that are technologically less advanced as well as for advanced economies. Coe et al. (1997) analysed how much developing countries, whose own R&D investments are marginal, gain from the R&D of developed countries, and they find the spillovers to be substantial. A similar finding is reported by Männasoo et al. (2018) in the context of European regions, and this study shows considerable productivity spillovers from the more affluent regions in the European Union towards their neighbouring, low R&D intensity regions in the newer member states. This shows that some technology transfer could also occur independently of R&D investments. Griffith et al. (2004), following Cohen and Levinthal (1989), present an empirical framework for analysing the dual effects of R&D, and they find that R&D investments not only stimulate growth directly through innovation, but also enable a country's industries that lag behind the productivity frontier to catch up faster.

There is substantial evidence from studies in recent decades (including Griffith et al., 2004; Cameron et al., 2005; Colino et al., 2014; Männasoo et al., 2016 and 2018) that R&D is an important factor for boosting growth. However, investments in R&D should also be efficient in order to utilise the potential. As indicated by Wang and Huang (2007), R&D investments are essential in stimulating scientific and technological progress, and so any country that uses its resources inefficiently could be penalised by progress being much slower. The authors further stress that using R&D resources inefficiently may mean that additional investment has no impact in stimulating growth. Kochanski et al. (2003) stress the particularity of R&D organisations that their success crucially hinges on people through innovation, leading-edge skills, discovery and collegiality. As the contribution of knowledge employees is an essential driver of R&D outcomes, it is important to provide appropriate motivation, engagement and retention if they are to be successful in product development and innovation (Chang and Choi, 2007), along with proper funding of R&D activities under regulatory and financing constraints (see e.g. Männasoo and Meriküll, 2014 and 2020). To motivate and retain R&D employees successfully, and so to gain an advantage in knowledge-based competition, it is essential for companies to have an insight into the factors that impact the performance of knowledge employees and their attitude to work (Aryee and Leong, 1991). Kochanski et al. (2003) state that R&D organisations that know what their employees value and that have introduced commensurate value propositions that emphasise the unique work environment and the R&D work itself are at a distinct advantage. The current thesis aims to shed further light on these topics.

1.2 Working Time Mismatch, Flexible Schedules and R&D

The findings of most empirical research do not support the neoclassical understanding of how the labour market should function, which proposes that employees should be free to choose and supply their working hours in a continuum of time. Their actual working hours are instead set by work-time packages that are designed around standard working schedules. The standard working schedules are in turn believed to reduce the transaction costs within the company for work organisation and monitoring. This argument though may compromise the aim of employees of maximising their utility and may cause their work performance to be less than optimal, whether they maximise their economic utility as suggested by neoclassical theory, or their broader wellbeing in terms perhaps of happiness as suggested by the economics of happiness, or other dimensions of subjective wellbeing as suggested in some contemporary schools of economic thought (Angner, 2010).

Neoclassical theory also claims that wage differentials from increased wages or fringe benefits are paid to compensate workers for the disutility associated with unpleasant job characteristics and for tolerating disagreeable working conditions (Purse, 2004). The theory of compensating differentials equally proposes that employees with flexible schedules or the schedules and conditions they desire are paid less (McCrate, 2005). In this way an efficient labour market should guarantee that employees receive their preferred schedules in the long term if they are willing to settle for a lower income or save on other costs in return, while those who do not receive their preferred schedules get an income premium (Golden, 2012). However, as summarised by McCrate (2005), markets may not compensate for poor working arrangements because reality diverges from a perfectly competitive model, because of trade unions, unemployment, free-rider problems, informational asymmetries and discrimination. This makes it important to understand better the cost-benefit perspective of flexible working schedules, potential market failure in the neoclassical sense of the labour market not compensating automatically for the working time mismatch, or the behavioural and institutional reasons beyond the classical cost-benefit considerations that may restrict employers and employees in their use of flexible working schedules even where these would benefit both. Given the limited literature on the specifics of R&D work, the literature review proceeds with general concepts and empirical findings on those issues, and then narrows the focus down to consider studies on R&D work in those areas.

As noted by Golden (2009), there are numerous upsides that should encourage employers to offer flexible schedules, but the decision to do so is based on a comparison of the perceived costs of reorganisation, administration and coordination with the related benefits. Altman and Golden (2007) further elaborate in their theoretical framework that if adopting flexible work schedules results in savings in net unit labour costs in the long run or if doing so is at least cost-neutral, it should be done by rational companies that are profit-maximising in the neoclassical context, while companies that do not adopt flexible schedules risk being at a competitive disadvantage. The authors also note that while technological progress has increased the capacity of companies to provide flexibility in their work schedules, the demand for flexible working time still exceeds the supply of it, which could be for institutional reasons such as employers having an advantage over employees in their bargaining power, and not because of economic cost-benefit considerations. This argument is also supported by Hohl (1996), who found that the cost of implementing and administering flexible schedules is clearly outweighed by the benefits from it. Mas and Pallais (2017) note that the costs from

providing flexibility to employees might be overestimated by many employers, in which case risk aversion could explain why the managers of some companies are reluctant to introduce flexibility. Another behavioural argument against flexible work schedules is that managers might be resistant to them, as flexible working creates new managerial challenges, and managers could fear a loss of control over employees and their work, as proposed by Lazer (1980).

An interesting point that suggests a market failure in how working time is allocated as a resource in the labour market is the finding by Böheim and Taylor (2004) and Barnay (2016) that a significant proportion of employees would like to work less than they do. Reynolds (2003) finds from a US sample that a majority of employees have a time mismatch, and discrepancies between the actual and desired working hours of the employees appear in both directions depending on gender, age, family status, opportunities for promotion, income and part-time or full-time work status. Otterbach (2010) also finds that working time mismatches exist in both directions, with a higher proportion of employees wanting to work more and earn more than wanting to work less and earn less. A mismatch in working hours has also been found by Stier and Lewin-Epstein (2003), who conclude that time preferences are impacted by individual characteristics like age, gender and education and by country-level characteristics like growth, inflation and inequality. Väisänen and Nätti (2002) analyse the actual and preferred working times of dual-earning households in Norway and European Union countries, and also find that there is a considerable mismatch between the actual and preferred working time of households, with the desired working time twelve hours a week shorter on average than the actual working time. Rätzel (2012) finds that employees who work more than they prefer to can experience labour disutility, which leads to reduced well-being and needs to be compensated for by additional income.

A consequent cost-benefit consideration is that longer working hours have been found to result in reduced productivity (Shepard and Clifton, 2000; Collewet and Sauermann, 2017) and so may have significant adverse effects on the financial performance of organisations. Collewet and Sauermann (2017) find that increasing working hours reduces productivity. Reynolds and Aletraris (2010) also propose that the working hours mismatch may make the operations of companies less efficient by reducing the well-being of employees. Shepard and Clifton (2000) find that a 10% increase in overtime hours reduces productivity by 2-4% across most manufacturing industries. In addition, overtime work may result in fatigue that may then cause health issues. Ricci et al. (2007) find that production time lost for health reasons by employees experiencing fatigue costs US employers around USD 100 billion a year more than if the employees were not fatigued.

Findings for the theory of compensating differentials have been mixed, with several empirical studies finding support for the theory (e.g. Lanfranchi et al., 2002; Daw and Hardie, 2012) and some finding partial support. McCrate (2005) for example finds that while US employees with more flexible schedules earn less, the wage premium for employees with rigid schedules may not be sufficient to compensate fully for the related disutility. Golden (2012), in his research synthesis paper, also concludes that the theory has received weak support when tested empirically.

Moving from general insights to the R&D context, the way work is organised in a knowledge economy influences the job autonomy of employees significantly, and this in turn impacts the creation and use of knowledge. Powell and Snellman (2004) note that using the productivity gains stemming from technological innovation would need working arrangements to be changed in line with the innovations, and that R&D professionals are

likely to prefer autonomy and flexibility in their work (Goswami et al., 2007). Several studies have indicated that allowing job autonomy, which includes flexible schedules, boosts creativity and promotes innovation. Mumford (2000) analyses the management of creative people and notes that increased job autonomy is likely to contribute to innovation, and that as creative employees are typically independent and motivated, allowing them liberty in time management would be expected to improve their work results.

Tan (2019) proposes in his theoretical framework that increased freedom at work enhances innovation by employees, as reduced control by employers over the work results encourages employees to innovate over a longer time because the outcomes are shared more fairly within the company than when the employer takes control of the innovation immediately. Flexible working time may contribute considerably to how freedom is exercised in innovative work. Although they focus not on time freedom specifically but rather on job autonomy in general, Deci and Ryan (1987) also find that job autonomy has a positive impact on creative activities in innovative jobs. Amabile et al. (2002) note that increasing stress and time pressure are among the factors that have a negative impact on the results of creative work, and that rigid working schedules amplify the negative effect of the factors that hinder creativity. Zampetakis et al. (2010) find that factors such as daily and long-term planning, time management and perceived control of time increase the self-perception of creativity. Wenjing et al. (2013) focus on knowledge employees and find that the younger and more educated the employee is, the better their innovative performance, and the greater the autonomy they have, the better their creative performance is. Eaton (2003), Kelliher and Anderson (2008), Shalley et al. (2000), Wang and Cheng (2010) and Coenen and Kok (2014) also find a positive connection between job autonomy and creative R&D work outcomes and creativity. This means that job autonomy is among the key features of a favourable environment for creative work, and flexibility in working time is one of the most common ways of increasing job autonomy (De Menezes and Kelliher, 2017). Autonomy is important because the flexibility in setting the work process means employees are free to choose their work schedules in alignment with their preferences and productivity peaks. Moreover, the literature leads to think that the more creative the work is, the more preferential flexible schedules should be for employees.

While flexible working time arrangements have become more common, studies on R&D and other employees have shown that these arrangements are not offered on an equal and fair basis to all employees, hinting at behavioural and institutional constraints stemming from social norms and risk perception. Golden (2001) finds that although over a quarter of the US workforce report flexibility in their work schedules, the likelihood of an employee having such an option is dependent on individual characteristics like education, race, gender and marital status, and the probability is smaller for women and the less educated. As noted by Hohl (1996), flexible schedules are more likely to be provided to professionals, managers, technicians and sales employees than to service and blue-collar employees. The connection between age and the preference for flexible work is another point that is indicated in literature. Kossek et al. (1999) find that flexible working schedules are more likely to be used by younger employees and women. Sharpe et al. (2002) also find that younger employees are more likely to use flexitime. A similar tendency was also found for employees with higher education and for those who have young children. Virkebau and Hazak (2017) find a contrary effect among employees with

small children, as family obligations may mean they need to follow fixed schedules whatever the needs of their creative work.

Although the focus is not specifically on R&D jobs, there is further literature that points to some other behavioural and institutional features behind the working time mismatch and the use of flexitime. Giannikis and Mikhail (2011) suggest that achieving the work-life balance they desire makes employees more likely to opt for flexible working time, while the probability may decrease if there is a negative impact on their career progress, relationships with colleagues or compensation. McNamara et al. (2012) also find that the main reason for not opting for a flexible schedule is the perceived adverse effect on career advancement, while Almer et al. (2003) note that employees also consider the attitude of colleagues to be a key aspect when deciding whether or not to use flexitime. One reason for not opting for flexible schedules even when they are offered may be the desire to keep work and non-work time separated. As outlined by Golden (2012), clear boundaries between personal time and work time could be preferred in order to minimise the potential spillovers between them, and this is especially relevant given the technological advancements and trends that have seen the appearance of a non-stop society where it is difficult to distinguish between work time and leisure time. As suggested by Albion (2004) however, the perceived barriers to opting for flexible working time do not outweigh the reasons for choosing it.

Previous studies have shown that women take up the option of flexible time more than men do (Giannikis and Mikhail, 2011; Kossek et al., 1999), despite some studies showing that women are less likely to be offered the option (e.g. Golden, 2001 and 2008; Atkinson and Hall, 2009). Albion (2004) and Sarbu (2014) suggest that the decision to use flexitime is mainly driven by family reasons, which may be why women use flexible work schedules more than men do. Bailey and Kurland (2002) outline work-related factors such as the attitude of the manager, workplace interaction, household distractions, a preference for working in a team, and self-perceived job suitability as indicators that predict whether an employee would opt to work remotely.

Moen et al. (2011) find that increased control over work schedules and decreased work–family conflict are associated with better health and wellbeing for employees. Several studies have found flexible work schedules to reduce work-family conflict (e.g. Hayman, 2009; Tausig and Fenwick, 2001).

Moving from general labour market phenomena to the specific findings concerning knowledge work, Nätti et al. (2012) suggest that knowledge work in itself leads to longer working hours and to compromises with family life. Kivistö et al. (2008) note that extended hours for creative work might result in reduced sleeping hours, which in turn could have a negative effect on work results and individual wellbeing. Gaultney and Collins-McNeil (2009) also find evidence that insufficient sleep reduces productivity. Related to this, Virkebau and Hazak (2017) find that there are two streams of reasons why R&D employees prefer flexible working time options, and these are the expected positive effects on work outcomes, and the positive impact on social and family affairs.

1.3 Gains for the Employer from Flexible Working Schedules

Economic theory proposes that companies, whether in R&D or other business lines, are motivated to introduce flexible schedules if profits increase in return through improved performance or lower costs (Budd and Mumford, 2006). Improvements in financial performance could be driven by increased productivity for example (Eaton, 2003; Konrad and Mangel, 2000) or higher job satisfaction (Thamhain, 2003). Cost savings may result

from lower salary as suggested by compensating wage differential theory, a lower level of absenteeism (Kauffeld et al., 2004) and reduced staff turnover (Berkery et al., 2017). Golden (2009) highlights in his study that the incentives for employers to provide flexitime include improvements in job performance and employee effort; reductions in absences, delays and employee work stress; enhanced retention of employees, particularly in highly valued positions; and enhanced recruitment with no consequent need to offer a relatively higher salary.

As summarised by Golden (2012) there are two channels through which flexible work arrangements can impact the financial performance of a company:

1. by increasing productivity and so restraining unit labour costs;
2. by improving employee wellbeing and satisfaction without escalating payroll costs, so saving on some investments in human capital.

1.3.1 Increasing Marginal Productivity

Konrad and Mangel (2000) analysed whether companies that have provided flexible work options in order to enhance work-life balance are more productive, and they find that employers with a higher share of professionals and women in their workforce appear to experience higher productivity. Goldin (2014) finds that rigid work schedules explain a large part of gender wage differentials and that inflexible work arrangements disadvantage female workers.

Eaton (2003) analyses biopharmaceutical companies and finds that work-family policies are related to higher productivity, and the linkage is stronger where these policies are perceived as usable by the employees. Furthermore, control over time, flexibility, and the pace of work was found to be connected to positive commitment and productivity among the sample employees. Hazak et al. (2017) find that allowing favourable working conditions for R&D employees enhances the use of their creative potential and increases their perceived productiveness. Baltes et al. (1999) also find that flexitime has positive effects on productivity and on employees' self-rated performance. Thamhain (2003) finds that personal and professional needs such as satisfaction, work challenges, accomplishments, and recognition all contribute to innovative performance.

Clifton and Shepard (2004) analyse Fortune 500 companies in 30 industries in the US economy and find that work-family support programmes, which include increased flexibility in scheduling, improve productivity. The results suggest that a 10% increase in the family friendliness index is linked with an increase of 1-3% in productivity. John (2017) in his literature review paper also concludes that organisations can increase productivity and efficiency if flexible working schedules are implemented at a strategic level, and that it is crucial to consider the preferences and needs of employees. Golden (2012), following the efficiency wage or exchange theory, proposes that the increase in productivity from offering flexible work time options could arise because employees are motivated to contribute more in exchange for having a supportive working environment.

1.3.2 Cost-Benefit Aspects

Cost savings from lower rates of absenteeism and employee turnover are found to be one of the main sources of financial improvement, with lower levels of absenteeism and turnover also associated with increased commitment from employees, which in turn impacts productivity (Golden, 2012). The findings of Kauffeld et al. (2004) indicate that employees who have access to flexitime are more loyal to their employer in meeting the

aims of the organisation, have lower absenteeism, and produce better quality work. Flexible working time has also been found to have a positive impact on reducing absenteeism by Baltes et al. (1999) and Direction (2008) among others.

Nabe-Nielsen et al. (2010) find that mismatches between desired and actual working schedules may lead to unwanted employee turnover. Berkery et al. (2017) analyse 1064 organisations in seven EU countries and find that organisations offering flexible working hours have significantly lower employee turnover than those where more traditional working hours are offered. The authors argue that this could be because organisations offering flexible working arrangements give a signal to their employees that they care about their wellbeing, which promotes higher psychological commitment, which in turn makes employees less likely to quit. Furthermore, the authors suggest that social exchange theory implies that employees who have access to flexible schedules could show their gratitude by repaying the organisation through their loyalty. As further outlined by Golden (2012), the unmet needs of flexible working arrangements were found to be the primary cause of employee turnover and the cost savings on it could be very substantial; a large international consulting firm calculated a cost saving of USD 41 million per annum from providing flexible working time options for employees who would otherwise have left the organisation.

Ahuja et al. (2002) point out that flexibility in schedules and in organising work helps to reduce the chances of an employee switching employer through two channels. The first is job satisfaction, which was found to be positively related to organisational commitment, which in turn is negatively related to turnover intention, and the second is the positive impact on exhaustion, which reduces job satisfaction. Shih et al. (2011) focus on how flexibility in the speed of work and procedures affects intentions concerning employee turnover among IT professionals, and they find that exhaustion at work is reduced when there is more flexibility, and this then lessens the turnover intentions of employees.

Support for the argument that autonomy increases job satisfaction has also been found by Taylor et al. (2003), Saragih (2015), and Kröll and Nüesch (2019). Equally, several studies (e.g. Butler et al., 2009; Bell et al., 2012; Moen et al., 2011; Hazak et al., 2018) have found that undesirable working schedules are likely to have a negative impact on subjective wellbeing and perceived health, through higher emotional stress, tiredness and sleepiness, and could also result in lower job satisfaction (e.g. Green and Tsitsianis, 2005; Hazak et al., 2016). It is found by Viñas-Bardolet et al. (2018) that the job satisfaction of knowledge employees is driven by collegial support, opportunities for career advancement and job security, as well as by flexible work schedules and work-family relations. This means that higher job satisfaction, which is associated with flexible work schedules, is a critical component that could lead to lower costs through reduced employee turnover and could also increase the productivity of employees.

As suggested by Golden (2012) in his literature review paper, the cost savings for organisations may also derive from employees being willing to work unpaid extended hours when needed, in exchange for the chance to use flexible working time. This is in line with the compensating wage differential theory discussed above, which suggests that employees who are allowed to work the schedules they desire should be willing to settle for lower income, or lower income per hour. Furthermore, compensating wage differential theory argues that cost savings for employers should also be derived from the salary premium that would need to be paid if the conditions provided by the employer do not match the needs of the employee. In a similar vein, employees who

experience a mismatch between their contractual and actual working times may request a risk premium for the legal exposure.

Ashoush et al. (2015) summarise the disadvantages of flexible working time from the employer's perspective found by earlier studies, which include:

- the costs associated with planning, coordination, implementation, controlling, and managers' training;
- difficulties in supervision caused by working times being different;
- lower productivity for individuals who are unable to use flexible working schedules;
- negative attitudes and resistance from managers who feel they lose some power;
- a decline in productivity at the early and late working times because actual work only begins after the manager has come to work;
- difficulties in coordination because working times are different; and
- the difficulty of measuring the benefits from flexible working time policies compared to the related costs.

As some earlier studies indicate (e.g. Hohl, 1996; Mas and Pallais, 2017), the benefits should overall outweigh the costs and employers may overestimate those costs, though there may be certain industries and jobs where introducing flexible working time does not result in net gains for the employer and so the idea remains discouraged. Although the literature on the cost-benefit perspective of flexible working time in R&D-specific jobs is limited, it is recognisable from the types of benefits and costs outlined above that the variety of benefits outweighs the costs of introducing flexible schedules in creative knowledge work.

To conclude, numerous studies, some of which have specifically focused on R&D jobs, have demonstrated the positive impacts from flexible working arrangements, which should result in cost savings for the employer through lower absenteeism because of better health, lower staff turnover because of higher satisfaction, and increased productivity resulting from the positive impact of flexible work arrangements on creativity. From the employee's perspective, the gains come from reduced work-family conflict and better health. While there are also downsides associated with flexible working arrangements, the benefits should outweigh the costs and so offering working schedules that match the needs of employees should be a win-win situation for both the employer and the employee. An interesting aspect to consider though is what compensation the employee should receive, or what the penalty should be for those employees who have the option of using flexible working arrangements but do not do so for reasons not attributable to the employer.

In the broader context of the benefits of flexible working schedules, previous studies have shown the importance of R&D in enhancing productivity and economic growth (Griffith et al., 2004; Männasoo et al., 2018), and economic growth through increased labour productivity requires jobs with higher value added. Similarly, proper employee motivation and retention in creative jobs is essential for successful product development and innovation, since the input from knowledge employees is among the key drivers of R&D outcomes (Chang and Choi, 2007).

2 Research Questions and Hypotheses

R&D employees are very important in today's knowledge-based economies, and so the focus of the thesis is on creative R&D employees. Properly designed working schedules help to make best use of the intellectual capacity of knowledge employees so that productivity gains and innovation can be achieved, and so the thesis seeks to identify the following aspects of flexible working arrangements and job autonomy:

- what type of employee prefers the different alternatives of daily and weekly working schedules;
- what are the drivers and extent of disparities between actual, contractual and desired working schedules; and
- what type of employee is more likely to be satisfied with flexible working time and what type with fixed time, and what drives other aspects of job autonomy that relate to time, such as how working time arrangements affect creativity, how free the employee is to decide upon their speed of work and when they take breaks, what the nature of work implies for working time, and what discontent and potential jealousy from colleagues might imply for working hours.

Following from the earlier studies outlined in the Overview of the Literature and the underlying papers, the research presented in the thesis sets the following hypothesis:

1. Working time preferences depend on individual characteristics such as gender, education, age and sleep regime.
2. The higher the desired share of creative tasks, the higher the probability of the employee preferring flexible schedules.
3. There is a considerable mismatch between desired and actual work schedules.
4. The creative intensity of work is positively related to the employee being satisfied with flexible working schedules.
5. The creative intensity of work is positively related to flexibility in setting the speed of work and the start and end times of the working day.
6. Rigid working conditions have an adverse impact on creativity.
7. Age is negatively related to the probability of being satisfied with flexible working conditions.
8. The number of family members is positively related to the probability of being satisfied with flexible working conditions.
9. Education is positively related to the probability of being satisfied with flexible working conditions.

3 Data and Methodology

All the three papers build on a survey conducted among creative R&D employees in Estonia, which was repeated in two waves in spring-summer 2015 and winter 2016. The survey data bring together unique information on the time use, organisation of work, compensation, health and sleep of the respondents. The economic aspects of the survey consider above all the labour supply and the individual utility related to the individual's preferences in working time and regime. The papers included in this thesis are part of a series of articles produced by a research group led by Professor Aaro Hazak, which use a similar sample from the same original survey carried out by the research group and include Hazak et al. (2017, 2018), Sõõru et al. (2020), and Virkebau and Hazak (2017).

The sample was formed using the latest R&D data then available for Estonia, retrieved from Statistics Estonia. The criteria of Statistics Estonia define an employee as engaged in R&D when at least 10% of their working time is allocated to R&D tasks. To capture those with creative tasks, only those in the category "researchers" were included in the sample from among R&D employees, and "technicians" and "supporting staff" were excluded as their work may not be creative. In 2010-2014, the total number of employees in the "researcher" category in Estonia ranged between 4.1 and 4.6 thousand full time equivalent. Some exclusions were made by omitting those employees who were working in higher education and healthcare from the sample, because the rigid schedules in teaching and medicine do not give employees the freedom of choice between various work schedules, which is where the research in this thesis is focused. Employees of microenterprises were also excluded. The target population that remained after these exclusions was around 1000 individuals. They were employed by 23 companies and research institutes, and 11 of the 23 employers agreed to participate in the survey.

The individuals in the target population were approached after their employer had given consent to participate in the study. This means that some of the target population members could not be included in the sample because their employer did not agree to let their company or institute participate. Further selection bias came from the potential differences between the characteristics of those who completed the survey and those who did not complete it. To deal with these potential selection biases, the sample was weighted with the respondent's gender and the employer's sector of activity to bring it into alignment with the gender and sectoral characteristics of the population. Standard errors were also clustered in the econometric models to account for dependencies in clusters of employers.

The study was carried out in two waves with the aim of identifying any potential differences in responses between the time of the year with most daylight in spring and summer, and the season with the least daylight in winter. Mann–Whitney U tests (Mann and Whitney, 1947) on the dependent variables of the studies presented in the three papers showed that the differences between the responses of those who participated in both the first and the second waves were statistically insignificant, and so the data from both waves were pooled. Which response from recurring respondents to use for the analysis was selected at random.

Paper I seeks to identify which types of employee prefer which daily and weekly working schedules and had a sample of 153 individuals, representing about 15 per cent of the total population of 1.0 thousand. Two dependent variables were used in Paper I, both representing discrete categorical responses to the survey questions about

(1) daily working time preferences and
(2) weekly working time preferences.

Explanatory variables were the creative intensity of the employee's work from the share of creative work in the total working time of the employee, age, gender, number of family members, years of education, a health factor covering various measures of general health, the score on the Reduced Morningness-Eveningness Questionnaire (rMEQ) by Adan and Almirall (1991) to capture the individual's chronotype, and their average daily hours of sleep. Since both of the dependent variables are non-ordered discrete categories, the econometric methodology for the study is a multinomial logit model with maximum likelihood estimations.

Paper II seeks to identify which individual characteristics might explain the disparities between the actual, contractual and desired working schedules of creative R&D employees. The two dependent variables used in the OLS models are (1) the difference between the contractual and actual duration of the working day, and (2) the difference between the contractual and actual starting time of the working day. The sample sizes were 90 for variable 1 and 65 for variable 2. Independent variables included the socio-demographic characteristics of age, gender, number of family members, and years of education for each individual. In addition, the health factor, the measure of chronotype (rMEQ), average daily sleeping hours, desired creative intensity of work, and salary level of the employee were included as explanatory variables. Descriptive statistical analysis was used for disparities between the actual, contractual and desired working schedules other than those captured by these two dependent variables because the subsamples were small in size.

Paper III strives to identify what type of employee is more likely to be satisfied with flexible working time and what type with fixed working time, and what drives some other aspects of job autonomy that relate to time. The study uses six dependent variables, all of which are five-level Likert type scale responses on the scale (1) "Not at all"; (2) "To a small extent"; (3) "Somewhat"; (4) "To a large extent"; and (5) "Totally" to the following five survey questions:

(1) "To what extent are you satisfied with your current work time arrangement?", which was analysed separately for those with flexible working time and those with fixed working schedules;
(2) "To what extent does your current working time arrangement have a negative effect on your creativity?";
(3) "To what extent can you decide for yourself about the speed of work and the time for breaks when you are at work?";
(4) "To what extent do restrictions arising from the nature of your work cause your working day not to start and end at the times that you would prefer?";
(5) "To what extent does discontent and potential jealousy from colleagues cause your working day not to start and end at the times that you would prefer?".

The explanatory variables covered various aspects of the arrangement of work. They took in the creative intensity of work, the availability or non-availability of flexitime, the option of working from distance, average daily working hours, the proportion of working hours worked at the workplace, and the nature of the employment contract. Age, gender, number of family members and level of education were incorporated as measures of some key socio-demographic characteristics of the employee. The employee's chronotype, average daily sleeping hours and health factor were incorporated among the explanatory variables as well. In addition, the salary level of the employee and the sector of activity of the employer were included as independent variables.

Since all the dependent variables constituted ordered discrete categories, an ordered probit regression model and a maximum likelihood estimator were used as the econometric tools in Paper III. Moreover, simultaneous multivariate ordered probit regression modelling was used to account for the interrelations between the individual measures of time-related job autonomy. The final sample for Paper III comprised 146 employees.

Descriptive statistics and histograms of the key variables along with more detailed explanations of the dependent and independent variables are provided in the three papers.

4 Discussion of Key Results and Conclusion

Improving how work is organised is an increasingly important topic given the quest for competitive advantages in the global economy, where even marginal cost reductions or productivity gains can be crucial. One of the key general messages from this thesis is that considering the inherent and behavioural individual differences between employees is one solutions that can reduce the disutility of work for employees without compromising the efficiency targets of companies. More than this, it might have a positive impact on productivity. The research in this thesis contributes to the existing literature by adding empirical evidence on how some individual characteristics are strongly linked with preferences for different work schedules. In addition, the thesis helps in understanding how various working arrangements and individual characteristics may shape restrictions on job autonomy in time terms, and what opportunities there may be to alleviate these restrictions.

No studies of creative knowledge employees have been run looking at the individual-level triggers of preferences for different work schedules, even though R&D jobs are key in creating and using knowledge in contemporary knowledge economies. Additionally, R&D jobs are highly complex and very specific, which renders the standard tools for measuring work effort, like the number of working hours spent on the work site, largely useless, if not obsolete. Restrictions on the amount of time autonomy in a job may have considerable adverse effects on how efficiently the intellectual capital of R&D employees is used. The thesis contributes to filling this gap in the literature by focusing on some aspects of job autonomy that relate to time and that may contribute to human capital being used more efficiently in knowledge work.

The results of the thesis could be useful for employers and regulators in designing work schedules and could potentially help companies to improve their financial performance by either enhancing productivity or reducing costs. Cost savings could derive from various sources, such as lower wages if employees seek a premium for their work schedule preferences being ignored, reduced absenteeism as health and wellbeing improve, and lower staff turnover as job satisfaction increases. Improved financial performance through increased productivity could be achieved by greater time autonomy in a job impacting creativity and innovativeness positively.

The findings of Paper I indicate that women are more likely than men to prefer a working week which is concentrated in 3-4 days. A similar preference was found among less educated employees, while more educated employees tend to prefer the standard five-day working week. The results also indicate that men are more likely to prefer a working week which is spread over 6-7 days. The findings also reveal that older employees are less likely to prefer a working day with irregular start and end times. As anticipated, the sleep patterns of individuals also affect their working time preferences. A working week spread over 6-7 days is preferred by employees who sleep less than seven hours a day and a standard five-day week is preferred by those who sleep more. Thus the results provide support for Hypothesis 1 and are a novel finding as previous studies have not focused on individual-level triggers of preferences for different work schedules in R&D. However, there have been studies that focus on working hour preferences which have indicated that these preferences depend on individual characteristics such as age, gender and education (e.g. Stier and Lewin-Epstein 2003; Reynolds, 2003), and studies that have found that the probability of using flexible working schedules depends on age and gender (e.g. Kossek et al., 1999). The study also

finds support for Hypothesis 2, as the results indicate that those who desire more creative intensity tend to prefer irregular daily working hours. While these are novel findings as there are no earlier studies focusing on these specific aspects in R&D jobs, they are in alignment with arguments provided in some earlier studies (e.g. Goswami et al., 2007; Mumford 2000), which have suggested that R&D employees are likely to prefer job autonomy and that higher flexibility contributes to better outcomes from creative efforts. Having further insights into the characteristics and time preferences of an employee and, more importantly, knowing the connections between these characteristics and preferences can give organisations an important input for designing work schedules. Working time arrangements that disregard the preferences of employees may have an adverse impact on efficiency and be harmful for the wellbeing of the employees.

If a standard five-day working week were imposed on all employees for example, it might not be the preference of the majority, either women or men. From the financial perspective of the employer, this may imply on the costs side that employees expect a wage premium on top of what they would ask from an otherwise similar employer who allowed flexibility in weekly work schedules, even if the total working hours remain the same with both of the employers. On the revenue side, the non-preferential weekly schedule may imply the creative capacity of the employee is being used less than optimally, leading to lower productivity and a suboptimal level of innovation, and even a marginal efficiency loss in these areas may have huge effects on competitive advantages and so on the financial performance of the company. The same logic applies for daily work schedules. The age group, educational background and sleep patterns appear to have a role in this like gender does.

The results of Paper II reveal considerable disparities between the actual, contractually agreed and desired working schedules of creative R&D employees. Some 64% of the studied employees had a mismatch between their desired and contractual schedules, and so the results find support for Hypothesis 3 and complement the findings from some earlier studies (e.g. Golden, 2001; Reynolds, 2003), although the focus in those studies was on a broader population than just R&D employees. The results of Paper II show that the standard nine-to-five working schedule is roughly followed by a considerable proportion of those employees who have access to flexible working options, even if their desired timing could be different. This could be explained by family commitments and various social norms that hinder the use of the preferred schedules. The study also finds that 90% of the employees work more than contractually agreed. As found by earlier studies (Shepard and Clifton, 2000; Ricci et al., 2007), longer working hours could cause health issues through fatigue and have a negative impact on productivity. The analysis reveals that more educated employees do less overtime work and so are less exposed to the associated risks, while the higher the salary of an employee the longer their hours of overtime work. These findings of Paper II are novel as such aspects have not earlier been studied from the perspective of individual R&D employees.

These results provide some insight into the potentially huge inefficiencies in how the intellectual capacity of R&D employees and their time are used, with both inefficiencies having adverse financial consequences for employers as the full productivity potential is not realised, resulting in competitive disadvantages. An important general message from this study is that simply aligning contractual conditions with the working time preferences of the employees may not be sufficient. Various behavioural and institutional factors such as social norms for normal working hours or the operating hours of schools, kindergartens, public transport, shops and more may cause the discrepancies

between the actual and desired work schedules. A broader discussion in society would be needed to promote the idea that work schedules are not just a matter of formality and regulation, and that the potentially large financial consequences for companies warrant the alignment of actual work schedules with desired working time so that both the intellectual capacity and the time of employees can be used as efficiently as possible.

The results of Paper III demonstrate that the higher the creative intensity of the work, the more likely it is that the employee will be satisfied with a flexible schedule. This supports Hypothesis 4 and the finding is in alignment with statements and arguments in earlier studies (e.g. Goswami et al., 2007; Wenjing et al., 2013; Tan, 2019). Paper III finds partial support for Hypothesis 5 as the results indicate that the higher the creative intensity of work, the more likely it is that the perceived constraints on time schedules from the nature of the work will be lower. However, no support was found for creative intensity being related to flexibility in setting the speed of work. This is indirectly not in alignment with some findings and arguments in earlier studies that suggest that job autonomy, which includes freedom in organising work, is associated with higher creativity (Deci and Ryan, 1987; Shalley et al., 2000), though this result from Paper III may just reflect that it was similarly possible to adjust the pace of work in jobs with lower creative intensity. Employees who have flexibility in both the timing and the place of their work are significantly less likely to perceive constraints on their creativity from working time. Thus Hypothesis 6 has also found support and is in alignment with the findings and arguments of earlier studies that suggest that time flexibility has a positive impact on creativity (e.g. Zampetakis et al., 2010). The findings also indicate that employees with less creative tasks and women perceive more constraints on the timing of their work because of the jealousy of colleagues, and they are also more likely to feel that their creativity is negatively impacted by their working time arrangements. The results also reveal that younger employees are more likely to be satisfied with flexible schedules, while older employees tend to be more satisfied with fixed schedules. Therefore Hypothesis 7 is supported by the findings, which complement findings from earlier studies that have found that younger employees are more likely to use flexible schedules (e.g. Sharpe et al., 2002). However, no support was found for Hypothesis 8, as the relationship between the number of family members and satisfaction with flexible working conditions was statistically insignificant. As suggested by Virkebau and Hazak (2017), family obligations may make it necessary to follow fixed schedules, while Sharpe et al. (2002) found that employees with younger children are more likely to use flexitime. Similarly, no support was found for Hypothesis 9, as employees with higher levels of education tend to be more satisfied with fixed schedules than employees with lower levels of education, while the relationship was statistically insignificant for those working with flexitime. The outcomes of the study may help companies to understand better the various and complicated aspects of job autonomy. When they assess the benefits of flexible work arrangements, they need to consider the individual characteristics of the employees and the reaction of colleagues in addition to simply allowing flexible arrangements officially.

One of the key general messages from this study is that time freedom really matters for creative employees. Granting more job autonomy in working time decisions may not cause any significant financial costs for the employer, while the employer might potentially see a large improvement in financial performance from making productivity gains and avoiding the possible wage premiums that employees may seek because their work schedules are unsuitable, or at least because of the risk that their work schedules

may not be aligned with their preferences. Moreover, the employees would gain from improved wellbeing if their work schedules were better aligned with their dynamic preferences.

Tying the results from these three papers in with some theories of economics and finance as well as with the findings from previous studies, it could be proposed that:

- Employers who ignore the desired working schedules of their employees, as identified in the research presented in this thesis, are likely to have a higher cost base through higher wages (Purse, 2004; McCrate, 2005; Golden, 2012), as the compensating differentials theory and individual risk/return considerations suggest that employees may seek premiums for non-preferential working time or the risk of it;
- Literature on the nexus of job autonomy and productivity (Eaton, 2003; Konrad and Mangel, 2000; Golden, 2012) suggests that working time autonomy is positively correlated with productivity, and therefore further insights are seriously needed into the complicated nature of job autonomy in time terms and the role of behavioural and institutional aspects in how flexitime options are used;
- As revenues could be increased through increased productivity or through a reduction in the cost base from avoiding unnecessary wage premiums or having a lower level of absenteeism and staff turnover (Kauffeld et al., 2004; Berkery et al., 2017), then the cost-benefit perspective may make employers decide to introduce work schedules that take account of individual preferences where this has a net positive effect on productivity, profitability and the sustainability of operations.

Although the research covered by the thesis is based on a relatively small sample of employees from specific jobs and from a specific country, and therefore any broad generalisation of the results could be misleading, the papers in the thesis do identify several larger scale propositions that could map the road for further research on larger samples from different countries.

List of Figures

References

Adan, A. and Almirall, H., 1991. Horne & Östberg morningness-eveningness questionnaire: A reduced scale. *Personality and Individual differences,* 12(3), pp. 241–253.

Ahuja, M., Chudoba, K.M., George, J.F., Kacmar, C. and McKnight, H., 2002, January. Overworked and isolated? Predicting the effect of work-family conflict, autonomy, and workload on organizational commitment and turnover of virtual workers. *In Proceedings of the 35th Annual Hawaii International Conference on System Sciences* (pp. 3586–3593). IEEE.

Albion, M.J., 2004. A measure of attitudes towards flexible work options. *Australian Journal of Management*, 29(2), pp. 275–294.

Almer, E.D., Cohen, J.R. and Single, L.E., 2003. Factors affecting the choice to participate in flexible work arrangements. *Auditing: A Journal of Practice & Theory,* 22(1), pp. 69–91.

Altman, M. and Golden, L., 2007. The economics of flexible work scheduling: Theoretical advances and contemporary paradoxes. *Research in Sociology of Work*, 17, p. 313.

Amabile, T.M., Hadley, C.N. and Kramer, S.J., 2002. Creativity under the gun. *Harvard Business Review*, 80, pp. 52–63.

Angner, E., 2010. Subjective well-being. The *Journal of Socio-Economics*, 39(3), pp. 361–368.

Atkinson, C. and Hall, L., 2009. The role of gender in varying forms of flexible working. *Gender, Work & Organization,* 16(6), pp. 650–666.

Aryee, S. and Leong, C.C., 1991. Career orientations and work outcomes among industrial R&D professionals. *Group & Organization Studies,* 16(2), pp. 193–205.

Ashoush, M.A., Abdelrahman, A. and Younis, R., 2015. Flexible work arrangements: Related topics and directions. *Journal of Business Studies Quarterly*, 7(2015), p. 36.

Bailey, D.E. and Kurland, N.B., 2002. A review of telework research: Findings, new directions, and lessons for the study of modern work. *Journal of organizational behavior,* 23(4), pp. 383–400.

Baltes, B.B., Briggs, T.E., Huff, J.W., Wright, J.A. and Neuman, G.A., 1999. Flexible and compressed workweek schedules: A meta-analysis of their effects on work-related criteria. *Journal of applied psychology*, 84(4), p. 496.

Barnay, T., 2016. Health, Work and Working Conditions: A Review of the European Economic Literature. *The European Journal of Health Economics*, 17(6), pp. 693–709.

Bell, D., Otterbach, S. and Sousa-Poza, A., 2012. Work hours constraints and health. *Annals of Economics and Statistics/Annales d'économie et de statistique*, pp. 35–54.

Berkery, E., Morley, M.J., Tiernan, S., Purtill, H. and Parry, E., 2017. On the uptake of flexible working arrangements and the association with human resource and organizational performance outcomes. *European Management Review*, 14(2), pp. 165–183.

Budd, J.W. and Mumford, K.A., 2006. Family-friendly work practices in Britain: Availability and perceived accessibility. *Human Resource Management: Published in Cooperation with the School of Business Administration, The University of Michigan and in alliance with the Society of Human Resources Management,* 45(1), pp. 23–42.

Butler, A.B., Grzywacz, J.G., Ettner, S.L. and Liu, B., 2009. Workplace flexibility, self-reported health, and health care utilization. *Work & Stress,* 23(1), pp. 45–59.

Böheim, R. and Taylor, M.P., 2004. Actual and preferred working hours. *British Journal of Industrial Relations*, 42(1), pp. 149–166.

Cameron, G., Proudman, J. and Redding, S., 2005. Technological convergence, R&D, trade and productivity growth. *European Economic Review*, 49(3), pp. 775–807.

Chang, J.Y. and Choi, J.N., 2007. The dynamic relation between organizational and professional commitment of highly educated research and development (R&D) professionals. *The Journal of Social Psychology,* 147(3), pp. 299–315.

Chung, H., 2018. Future of work and flexible working in Estonia: The case of employee-friendly flexibility. *Arenguseire Keskus*, 48 p.

Clifton, T.J. and Shepard, E., 2004. Work and family programs and productivity. *International Journal of Manpower*, 25(7/8), p. 714.

Coe, D.T., Helpman, E. and Hoffmaister, A.W., 1997. North-South R&D Spillovers. *Economic Journal*, 107(440), pp. 134–149.

Coenen, M. and Kok, R.A., 2014. Workplace flexibility and new product development performance: The role of telework and flexible work schedules. *European Management Journal,* 32(4), pp. 564–576.

Cohen, W. and Levinthal, D., 1989. Innovation and Learning: Two Faces of R&D. *Economic Journal*, vol 99, pp. 569–596.

Cohen, W. and Levinthal, D., 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 35, pp. 128–152.

Colino, A., Benito-Osorio, D. and Rueda-Armengot, C., 2014. Entrepreneurship culture, total factor productivity growth and technical progress: Patterns of convergence towards the technological frontier. *Technological Forecasting and Social Change*, 88, pp. 349–359.

Collewet, M. and Sauermann, J., 2017. Working hours and productivity. *Labour economics*, 47, pp. 96–106.

Daw, J. and Hardie, J.H., 2012. Compensating differentials, labor market segmentation, and wage inequality. *Social science research*, 41(5), pp. 1179–1197.

De Menezes, L.M. and Kelliher, C., 2017. Flexible Working, Individual Performance, and Employee Attitudes: Comparing Formal and Informal Arrangements. *Human Resource Management,* 56(6), pp. 1051–1070.

Deci, E.L. and Ryan, R.M., 1987. The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology*, 53(6), pp. 1024–1037.

Direction, S., 2008. Flexible working as human resources strategy: Benefits to the organization and its personnel. *Strategic Direction*, 24(8), pp. 9–11.

Eaton, S.C., 2003. If you can use them: Flexibility policies, organizational commitment, and perceived performance. *Industrial Relations: A Journal of Economy and Society,* 42(2), pp. 145–167.

Freeman, J. 1999. Efficiency and Rationality in Organization. *Administrative Science Quarterly*, 44(1), pp. 163–175.

Gaultney, J.F. and Collins-McNeil, J., 2009. Lack of sleep in the workplace: What the psychologist-manager should know about sleep. *The Psychologist-Manager Journal*, 12(2), p. 132.

Giannikis, S.K. and Mihail, D.M., 2011. Flexible work arrangements in Greece: a study of employee perceptions. *The International Journal of Human Resource Management,* 22(02), pp. 417–432.

Golden, L., 2001. Flexible work schedules: Which workers get them?. *American Behavioral Scientist,* 44(7), pp. 1157–1178.

Golden, L., 2008. Limited access: Disparities in flexible work schedules and work-at-home. *Journal of Family and Economic Issues,* 29(1), pp. 86–109.

Golden, L., 2009. Flexible daily work schedules in US jobs: Formal introductions needed?. *Industrial Relations: A Journal of Economy and Society,* 48(1), pp. 27–54.

Golden, L., 2012. The effects of working time on productivity and firm performance. Research Synthesis Paper*, International Labor Organization (ILO) Conditions of Work and Employment Series. Geneva: International Labor Organization*.

Goldin, C., 2014. A grand gender convergence: Its last chapter. *American Economic Review*, 104(4), pp. 1091–1119.

Goswami, S., Mathew, M. and Chadha, N.K., 2007. Differences in occupational commitment amongst scientists in Indian defence, academic, and commercial R&D organizations. *Vikalpa,* 32(4), pp. 13–28.

Griffith, R., Redding S. and Van Reenen, J., 2003. R&D and absorptive capacity: Theory and empirical evidence. *Scandinavian Journal of Economics*, 105(1), pp. 99–118.

Griffith, R., Redding, S. and Van Reenen, J., 2004. Mapping the two faces of R&D: Productivity growth in a panel of OECD industries. *Review of Economics and Statistics*, 86(4), pp. 883–895.

Green, F., and Tsitsianis, N., 2005. "An investigation of national trends in job satisfaction in Britain and Germany." *British Journal of Industrial Relations* 43(3), pp. 401–429.

Güngör, A. and Alp, G.T., 2019. Generational motivation differences at the R&D centers: Gen Y and Gen Z. *Innovations*, 7(2), pp. 50–53.

Hazak, A., Männasoo, K. and Virkebau, M., 2017. Effects of Work Arrangements on Creative R&D Work Outcomes. *Eastern European Economics*, 55(6), pp. 500–521.

Hazak, A., Sõõru, E., Hein, H. and Männasoo, K., 2018. Effects of work arrangements on the sleep regimen of creative research and development employees. *International Journal of Occupational Safety and Ergonomics*, pp. 1–12.

Hazak, A., Tint, P., Virkebau, M., Pille, V., Tuulik, V. and Sõõru, E., 2016. Social Innovation Potential in Working Arrangements of R&D Employees: Repeated Employee Survey from Estonia. *2016 IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech)*, IEEE, pp. 210–213.

Hayman, J.R., 2009. Flexible work arrangements: Exploring the linkages between perceived usability of flexible work schedules and work/life balance. *Community, Work & Family,* 12(3), pp. 327–338.

Hohl, K.L., 1996. The effects of flexible work arrangements. *Nonprofit Management and Leadership*, 7(1), pp. 69–86.

John, W., 2017. Flexible working hours and organizational productivity: exploring the potential linkage. *AIMA Journal of Management & Research*, 11(4/4), pp. 1–7.

Kauffeld, S., Jonas, E. and Frey, D., 2004. Effects of a flexible work-time design on employee-and company-related aims. *European journal of work and organizational psychology,* 13(1), pp. 79–100.

Kelliher, C. and Anderson, D., 2008. For better or for worse? An analysis of how flexible working practices influence employees' perceptions of job quality. *The International Journal of Human Resource Management,* 19(3), pp. 419–431.

Kivistö, M., Härmä, M., Sallinen, M. and Kalimo, R., 2008. Work-related factors, sleep debt and insomnia in IT professionals. *Occupational Medicine,* 58(2), pp. 138–140.

Kochanski, J., Mastropolo, P. and Ledford, G., 2003. The Human Side: People Solutions for R&D, *Research-Technology Management*, 46(1), pp. 59–61.

Konrad, A.M. and Mangel, R., 2000. The impact of work-life programs on firm productivity. *Strategic Management Journal*, 21(12), pp. 1225–1237.

Kossek, E.E., Barber, A.E. and Winters, D., 1999. Using flexible schedules in the managerial world: The power of peers. *Human Resource Management,* 38(1), pp. 33–46.

Kröll, C. and Nüesch, S., 2019. The effects of flexible work practices on employee attitudes: evidence from a large-scale panel study in Germany. *The International Journal of Human Resource Management*, 30(9), pp. 1505–1525.

Lanfranchi, J., Ohlsson, H. and Skalli, A., 2002. Compensating wage differentials and shift work preferences. *Economics Letters*, 74(3), pp. 393–398.

Lazer, R.I., 1980. The Pros and Cons of Flexible Working Hours in R&D Labs. *Research Management*, 23(1), pp. 19–22.

Lester, S.W., Standifer, R.L., Schultz, N.J. and Windsor, J.M., 2012. Actual versus perceived generational differences at work: An empirical examination. *Journal of Leadership & Organizational Studies*, 19(3), pp. 341–354.

Mann, H.B. and Whitney, D.R., 1947. On a test of whether one of two random variables is stochastically larger than the other. *The annals of mathematical statistics*, pp. 50–60.

Mas, A. and Pallais, A., 2017. Valuing alternative work arrangements. *American Economic Review*, 107(12), pp. 3722–3759.

McCrate, E., 2005. Flexible hours, workplace authority, and compensating wage differentials in the US. *Feminist Economics*, 11(1), pp. 11–39.

McNamara, T. K., Pitt-Catsouphes, M., Brown, M., and Matz-Costa, C., 2012. Access to and utilization of flexible work options. *Industrial Relations: A Journal of Economy and Society,* 51(4), pp. 936–965.

Moen, Phyllis, Erin L. Kelly, Eric Tranby, and Qinlei Huang. 2011. "Changing work, changing health: can real work-time flexibility promote health behaviors and well-being?" *Journal of Health and Social Behavior*, 52(4), pp. 404–429.

Mumford, M.D., 2000. Managing creative people: Strategies and tactics for innovation. *Human resource management review,* 10(3), pp. 313–351.

Männasoo, K., Hein, H., and Ruubel, R., 2018. The contributions of human capital, R&D spending and convergence to total factor productivity growth. *Regional Studies*, 52(12), pp. 1598–1611.

Männasoo, K. and Meriküll, J., 2014. R&D, credit constraints, and demand fluctuations: Comparative micro evidence from ten new EU members. *Eastern European Economics*, 52(2), pp. 49–64.

Männasoo, K. and Meriküll, J., 2020. Credit constraints and R&D over the boom and bust: Firm-level evidence from Central and Eastern Europe. *Economic Systems*, pp. 1–14.

Männasoo, K., Hein, H., and Ruubel, R., 2016. Regional Productivity Convergence in Advanced and Emerging European Economies. *European Policy Analysis*, 12, pp. 1–12.

Nabe-Nielsen, K., Kecklund, G., Ingre, M., Skotte, J., Diderichsen, F. and Garde, A.H., 2010. The importance of individual preferences when evaluating the associations between working hours and indicators of health and well-being. *Applied ergonomics*, 41(6), pp. 779–786.

Nätti, J., Anttila, T. and Tammelin, M., 2012. Knowledge work, working time, and use of time among Finnish dual-earner families: Does knowledge work require the marginalization of private life? *Journal of Family Issues*, 33(3), pp. 295–315.

Otterbach, S., 2010. Mismatches between actual and preferred work time: Empirical evidence of hours constraints in 21 countries. *Journal of Consumer Policy*, 33(2), pp. 143–161.

Powell, W.W. and Snellman, K., 2004. The knowledge economy. *Annual Review of Sociology,* 30, pp. 199–220.

Purse, K., 2004. Work-related fatality risks and neoclassical compensating wage differentials. *Cambridge Journal of Economics*, 28(4), pp. 597–617.

Reynolds, J., 2003. You can't always get the hours you want: Mismatches between actual and preferred work hours in the US. *Social Forces*, 81(4), pp. 1171–1199.

Reynolds, J. and Aletraris, L., 2010. Mostly mismatched with a chance of settling: Tracking work hour mismatches in the United States. *Work and Occupations*, 37(4), pp. 476–511.

Ricci, J.A., Chee, E., Lorandeau, A.L. and Berger, J., 2007. Fatigue in the US workforce: prevalence and implications for lost productive work time. *Journal of occupational and environmental medicine*, 49(1), pp. 1–10.

Rätzel, S., 2012. Labour supply, life satisfaction, and the (dis) utility of work. *The Scandinavian Journal of Economics*, 114(4), pp. 1160–1181.

Saragih, S., 2015. The effects of job autonomy on work outcomes: Self efficacy as an intervening variable. *International Research Journal of Business Studies,* 4(3).

Sarbu, M., 2014. Determinants of flexible work arrangements. *ZEW-Centre for European Economic Research* Discussion Paper, (14-028).

Shalley, C.E., Gilson, L.L. and Blum, T.C., 2000. Matching creativity requirements and the work environment: Effects on satisfaction and intentions to leave. *Academy of Management Journal*, 43(2), pp. 215–223.

Sharpe, D.L., Hermsen, J.M. and Billings, J., 2002. Factors associated with having flextime: A focus on married workers. *Journal of Family and Economic Issues,* 23(1), pp. 51–72.

Shepard, E. and Clifton, T., 2000. Are longer hours reducing productivity in manufacturing?. *International Journal of Manpower*, 21(7), pp. 540–553.

Shih, S.P., Jiang, J.J., Klein, G. and Wang, E., 2011. Learning demand and job autonomy of IT personnel: Impact on turnover intention. *Computers in Human Behavior,* 27(6), pp. 2301–2307.

Stier, H. and Lewin-Epstein, N., 2003. Time to work: A comparative analysis of preferences for working hours. *Work and Occupations*, 30(3), pp. 302–326.

Sõõru, E., Hazak, A. and Rebane, M., 2020 Does chronotype restrict the employment options of creative R&D professionals? *Biological Rhythm Research*, 51(2), pp. 283–293.

Tan, T.Y., 2019. Knowledge as Property Rights Under the Ratchet Effect of Innovation. *Journal of the European Economic Association*. Tausig, M. and Fenwick, R., 2001. Unbinding time: Alternate work schedules and work-life balance. *Journal of family and economic issues,* 22(2), pp. 101–119.

Tausig, M. and Fenwick, R., 2001. Unbinding time: Alternate work schedules and work-life balance. *Journal of family and economic issues*, 22(2), pp. 101–119.

Taylor, J., Bradley, S. and Nguyen, A.N., 2003. Job autonomy and job satisfaction: new evidence.

Thamhain, H.J., 2003. Managing innovative R&D teams. *R&D Management,* 33(3), pp. 297–311.

Viñas-Bardolet, C., Torrent-Sellens, J. and Guillen-Royo, M., 2018. Knowledge Workers and Job Satisfaction: Evidence from Europe. *Journal of the Knowledge Economy*, pp. 1–25.

Virkebau, M. and Hazak, A., 2017. What Type of R&D Employees Use Flextime? *The International Journal of Organizational Diversity*, 17(2), pp. 1–9.

Väisänen, M. and Nätti, J., 2002. Working time preferences in dual-earning households. *European Societies*, 4(3), pp. 307–329.

Wang, A.C. and Cheng, B.S., 2010. When does benevolent leadership lead to creativity? The moderating role of creative role identity and job autonomy. *Journal of organizational behavior,* 31(1), pp. 106–121.

Wang, E.C. and Huang, W., 2007. Relative efficiency of R&D activities: A cross-country study accounting for environmental factors in the DEA approach. *Research Policy*, 36(2), pp. 260–273.

Wenjing, C.A.I., Wei, S.O.N.G. and Shuliang, Z.H.A.O., 2013. An empirical study on the effects of creative personality and job autonomy on individual innovation performance of knowledge workers. *International Business and Management,* 6(2), pp. 24–30.

Wey Smola, K. and Sutton, C.D., 2002. Generational differences: Revisiting generational work values for the new millennium. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 23(4), pp. 363–382.

Zampetakis, L.A., Bouranta, N. and Moustakis, V.S., 2010. On the relationship between individual creativity and time management. *Thinking skills and creativity*, 5(1), pp. 23–32.

Acknowledgements

I would like to thank:

- Professor Aaro Hazak, the thesis supervisor and co-author of papers I and II, for proposing this interesting research topic, for his excellent feedback, help and coaching on academic writing, on conducting the literature review, and on econometrics, for always finding time to discuss our research, for helping me to focus and giving me motivation, and for his tireless devotion when we were meeting the deadlines for conferences and publishers;
- Professor Kadri Männasoo, co-supervisor of the thesis for her valuable advice and guidance on the economics of organisation literature, for her advice on econometric references and empirical methodology, for involving me in her research on productivity drivers published in Regional Studies (2018) and in European Policy Analysis (2016), for her excellent comments and feedback throughout the thesis writing process, and for giving me motivation;
- Professor Aaro Hazak, Professor Kadri Männasoo, Marko Virkebau and Erve Sõõru for making available the data from their survey for this thesis;
- Professor Karsten Staehr, Karin Jõeveer and Lenno Uusküla for valuable doctoral seminars that gave guidance on conducting research and academic writing, and for their detailed and valuable comments on all the papers;
- Robin Hazlehurst for his quick, precise and excellent language editing;
- Reviewers of the pre-defence version of the thesis, professors, staff and doctoral students at Tallinn University of Technology and Professor Josef C. Brada from Arizona State University, for their useful ideas and valuable comments on improving the thesis research and for providing overall support throughout the study process;
- The editors and referees of the *International Journal of Organizational Analysis, Knowledge Management* and *Journal of the Knowledge Economy* for their comments and for a rewarding focus in expecting high-quality research for publication;
- Organisers, discussants and participants at all the conferences and seminars where the present work was presented in its early stages for their participation, comments and feedback;
- All the institutions that have provided financial support during my studies: Tallinn University of Technology, the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 952574, the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 734712, Estonian Research Council grant PUT315, the Doctoral School in Economics and Innovation supported by the European Union European Regional Development Fund (Tallinn University of Technology ASTRA project "TTÜ Development Program 2016–2022," project code: 2014-2020.4.01.16-0032), and the Doctoral School of Economics and Innovation created under the auspices of the European Social Fund;
- AS PricewaterhouseCoopers Advisors for giving me the chance to take study leave;

- Kerli for her understanding and support during the doctoral studies and Bianca;
- My parents and family, for their support and interest in my academic activities; and
- My friends and all the other people who have contributed and supported me during my doctoral studies.

Abstract
Working Schedules and Efficient Time-Use in R&D Work

While companies are constantly looking for competitive advantages under global competition, improving the efficiency of the work schedules of knowledge employees is becoming an increasingly important area for enhancing innovation and achieving productivity gains and cost reductions. A key challenge for organisations is how they manage to strike the balance between their employees' aim of utility maximisation and the goal of maximising organisational efficiency. Employees may maximise their utility by optimally dividing their time between work and leisure, while companies try to improve efficiency by organising work so as to reduce transaction costs and increase unit productivity. A key source of distortion comes from individual heterogeneities in preferences for work arrangement and work schedules that confront the rigidity in work schedules. If knowledge employees are required to work during hours that they would prefer not to allocate to their work, they may wish to get a wage premium for the inconvenience or the related risks. Moreover, using labour resources like this is inefficient from the perspective of the employer because work outcomes or work commitment may be impaired, which in turn may lead to wages being suboptimal. As a consequence, work schedules have potentially large financial implications for companies on both the revenue and cost sides.

This thesis is based on three published empirical papers that study differences between the preferences of R&D employees for daily and weekly working schedules, the disparities between their actual, contractual and desired working schedules, the types of employee that are more likely to be satisfied with either flexible or fixed working schedules, and what drives some other aspects of job autonomy that are related to time. The contribution of the thesis lies in providing novel empirical evidence on the research questions using data from a pilot questionnaire study carried out among Estonian creative R&D employees that brings together unique information on time use, the organisation of work, and the compensation, health and sleep of the employees; and a discussion of the background and results in the papers and thesis that helps give a better understanding of the linkages between the working time schedules of R&D employees and the financial performance and economic efficiency of companies.

The results of the thesis could be useful for employers and regulators in designing work schedules and could potentially help companies to improve their financial performance by either enhancing productivity or reducing costs, which would then support economic development at large. Cost savings could derive from lower wages, as employees may seek a premium if their work schedule preferences are ignored, absenteeism may be lower because of improved health and wellbeing, and staff turnover may be lower because job satisfaction is higher. Improved financial performance through increased productivity and innovativeness could be achieved if enhanced job autonomy in time terms has a positive impact on creative work outcomes.

One of the key general messages from this thesis is that considering the inherent and behavioural individual differences between employees when designing their work schedules is one way to improve efficiency. The research in this thesis contributes to the existing literature by adding empirical evidence on how some individual characteristics like gender, education and sleep patterns are strongly linked to preferences for different work schedules. In addition, the thesis helps give an understanding of how various

working arrangements and individual characteristics may shape restrictions on time autonomy in jobs, and what may be done to alleviate these restrictions.

The results further indicate considerable disparities between the actual, contractually agreed and desired working time of creative R&D employees, and show that individual and work-specific characteristics are significant in explaining the amount of overtime work done. The analysis also reveals that high creative intensity in work is a strong predictor of an R&D employee preferring flexible rather than fixed working schedules, while individual and work-specific characteristics explain what type of employee perceives constraints from working time on their creativity, or the jealousy of their colleagues as a restraint on their working time choices.

Furthermore, even though R&D jobs are important for the creation and use of knowledge, there have been no studies on creative knowledge employees looking at various individual-level triggers of preferences for alternative work schedules. Restrictions in job autonomy in time terms may have considerable adverse effects on how efficiently the intellectual capital of R&D employees is used. The thesis contributes to filling this gap in the literature by focusing on some time-related aspects of job autonomy that may contribute to human capital being used more efficiently in knowledge work. A broader discussion in society would be needed for it to be understood that work schedules are not just a matter of formality and regulation, and that the potentially large financial consequences for companies warrant alignment of actual and desired work schedules so that both the intellectual capacity and the time of employees can be used as efficiently as possible.

Lühikokkuvõte

Tööajakorraldus ning efektiivne ajakasutus teadus- ja arendustegevuses

Ajal, mil ettevõtted on globaalses konkurentsis järjepidavalt otsimas konkurentsieelised, muutub innovatsiooni ja tootlikkuse tõstmine ning kulude optimeerimine järjest olulisemaks. Seetõttu on ka teadus- ja arendustöötajate tööajakorraldus ning võimalikult efektiivne ajakasutus oluline, kuna see on potentsiaalselt oluline meede nende eesmärkide saavutamiseks. Tänapäeva organisatsioonide üks olulisi väljakutseid on tasakaalu leidmine töötajate heaolu ja tööandja efektiivsuse maksimeerimise eesmärkide vahel. Töötajad maksimeerivad oma heaolu jaotades aega optimaalselt töö- ja vaba aja vahel ning tööandjad püüavad töö organiseerimisega parandada efektiivsust, vähendades kulusid ja suurendades tootlikkust. Üks peamistest ebakõladest tekib seoses indiviidide heterogeenusega tööajakorralduse eelistustes ja tööaja fikseeritusega. Kui teadus- ja arendustöötajad on sunnitud töötama aegadel, mis ei ole nende poolt eelistatud, võivad nad soovida lisatasu kompenseerimaks kaasnevaid ebamugavusi või riske. Lisaks ei ole tööjõu kasutamine tööandja poolt sellisel juhul efektiivne, tingides potentsiaalselt halvemad töötulemused või madalama tööpanuse, mis omakorda võib viia mitteoptimaalse palgani. Seetõttu võivad töökorraldusel olla ettevõtetele potentsiaalselt märkimisväärsed finantsmõjud nii tulude kui ka kulude poolel.

Doktoritöö põhineb kolmel avaldatud empiirilisel artiklil, mis uurivad erinevusi teadus- ja arendustegevuse valdkonna töötajate päevaste ja nädalaste töögraafikute eelistustes, erinevusi nende tegelike, lepinguliste ja soovitud töögraafikute vahel ning seda, mis laadi töötajad on suurema tõenäosusega rahul paindliku ja millised fikseeritud tööaegadega ning mis mõjutab muid töö autonoomsuse ajalisi aspekte. Doktoritöö panus seisneb uudsetes empiirilistes tulemustes ülaltoodud uurimusküsimustes, kasutades andmetena pilootküsitlusuuringut, mis katab Eesti teadus- ja arendustegevuse valdkonna loovaid töötajaid ning võimaldab siduda tööaja kasutuse, töökorralduse, majandusliku, tervise ja unega seotud unikaalse informatsiooni. Lisaks aitab artiklite ning doktoritöö tausta ja tulemuste arutelu lahti mõtestada teadus- ja arendustegevuse töötajate töögraafikute ja ettevõtete finantstulemuste ning majandusliku efektiivsuse vahelisi seoseid.

Doktoritöö tulemused võivad olla kasulikud nii tööandjatele kui ka regulatsioonide kujundajatele töökorralduse kavandamisel ning võivad luua ka ettevõtetele võimalusi finantstulemuste parandamiseks läbi tootlikkuse kasvu või kulude vähenduse ning seeläbi toetada laiemat majandusarengut. Kulude kokkuhoid võib tuleneda eri allikatest, sealhulgas läbi madalama palgakulu, kuna töötajad võivad soovida palgalisa tulenevalt ebasobivast tööajakorraldusest, läbi vähenenud töölt puudumise tulenevalt paremast tervisest ja heaolust ning läbi tööjõu madalama voolavuse tulenevalt suuremast töörahulolust. Positiivne mõju võib tuleneda ka läbi kõrgema tootlikkuse ja innovatsiooni, kuna töö ajaline autonoomsus omab positiivset mõju loova töö tulemustele.

Doktoritöö üks olulisemaid üldsõnumeid on, et töötajate isikupära ja käitumuslike erinevustega arvestamine on üks lahendustest efektiivsuse parandamiseks läbi tööajakorralduse. Doktoritöö tulemused panustavad teaduskirjandusse lisades empiirilist kinnitust, et individuaalsed tunnused nagu sugu, haridus ja uni on tugevalt seotud erinevate tööajakorralduse eelistustega. Lisaks aitavad doktoritöö tulemused lahti mõtestada, kuidas erinevad töökorralduslikud aspektid ja individuaalsed tunnused võivad võimendada töö ajalise autonoomsuse piiranguid ning millised võivad olla lahendused nende piirangute leevendamisel.

Lisaks toovad doktoritöö tulemused välja olulised erinevused loovate teadus- ja arendustöötajate tegeliku, lepingulise ja soovitud tööaja vahel ning asjaolu, et ületundide maht oleneb teatud individuaalsetest ja tööalastest tunnustest. Doktoritöö tulemused näitavad, et kõrge loovtöö osakaal on oluline määraja, kas töötaja on rahul pigem paindliku või fikseeritud tööajaga, ning teatud individuaalsed ja tööalased tunnused selgitavad, mis tüüpi töötajad tunnetavad tööajaga seotud piirangute mõju loovusele või kolleegide kadedusest tingituid piiranguid tööaja valikule.

Samuti ei ole varasemalt spetsiifiliselt uuritud erineva tööaja eelistusega seotud tegureid teadus- ja arendustöötajate hulgas, samas kui need töötajad on võtmetähtsusega teadmiste loomisel tänavapäeva teadmispõhises majanduses. Piirangud töö autonoomsuse ajalistes aspektides võivad oluliselt piirata teadus- ja arendustöötajate intellektuaalse potentsiaali kasutamist. Doktoritöö panus seisneb ka selle lünga täitmises teadustöös, keskendudes mõningatele töö autonoomsuse ajalistele aspektidele, mis võib anda võimaluse inimkapitali efektiivsemaks kasutamiseks teadmispõhises töös. Samuti on vaja laiemat ühiskondlikku arutelu jõudmaks arusaamale, et tööaja korraldus ei ole pelgalt formaalsus ja regulatsiooni küsimus ning et potentsiaalselt suured finantsmõjud ettevõttele õigustavad tegeliku tööaja seadistamist selliselt, et nii intellektuaalne potentsiaal kui ka töötajate aeg oleks võimalikult efektiivselt kasutatud.

Appendix

Publication I

Hazak, A., Ruubel, R. and Virkebau, M., 2019. When would creative R&D employees like to work? *International Journal of Organizational Analysis*, 27 (3), 596−612. DOI: 10.1108/IJOA-04-2018-1409

When would creative R&D employees like to work?

Aaro Hazak, Raul Ruubel and Marko Virkebau
Department of Economics and Finance, Tallinna Tehnikaülikool, Tallinn, Estonia

Received 17 April 2018
Revised 23 July 2018
Accepted 27 July 2018

Abstract

Purpose – This paper aims to identify which types of creative R&D employees prefer which daily and weekly working schedules.

Design/methodology/approach – This paper builds on an original repeated survey of creative R&D employees from Estonia and presents multinomial logit regression estimates based on a sample of 153 individuals from 11 entities.

Findings – The probability of women preferring their weekly work to be concentrated in three to four days is 20 percentage points higher than in men, and the case is similar for less-educated creative R&D employees. The more educated prefer the standard five-day working week. Men have a stronger preference for their week of work to be dispersed over six to seven days. Sleep patterns appear to relate to working time preferences as morning-type individuals have a stronger preference for a working day with fixed start and end times. Those who sleep 7 h or more per day prefer the standard five-day working week more, while employees who sleep less than 7 h favour a working week of six to seven days. Employees who desire more creativity intensity at work have a stronger preference for irregular daily working hours, as do those with poorer general health.

Originality/value – The results indicate that individual characteristics have a significant impact on the preferences for working time arrangements. Similar working time regulations for all employees appear outdated, therefore, and may make work inefficient and harm individual well-being, at least for creative R&D employees.

Keywords Creativity, Flexibility, Sleep, Working time, R&D jobs

Paper type Research paper

Introduction

It is readily apparent that people have different preferences for their working time arrangements. Some complain that weekends are too short and would prefer to get their work done in just three or four days, while others may not wish to distinguish clearly between their work and leisure time and would rather combine both at their discretion at any time of the day or any day of the week. While some favour fixed start and end times for the working day, there are many who like to work at irregular hours. The neoclassical labour supply assumes in general that employees are free to choose their working hours to suit their preference between labour and leisure. This proposition does not appear to hold

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 734712. The authors gratefully acknowledge support from grant PUT315 provided by the Estonian Research Council. This research project has been approved by the Tallinn Medical Research Ethics Committee on 9 February 2015 by decision No. 894.

International Journal of Organizational Analysis
Vol. 27 No. 3, 2019
pp. 596-612
Emerald Publishing Limited
1934-8835
DOI 10.1108/IJOA-04-2018-1409

fully, however, as the rigidity of statutory and employers' working time regulations limits the freedom of employees to choose the working hours they really want, resulting in a mismatch between their preferences and actual working time (Reynolds, 2003; Stier and Lewin-Epstein, 2003; Böheim and Taylor, 2004). Whether an employee is reasonably able to align their actual working time with their preferences may depend on their individual characteristics.

As conflicts between the organisation's working time and the time-use preferences of employees may lead to unwanted employee turnover (Nabe-Nielsen *et al.*, 2010), declines in productivity (Konrad and Mangel, 2000; Gaultney and Collins-McNeil, 2009) or harm to individual well-being and health (Bell *et al.*, 2012), employers should be keen to introduce working plans that consider individual preferences as to have a net positive effect on productivity and the sustainability of operations. Reducing the mismatch in working hours can help organisations retain the employees they have recruited and trained and could give them a broader competitive advantage in the labour market. What kind of working time arrangements should be offered to which employees remains an area of study that is as yet little explored.

Moreover, reducing conflicts in working time arrangements may have a positive socio-economic impact in general. Enhancing the competitive advantages of intellectual capital to achieve and sustain economic growth and capturing the intellectual potential of society have become essential challenges in modern knowledge-based economies. As innovation builds on human capital, it is important that the employees who create and use the knowledge can work in a suitable environment. How the daily and weekly working time of creative employees in R&D is organised may, therefore, make a significant contribution to how efficiently the creative potential of these employees is used. This paper contributes to the field by seeking to identify which types of employees prefer which daily and weekly working schedules. The study uses data from our original repeated survey among Estonian creative R&D employees, with a sample of 153 individuals from 11 entities. Although this study is based on a limited sample, it appears to be the first to map the working time preferences of creative R&D employees. The results of this pilot study are useful for employers and regulators in designing working time arrangements, and it points to interesting paths for research in future studies using broader samples from other countries and industries.

Literature

In a knowledge economy, organisation of work has an important effect on job autonomy of employees, which in turn is key to the creation and use of knowledge. Work arrangements need to change in line with the underlying technological innovation to realise productivity gains from these inventions (Powell and Snellman, 2004). Tan (2017) argues, in his recent theoretical framework, that innovation by employees is improved when there is increased freedom at work as the reduction in the employer's control over the outcomes of innovative work motivates the employee to create innovation in a longer perspective, and the outcomes are shared more fairly within the organisation than they are when the innovation is immediately captured by the employer with limited freedom and strict control. In their literature review paper, Deci and Ryan (1987) conclude that job autonomy tends to support creative activities in innovative jobs. Focussing on jobs that involve creativity, Amabile *et al.* (2002) highlight the finding that increasing time pressure and stress are the key variables that negatively affect creative work outcomes, claiming that strict work schedules magnify the adverse effect of those factors that suppress creativity. Flexibility in working time can be, therefore, clearly seen as one of the important factors contributing to a suitable

work environment in creative jobs, as employees are allowed to adjust their working time according to their individual preferences and work at their peak productivity.

Most empirical research findings strongly contradict the traditional neoclassical view of a labour market in which employees are free to choose their work and leisure time and working schedules appear not to be determined solely by the labour supply (Otterbach, 2010). Reynolds (2003) describes how the majority of US employees have mismatches between their actual working hours and the hours they desire, with the discrepancies going both ways as some want to work more and others less, depending on age, gender, family structure, income, chances of promotion and part- or full-time status. Stier and Lewin-Epstein (2003) find, from a sample from 22 countries, that the mismatch in working hours is present for a significant number of employees, while their time preferences are affected by both individual characteristics, such as age, gender, education and income level, and by country-level measures, such as the rate of economic growth, inflation and inequality.

Several studies have looked at how far employees can alter their working schedules in practice. Böheim and Taylor (2004) examine data from the British Household Survey and find that overall employees do have some autonomy over their working hours, but these opportunities are strongly restricted by the formal and informal regulations set by their employers. Interestingly, they find that some groups of employees, such as those who change jobs often and males who work part-time, are able to adjust their working time more than others. This could suggest that individuals are forced to change jobs or switch to part-time work to have their preferred working schedule. Additionally, older and more highly educated employees are more likely to be able to adjust their working time, while Böheim and Taylor (2003) show that being academically successful increases the probability of overemployment and reduces the probability of underemployment. Böheim and Taylor (2004) also claim that about 40 per cent of full-time employees would prefer to work a different – and mostly lesser – number of working hours than they actually do. This can be explained by companies in general not being willing to offer jobs with a few working hours because of the fixed costs of recruiting and managing employees. Reynolds and Aletraris (2010) study the mismatch in working hours using data from the US National Survey of Families and Households and highlight that the mismatch in hours is a threat to the efficiency and safety of companies because of the adverse effects it has on the well-being of employees. They find that the mismatch between actual and desired working hours tends to persist over a long time, and that employees are more likely to be able to solve an underemployment mismatch than an overemployment one, while overemployment is more common for men.

Using a Time Competition Survey of 30 Dutch organisations, van Echtelt *et al.* (2006) arrive at a similar conclusion of employees spending more hours at work than they would prefer to. They note that employers have an incentive to hire employees for a large number of working hours, and employees are usually not in a position to bargain on this number. The result is a structural effect of employees being forced to work more than they want to. Importantly, they note that even if employees are offered flexible working schedules, employers could still arrange work in such a way that the actual use of flexible options remains limited.

Otterbach (2010) uses data from the International Survey Program covering 21 countries to investigate constraints on preferred working hours in a comparative international context. There are crucial differences between countries in how individuals prefer to work, and the variances can be attributed, to a large extent, to the labour market situation in the given country. However, age remains an important individual factor across countries, with older employees wanting more flexible working arrangements.

Several studies have investigated how the mismatch in hours impacts health. Bell *et al.* (2012) find, from the British Household Panel Survey and German Socio-economic Panel Survey, that overemployment has negative effects on employee health, even when the actual hours are relatively short. They stress that reducing the mismatch should increase the motivation and productivity of employees while reducing absenteeism caused by health issues. Moen *et al.* (2011) find that greater schedule control and reduced work–family conflict for employees result in positive changes in their health and in measures of well-being.

Konrad and Mangel (2000) examine whether companies that have given flexibility to employees to help them balance their demand for work and personal life are more productive. Their results indicate that the impact on productivity depends on the type of employee. Companies with a higher proportion of professionals and female employees tend to gain more from the adoption of work–life programmes. Moreover, companies employing higher proportion of professionals are also more likely to adopt extensive work–life programmes.

Nabe-Nielsen *et al.* (2013) investigate which factors employees prioritise when given the chance to schedule their work shifts. Although their intervention study included a specific sample of caregivers and employees in financial sector call centres, the results show that family life and leisure time activities were given high priority by a vast majority of the study population in setting their working time preferences, while gender, age, education and cohabitation status played a significant role in the setting of priorities. Presser (1995) explores the determinants of nonstandard work schedules, using a monthly survey of 57,000 households in the USA, conducted in May 1991 by the US Bureau of the Census. Working outside standard work hours and days was common for both men and women and was largely driven by work characteristics. Employees in service industries were especially likely to work nonstandard hours. Married people, both men and women, tended to work less on weekends and variable days, while married women were less likely than others to work nonstandard daytime hours. Having children only affected the working hours of women, and the direction of the effect depended on the age of the children. Nabe-Nielsen *et al.* (2010) find from a sample of 173 Danish employees working in care for the elderly that an extensive number of consecutive working days, long working days, night work and irregular working hours were less preferred in general, while their studies demonstrate once again that individual characteristics impact the preferences greatly. Employees who had mismatches between their preferences and their actual schedule were more likely to leave the job. Further, Mumford (2000) highlights in his study that promoting flexible work schedules, telecommunicating and self-defined work plans is likely to contribute to innovation.

Only a few empirical studies have considered R&D employees. In addition to the Amabile *et al.* (2002) study and the Deci and Ryan (1987) literature review paper referred to above, Eaton (2003), surveying biotechnology firms, Kelliher and Anderson (2008), studying a large UK software company, and Shalley *et al.* (2000) find support to the finding that increased job autonomy supports creative R&D work. Coenen and Kok (2014) investigate new product development in the technology sector in Belgium and arrive at a similar conclusion that flexibility in work options has a positive impact on creative work results. Nätti *et al.* (2012) find that the nature of knowledge work leads creative employees to work extended hours and make trade-offs with family life. Kivistö *et al.* (2008) suggest that the extended working hours in creative work could lead to reduced sleep hours, which in turn may have an adverse effect on both work outcomes and individual well-being.

Individual preferences for work time arrangements could be driven by circadian rhythms and whether the individual is of a morning or evening type, with different preferences for waking up and bedtime, which in turn impact their preferences for working time. Paine *et al.* (2006) stress that morningness–eveningness preference is quite a stable characteristic, while Gaultney and Collins-McNeil (2009) show that although insufficient sleep has a significant adverse effect on productivity, quality of life and health and safety, individual sleep patterns are still largely ignored by employers. Given this, it is beneficial for both employees and employers to allow working schedules which take the circadian rhythms of employees into consideration, as well-rested employees are likely to be healthier, happier and more productive (Gaultney and Collins-McNeil, 2009).

In general, plenty of empirical studies have demonstrated the important role played by individual characteristics like age, gender, family status and size, education, health and sleep patterns in shaping working time preferences. Numerous studies have shown that labour markets are not perfect in terms of allowing employees to work at the time they would prefer, and empirical support has been found for a significant mismatch in hours. As the current literature demonstrates, this mismatch tends to have adverse effects for both the employer and the employee. Moreover, there have been no studies on the individual drivers of preferences for different working schedules among creative R&D employees, while they are crucial for the creation of knowledge in the modern economy (Powell and Snellman, 2004). To help address these issues and find practical solutions, this paper contributes to the literature by seeking to identify which individual and job characteristics are related to which type of preferences for working schedules among creative knowledge employees.

Data and methodology

This study builds on an original survey conducted among creative R&D employees in Estonia that was repeated in two waves in Spring–Summer 2015 and Winter 2016. The sample was set up from the latest available national R&D data retrieved from Statistics Estonia. The Statistics Estonia criteria consider an employee to be engaged in R&D when at least 10 per cent of their working time is allocated to R&D tasks. To capture those with creative tasks, the sample used in this study accepts only the category "researchers" from among R&D employees and excludes "technicians" and "supporting staff" as their work may not be creative. Over the years 2010-2014, the number of creative R&D employees in Estonia ranged between 4,100 and 4,600 full-time equivalent. Further exclusions have been made by omitting those employees who were working in higher education and healthcare, as the schedules of teaching and medical procedures interfere significantly with the working time patterns that this study is focussed on. In addition, employees of microenterprises were excluded. After these exclusions, the population of interest for this study comprises approximately 1,000 creative R&D employees who work for 23 employers, both private companies and public research institutes. Eleven of these employers agreed to participate in the study.

The study was run in two waves so that any potential differences in responses might be revealed between the time of the year with most daylight in the first wave in Spring–Summer 2015 and the season with the least daylight in Winter 2016. Mann–Whitney U tests (Mann and Whitney, 1947) on the working time preference variables showed that the differences in the responses of the respondents who recurred in the two waves were statistically insignificant; therefore, data from both waves of the survey have been pooled for this study. Which of the responses of recurring participants to use for the econometric analysis was selected randomly. Furthermore, inconsistent and irrelevant responses were eliminated. The final sample comprises 153 employees, representing about 15 per cent of the

total population of 1,000. Of these, 54 worked in R&D companies or institutes, with 32 in the public sector and 22 in the private, 43 were in the product or IT development units at banks, 35 worked in the technology industry and 21 were in IT.

The employees in the population were approached after their employer had given consent to them to participate in the study. This meant the individuals in the population could not be included in the sample if their employer did not agree to let them participate. Another selection bias may incur in relation to completion or non-completion of the survey by a respondent. These potential selection biases are addressed to some extent by weighting the sample, bringing it into alignment with the characteristics of the population for the respondent's gender and the employer's sector of activity. Standard errors for employers have been clustered in the econometric models to further account for dependencies in clusters by employers.

There were 90 questions in the questionnaire, covering various aspects of the organisation of work, results of work, employee well-being, job satisfaction, sleep patterns, health and other socio-demographic characteristics. The participation of the employees who were invited to complete the online electronic survey was voluntary and confidential.

There are two dependent variables used in this study, both representing discrete categorical responses to the survey questions about:

- daily (variable daypreference); and
- weekly (variable weekpreference) working time preferences (Table I).

Explanatory variables were selected from the literature (see the summary of the literature in the previous section). The creativity intensity of work (variable creative) reflects the share of the total working time that the employee wants to spend on creative work, with the aim of distinguishing between employees with different expectations on how their working time should be divided between creative work and administrative and other non-creative tasks. Age, gender, number of family members and years of education reflect the important socio-demographic characteristics of the employee and the health factor controls for their general

Dependent variable/survey question and response categories	All	Men	Women
N	153	87	66
daypreference			
When would your workday start and end if you could choose it freely by yourself?			
1: Workday would start and end at a fixed time	27	17	10
2: Workday would start at a fixed time but end irregularly	35	18	17
3: Workday would start irregularly but end at a fixed time	4	1	3
4: There would be a regular part of the workday which would start and end at a fixed time and an irregular part of the workday which would differ from day-to-day	33	18	15
5: Regular workday cannot be defined as my workload would differ considerably from day-to-day (for example, working 4 h on one day and 12 h on another)	54	33	21
weekpreference			
How would you prefer to work in case you could freely divide your workload within a week?			
1: With high concentration on one to two days a week	7	1	6
2: With high concentration on three to four days a week	91	45	46
3: By a common standard of five days a week	39	15	24
4: With a dispersed workload on six to seven days a week	16	5	11

Table I.
Dependent variables

health. The score of the reduced Morningness–Eveningness Questionnaire (rMEQ, by Adan and Almirall, 1991) shows the type of sleep regimen the employee has, and their average daily hours of sleep (variable sleep hours) have been included to capture another angle of individual sleep patterns. The explanatory variables are outlined in Table II, along with descriptive statistics, and Appendix 1 provides histograms of some of the key variables.

As the dependent variables represent non-ordered discrete categories, multinomial logit maximum likelihood estimations have been used as the econometric modelling approach. The models are outlined in Appendix 2, where Model 1 represents the baseline model for daily working time preferences (dependent variable daypreference), and Model 4 represents weekly preferences (dependent variable weekpreference). For robustness tests, sleep hours were excluded from Models 2 and 5 and creative from Models 3 and 6 because of potential endogeneity issues (Zaitouni and Ouakouak, 2018 [for a discussion on the complex interactions between creativity and organisational context]). To control for unobserved employer-specific dependencies, standard errors have been adjusted for 11 clusters representing the 11 employers in the sample.

Results

Quantitative results of the six multinomial logit models are presented in Appendix 2.

We find that the level of creativity intensity that R&D employees desire in their work is strongly related to both their daily and weekly working time preferences. Employees who wanted a higher share of creative work are significantly less likely to prefer a working day with a fixed start and end times. As a corollary, those creative R&D employees who are willing to spend more time on administrative and other non-creative tasks have a significantly stronger preference for a working day with a fixed start and end times than those who would like to dedicate more time to creative tasks. These results are outlined in Figure 1, where the left panel illustrates the decline in the probability of an employee preferring a working day with a fixed start and end times, along with the increase in the creativity intensity of work that they want. The right panel of Figure 1 shows that the higher the level of creativity intensity that the employee would like in their work, the higher the likelihood of them being willing to work with irregular daily schedules.

The modelling results (Models 4 and 5 in Appendix 2) reveal that those wanting a higher level of creativity intensity in their work have a significantly stronger preference for weekly work concentrated in three to four (or six to seven) days rather than the usual five days of the working week. Or equally, the more tolerant the creative employee is of administrative and other non-creative work, the more tolerant he/she is of the standard working week of five days.

Younger employees appear to have a stronger preference for a working day with irregular start and end times, while older employees prefer their working day to have a fixed start and end times (Models 1 and 2 in Appendix 2). The study provides evidence that older employees are more likely to prefer a working week spread over six to seven days rather than the standard five-day working week.

In alignment with the literature, we find gender differences in working time preferences. However, we find support for gender effects in weekly working time preferences but not in daily preferences. The probability of women preferring a working week concentrated in three to four working days is 20 percentage points higher than the probability for men, while men are 4.5 percentage points more likely than women to prefer a working week spread over six to seven days (marginal gender effects in Table III).

Educational level appears to have a significant effect on weekly working time preferences. While more educated creative R&D employees prefer the standard five-day

Variable	Description	All Mean/% (SD)	Men Mean/% (SD)	Women Mean/% (SD)
	N	153 (100%)	87 (57%)	66 (43%)
Creative	Employee desired share of creative work in total working time (%)	71.70 (20.49)	71.18 (21.03)	72.38 (19.90)
Age	Age in years	38.76 (11.51)	37.72 (12.19)	40.12 (10.48)
Gender	Male (= 1) vs female (= 0)	57%	100%	100%
Family	Employee reported number of people living together with the employee	1.66 (1.46)	1.72 (1.54)	1.58 (1.36)
Education	Years of education starting from primary education	16.58 (2.66)	15.96 (2.85)	17.39 (2.14)
Health	General health condition factor with overall Kaiser–Meyer–Olkin measure of sampling adequacy of the factor 0.6, comprising (1) "Do you have high blood pressure or have you ever used medicine for high blood pressure?" (Yes = 1); (2) "Do you suffer or have you suffered from diseases that significantly affect your mental fatigue?" (Five-level Likert type scale; "Never" = 1, "Often" = 5); (3) "Does your disease or injury interrupt you while doing your daily job?" (Five-level Likert type scale; "No obstacles" = 1, "Not able to work" = 5); (4) "How many workdays have you been absent from work due to disease or medical examination in the past 12 months?" (five-level scale; "None" = 1, "100-365 days" = 5); and (5) body mass index (continuous)	0.00 (0.81)	0.05 (0.81)	−0.07 (0.81)
rMEQ	rMEQ score, 1. . . 25 scale ranging from "definitely an evening type" to "definitely a morning type"	14.73 (3.53)	14.98 (3.57)	14.39 (3.49)
Sleep hours	Employee reported average sleeping hours per day on the scale:			
	"Less than 6 h" (base)	7%	6%	8%
	"6-7 h" (= 2)	50%	49%	50%
	"7-8 h" (= 3)	38%	39%	36%
	"8-9 h" (= 4)	6%	6%	6%
	"over 9 h" (= 5)	0%	0%	0%

Table II.
Explanatory variables and description of the sample (mean and standard deviation [SD] shown for continuous and ordered variables; percentage of respondents shown for binary and categorical variables)

working week more strongly, a working week concentrated in three to four days (or spread over six to seven days) has a higher probability of being preferred by those who are less educated. This is illustrated in Figure 2.

This study reveals that sleep patterns are related to daily and weekly working time preferences. A working week spread over six to seven working days is preferred more by those who sleep less, while those who sleep 7 h or more appear to prefer the standard five-day working week more. These results are illustrated in Figure 3.

In line with past research, the study shows that morning- and evening-type individuals have different working time preferences. Morning-type people appear to have a stronger preference than others for working days that have a fixed start and end times (right panel of Figure 3). Employees with poorer general health appear to have a stronger preference for irregular daily working hours.

Discussion

The findings of this study that the more creative work the employee would prefer to do, the less likely it is that he/she would like to have a fixed start and end times for each working day and the less tolerant he/she would be of the standard working week of five days may be useful for managers in designing work schedules for creative employees. Employees who want a lot of creativity intensity in their work may need to be given more flexibility in choosing the most appropriate times to realise their creative potential. Meeting the flexitime preferences for employees who want a higher share of creative work may lead to increased innovativeness, as suggested by Mumford (2000), who noted that promoting flexitime is likely to contribute to innovation as the outcomes of creative efforts are uncertain and employees need freedom of time for exploring options. These findings fit well with the

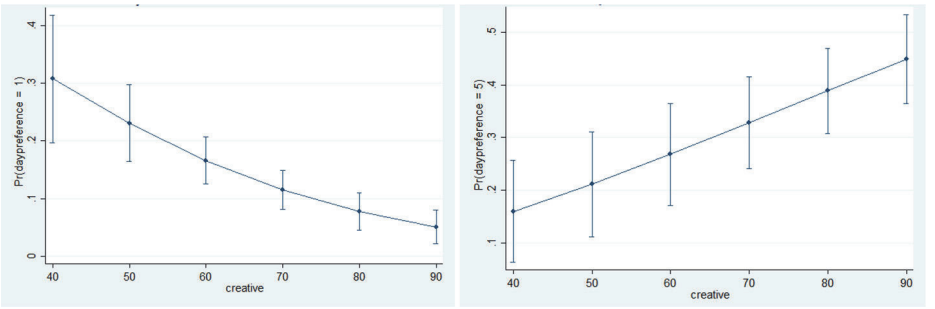

Figure 1.
Probabilities of an employee preferring working days to start and end (1) at a fixed time (daypreference = 1; left panel); and (2) at irregular times (daypreference = 5; right panel) for different levels of desired creativity intensity of work (with 90% confidence intervals, other variables at means)

Table III.
Average marginal gender effects in the weekpreference estimates

Dependent variable: *weekpreference* =	1	2	3	4
Gender (male = 1)	0.010 (−0.015)	−0.202** (0.091)	0.146 (0.092)	0.045*** (0.027)

Notes: *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

theoretical framework by Tan (2017), suggesting that innovation by employees is improved when there is increased freedom at work and less control over the work process by the employer. Flexibility in choosing working hours is an important form of job autonomy, and increased autonomy has been found to support creative work in previous studies (Deci and Ryan, 1987; Shalley *et al.*, 2000). Managers of R&D employees might discover that offering freedom in choosing daily and weekly working time in creativity-intensive R&D jobs may benefit both the employer and the employee.

As the paper reveals that younger employees have a stronger preference for working days with irregular start and end times, employers may wish to take these preferences into account when designing working time arrangements in creative R&D jobs. The effects of age can be explained by generational differences, as younger employees may not perceive the standard nine-to-five working day as a norm and may be more willing to explore flexible working time arrangements. Moreover, the nature of work itself, and creative knowledge work in particular, has changed considerably in recent decades, and younger professionals entering the workforce might be more able to adapt to those changes by using more flexible working time to improve their individual competitiveness in the creative R&D labour market. This once again suggests that flexibility in working time arrangements can play an important role for employers who want to attract and retain young and highly educated staff.

The study shows that female R&D employees would prefer to get their work done in three to four days rather than in the standard five days, while men have a stronger preference than women for a working week spread over six to seven days. Although direct comparison with previous studies is hard because of differences in the industries and jobs covered, Nabe-Nielsen *et al.* (2013) found, for example, when investigating the factors that employees consider when scheduling their work that female employees are more likely to prioritise having consecutive time off. Moreover, as Konrad and Mangel (2000) find that companies with a higher proportion of professionals and female employees tend to gain more in productivity from the adoption of flexible work options, in the interest of both improved R&D output and individual well-being, employers should account for gender differences in preferences for work arrangements.

More educated employees have a stronger preference than their less educated colleagues for the standard five-day working week. The five-day working week arrangement is also preferred by those who sleep seven or more hours per day, while those who sleep less appear

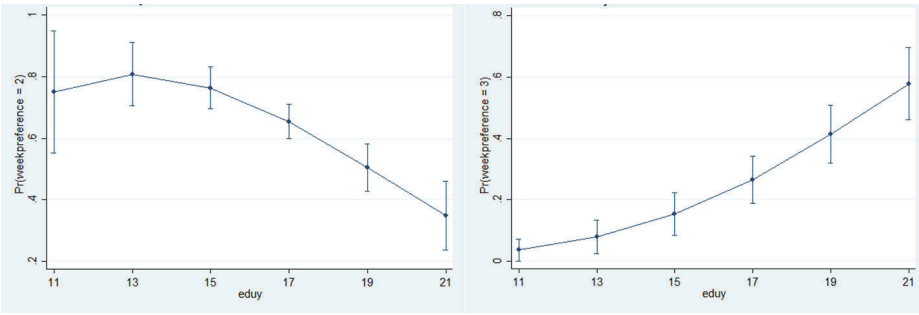

Figure 2.
Probabilities of an employee preferring a working week of three to four days (weekpreference = 2; left panel) and five days (weekpreference = 3; right panel) for different years of education (with 90% confidence intervals, other variables at means)

to have a greater preference for the working week being spread over six to seven days. This may be because they are more tired and therefore cannot achieve the creative work outcomes they want over longer regular working days. The finding that morning-type people have a stronger preference for working days that have a fixed start and end times may relate to the standard timing of work, typically from nine to five, being much better aligned with the preferences of morning types than with those of their evening-type colleagues. Employees with poorer general health appear to have a stronger preference for irregular daily working hours. Intuitively, employees with poorer health may have more health-related time restrictions, which make it harder for them to cope with fixed start and end times.

Overall, individual characteristics have a strong impact on the working time arrangements that creative R&D employees prefer. It appears to be unwise to have similar working time regulations for all employees. Providing specific types of working time arrangements, such as fixed daily and weekly schedules, may attract specific types of employees to a job while being unattractive for others. Working time arrangements that ignore the individual preferences of the employee may make work results less efficient and could harm the well-being of the employee, at least in the case of the creative R&D employees covered by this study. Further studies on larger samples from different countries would be an interesting path for future research on these important matters of organising work in modern knowledge-intensive societies.

Conclusions

This paper investigates which types of creative knowledge employees would like to work under which daily and weekly schedules. The paper presents multinomial logit regression estimates, using data from our original repeated survey of Estonian creative R&D employees on a sample of 153 individuals from 11 entities.

The paper reveals that the more creative work the employee would prefer to do, the less likely it is that he/she would like to have a fixed start and end times for each working day. Moreover, the more reluctant the creative employee is to do administrative and other non-creative tasks, the less tolerant he/she will be of the standard working week of five days. These findings may be useful for managers in designing work schedules for R&D employees, highlighting that employees who want a lot of creativity in their work may need to be given more flexibility in choosing the most appropriate times to realise their creative potential.

This study finds that younger employees have a stronger preference for working days with irregular start and end times. Employers may wish to take these preferences into account when designing working time arrangements in R&D to make the jobs more attractive to younger employees. The paper shows that female R&D employees would

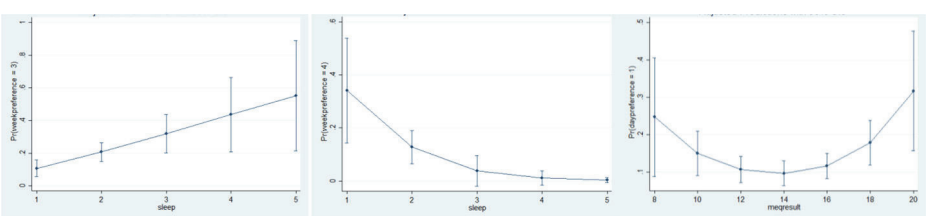

Figure 3.
Probabilities of an employee preferring a working week of five days (weekpreference = 3; left panel) and six to seven days (weekpreference = 4; middle panel) for different levels of average daily hours of sleep; probabilities of an employee preferring working days to start and end at a fixed time (daypreference = 1; right panel) for different levels of morningness–eveningness rMEQ (with 90% confidence intervals, other variables at means)

prefer to get their work done in three to four days rather than in the standard five days, letting them keep the rest of the week for family and other commitments. Men, however, have a stronger preference than women for a working week spread over six to seven days, revealing that their demand for days free of paid work is lower than that of women.

Moreover, the study demonstrates that sleeping hours and morningness–eveningness type of the employee are linked to the preference for specific daily and weekly working time arrangements. These findings highlight that the standard timing of work, typically from nine to five, may be much better aligned with the preferences of morning types than with those of their evening-type colleagues.

Knowing the characteristics and time preferences of an individual better and, moreover, the linkages between them, may give employers a valuable insight when they are designing working time arrangements for R&D employees. Working time arrangements that ignore the individual preferences of the employee may make work results less efficient and could harm the well-being of the employee, at least in the case of the creative R&D employees covered by this study.

References

Adan, A. and Almirall, H. (1991), "Horne and Östberg morningness-eveningness questionnaire: a reduced scale", *Personality and Individual Differences*, Vol. 12 No. 3, pp. 241-253.

Amabile, T.M., Hadley, C.N. and Kramer, S.J. (2002), "Creativity under the gun", *Harvard Business Review*, Vol. 80 No. 8, pp. 52-63.

Bell, D. Otterbach, S. and Sousa-Poza, A. (2012), "Work hours constraints and health", Annals of Economics and Statistics/Annales d'économie et de statistique, pp. 35-54.

Böheim, R. and Taylor, M.P. (2003), "Option or obligation? The determinants of labour supply preferences in Britain", *The Manchester School*, Vol. 71 No. 2, pp. 113-131.

Böheim, R. and Taylor, M.P. (2004), "Actual and preferred working hours", *British Journal of Industrial Relations*, Vol. 42 No. 1, pp. 149-166.

Coenen, M. and Kok, R.A. (2014), "Workplace flexibility and new product development performance: the role of telework and flexible work schedules", *European Management Journal*, Vol. 32 No. 4, pp. 564-576.

Deci, E.L. and Ryan, R.M. (1987), "The support of autonomy and the control of behavior", *Journal of Personality and Social Psychology*, Vol. 53 No. 6, pp. 1024-1037.

Eaton, S.C. (2003), "If you can use them: flexibility policies, organizational commitment, and perceived performance", *Industrial Relations: A Journal of Economy and Society*, Vol. 42 No. 2, pp. 145-167.

Gaultney, J.F. and Collins-McNeil, J. (2009), "Lack of sleep in the workplace: what the psychologist-manager should know about sleep", *The Psychologist-Manager Journal*, Vol. 12 No. 2, p. 132.

Kelliher, C. and Anderson, D. (2008), "For better or for worse? An analysis of how flexible working practices influence employees' perceptions of job quality", *The International Journal of Human Resource Management*, Vol. 19 No. 3, pp. 419-431.

Kivistö, M., Härmä, M., Sallinen, M. and Kalimo, R. (2008), "Work-related factors, sleep debt and insomnia in IT professionals", *Occupational Medicine*, Vol. 58 No. 2, pp. 138-140.

Konrad, A.M. and Mangel, R. (2000), "The impact of work-life programs on firm productivity", *Strategic Management Journal*, Vol. 21 No. 12, pp. 1225-1237.

Mann, H.B. and Whitney, D.R. (1947), "On a test of whether one of two random variables is stochastically larger than the other", *The Annals of Mathematical Statistics*, Vol. 18 No. 1, pp. 50-60.

Moen, P., Kelly, E.L., Tranby, E. and Huang, Q. (2011), "Changing work, changing health: can real work-time flexibility promote health behaviors and well-being?", *Journal of Health and Social Behavior*, Vol. 52 No. 4, pp. 404-429.

Mumford, M.D. (2000), "Managing creative people: strategies and tactics for innovation", *Human Resource Management Review*, Vol. 10 No. 3, pp. 313-351.

Nabe-Nielsen, K., Kecklund, G., Ingre, M., Skotte, J., Diderichsen, F. and Garde, A.H. (2010), "The importance of individual preferences when evaluating the associations between working hours and indicators of health and well-being", *Applied Ergonomics*, Vol. 41 No. 6, pp. 779-786.

Nabe-Nielsen, K., Lund, H., Ajslev, J.Z., Hansen, Å.M., Albertsen, K., Hvid, H. and Garde, A.H. (2013), "How do employees prioritise when they schedule their own shifts?", *Ergonomics*, Vol. 56 No. 8, pp. 1216-1224.

Nätti, J., Anttila, T. and Tammelin, M. (2012), "Knowledge work, working time, and use of time among Finnish dual-earner families: does knowledge work require the marginalization of private life?", *Journal of Family Issues*, Vol. 33 No. 3, pp. 295-315.

Otterbach, S. (2010), "Mismatches between actual and preferred work time: empirical evidence of hours constraints in 21 countries", *Journal of Consumer Policy*, Vol. 33 No. 2, pp. 143-161.

Paine, S.J., Gander, P.H. and Travier, N. (2006), "The epidemiology of morningness/eveningness: influence of age, gender, ethnicity, and socioeconomic factors in adults (30-49 years)", *Journal of Biological Rhythms*, Vol. 21 No. 1, pp. 68-76.

Powell, W.W. and Snellman, K. (2004), "The knowledge economy", *Annual Review of Sociology*, Vol. 30 No. 1, pp. 199-220.

Presser, H.B. (1995), "Job, family, and gender: determinants of nonstandard work schedules among employed Americans in 1991", *Demography*, Vol. 32 No. 4, pp. 577-598.

Reynolds, J. (2003), "You can't always get the hours you want: mismatches between actual and preferred work hours in the US", *Social Forces*, Vol. 81 No. 4, pp. 1171-1199.

Reynolds, J. and Aletraris, L. (2010), "Mostly mismatched with a chance of settling: tracking work hour mismatches in the United States", *Work and Occupations*, Vol. 37 No. 4, pp. 476-511.

Shalley, C.E., Gilson, L.L. and Blum, T.C. (2000), "Matching creativity requirements and the work environment: effects on satisfaction and intentions to leave", *Academy of Management Journal*, Vol. 43 No. 2, pp. 215-223.

Stier, H. and Lewin-Epstein, N. (2003), "Time to work: a comparative analysis of preferences for working hours", *Work and Occupations*, Vol. 30 No. 3, pp. 302-326.

Tan, T.Y. (2017), "The extrinsic motivation of freedom at work", Job Market Paper.

Van Echtelt, P.E., Glebbeek, A.C. and Lindenberg, S.M. (2006), "The new lumpiness of work: explaining the mismatch between actual", *And Preferred Working Hours. Work, Employment and Society*, Vol. 20 No. 3, pp. 493-512.

Zaitouni, M. and Ouakouak, M.L. (2018), "Key predictors of individual creativity in a middle eastern culture: the case of service organizations", *International Journal of Organizational Analysis*, Vol. 26 No. 1, pp. 19-42.

Corresponding author
Aaro Hazak can be contacted at: aaro.hazak@ttu.ee

Appendix 1

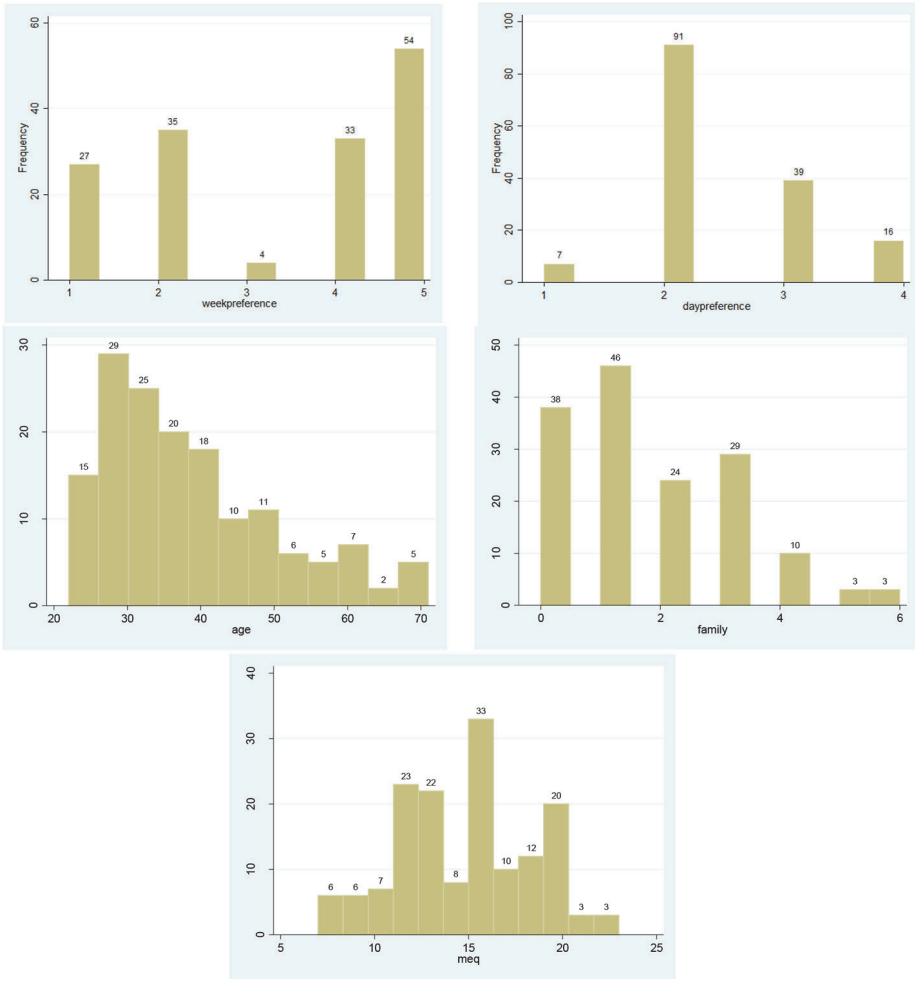

Figure A1. Histograms for weekpreference, daypreference, age, family and rMEQ

Appendix 2

Table AI.
Multinomial logit regression estimates of daypreference and weekpreference

Variable	Model 1: daypreference						Model 2: daypreference					
	1	2	3¥	4	5	1	2	3¥	4	5
Creative		0.025** (0.012)	−0.047 (0.075)	0.040*** (0.016)	0.056*** (0.012)		0.026** (0.112)	−0.043 (0.071	0.041*** (0.016)	0.056*** (0.012)
Age	base outcome	−0.021 (0.015)	−0.448 (0.313)	−0.027 (0.019)	−0.036* (0.021)	base outcome	−0.021 (0.016)	−0.439 (0.325)	−0.025 (0.018)	−0.036* (0.021)
Gender (male = 1)		0.042 (0.490)	−3.37*** (1.243)	0.074 (0.696)	−0.283 (0.315)		0.032 (0.490)	−3.229 (2.267)	0.071 (0.717)	−0.296 (0.304)
Family		0.256 (0.204)	2.057 (1.368)	0.220 (0.214)	0.225 (0.160)		0.254 (0.207)	1.853 (1.286)	0.225 (0.221)	0.221 (0.156)
Education		0.132 (0.116)	−0.610** (0.310)	0.111 (0.083)	0.016 (0.083)		0.130 0.116)	−0.624 (0.426)	0.111 (0.084)	0.017 (0.082)
Health		−0.707 (0.472)	−1.265 (1.218)	−0.300 (0.595)	0.038 (0.361)		−0.719 0.452)	−1.187 (1.967)	−0.313 0.588)	0.029 (0.350)
rMEQ		0.838** (0.366)	2.591 (3.574)	1.665** (0.838)	0.685 (0.618)		0.810** (0.325)	1.837 (4.274)	1.576* (0.836)	0.685 (0.667)
rMEQ^2		−0.032** (0.013)	−0.120 (0.158)	−0.060** (0.030)	−0.025 (0.022)		−0.031** (0.012)	−0.093 (0.187)	−0.057* (0.0297)	−0.025 (0.023)
Sleep hours		−0.106 (0.450)	−0.773* (0.469)	−0.243 (0.327)	−0.004 (0.370)					
Constant		−8.269*** (2.928)	9.795 (16.030)	−13.94** (6.888)	−6.582 (5.333)		−0.83*** (2.825)	12.289 (15.051)	−13.95** (6.874)	−6.529 (5.250)
No. of obs			153					153		
Pseudo R^2			0.1388					0.1368		
pseudo-log-likelihood			−187.6***					−188.0***		

Notes: *$p < 0.10$; **$p < 0.05$; and ***$p < 0.01$; significance of pseudo-log-likelihoods is based on the Wald's chi; ¥daypreference = 3 had only four observations, as a result of which the results in this category are considered irrelevant; and ‡weekpreference = 1 had only seven observations, as a result of which the results in this category are considered irrelevant

(*continued*)

Variable	Model 3: daypreference						Model 4: weekpreference			
	1	2	3[¥]	4	5	1[‡]	2	3	4	
Creative						0.101 (0.064)	0.018* (0.010)	base outcome	0.034 (0.021)	
Age	base outcome	−0.016 (0.017)	−0.378*** (0.171)	−0.015 (0.019)	−0.018 (0.024)	−0.430 (0.038)	−0.002 (0.022)		0.058** (0.029)	
Gender (male = 1)		0.104 (0.537)	−3.393*** (0.607)	0.177 (0.724)	−0.157 (0.313)	1.535 (2.274)	−0.931* (0.558)		0.037 (0.741)	
Family		0.193 (0.201)	1.140 (0.798)	0.137 (0.199)	0.110 (0.146)	−0.236 (0.217)	−0.050 (0.157)		−0.174 (0.163)	
Education		0.163* (0.088)	−0.551*** (0.157)	0.162** (0.082)	0.076 (0.071)	−0.923*** (0.245)	−0.352*** (0.076)		−0.202*** (0.075)	
Health		−0.751* (0.453)	−1.729*** (0.611)	−0.368 (0.582)	−0.016 (0.336)	1.189*** (0.373)	−0.027 (0.270)		−0.228 (0.615)	
rMEQ		0.709* (0.377)	1.223 (1.522)	1.526* (0.795)	0.525 (0.557)	1.250 (0.943)	0.395 (0.356)		0.365 (0.607)	
$rMEQ^2$		−0.027* (0.014)	−0.058 (0.066)	−0.055** (0.028)	−0.020 (0.020)	−0.043 (0.029)	−0.013 (0.012)		−0.016 (0.023)	
Sleep hours		−0.226 (0.456)	−0.736 (0.630)	−0.399 (0.339)	−0.215 (0.339)	0.108 (0.554)	−0.471* (0.279)		−1.646** (0.727)	
Constant		−6.013*** (2.029)	13.218 (10.629)	−11.001 (6.714)	−2.364 (4.181)	−4.124 (7.736)	4.418 (3.113)		−0.061 (4.365)	
No. of obs			153				153			
Pseudo R^2			0.0862				0.2363			
pseudo-log-likelihood			−199.0***				−128.3***			

(*continued*)

Table AI.

Table AI.

Variable	Model 5: weekpreference				Model 6: weekpreference			
	1≠	2	3	4	1≠	2	3	4
Creative	0.010 (0.064)	0.019** (0.009)	base outcome	0.042** (0.021)			base outcome	
Age	−0.037 (0.037)	−0.002 (0.022)		0.059* (0.031)	−0.031 (0.020)	0.001 (0.018)		0.070** (0.029)
Gender (male = 1)	1.883 (2.367)	−0.943* (0.573)		−0.0180 (0.770)	0.983 (1.607)	−0.899 (0.555)		0.119 (0.780)
Family	−0.180 (0.235)	−0.027 (0.142)		−0.036 (0.168)	−0.417** (0.193)	−0.067 (0.151)		−0.190 (0.152)
Education	−0.896 (0.248)	−0.348*** (0.072)		−0.2231*** (0.079)	−0.797*** (0.185)	−0.230*** (0.072)		−0.121 (0.010)
Health	1.240*** (0.425)	−0.074 (0.282)		−0.054 (0.570)	0.999** (0.483)	−0.054 (0.278)		−0.257 (0.591)
rMEQ	1.898*** (0.651)	0.361 (0.422)		0.265 (0.594)	1.520** (0.672)	0.371 (0.345)		0.320 (0.637)
$rMEQ^2$	−0.065*** (0.019)	−0.012 (0.014)		−0.014 (0.023)	−0.052*** (0.018)	−0.012 (0.011)		−0.015 (0.024)
Sleep hours					−0.047 (0.408)	−0.487* (0.279)		−1.723** (0.680)
Constant	−9.295 (7.321)	3.382 (2.939)		−3.232 (3.316)	0.713 (4.341)	4.917 (3.049)		1.130 (4.574)
No. of obs						153		
Pseudo R^2		0.2060				0.1977		
pseudo-log-likelihood		−133.4**				−134.8***		

Publication II

Ruubel, R. and Hazak, A., 2018. Disparities in Knowledge Employees' Actual Contractual and Desired Working Schedules. *Knowledge Management: An International Journal*, 18 (1), 17−30. DOI: 10.18848/2327-7998/CGP/v18i01/17-30

Disparities in Knowledge Employees' Actual, Contractual, and Desired Working Schedules

Raul Ruubel,[1] Tallinn University of Technology, Estonia
Aaro Hazak, Tallinn University of Technology, Estonia

Abstract: Our study on a sample of Estonian creative knowledge employees indicates considerable disparities between their actual, contractually agreed, and desired amounts of working time. Nearly two thirds of the employees studied exhibited a mismatch between their desired and contractual working schedules, reflecting the constraints that employment contracts set on preferred working time. Our study results reveal that even if the employees had access to flexible working time options, a majority of them still followed roughly the standard nine-to-five working schedule even though their desired timing of work may have been different. This may be driven by various social norms and family commitments that warrant further study. The actual duration of the working day is longer than contractually agreed for 90 percent of the employees studied, which may pose health risks to employees. Our ordinary least squares (OLS) regression estimates show that the more educated the employee is, the less overtime work they did, while the higher their salary level, the more hours of overtime the employee did. The OLS regression estimates for the time difference between the actual start and the contractual start of the working day show that women tended to start their working day later and men earlier than officially required. Interestingly, the larger the family the employee had, the more the actual start time of work shifted to being earlier than contractually required. The older the employee, the later the start of their working day was from the official schedule. Our study highlights potentially large inefficiencies in industrial relations and in the use of the potential of employees in creative knowledge work that may have considerable adverse effects on the financial results of companies and on socio-economic development in general.

Keywords: Working Schedules, Preferences, Mismatch, R&D Jobs, Estonia

Introduction

Differences between actual and desired working schedules may indicate inefficiencies in the labour market, as unfavourable working arrangements may constrain employment and result in wages being suboptimal, both of which have adverse effects on the financial performance and competitive advantages of companies. Moreover, the intellectual capacity of knowledge employees may be used less effectively if there is a mismatch between actual and desired working time as the employees might not be able to contribute as much as they potentially could. However, the costs for the employer may remain the same or may even be higher than they would if the employees were allowed to choose their working schedules freely.

Actual working schedules differing from contractual ones may put the health of knowledge employees at risk if they have to work considerably more than contractually agreed or than is stipulated in statutory employment regulations, or it may result in legal risks if the actual working schedules remain different from the officially agreed ones. It is therefore important to understand how significant the differences between actual, contractually agreed, and desired working hours are, and the types of employee most likely to feel these disparities. This would be useful for rethinking the contractual terms of employment so that employees could work at the times they preferred, from which their employers may gain in their financial and operational results. Moreover, knowing the differences between the actual and desired working schedules may help in the design of further studies on the economic and financial efficiency of working arrangements and could initiate a public discussion about the underlying social norms and other institutional issues that should perhaps be reconsidered, such as attitudes and regulations surrounding the timing, place, and broader organisation of work.

[1] Corresponding Author: Raul Ruubel, Akadeemia tee 3, Department of Economics and Finance, Tallinn University of Technology, Tallinn, 12611, Estonia. email: raul.ruubel@ttu.ee

Knowledge Management: An International Journal
Volume 18, Issue 1-2, 2018, http://organization-studies.com

ISSN: 2327-7998 (Print) 2327-9249 (Online)
http://doi.org/10.18848/2327-7998/CGP/v18i01/17-30 (Article)

COMMON GROUND

Our study of Estonian employees working in creative research and development (R&D) aims to shed light on the drivers of their actual, contractual, and desired working hours, and the extent of disparities between those sets of hours. Creative knowledge work is a specific area of activity where rigid working schedules may be much less necessary than in some other jobs. Although there has been a clear change in the nature of work away from manual and routine work and towards more creative and intellectual work in increasingly knowledge-based advanced economies, changes to work arrangements may not have kept pace with the intensification of knowledge. This makes the study of the discrepancies between the actual, desired, and contractually agreed organisation of work in knowledge jobs a particularly interesting and relevant topic. Moreover, knowledge-intensive work and innovation is critical for economic development and the efficiency of it may be crucial for companies to achieve competitive advantages and improve their financial results in a globally competitive market.

For a theoretical framework, Tan (2018) argues that more freedom at work leads to better work results from knowledge employees given that the more flexible the working arrangements are and the less control there is over the employee, the larger the informational asymmetry is between the employer and the knowledge employee about the innovative work. The theoretical argumentation by Tan (2018) suggests that the informational asymmetry is in the interest of the employer because it means the outcomes of the innovative work have to be shared more fairly between the employer and the employee, and so flexible work arrangements have an important role in encouraging the employee to innovate.

This pilot study is based on a relatively small sample of employees from a specific industry and a specific country, and so the results cannot be broadly generalised. However, this exploratory empirical study is needed to understand better whether the disparities in the actual, contractual, and desired working schedules of knowledge employees are significant, and which of these discrepancies would warrant further study.

Literature

Numerous studies have shown that employees are not usually able to choose their desired working hours, and quite a substantial number of employees have a mismatch between their preferences and their actual working time. This contradicts the neoclassical theory of labour supply, which assumes that employees are free to choose their working hours. Böheim and Taylor (2004) find, for instance, that some 40 percent of full-time British employees would prefer to work fewer hours than they actually do. Barnay (2016) concludes that 29 percent of European employees would like to work less than they do, which is a significant proportion given that several studies (e.g. Bell, Otterbach, and Sousa-Poza 2012; Moen et al. 2011; Hazak et al. forthcoming) have found that unwanted long hours are likely to have an adverse impact on perceived health and wellbeing, because of increased emotional stress, tiredness, and sleepiness, and that they lead to lower levels of job satisfaction (e.g. Green and Tsitsianis 2005; Hazak et al. 2016). Studying a much broader set of work arrangements than the time aspects in the European working conditions survey, Barnay (2016) further stresses that having appropriate working conditions plays a protective role for the physical and emotional health of the employee, while working more than desired has a harmful impact on health; he concludes that existing studies already encourage employers to consider the preferences of employees more when setting working hours.

Van Wanrooy (2013) finds that Australian employees tend to prefer a standard forty-hour working week, but over the past few decades the hours of full-time Australian employees have been increasing steadily. Her findings suggest that on average men prefer to work around forty hours a week and women twenty-eight to thirty, and that various demographic and work factors such as age, the current actual number of hours worked, and the share of paid work in the household contribute further to the mismatch with desired working hours. Kossek, Barber, and Winters (1999) study the use of flexible working schedules and find that women and younger

employees are more likely to take advantage of them. Similarly, Sharpe, Hermsen, and Billings (2002) find younger employees, those who are more educated, and those with young children to be more likely to use flexible schedules, while Virkebau and Hazak (2017) find the impact to be the opposite for employees with children in the family below school-age, where the daily routine of family life may create a demand for fixed schedules whatever the creative needs of the work. Hazak, Ruubel, and Virkebau (forthcoming) find in a study using data from the same survey of Estonian R&D employees that only one quarter of employees favoured a standard five-day working week, while more than half would prefer a working week concentrated in three or four days, with the differences in preferences explained by gender, education, health, sleeping hours, whether the employee is of morning type or evening type as their inherent circadian rhythms leave them more alert in the morning or in the evening, and the desired share of time spent on creative work.

Bryan (2007) uses matched employer-employee data and finds that weekly working hours in the United Kingdom depend mainly on the employer and that switching employer to gain more suitable working hours appears to be a common tactic for employees. He also finds some support for the use of within-firm flexibility, or job-switching within a firm. The results of Bryan (2007) indicate that both skills and family characteristics have a strong impact on working hours. Sousa-Poza and Henneberger (2000) find that men tend to prefer longer working hours than women do, while older men want fewer working hours than younger men do. In addition, women with higher levels of education and employees with better job security and higher incomes tend to prefer to work less than they actually do. Another perspective on the discrepancies between actual hours working and desired hours is given by Väisänen and Nätti (2002), who observe a mismatch between actual and preferred household working time in the European Union countries and Norway, where dual-earner households were on average overworked rather than underworked and were willing to reduce their working time by an average of twelve hours a week. They find that preferences for working hours can be explained by caring responsibilities, education, and the regulatory context in each country.

Van Echtelt et al. (2006) focus on the gap between actual and preferred working hours in Dutch companies, finding limited support for the hypothesis that over-employment is caused by restrictions imposed by the employer, while demonstrating that more flexibility in the labour market and a broader set of institutional factors, combined with job design and organisational incentives, can impact the way individuals make their decisions about working time. They suggest that greater job autonomy makes it more likely that working time decisions will be based on the need to complete specific tasks or projects, with the employee consequently working more hours than they would prefer to.

Van Emmerik and Sanders (2005) find that a mismatch in working hours is associated with affective job commitment, where the impacts are different for those who prefer to work less and those who prefer to work more. Employees who favour working fewer hours showed less affective commitment, while employees who work more hours than they would prefer to appeared to become more committed. While the reasons for that finding warrant further study, the finding itself provides an additional insight into the complex linkages between individual preferences for working hours and the attitude toward work. Otterbach (2010) finds support for the mismatch in working hours in his study of twenty-one countries, showing that more than a third of the employees studied faced working time constraints, and that these constraints have increased over recent decades. He finds that the differences between countries are interrelated with key macroeconomic variables such as the unemployment rate, GDP per capita, average weekly hours of work, and income inequality, showing that in countries with high unemployment rates, relatively more employees prefer to have additional working hours and earnings, while in only a few wealthy countries are there large shares of employees who would like to work longer and earn more. The results of Otterbach (2010) further suggest that the desire to work more or fewer hours is strongly related to income considerations and the expected employment situation.

Knowledge work in the area of research and development (R&D), on which our study is focused, is a specific case given that high knowledge intensity in a business may be accompanied by increased credit constraints and difficulties in getting financing because of the high risks involved and the poor ability of the companies to provide collateral for the financing that is needed for R&D investment (Männasoo and Meriküll 2014). Difficulties in getting external financing may lead to low leverage and constraints on investment, and the reduced intensity of investment may in turn have adverse consequences for how productively the intellectual capital and labour can be utilised and for the overall financial performance of the company (see Kotšina and Hazak 2012; Hazak 2008; Männasoo, Maripuu, and Hazak 2018; Avarmaa, Hazak, and Männasoo 2014; among others). In parallel to these features, knowledge work is heavily reliant on the ability of the employee to produce creative outcomes. Creative knowledge jobs may therefore require employers to pay extra attention to providing favourable work arrangements for their employees as the entire business and its financial performance are heavily reliant on how efficiently the intellectual capital of the employees is used (see Coenen and Wok 2014; Kelliher and Anderson 2008; Nätti et al. 2012).

While several studies have focused on the mismatch between actual and desired hours, to the best of our knowledge, no studies have focused on the difference between actual and contractual working hours, which is addressed in this study. We put more focus on the mismatch between the actual and desired start and end times of the working day than previous studies on the mismatch in working hours have.

Data and Methodology

This study draws on our original repeated survey among creative R&D employees in Estonia, conducted in two waves in 2015 and 2016. Out of all those reported as R&D employees in Estonia in the Statistics Estonia dataset, our focus is on the category of "researchers" so we can capture knowledge employees whose work is creative in nature. From 2010 to 2014, the number of full-time-equivalent creative R&D employees classed as "researchers" in Estonia ranged between 4,100 and 4,600 according to the Statistics Estonia data. In compiling our study sample, we have disregarded those creative R&D employees who were working in higher education and healthcare because their working arrangements with fixed times for lectures and medical procedures may be substantially different from those in other creative R&D jobs. Furthermore, employees working at microenterprises and research institutes with fewer than fifteen creative R&D employees were also excluded. As a result of these exclusions, the population of knowledge employees of interest for our study totalled approximately 1,000, and our final survey sample of 153 employees represents about 15 percent of that population, which is a normal sample size for a voluntary full population survey. The sample can be smaller for some of the analysis presented in this article however, depending on the number of employees who provided answers to the specific questions addressed in this study, such as the contractual, desired, and actual start and end times of their working days and the duration of their actual working day.

There may be some selection bias in the decision by a respondent to complete the survey or not to complete it, and further selection biases may arise since employees could participate in the survey only if their employer agreed to take part in the project. We address these selection issues by weighting the sample to align it with the characteristics of the target population for the respondent's gender and the employer's sector of business. As the Statistics Estonia dataset shows the distribution of the employers by their area of business and the gender split of the employees in the total population of interest of around 1,000 employees, we have assigned a weight to each observation in our final sample to reflect the gender and the area of business of the observation. As a consequence the distribution of the areas of business of the employers and the gender distribution of employees in the weighted sample matches the population of interest. Another measure we use to address the employer-driven selection issues is clustering of standard errors by employers in the regression models.

We use the following dependent variables in the two regression models presented in this article: (1) the difference between the contractual and actual duration of a working day (*duration_dif*), and (2) the difference between the contractual and actual start times of the working day (*start_dif*). The subsamples for the analysis of the differences between the actual, contractual, and desired end times of the working day, and the desired and actual and desired and contractual start times of the working day were too small for meaningful regression analysis to be conducted, but we present some findings based on descriptive statistical analysis in the Results and Discussion section for those.

Independent variables were selected in view of the earlier literature. Age, gender, number of family members, and years of education are important socio-demographic characteristics, and the health factor reflects the general health of the employee (see Table 1 for details of the composition of the health factor). The score of the Reduced Morningness-Eveningness Questionnaire by Adan and Almirall (1991), which has been extensively used in medical research into sleep, shows the morningness-eveningness preference of the employee, and the average daily hours of sleep is another independent variable. The desired creative intensity of work, which is the share of their total working time that the employee wants to spend on creative work, and the salary level reflect aspects specific to the job.

The explanatory variables have been outlined in Table 1 with descriptive statistics of all the 153 employees studied; the ninety employees for whom the difference between the contractual and actual durations of the working day (*duration_dif*) was available, meaning those who have contractually agreed working hours; and the sixty-five employees for whom the difference between the contractual and actual start times of the working day (*start_dif*) could be studied, which is those who have contractually agreed working hours and a regular actual starting time for daily work. We note the limitations of the study that arise from the relatively small sample size.

To identify simultaneously the significance and magnitude of the explanatory variables of interest and the other control variables for the extent of the difference between the contractual and actual durations of the working day *(duration_dif*) and the difference between the contractual and actual start times of the working day (*start_dif*), we use an ordinary least squares (OLS) regression for the two dependent variables *duration_dif* and *start_dif* for the econometric analysis. For the other aspects of the disparities between the actual, contractual, and desired working schedules, descriptive statistical analysis has been used given the small subsample sizes.

Table 1: Explanatory Variables and Description of the Subjects
(Mean and Standard Deviation Shown for Continuous and Ordered Variables;
Percentage of Respondents Shown for Binary and Categorical Variables)

Variable	*Description*	***All*** *Mean/% (Std. Dev.)*	***duration_dif*** *Mean/% (Std. Dev.)*	***start_dif*** *Mean/% (Std. Dev.)*
	N	153	90	65
age	Age in years	38.76 (11.51)	38.46 (10.96)	38.09 (10.87)
gender	Male (= 1) vs. female (= 0); the figures in the cells to the left show the percentage of males	56.9%	52.2%	38.1%
family	Employee reported number of people living together with the employee	1.66 (1.46)	1.76 (1.42)	1.85 (1.55)
education (years)	Years of education starting from primary education	16.58 (2.66)	16.18 (2.37)	15.74 (2.35)
fhealth (factor)	General health condition factor with overall Kaiser-Meyer-Olkin measure of sampling adequacy of the factor 0.6; comprising (1) "Do you have high blood pressure or have you ever used medicine for high blood pressure?" (yes=1); (2) "Do you suffer or have you suffered from diseases that significantly affect your mental fatigue?" (5-level Likert type scale, "Never"=1, "Often"=5); (3) "Does any disease or injury interrupt you while doing your daily work?" (5-level Likert type scale, "No obstacles"=1, "Not able to work"=5); (4) "How many working days have you been absent from work due to disease or medical examination in the past 12 months?"(5-level scale, "None" = 1, "100-365 days" = 5); (5) Body-Mass Index (continuous)	0.00 (0.81)	-0.01 (0.82)	-0.01 (0.76)
meq	rMEQ score, 1…25 scale ranging from "Definitely an evening type" to "Definitely a morning type"	14.73 (3.53)	14.64 (3.39)	15.02 (3.35)
sleephours	Employee reported average sleeping hours per day on the scale:			
	"Less than 6 hours" (base)	7%	4%	5%
	"6–7 hours" (= 2)	50%	54%	55%
	"7–8 hours" (= 3)	38%	37%	34%
	"8–9 hours" (= 4)	6%	4%	6%
	"more than 9 hours" (= 5)	0%	0%	0%
creatime	Employee desired share of creative work in total working time of the employee (%)	52.71 (21.43)	49.22 (21.15)	46.69 (20.90)
salary	Employee reported monthly gross salary on the scale:			
	"Below 1000 euros" (=1, base)	7%	4%	3%
	"1000 - 2000 euros" (=2)	58%	54%	52%
	"2000 - 3000 euros" (=3)	23%	37%	32%
	"3000 - 5000 euros" (=4)	11%	4%	11%
	"above 5000 euros" (=5)	1%	0%	2%

Source: Authors 2018

Results and Discussion

First, we present the distributional patterns of the actual, contractually agreed and desired start and end times of working days in the histograms in Figure 1. The rightmost panels on the desired start and end time of the working day reflect only those participants in the survey who would like to have a fixed start and end time for their working day and does not include the 57 percent of sample members who prefer to have irregular working hours. The left and middle panels of Figure 1 on the actual and contractual start and end times of the working day, however, include those employees who prefer flexible schedules. When interpreting the rightmost histograms it should therefore be noted that those who expressed a desired start or end time for their working day and whose preferences are depicted on the figure are a specific type of employee separate from those who would like to start or end their work at different times on different days and whose preferences are not reflected in the figure.

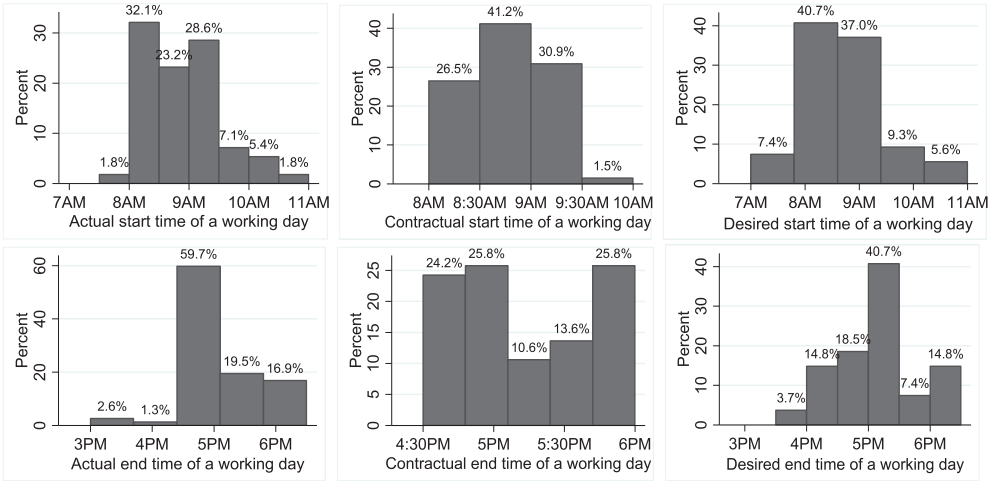

Figure 1: Distribution of Actual, Contractual and Desired Start, and End Times of the Working Day
Source: Authors 2018

It appears that in our subsample, the contractual start and end times of the working day are overall in line with the traditional standard hours, while the actual and desired start and end times have a broader variance. Overall, a majority of creative R&D employees in our subsample end their working day near the traditional time of 5 p.m., whereas the contractual end time of the working day is more evenly distributed between 4:30 p.m. and 6 p.m. As 70 percent of the employees in our subsample finish their working day at the contractually agreed time, and the mismatch is not significant for those who experience one, the mismatch between the contractual and actual end times of the working day does not in general appear to be an issue of major concern for our quite small study sample. However, studies on a larger sample would be needed to provide further evidence for this. Disparities between the contractual and actual start times of the working day seem to be more evident, as 40 percent the respondents exhibit a deviation between the actual start time and the contractually agreed one and, as illustrated in Figure 1, many of these deviations are large. The results of the regression analysis presented below seek to explain what type of employee experiences these disparities and to what extent.

The differences between the desired and actual start times of the working day in our subsample show that 19 percent of the employees who would like to have a fixed start for a working day would prefer to start earlier than they actually do, while 39 percent of the respondents would prefer to start their working day later than they do. For the end time of the

working day, 35 percent of those who would like to have a fixed end time for the working day would want to end earlier than they actually do and 13 percent later, indicating that for some of the employees the working day they desire may be shorter than their actual working day, which is line with previous literature (e.g. Böheim and Taylor 2004; Barnay 2016). The large and heterogeneous mismatch between the desired and actual start and end times of the working day is therefore an issue that warrants further study on larger samples from different industries and countries using sophisticated econometric analysis.

Interesting results appear when the start and end times of the working day are studied for those employees who have the option of flexitime. A majority of the knowledge employees in our sample who can choose a flexible working schedule still follow schedules that are quite similar to the standard nine-to-five routine, although the timing they desire for their work may be different. Among the employees who have the option of flexitime, 57 percent start their working day between 8 a.m. and 9 a.m., and 41 percent finish their working day between 4:30 p.m. and 5:30 p.m. Moreover, 38 percent of the employees with flexitime start between 8 a.m. and 9 a.m. and end between 4:30 p.m. and 5:30 p.m. Various social norms and family commitments may explain this behaviour, but it warrants further study. Past research (e.g. Sharpe, Hermsen, and Billings 2002; Van Echtelt et al. 2006) suggests the reasons may lie in the fixed daily routines of children, spouses or other family members, social norms for what are normal working hours, and conventional fixed daily mealtimes, sleep times and other routines. Though these possible reasons remain purely hypothetical in this article, the study of them remains an interesting and promising avenue for future research.

Among the employees in our subsample, 93 percent had a mismatch between the actual and contractual durations of their working day, indicating that contractual working schedules do not reflect the reality, whether the difference is due to the employee or the employer. Moreover, for 90 percent of the employees studied, the actual working day lasted longer than the contractual day, which may pose health risks to knowledge employees and lead to them having a lower level of job satisfaction (e.g. Bell, Otterbach and Sousa-Poza 2012; Moen et al. 2011; Green and Tsitsianis 2005). The regression analysis presented below aims to identify what type of employee experiences the mismatch between the actual and contractually agreed durations of the working day and to what extent.

Analysis of the disparities between the desired and contractually agreed start and end times of the working day shows almost two thirds of the employees in our subsample experienced a mismatch. This reflects how the contractual arrangement of working hours may constrain the use of desired work schedules not only for those who would like to have flexible schedules but also for those who prefer to have a fixed component in their working day schedule as well. This potentially serious inefficiency in contractual working arrangements in creative knowledge work warrants further study on larger samples.

Next, we will move to the regression models to investigate what type of employee exhibits some of the more serious mismatches in working hours discussed above. Table 2 outlines the OLS estimates of the difference between the actual and contractual durations of the working day (Models 1 and 2), and the difference between the contractual and actual start times of the working day (Models 3 and 4). The difference between the specifications of Models 1 and 2 and 3 and 4 lies in whether average sleeping hours are included among the explanatory variables or not, given that there may be a potential reverse causality if employees who work more extended hours have fewer sleeping hours. However, both specifications of both of the models have similar results. The R-squared ranging between 0.2 and 0.4 in these models suggests the working hours mismatch is driven not only by the variables incorporated in the model but also by various other individual and possibly behavioural factors and employer related factors that could derive from organisation culture and the work environment.

Table 2: OLS Estimates of *duration_dif* and *start_dif*

	Model 1	Model 2	Model 3	Model 4
Explanatory Variable	*duration_dif*	*duration_dif*	*start_dif*	*start_dif*
creatime	0.005	0.003	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
age	-0.004	-0.004	-0.014***	-0.014***
	(0.01)	(0.01)	(0.00)	(0.00)
gender (Male=1)	0.153	0.258	0.406***	0.413**
	(0.17)	(0.18)	(0.12)	(0.12)
family	0.025	0.034	0.082*	0.083*
	(0.10)	(0.10)	(0.04)	(0.04)
educationy	0.072*	0.087*	0.012	0.015
	(0.04)	(0.04)	(0.02)	(0.02)
fhealth (factor)	0.060	0.088	-0.055	-0.042
	(0.10)	(0.08)	(0.09)	(0.09)
meq	-0.028	-0.002	0.021	0.027
	(0.03)	(0.03)	(0.02)	(0.02)
sleep	0.341**		0.068	
	(0.11)		(0.05)	
salary	-0.316**	-0.301**	-0.027	-0.026
	(0.12)	(0.12)	(0.02)	(0.02)
constant	-2.274**	-2.102*	-0.517	-0.481
	(0.96)	(1.10)	(0.35)	(0.34)
R^2	0.231	0.183	0.365	0.357
F-test	***	*	**	***
N	90	90	65	65

Notes: * p < 0.10, ** p < 0.05, *** p < 0.01
Source: Authors 2018

The findings from Models 1 and 2 indicate that the more educated the employee is, the smaller is the gap between the durations of the contractual and actual working days (see Figure 2), and the less overtime work the employee does, although the variance is quite small. This may be because the more educated employees are better placed in the labour market and thus have better bargaining power and higher job security, in line with Otterbach (2010), who finds that concerns about losing a job explain the mismatches between actual and desired work hours. Furthermore, when employees are judged and rewarded by the satisfactory completion of tasks and projects, as outlined by Van Echtelt et al. (2006), the more educated employees may be more efficient at performing their tasks and therefore have less need to work overtime. The positive relationship between education and work outcome in the same sample of Estonian creative R&D employees is demonstrated by Hazak, Männasoo, and Virkebau (2017).

The regression estimates from Models 1 and 2 show that the higher the salary level is, the more overtime work the employee does, although the variance is not large as shown in Figure 2. This indicates that a higher salary may increase job commitment, at least in terms of time, and

may motivate the employees to sacrifice their leisure time for the benefit of their employer (see van Emmerik and Sanders 2005).

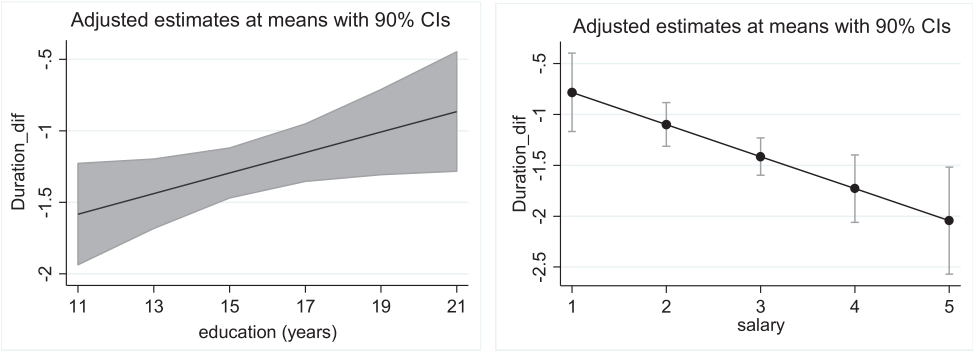

Figure 2: Difference in hours between the actual and contractual durations of the working day at different education and salary levels (with 90% confidence intervals, other variables at means)
Source: Authors 2018

We find a positive and significant relationship between sleep hours and the difference between actual and contractual working hours, meaning those who sleep less tend to do more overtime work. However there may be a reverse causality in that relationship, so the more hours the employees work, the less time they have for sleep.

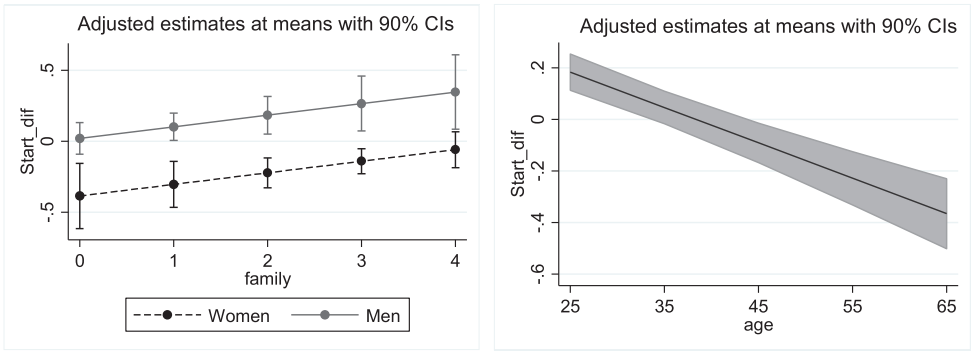

Figure 3: Difference between actual and contractual working day start times with different numbers of family members for men and women and age (with 90% confidence intervals, other variables at means)
Source: Authors 2018

Figure 3 outlines the difference in hours between the actual and contractual start times of the working day with different numbers of family members for men and women, and for various ages of the employee. We find that women tend to start their working day later than contractually agreed, while men start their working day on average earlier than the contractual time. Moreover, the more family members the employee has, the more the actual start time of the working day shifts earlier from the contractual time, although the shift is quite small. It could be that family obligations drive that shift as well as gender differences. It is also worth mentioning that findings for how young children impact the use of flexitime have been mixed in the previous literature (e.g. Virkebau and Hazak 2017; Sharpe, Hermsen, and Billings 2002), which indicates that the decision to use flexitime or not may be driven by the match between work schedules and family time, with family time impacting the actual start time of the working day.

Both Model 3, where sleeping hours is included as an explanatory variable, and Model 4, where sleeping hours is excluded, reveal that the older the employee is, the later the start of their working day is from the contractually agreed start time. This may indicate that younger

employees abide by official work schedules more strictly because they have been in the labour market for fewer years and could therefore have less negotiating power and be more diligent. As older employees have previously been found to prefer to have fewer working hours (e.g. van Wanrooy 2013; Sousa-Poza and Henneberger 2000), starting the working day later than contractually agreed may be a way for them to reduce the actual duration of the working day a little. However, when interpreting the results, the small sample size of our study should be noted.

The results of this exploratory pilot study may be useful for employers of creative knowledge employees in designing not only contractual work arrangements but also in reconsidering various norms and behaviours in their organisations that could help to address the discrepancies between the desired, actual and contractually required working hours. The significant differences identified in this study between the actual and desired working schedules reveal labour market inefficiencies that may pose constraints on employment options for employees with different working time preferences. Another potential result is that wages may be suboptimal, meaning that employees may desire extra compensation for their working hours not being aligned with their preferences, while their work contribution may be no higher than if they could work at the desired time and could be even lower. Suboptimal wages would in turn have clearly negative implications for financial results and for competitiveness.

The large mismatch between the actual and contractually agreed durations of the working day and in its start time may result in legal risks for the employees as well as for the employers. Moreover, the large amount of overtime work may lead to health risks for knowledge employees. Rethinking the contractual arrangements of knowledge work would be necessary to ensure that creative employees, the nature of their work permitting, could work at their preferred times, which may help their employers to improve their operational and financial performance.

Conclusion

Our study on a sample of Estonian creative research and development employees indicated considerable disparities between their actual, contractual, and desired working schedules. A majority of the employees in the sample work more than contractually agreed, and it appears from the regression models presented in the article that education and salary levels help to explain which types of employee tend to be more exposed to these disparities. Although it remains outside the scope of our study, past research suggests that working a significant amount of overtime may result in health risks for creative knowledge employees, which may lead to adverse operational and financial consequences for their employers in the longer term. In line with the previous literature, we find that for a large part of the employees studied there was a difference between the actual start and end times of the working day and the desired times. Nearly two thirds of the employees studied have a mismatch between their contractually agreed start and end times and their desired times, indicating that the contractual arrangement of working hours may severely constrain the use of desired work schedules. Interestingly, a majority of the knowledge employees in our sample who have flexible working schedules still follow working schedules that are quite similar to the standard nine-to-five, although the timing they desire for their work may be different. Various social norms and family commitments may explain these discrepancies.

Regression estimates for the difference between the actual and contractual start times of the working day show women tend to start their working day later after the contractual start time than men do. The more family members the employee has, the more the actual start time of the working day shifted earlier than the contractual time, while the opposite relationship was found for age. However, when interpreting the results, it should be noted that the sample for our study is small and there may be some sample selection biases.

Rethinking contractual arrangements for knowledge work would be necessary to make sure that creative employees could work at the times they prefer if the nature of their work permits.

That may help not only to achieve improvements in the wellbeing of the employees, but also to enhance the operational and financial performance of their employers.

Acknowledgement

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 734712. The authors gratefully acknowledge support from grant PUT315 provided by the Estonian Research Council and support from the Doctoral School in Economics and Innovation, supported by the European Union, European Regional Development Fund (Tallinn University of Technology ASTRA project "TTÜ Development Program 2016–2022," project code: 2014-2020.4.01.16-0032). This research project was approved by the Tallinn Medical Research Ethics Committee on February 9, 2015, by decision No. 894.

REFERENCES

Adan, Ana, and Helena Almirall. 1991. "Horne & Östberg Morningness-Eveningness Questionnaire: A Reduced Scale." *Personality and Individual Differences* 12 (3): 241–53.

Avarmaa, Mari, Aaro Hazak, and Kadri Männasoo. 2013. "Does Leverage Affect Labour Productivity? A Comparative Study of Local and Multinational Companies of the Baltic Countries." *Journal of Business Economics and Management* 14 (2): 252–75.

Barnay, Thomas. 2016. "Health, Work and Working Conditions: A Review of the European Economic Literature." *The European Journal of Health Economics* 17 (6): 693–709.

Bell, David, Steffen Otterbach, and Alfonso Sousa-Poza. 2012. "Work Hours Constraints and Health." *Annals of Economics and Statistics*: 35–54.

Bryan, Mark L. 2007. "Workers, Workplaces and Working Hours." *British Journal of Industrial Relations* 45 (4): 735–59.

Böheim, René, and Taylor, Mark P. 2004. "Actual and Preferred Working Hours." *British Journal of Industrial Relations* 42 (1): 149–66.

Coenen, Marja, and Robert AW Kok. 2014. "Workplace Flexibility and New Product Development Performance: The Role of Telework and Flexible Work Schedules." *European Management Journal* 32(4): 564–76.

Green, Francis, and Nicholas Tsitsianis. 2005. "An Investigation of National Trends in Job Satisfaction in Britain And Germany." *British Journal of Industrial Relations* 43 (3): 401–29.

Hazak, Aaro. 2008. "Profit vs. Distributed Profit Based Taxation and Companies' Capital Structure." *International Journal of Entrepreneurship and Innovation Management* 8 (5): 524–41.

Hazak, Aaro, Erve Sõõru, Heili Hein, and Kadri Männasoo. Forthcoming. "Effects of Work Arrangements on the Sleep Regimen of Creative R&D Employees." *International Journal of Occupational Safety and Ergonomics*.

Hazak, Aaro, Kadri Männasoo, and Marko Virkebau. 2017. "Effects of Work Arrangements on Creative R&D Work Outcomes." *Eastern European Economics* 55 (6): 500–21.

Hazak, Aaro, Piia Tint, Marko Virkebau, Viive Pille, Viiu Tuulik, and Erve Sõõru. 2016. "Social Innovation Potential in Working Arrangements of R&D Employees: Repeated Employee Survey from Estonia." *2016 IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech)*, 210–13.

Hazak, Aaro, Raul Ruubel, and Marko Virkebau. Forthcoming. "When Would Creative R&D Employees Like to Work?" *International Journal of Organizational Analysis*.

Kelliher, Clare, and Deirdre Anderson. 2008. "For Better or for Worse? An Analysis of How Flexible Working Practices Influence Employees' Perceptions of Job Quality." *The International Journal of Human Resource Management* 19 (3): 419–31.

Kossek, Ellen Ernst, Alison E. Barber, and Deborah Winters. 1999. "Using Flexible Schedules in the Managerial World: The Power of Peers." *Human Resource Management* 38 (1): 33–46.

Kotšina, Svetlana, and Aaro Hazak. 2012. "Does Investment Intensity Impact Company Profitability? A Cross-Country Empirical Study." *2012 2nd International Conference on Economics, Trade and Development, IPEDR* 36: 157–61.

Moen, Phyllis, Erin L. Kelly, Eric Tranby, and Qinlei Huang. 2011. "Changing Work, Changing Health: Can Real Work-Time Flexibility Promote Health Behaviors and Well-Being?" *Journal of Health and Social Behavior* 52 (4): 404–29.

Männasoo, Kadri, and Jaanika Meriküll. 2014. "R&D, Credit Constraints, and Demand Fluctuations: Comparative Micro Evidence from Ten New EU Members." *Eastern European Economics* 52 (2): 49–64.

Männasoo, Kadri, Peeter Maripuu, and Aaro Hazak. 2018. "Investments, Credit, and Corporate Financial Distress: Evidence from Central and Eastern Europe." *Emerging Markets Finance and Trade* 54 (3): 677–89.

Nätti, Joukko, Timo Anttila, and Mia Tammelin. 2012. "Knowledge Work, Working Time, and Use of Time Among Finnish Dual-Earner Families: Does Knowledge Work Require The Marginalization of Private Life?" *Journal of Family Issues* 33 (3): 295–315.

Otterbach, Steffen. 2010. "Mismatches between Actual and Preferred Work Time: Empirical Evidence of Hours Constraints in 21 Countries." *Journal of Consumer Policy* 33 (2): 143–61.

Sharpe, Deanna L., Joan M. Hermsen, and Jodi Billings. 2002. "Factors Associated with Having Flextime: A Focus on Married Workers." *Journal of Family and Economic Issues* 23 (1): 51–72.

Sousa-Poza, Alfonso, and Fred Henneberger. 2000. "Work Attitudes, Work Conditions and Hours Constraints: An Explorative, Cross-national Analysis." *Labour* 14 (3): 351–72.

Tan, Teck Yong. 2018. "Contracting with Strategic Ignorance and the Ratchet Effect of Innovation" *Working Paper*. http://www.teckyongtan.site/.

Van Echtelt, Patricia E., Arie C. Glebbeek, and Siegwart M. Lindenberg. 2006. "The New Lumpiness of Work: Explaining the Mismatch between Actual and Preferred Working Hours." *Work, Employment and Society* 20 (3): 493–512.

Van Emmerik, I. J., and Karin Sanders. 2005 "Mismatch in Working Hours and Affective Commitment: Differential Relationships for Distinct Employees Groups." *Journal of Managerial Psychology* 20 (8): 712–26.

van Wanrooy, Brigid. 2007. "A Desire for 9 to 5: Australians' Preference for a Standard Working Week." *Labour & Industry: A Journal of the Social and Economic Relations of Work* 17 (3): 71–95.

Virkebau, Marko, and Aaro Hazak. 2017. "What Type of Research and Development Employees Use Flextime?." *The International Journal of Organizational Diversity* 17 (2): 1–9.

Väisänen, Mia, and Jouko Nätti. 2002. "Working Time Preferences in Dual-Earning Households." *European Societies* 4 (3): 307–29.

ABOUT THE AUTHORS

Raul Ruubel: PhD Student, Department of Economics and Finance, Tallinn University of Technology, Tallinn, Estonia

Aaro Hazak: Professor, Department of Economics and Finance, Tallinn University of Technology, Tallinn, Estonia

Publication III

Ruubel, R., 2020. Time dimensions of job autonomy in Estonian R&D institutions. *Journal of the Knowledge Economy*. DOI: 10.1007/s13132-020-00633-5

Journal of the Knowledge Economy
https://doi.org/10.1007/s13132-020-00633-5

Time Dimensions of Job Autonomy in Estonian R&D Institutions

Raul Ruubel[1]

Received: 17 June 2018 / Accepted: 6 January 2020/ Published online: 11 May 2020

Abstract

This paper seeks to identify what type of employees are more likely to be satisfied with flexible working time and what type with fixed time, and what drives some other time-related aspects of job autonomy. The paper uses multivariate ordered probit modelling on data from an original repeated survey of Estonian creative R&D employees. The results indicate that high creative intensity of work is a strong predictor of an R&D employee being satisfied with flexible rather than fixed working schedules. Women and employees with less creative and more administrative tasks perceive more constraints on the timing of their work due to jealousy of colleagues and they are more likely to feel that their creativity is adversely affected by their working time arrangements. Employees with flexibility in both the timing and place of doing their work are significantly less likely to perceive working time–related constraints on their creativity or jealousy of their colleagues as a restraint on their working time choices than are those with a fixed working time and place. The higher the salary level of the employee, the more likely they are to feel that the nature of their work constrains their working time choices. The study helps in understanding and alleviating restrictions on time-wise job autonomy that may have considerable adverse effects on how efficiently the intellectual capital of R&D employees is used.

Keywords Creative jobs · Flexibility · Job autonomy · Time use · Work arrangements

Introduction

Time has become an increasingly scarce resource in modern societies, where striving for more income has become a norm, and economies that cannot rely on cheap labour any more seek for ways to grow to meet the demands of their inhabitants for a better

✉ Raul Ruubel
raul.ruubel@taltech.ee

[1] Department of Economics and Finance, Tallinn University of Technology, Akadeemia tee 3, 12611 Tallinn, Estonia

life. Economic growth through increased labour productivity requires jobs with higher added value and development through increasing reliance on knowledge intensive jobs is often the key for progress in both advanced and emerging economies. Powell and Snellman (2004) highlight how heavily development in knowledge-based economies relies on intellectual capabilities rather than on physical inputs or natural resources, meaning that efficiency in creating and using the intellectual capital is crucial for growth. Clarke (2001) emphasises that while creation, transmission, and use of information and knowledge is important, the effectiveness in gathering and utilising knowledge is a critical determinant of success.

While increasing knowledge intensity has meant a significant change in the structure of economies and in the nature of work, social norms on how work ought to be organised has not always followed these socio-economic transformations. As different people have different expectations for when, how much, and how they would like to work, it is particularly important to arrange work so that the personal abilities of each employee are used efficiently and sufficient flexibility and autonomy is granted. This is not just a question of statutory and employer-level working time regulations, as the attitudes and potential jealousy of colleagues and other constraints on job autonomy may matter a lot for decisions on working time. The time arrangements of work have been studied from different angles, including analysis of benefits from the perspectives of both the employee and the employer (e.g. Kauffeld et al. 2004; Golden 2009). However, little attention has been paid to the question of what type of individual is more likely to be satisfied with flexible work time arrangements and what type with fixed working time, and what the drivers are of other constraints on the desired freedom in working time decisions.

This study aims to help to fill this gap in the literature by focusing on some time-related aspects of job autonomy that may contribute to more efficient use of human capital in knowledge work. The focus of the paper is creative R&D employees as the driving force in the process of knowledge intensification and innovation. As enhancing economic growth through innovation is one of the main challenges in modern economies and innovation largely depends on human capital, then improving the time freedom of employees and their satisfaction with their working time arrangements may contribute considerably to the more efficient use of the creative potential of R&D employees. The research questions addressed in this study are:

RQ1. What type of individuals and under which working arrangements are more likely to be satisfied with flexible and what type with fixed working time?
RQ2. Which individual and working time–related factors have an adverse effect on the creativity of the employee?
RQ3. Which working arrangements make what type of individuals more likely to feel that they are flexible to decide about the speed of their work?
RQ4. Which individual and work related factors contribute to the working day not starting and ending at the time preferred by the employee?

Theoretical and Empirical Background

As the creative and intellectual efforts of knowledge employees are among the main drivers of R&D outcomes, the proper motivation, engagement, and retention of R&D

employees is critical for successful product development and innovation (Chang and Choi 2007). For the right motivation package to be put in place and R&D employees retained so that advantage can be achieved in knowledge-based competition, it is important to have some insight into the factors that impact the performance of these employees and their attitude to work (Aryee and Leong 1991).

Referring to previous studies, Ahuja et al. (2002) point out that autonomy at work where employees are able to schedule their work independently and discretionally and determine the work procedures needed is considered to improve work performance. They show that job autonomy is negatively associated with exhaustion at work and positively with job satisfaction. Support for the argument that autonomy increases job satisfaction has also been found by e.g. Saragih (2015) and Viñas-Bardolet et al. (2018). Moreover, similarly to Shih et al. (2011), Ahuja et al. (2002) find that autonomy helps reduce the probability of an employee switching employer. One of the most common policies for increasing the autonomy of employees is the introduction of flexible working time arrangements, and this has become more common in recent years, with a large number of employers providing opportunities for flexible working time at least to some extent, and a wide range of employees keen to profit from these opportunities (De Menezes and Kelliher 2017). However, these opportunities are not offered on an equal and fair basis to all employees, with the probability of being given a flexible work schedule depending on individual characteristics such as education, race, and gender (Golden 2001). Golden (2009) outlines that the motivations for an employer to offer flexible schedules include among others enhancement of on-the-job performance, a boost to the labour effort, reduction in unscheduled absences, and improved retention of specific human capital, as well as easier recruitment of new employees without having to escalate monetary compensation. Kauffeld et al. (2004) also find that employees with flexible working time options tend to be more loyal towards the company's goals and have a lower degree of absenteeism and higher quality of work.

Goswami et al. (2007), referring to earlier literature, highlight that R&D professionals are likely to prefer autonomy and flexibility in their work. Mumford (2000), exploring the management of creative people, points out that promoting flexible work schedules, telecommunicating and self-defined work plans is likely to contribute to innovation as outcomes of creative efforts are uncertain and employees need time for exploring and experimenting with different options and streams of thought. Further, creative people are typically autonomous and motivated in general, and so allowing them discretion in time management should have positive effects on their work outcomes. Zampetakis et al. (2010), focusing on time management through activities to make the use of time more effective, which should facilitate productivity and relieve stress, find that daily and long-term planning, time management, and perceived control of time are all positively related to self-perceived creativity. Eaton (2003) finds in a study of employees of biopharmaceutical firms that having formal or informal work-family policies is related with higher productivity, and the association is stronger where these policies are seen by the employees to be usable. Furthermore, control over time, flexibility, and the pace of work are all important in predicting positive levels of commitment and productivity for all employees. Wenjing et al. (2013), like the present study, focus on knowledge employees and seek to identify factors which impact individual innovative performance and how job autonomy moderates creative personalities. Their results show the greater the autonomy, the better the employees' creative

performance. Wang and Cheng (2010) also find support for job autonomy having a positive impact on creativity, while Abbey and Dickson (1983) found the impact of job autonomy on the R&D outcomes to be insignificant. Considering the above, the following hypotheses in respect of working arrangements are suggested:

H1. Creative intensity of work is positively related to the employee being satisfied with flexible working schedules.
H2. Creative intensity of work is positively related to flexibility in setting speed of work and start and end time of workday.
H3. Rigid working conditions have an adverse impact on creativity.

Butler et al. (2009) find that greater levels of flexibility are associated with better health. Similar associations have been found in other studies, e.g. Janssen and Nachreiner (2004) and Moen et al. (2011). Moreover, several studies have highlighted the positive impact that flexible work schedules have in reducing work-family conflict (e.g. Hayman, 2009; Tausig and Fenwick, 2001). Anttila et al. (2005) analyse the experiment of shorter working hours in Finnish municipalities and find the experiment to have had a positive impact on reducing work-family conflict, with employees with children seeing more of an impact. Virkebau and Hazak (2017) find that there are two streams of reasons why R&D employees prefer flexible working time options, these being the expected positive effects on work outcomes, and the positive impact on social and family-related affairs. Similarly, Giannikis and Mikhail (2011) propose that employees are more likely to opt for a flexible working time option if it helps them achieve the work-life balance they desire. Although previous studies have found that women are less likely to have access to flexible working time options than men are (e.g. Golden 2001, 2008; Atkinson and Hall 2009), they take those options up more than men do (Giannikis and Mikhail 2011; Kossek et al. 1999). The decision to use the option of flexible working time is mainly driven by family responsibilities, which could explain these findings (Albion 2004; Sarbu 2014). Kossek et al. (1999) find that younger employees are more likely to use flexible working time, though it depends on whether team members have similar working schedules. Sharpe et al. (2002) also find support for the finding that younger employees are more likely to use flexible working time options, as are those with a higher level of education and employees with young children, as such employees see more positive effects of flexibility. In addition, Wenjing et al. (2013) find that the younger the employee and the higher their education, the better their innovative performance is. Considering the above, the following hypotheses are suggested:

H4. Age is negatively related to preference for flexible working conditions.
H5. Number of family members is positively related to preference for flexible working conditions.
H6. Women are more likely to feel that working time–related constraints impinge their creativity.
H7. Education is positively related to preference for flexible working conditions.

The changing environment means the culture of organizations is constantly shifting. Kalleberg (2001) highlights that social and economic changes emphasise the need for

organisations to have greater flexibility in their employment systems. Examples of potential external sources of pressure to providing more attractive working conditions may include changes in funding opportunities (see e.g. Avarmaa et al. 2013) or the institutional environment, like taxes (see e.g. Hazak 2009). However, such changes could trigger new challenges. Allvin (2004) argues that the diversity of working conditions, which is one of most prominent features of today's labour market, leads to a mixture of rules, placing employees in different conditions, sometimes even within the same place of work. This can cause social tension and stress, as an employee with flexible working conditions within an otherwise traditionally organised workplace could be a focus of attention and envy, while an employee who insists on sticking to traditional working conditions in an otherwise flexible workplace may, likewise, be a source of irritation. Further, Anttila et al. (2005) find based on an experiment conducted in Finnish municipalities that in a culture in which full-time work is seen as traditional, reduced working hours were found to cause feelings of guilt among some participants. Felstead et al. (2003) note that a number of managers and employees perceive telework as a potential threat to team integration, mainly because it weakens the ties between employees who enjoy the opportunity of teleworking and team members who remain in the place of work, which could generate resentment and lead to tensions. They stress that such resentments could be intensified by envy among on-site workers of the spatial and temporal discretion afforded to teleworking employees. Greer and Payne (2014) also point out that the lack of face-to-face communication and interdependency of teamwork are among the main challenges of teleworking. Giannikis and Mikhail (2011) propose that employees are less likely to opt for a flexible working time option if employees recognise there will be a negative impact on their career progress, relationships with colleagues and compensation. McNamara et al. (2012) also find that the perceived negative effect on career progress is the main reason employees do not opt for flexible working time and Almer et al. (2003) conclude that the attitude of colleagues is an important factor when people consider whether to opt for a flexible working arrangement. However, Albion (2004) suggests that the reasons for opting for flexible working time outweigh the perceived barriers to it.

To conclude, using human capital efficiently in knowledge work is a key determinant of success in today's knowledge-based economies, where creative employees are the main drivers of the innovation process. Previous studies suggest that, overall, job autonomy increases self-perceived creativity, and it also increases job satisfaction and reduces work exhaustion. The most common way of increasing job autonomy is to allow flexible working time options, including teleworking. Extant studies have highlighted several positive impacts that flexible working time options can have, such as enhancing on-the-job performance, reducing work stress, helping retain employees, increasing employee loyalty towards company goals, improving health, aiding employees' personal development and learning opportunities, and reducing conflict between work and family. However, the use of flexible working time options may also have downside such as envy from colleagues and constraints on team integration. These multifaceted linkages between individual characteristics, job specifics, job autonomy, working time arrangements, and work outcomes, together with the need for social innovation in work arrangements (Hazak et al. 2016), justify the need for the current study, which seeks to identify the type of employee that is more likely to be satisfied with flexible working time arrangement and the type that prefers fixed

arrangements, and what the drivers are of some other time-related aspects of job autonomy.

Data and Methodology

This study draws on an original repeated questionnaire survey among creative R&D employees in Estonia, conducted in two waves in spring-summer 2015 and winter 2016. The sample was formed from the latest available (2012) R&D data retrieved from Statistics Estonia. The study sample builds on the "researchers" category of the R&D employees, and "technicians" and "supporting staff" have been left out as the nature of their work may not be creative. Over 2010–2014, the number of creative R&D employees in Estonia has ranged between 4.1 and 4.6 thousand full time equivalent.

Creative R&D employees who were working in higher education and healthcare were disregarded when the study sample was compiled, as work schedules in such institutions significantly interfere with the job autonomy that this study considers. In addition, R&D employees working at micro-entities with less than 15 creative R&D employees were excluded because the context of job autonomy in such companies is substantially different from what it is in larger organisations. After these exclusions, the population of interest for this study totals approximately 1.0 thousand. That population represents 23 employers, both private companies and public research institutes, of which 11 employers agreed to participate in the study.

Further eliminations from the sample were made if the survey participants had provided inconsistent responses to certain control questions or if their engagement in creative R&D activities for their employer was not sufficiently high. The final sample of 146 employees whose responses to the survey were taken into account forms 15% of the total population of interest.

Mann–Whitney *U* tests (Mann and Whitney 1947) were performed on the variables for time-related job autonomy, in order to identify the statistical significance of the differences in the responses of the 34 recurring respondents. As the differences in their responses in the two waves were statistically insignificant, the data from both waves of the survey were pooled and which of the recurring participants' responses to use for the analysis was selected randomly.

Participation in the survey was voluntary and confidential for the employees. However, the creative R&D employees in the population could only be included in the sample if their employer agreed to participate in the study, leading to potential for selection bias at the employer level. Completing the survey might also have incurred some employee level selection bias among respondents. These biases are addressed through sample weights that bring the final sample into alignment with the characteristics of the population of interest in terms of the gender of the respondent and the business of the employer. Clustering of standard errors by employers or employer-gender interactions in the econometric models provides further ways of considering unobserved dependencies in clusters by the different employers.

The dependent variables in the regression models comprise various time-related aspects of job autonomy. These represent 5-level Likert type scale responses on the scale (1) "Not at all"; (2) "To a small extent"; (3) "Somewhat"; (4) "To a large extent"; and (5) "Totally" to the following survey questions: (1) "To what extent are you

satisfied with your current work time arrangement?" (dependent variable *content*); (2) "To what extent does your current working time arrangement have a negative effect on your creativity?" (*creaimpede*); (3) "To what extent can you decide yourself about the speed of work and the time for breaks when you are at work?" (*pace*); (4) "To what extent do restrictions arising from the nature of your work cause your working day not to start and end at the times that you would prefer?" (*worknature*); (5) "To what extent does discontent and potential jealousy from colleagues cause your working day not to start and end at the times that you would prefer?" (*colleagues*).

Figure 1 presents the distribution of the Likert type scale responses in the sample for each of the dependent variables. In the case of *content*, the split between employees who have flexible working time (*flextime* = 1) and those who have rigid working hours (*flextime* = 0) has been shown.

The explanatory variables have primarily been selected following the earlier literature and research hypotheses. Several explanatory variables reflect various aspects of the arrangement of work—the creative intensity of work, the availability of flexitime, the option of working from distance, average daily working hours, and the proportion of working hours worked at the place of work. Age, gender, number of family members, and level of education have been incorporated as measures of the key socio-demographic characteristics of the employee. The first principal component score of various health measures controls for the general health condition of the respondent while the sleep patterns of the employee are reflected through the score of the Reduced Morningness-Eveningness Questionnaire (*meq*) by Adan and Almirall (1991) and average daily sleeping hours. In addition, the salary level of the employee, area of business of the employer and the nature of the employment contract are included as independent variables. The explanatory variables have been outlined in Appendix Table 1 along with the sample description.

Since all the dependent variables constitute ordered discrete categories, ordered probit regression analysis was used for the estimations. Moreover, to account for the interrelations between the individual measures of time-related job autonomy, simultaneous multivariate ordered probit regression modelling of *creaimpede*, *pace*, *worknature*, and *colleagues* was used. The numeric results of the regression models

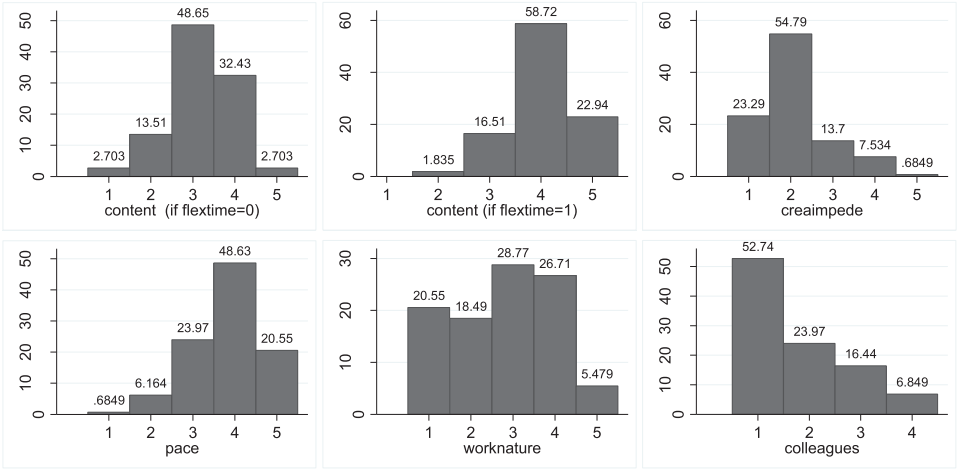

Fig. 1 Histograms of dependent variables

are presented in Appendices Table 2 (ordered probit models) and Table 3 (multivariate ordered probit model), and these are explained and discussed in the following section.

Results

The results of models 1 and 2 help to understand what type of employees are satisfied with fixed working time and what type of employees prefer flexible arrangements. The creative intensity of work appears a robust predictor of satisfaction with either fixed or flexible working time arrangements. The higher the share of creative tasks in total working time, the higher the probability that the employee is totally satisfied with flexible working schedules (right panel of Fig. 2) and the less likely it is that they prefer rigid working schedules (left panel of Fig. 2). Therefore, the proposed H1 is supported with the findings on this sample.

The option of teleworking is another key factor closely related to satisfaction with working time arrangements. Employees with flexible work schedules who can work from distance have a probability of 35% of being totally satisfied with their working time arrangements, while the probability is 8% for those who can use flexitime but cannot use teleworking, assuming other variables at their mean levels. Moreover, the actual use of the distance work option has a significant positive effect on how satisfied the employee is with their working time arrangements. The larger the share of total working time that the employee works at the place of work, the less content they are with their working time arrangements. This can be said of employees with flexible working schedules, while there are only four employees in the sample who have a distance work option but rigid working hours, which is not a surprise as distance work usually comes together with flexible schedules.

As regards individual characteristics, age is an important determinant of how satisfied employees are with fixed or flexible schedules. As illustrated in Fig. 3, the younger the employee is, the more likely they are to be totally satisfied with working time arrangements if they can use flexitime (right panel), while older employees tend to be more content with working time arrangements under fixed schedules (left panel). Consequently, H4 is supported with the findings in this sample.

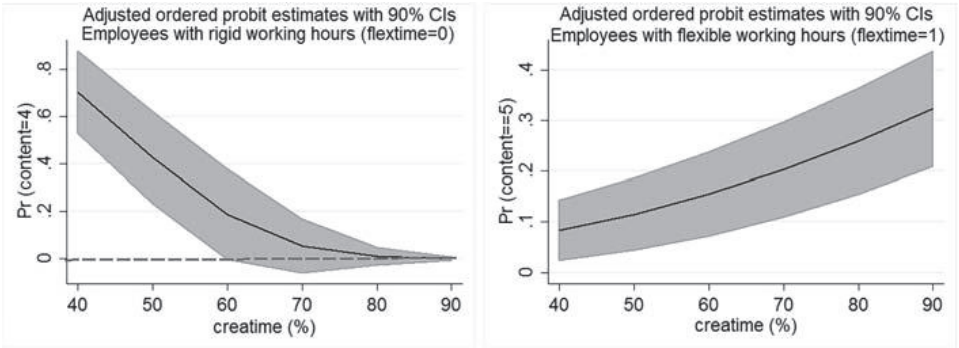

Fig. 2 Content with rigid (left) and flexible (right) working time under different levels of creative intensity of work

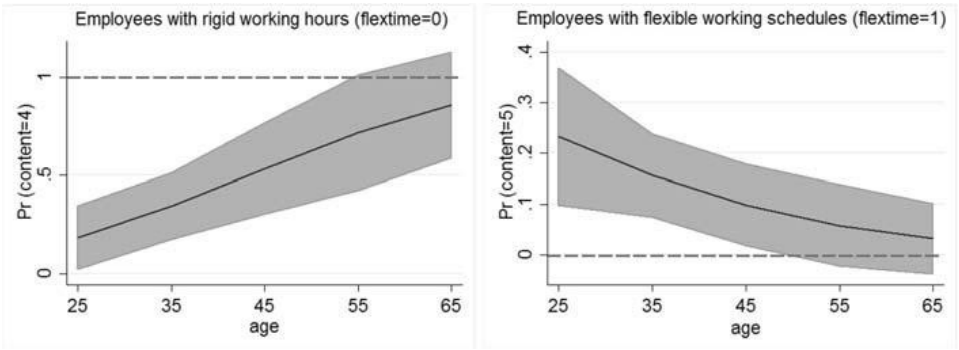

Fig. 3 Contentment with rigid (left) and flexible (right) working time for different ages of the employee (with 90% confidence intervals)

Gender is another individual characteristic that determines whether the creative R&D employee is satisfied with their working time arrangements, but gender does not appear to differentiate clearly the preference for rigid or flexible working hours. Overall, men appear more satisfied with their working arrangements than women, whether they have fixed or flexible schedules. Assuming other variables at their mean, male employees with flexitime have a probability of 17% of being totally satisfied with their working time arrangements, while the probability is 8% for female employees who can use flexible work schedules. Among those who work with rigid working hours, men are 30 percentage points more likely than women to be largely satisfied with their working time arrangements.

The results of model 2 indicate that among employees with flexible working time, morning type people are significantly more likely to be totally satisfied with their working time arrangement, as illustrated in the left panel of Fig. 4. The morningness-eveningness effect on satisfaction with working time arrangements is not visible among employees with fixed schedules though.

The results from model 1 indicate that when employees with higher education have fixed working time, they are more likely to be satisfied to a large extent with their working time arrangements than are employees with lower levels of education (see the right panel of Fig. 4). No statistically significant similar relationship appears for those working with flexitime. H7 is thus not supported with the findings. Similarly, no support is found for H5, as the relationship between the number of family members and satisfaction with flexible working schedule turned out to be statistically insignificant.

The study finds some weaker support for sectoral differences. Model 1 reveals that creative R&D employees in private R&D companies are more satisfied with their working arrangements under fixed schedules than are those working in public R&D entities. In a similar vein, model 2 shows that creative R&D employees in IT and technology companies are less satisfied with their working arrangements under flexible schedules than are the creative employees of public R&D institutes included in the sample.

For a robustness check, these models were alternatively estimated with either salary, sleep hours, or timeshare eliminated from the explanatory variables in the models, but this did not lead to any significant differences in the results. Equally, alternative ways of

Fig. 4 Content with flexible working time in morning and evening types (left panel) and content with rigid working time in employees with different years of education (right panel) (with 90% confidence intervals)

clustering standard errors were tested but the results remain qualitatively similar. These alternative modelling results are available upon request from the author.

The next set of results concerns perceived constraints on creativity deriving from working time arrangements. Flexible working arrangements have a significant effect on how severely employees feel working time–related constraints impinge on their creativity. The probability of an employee perceiving that their current working time arrangement has a somewhat negative effect on their creativity is 3% among those who have flexibility in both the time and the place that they work, but 8% for those who enjoy only flexitime, and 12% for employees without any flexibility in either their working time or their working place, provided other variables are at their means. Consequently, H3 is supported with the findings in this sample.

There are significant gender differences in how intensely employees perceive time-related limitations on their creativity. The likelihood of male employees perceiving that their working time arrangement has a somewhat negative effect on their creativity is 5% but for female employees it is 14%, assuming other variables are at their means. Thus, H6 is supported with the findings in this study.

As illustrated in Fig. 5, the higher the employee's level of education and the higher the creative intensity of their work, the lower is the likelihood that they will perceive working time–related constraints on their creativity. These effects are related to each other as employees who have spent more years in education are more likely to get or opt for positions with a higher creative intensity (Hazak et al. 2017).

As expected, employees whose working days are longer perceive constraints from working time arrangements on their creativity more intensely (rightmost panel in Fig. 5). There appear to be significant sectoral differences in this, with creative R&D employees in the private sector having a higher likelihood by 9 to 11 percentage points of perceiving some working time–related constraints on their creativity than their colleagues in public research institutes included in the sample.

Another dimension of job autonomy that the study results address is the extent to which the creative R&D employee can decide for themselves about the speed of work and the time for breaks. The availability of flexible working schedules and distance work options are among the key drivers of that measure of job autonomy as well. While employees with rigid working hours and a

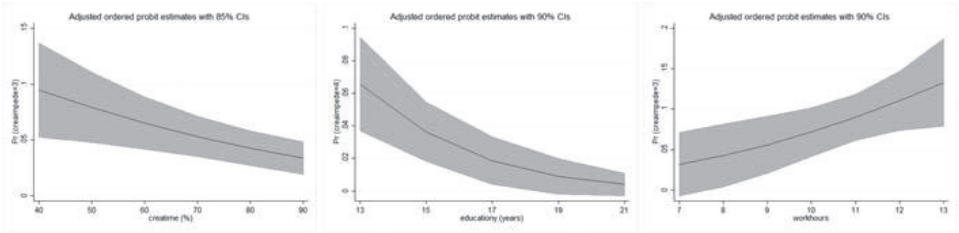

Fig. 5 Probabilities of an employee perceiving constraints on their creativity due to working time arrangements

fixed place of work have a probability of 12% of being totally in control of the pace of their work, the probability in those with flexible schedules but a fixed working place is 15% and in those with flexibility in both the time and place of work it is as high as 38%. This study finds some evidence that older creative R&D employees and those in weaker general health perceive better control of the pace of their work. Morning type employees also have a higher likelihood of being in better control of the speed of their work and the time for breaks. Acknowledging that the industry composition of the sample has its constraints, creative R&D employees of IT and technology companies and banks do not appear to exercise as much control over their working pace as their colleagues in the public R&D institutions included in the sample. However, the effect of creative intensity of work was found to be statistically insignificant, and H2 did therefore not find support in model 4.

Model 5 aims to identify some key drivers of the extent to which restrictions arising from the nature of the work cause the working day of the employee not to start and end at the times that they would prefer. The lower the creative intensity of work, the greater the perceived constraints from the nature of the work on the start and end time of work are. Therefore H2 is supported with the findings in model 5. Those with a fixed terms employment contract and with a higher salary level appear to be more likely to feel these constraints as well (see left panel of Fig. 6). Weaker general health appears to be positively related with the perceived extent to which restrictions due to the nature of work cause the workday not to start and end at preferred times. The explanatory power of model 5 remains quite low however with pseudo-*R*-squared of 0.06.

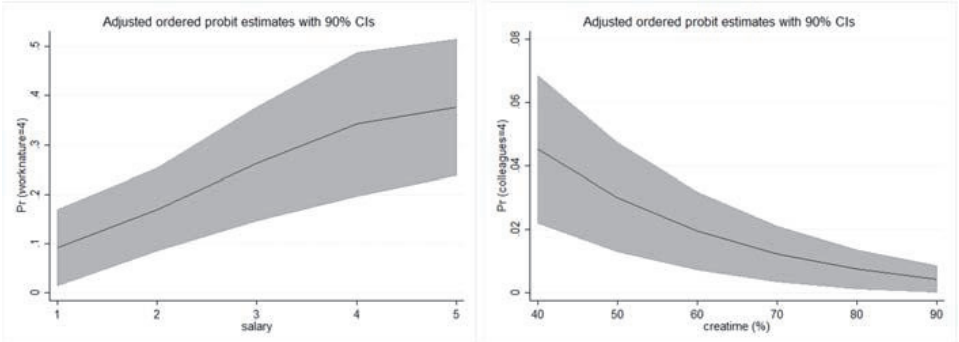

Fig. 6 Probabilities of an employee perceiving constraints on the start and end time of their working day from the nature of the work (left panel) and from the discontent and potential jealousy from colleagues (right panel)

The study provides an interesting insight into the perceived discontent and potential jealousy from colleagues as a cause for workday not starting and ending at the times that the employee would prefer. The lower the creative intensity of the work, the higher the likelihood of the employee perceiving such constraints on their job autonomy. See the right panel of Fig. 6 for an illustration of that relationship. Employees who are granted flexibility in both the timing and place of their work have a significantly lower probability of perceiving these constraints than do those with a fixed working place and rigid schedules. While men have a 1.7% probability of feeling to a large extent that discontent and potential jealousy from colleagues causes their working day not to start and end at their preferred times, the probability for women is 4.3%.

The alternative multivariate ordered probit estimates presented in Table 3 in the Appendix provide similar results to the ordered probit estimates in models 3–6. An interesting additional insight that the multivariate ordered probit estimates provide is the interrelations between the regression estimates of the four dependent variables (see the *atanhrho* estimates in Appendix Table 3). It appears that there is a significant positive relationship between the perceived jealousy of colleagues as a cause for undesired start and end times of the working day and the perceived extent of working time arrangements having a negative effect on the creativity of the employee. Moreover, the drivers of the latter two perceptions perceived appear to be strongly related to the determinants of low control over the pace of work.

Discussion and Conclusions

This paper investigates the drivers of various aspects of job autonomy in terms of working time arrangements and it presents ordered probit and multivariate ordered probit regression estimates, based on data from an original repeated survey of Estonian creative R&D employees on a sample of eleven employers and 146 employees.

This study finds that the higher the creative intensity of work of an R&D employee is the more likely the employee is to be satisfied with flexible rather than with fixed working schedules. Moreover, both the availability of distance work options and their actual use have a positive effect on how content creative employees are with their working time arrangements. This study reveals that flexible work is strongly linked to another dimension of time-related job autonomy, which is the extent to which creative R&D employees can decide for themselves about the speed of their work and the time they take breaks. While employees with rigid working hours and a fixed place of work have a probability of 12% of being totally in control of the pace of their work, the probability for those with flexible schedules but a fixed working place is 15% and for those with flexibility in both working time and the place of work it is as high as 38%. These findings are in alignment with the argumentation of Goswami et al. (2007) and Mumford (2000), among others, suggesting that employees who are devoted to creative R&D work prefer and need autonomy and flexibility in their work arrangements. The results also indicate that in

terms of job autonomy, teleworking seems to have a more substantial role than flexitime. The option of teleworking increases the probability of being totally satisfied with working time arrangements by 27 ppt, from 8% for those who can use flexitime but cannot use teleworking to 35% for those who enjoy both teleworking and flexitime and probability of being totally in control of the pace of their work by 23 ppt, from 15 to 38%. This might partially be driven by the findings discussed below, namely upside on creativity and jealousy of colleagues being a constraint on working time choices for which teleworking might have a more significant impact than flexitime. Also, creative knowledge employees who mainly use distance work tend to be more satisfied with their work results (Hazak et al. 2017).

Another finding is that women and employees with less creative work and more administrative and other non-creative tasks perceive more constraints on the start and end times of their work because of the discontentment and jealousy of their colleagues. Moreover, they are more likely to perceive that their working time arrangements affect their creativity adversely. Although this is broadly in alignment with the argument of Allvin (2004) and Felstead et al. (2003) that discontentment rises among colleagues when flexible work arrangements are used more, it is a novel finding, suggesting that employees whose position may be more vulnerable, like women rather than men, or whose work behaviour attracts more attention like staff with administrative duties rather than fully creative employees, appear more likely to become targets of the jealousy of colleagues if they start using more flexible working time options. This finding, complementing Ruubel and Hazak (2018), is important in highlighting that allowing the use of flexible working time alone may not be sufficient to make employees enjoy freedom in their working time. Employers seeking to implement flexible work practices should deal with the attitudes and behaviours of employees towards job autonomy in order to take full benefit from flexible work options.

The study also finds that men appear to be more satisfied with their working arrangements than women, irrespective of fixed or flexible schedules and male employees also have a smaller probability of perceiving that working time arrangement has somewhat negative effect on their creativity. As found by Albion (2004) and Sarbu (2014), the decision to use the option of flexible working time is mainly driven by family responsibilities. It could be that the family responsibilities on women are much larger than for men, and irrespective of the working schedule, it is more difficult to have a well-functioning work-family balance which could result in lower satisfaction among women. Hazak et al. (2019) elaborates further on the working time preferences of creative R&D employees covered by the same survey, highlighting significant differences in the time preferences of men and women.

This study demonstrates that employees who have flexibility in both the timing and the place of their work are significantly less likely to perceive working time–related restraints on their creativity or to see the jealousy of their colleagues as a constraint on their working time choices than are those with a fixed working time and place. This finding follows in general the outcomes of Giannikis and Mikhail (2011), McNamara et al. (2012), and Almer et al.

(2003), which all suggest that employees would be more likely to start using flexible working options if doing so contributes to achieving the desired work-life balance without hindering relationships with colleagues. Another explanation could be however that those working from distance are out of sight of their colleagues and can thus decide more freely about the start and end times of their working day, which in turn facilitates their creativity. In any case, the finding suggests once again that behavioural aspects are important in how efficiently flexible work options are implemented and the availability of flexitime alone does not yet mean it fulfils its purpose in improving work outcomes and employee well-being.

Another interesting finding from this study is that a higher salary level increases the likelihood that the employee will perceive the nature of their work to constrain their working time choices. This novel finding may be explained by the stronger attachment of more highly paid employees to their job and increased job insecurity, which in turn may have an adverse effect on job autonomy in terms of time freedom. This phenomenon warrants further study in order to understand whether a higher salary functions as a way of compensating a creative employee for reduced job autonomy, which may appear beneficial to the employer in the shorter term but may have considerable adverse effects in the longer term if it reduces the productivity of the time constrained creative employee.

The results also indicate that among employees with flexible working time, morning type people are significantly more likely to be totally satisfied with their working time arrangement and also have a higher likelihood of being in better control of the speed of their work and the time for breaks than evening type people. Work routine, i.e. the broadly nine-to-five working mentality in the society, is mostly adjusted to fit the morning type people and therefore employees with different biorhythm might not get full benefit of flexitime options despite the formal flexitime option. Morningness-eveningness profile of an individual is of exogenous nature having some genetic background (Kalmbach et al. 2017), explaining why it might be difficult for the evening type people to adjust to the prevailing working time routine. These issues affect a large number of people considering that, quite similarly to overall proportions in the society (Adan et al. 2012), 18% of the employees in the sample are evening types, 25% are morning types and the remaining 57% are typeless. Sõõru et al. (2018) study on the same sample the restrictions that morningness-eveningness sets on employment options, elaborating further on the linkages between sleep habits and working time.

Further findings of the study point to various individual characteristics like age, education, health, and sleep patterns being related to time-wise job autonomy. The employer's industry and whether the job is fixed term or permanent appear to be connected to job autonomy and working time flexibility.

The outcomes of this study may be useful for R&D companies in understanding the complicated nature of job autonomy in terms of time freedom and the role of various behavioural aspects in implementing flexible work options. In addition to making flexible work available formally, it is important for employers to consider the individual characteristics of the employees and the reactions of their colleagues when assessing the utility of flexible work in practice.

Acknowledgements The author is grateful to Professor Aaro Hazak, Professor Kadri Männasoo, Marko Virkebau, and Erve Sõõru for making available the data from their survey for this study and for their valuable input in writing the paper. The author appreciates comments from participants at the Department of Economics and Finance seminar at Tallinn University of Technology and at the 10th international conference Economic Challenges in Enlarged Europe.

Funding Information This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement no. 734712. This work also received support from grant PUT315 provided by the Estonian Research Council and support from the Doctoral School in Economics and Innovation, supported by the European Union, European Regional Development Fund (Tallinn University of Technology ASTRA project "TTÜ Development Program 2016–2022," project code: 2014-2020.4.01.16-0032).

Compliance with Ethical Standards This research project has been approved by the Tallinn Medical Research Ethics Committee on 9 February 2015 by decision No. 894.

Appendix

Table 1 Explanatory variables and sample description

Variable	Description	All	*Flextime* = 0	*Flextime* = 1
		Mean/% (Std. Dev.)	Mean/% (Std. Dev.)	Mean/% (Std. Dev.)
	N	146 (100%)	37 (25%)	109 (75%)
Creatime	Employee reported share of creative work in total working time of the employee (%)	52.29 (21.64)	48.51 (19.24)	53.58 (22.33)
Workhours	Employee reported average working hours per working day	10.12 (1.69)	9.95 (1.61)	10.17 (1.72)
Place	It is possible (= 1) vs not possible (= 0) to work from a location suitable for the employee (e.g. home) as often as he/she likes	27%	11%	33%
Flextime	Flexible (= 1) vs fixed (= 0) working time arrangement of the employee	75%	0%	100%
Atwork	Share of work hours at workplace from total work hours (%)	82.0 (12.85)	86.2 (9.2)	80.5 (13.6)
Nature	"Permanent work" (base)	90%	97%	88%
	"Non-permanent work, with a duration of more than 1 year" (= 2)	7%	3%	8%
	"Non-permanent work, with a duration of less than 1 year" (= 3)	3%	0%	4%
Salary	Employee reported monthly gross salary on the scale:			
	"Below 1000 euros" (= 1, base)	7%	11%	6%
	"1000–2000 euros" (= 2)	58%	62%	57%
	"2000–3000 euros" (= 3)	23%	16%	25%
	"3000–5000 euros" (= 4)	12%	11%	12%

Table 1 (continued)

Variable	Description	All	*Flextime* = 0	*Flextime* = 1
		Mean/% (Std. Dev.)	Mean/% (Std. Dev.)	Mean/% (Std. Dev.)
	"Above 5000 euros" (= 5)	1%	0%	1%
Age	Age in years	38.75 (11.44)	42.38 (12.71)	37.52 (10.76)
Gender	Male (= 1) vs female (= 0)	56%	43%	61%
Family	Employee reported number of people living together with the employee	1.68 (1.46)	1.59 (1.38)	1.71 (1.49)
Education	Years of education starting from primary education	16.53 (2.66)	16.43 (2.63)	16.57 (2.69)
phealth	First principal component score of general health condition with overall Kaiser-Meyer-Olkin measure of sampling adequacy of 0.6; comprises (1) "Do you have high blood pressure or have you ever used medicine for high blood pressure?" (yes = 1); (2) "Do you suffer or have you suffered from diseases that significantly affect your mental fatigue?" (5-level Likert type scale, "Never" = 1, "Often" = 5); (3) "Does your disease or injury interrupt you while doing your daily job?" (5-level Likert type scale, "No obstacles" = 1, "Not able to work" = 5); (4) "How many workdays have you been absent from work due to disease or medical examination in the past 12 months?"(5-level scale, "None" = 1, "100–-365 days" = 5); (5) body mass index (continuous)	0.00 (1.41)	0.13 (1.50)	− 0.05 (1.38)
meq	rMEQ score, 1…25 scale ranging from "Definitely an evening type" to "Definitely a morning type"	14.72 (3.55)	14.73 (3.46)	14.72 (3.60)
Sleephours	Employee reported average sleeping hours per day on the scale:			
	"Less than 6 h" (= 1, base)	5%	8%	5%
	"6–7 h" (= 2)	50%	51%	50%
	"7–8 h" (= 3)	38%	35%	39%
	"8–9 h" (= 4)	6%	5%	6%
	"Over 9 h" (= 5)	0%	0%	0%
Sector	Area of activity of the employer:			
	R&D institutes (= 1, base)	20%	19%	21%
	Private R&D companies (= 2)	14%	11%	15%
	Private IT and technology companies (= 3)	37%	46%	34%
	IT and product development units at commercial banks (= 4)	29%	24%	30%

Mean and standard deviation shown for continuous and ordered variables; percentage of respondents shown for binary and categorical variables

Table 2 Ordered probit estimates

Variable	Model 1 Satisfied: flextime = 0	Model 2 Satisfied: flextime = 1	Model 3 Creaimpede	Model 4 Pace	Model 5 Worknature	Model 6 Colleagues
Creatime	− 0.071*** (0.02)	0.019*** (0.00)	− 0.012*** (0.00)	0.007 (0.01)	− 0.008* (0.00)	− 0.019***(0.00)
Workhours	− 0.898*** (0.19)	0.070 (0.10)	0.147* (0.08)	0.068 (0.06)	0.086 (0.08)	0.047 (0.06)
Place = 1	1.888*** (0.51)	0.995** (0.48)				
Flextime = 0, place = 1			− 0.524 (0.71)	− 0.650 (0.56)	0.196 (0.37)	0.039 (0.47)
Flextime = 1, place = 0			− 0.296* (0.18)	0.158 (0.21)	0.216 (0.16)	0.389 (0.34)
Flextime = 1, place = 1			− 0.880*** (0.30)	0.872** (0.38)	0.089 (0.40)	− 0.555* (0.31)
Atwork	− 17.959*** ♯ (5.42)	− 1.889¥ (1.25)	1.014 (1.04)	0.449 (0.80)	0.670 (1.49)	0.412 (0.81)
Nature = 2	0.477 (1.28)	0.069 (0.43)	0.158 (0.41)	0.203 (0.25)	0.474** (0.22)	− 0.137 (0.27)
Nature = 3		− 0.941** ♯ (0.46)	− 0.637 (0.88)	− 1.082** (0.51)	0.506 (0.90)	− 1.699*** (0.51)
Salary	− 0.484 (0.38)	− 0.127 (0.28)	− 0.136 (0.28)	0.066 (0.17)	0.429** (0.17)	− 0.138 (0.10)
Age	0.049** (0.02)	− 0.028¥ (0.02)	0.014¥ (0.01)	0.019* (0.01)	− 0.010 (0.01)	− 0.006 (0.01)
Gender (male = 1)	0.780*** (0.30)	0.402*** (0.15)	− 0.746*** (0.15)	− 0.038 (0.26)	− 0.212 (0.24)	− 0.403* (0.24)
Family	0.271 (0.24)	0.092 (0.08)	− 0.058 (0.07)	− 0.094 (0.08)	− 0.027 (0.03)	0.131 (0.11)
Education	0.375*** (0.10)	0.079 (0.06)	− 0.144*** (0.05)	0.069 (0.06)	− 0.057 (0.04)	− 0.027 (0.13)
phealth	0.024 (0.14)	− 0.003 (0.11)	0.041 (0.06)	0.140*** (0.04)	0.122* (0.07)	0.006 (0.09)
meq	− 0.102 (0.08)	0.097** (0.04)	− 0.023 (0.02)	0.037* (0.02)	− 0.022 (0.02)	0.043 (0.03)
Sleephours	0.089 (0.49)	0.080 (0.15)	− 0.254 (0.20)	0.140 (0.13)	− 0.033 (0.19)	− 0.070 (0.13)
Sector = 2	1.347** (0.65)	− 0.218 (0.40)	1.235*** (0.40)	0.286 (0.35)	− 0.360 (0.27)	0.330 (0.39)
Sector = 3	0.046 (0.83)	− 1.288** (0.65)	1.203* (0.64)	− 0.470* (0.26)	− 0.088 (0.36)	− 0.282 (0.43)
Sector = 4	− 1.520 (1.18)	− 0.313 (0.46)	1.077* (0.61)	− 0.668** (0.32)	− 0.258 (0.44)	0.309 (0.38)
Cut1	− 25.628*** (8.14)	− 1.506 (2.28)	− 2.516 (2.41)	0.594 (1.76)	− 0.743 (2.17)	− 0.479 (2.04)
Cut2	− 23.482*** (7.47)	0.602 (2.38)	− 0.321 (2.57)	2.366¥ (1.58)	− 0.061 (2.23)	0.182 (1.97)

Table 2 (continued)

Variable	Model 1 Satisfied: flextime = 0	Model 2 Satisfied: flextime = 1	Model 3 Creaimpede	Model 4 Pace	Model 5 Worknature	Model 6 Colleagues
Cut3	− 20.684*** (7.47)	3.097 (2.42)	0.397 (2.53)	3.394** (1.66)	0.789 (2.30)	1.111 (1.97)
Cut4	− 15.805** (6.86)		2.125 (2.74)	5.132*** (1.80)	1.773 (2.20)	
Pseudo-R^2	0.53	0.31	0.25	0.17	0.06	0.11
Pseudo-log-likelihood	− 22.4***	− 73.5***	− 124.5***	− 146.7***	− 208.7***	− 133.0***
No. of obs.	37	109	146	146	146	146

¥ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; significance of pseudo-log-likelihoods is based on the Wald's chi^2 ; ‡ only 4 observations in this category making the regression results for these irrelevant

Table 3 Multivariate ordered probit estimate

Variable	Creaimpede	Pace	Worknature	Colleagues
Creatime	− 0.012*** (0.00)	0.007 (0.01)	− 0.008* (0.00)	− 0.019*** (0.00)
Workhours	0.140* (0.08)	0.072 (0.06)	0.081 (0.09)	0.061 (0.06)
Flextime = 0, place = 1	− 0.393 (0.72)	− 0.647 (0.57)	0.204 (0.36)	− 0.057 (0.47)
Flextime = 1, place = 0	− 0.258* (0.16)	0.167 (0.20)	0.209 (0.16)	0.353 (0.33)
Flextime = 1, place = 1	− 0.876*** (0.29)	0.884** (0.39)	0.086 (0.40)	− 0.659** (0.33)
Atwork	0.968 (1.02)	0.421 (0.80)	0.657 (1.50)	0.498 (0.80)
Nature = 2	0.157 (0.43)	0.216 (0.25)	0.471** (0.22)	− 0.217 (0.28)
Nature = 3	− 0.599 (0.81)	− 1.121** (0.48)	0.508 (0.90)	− 1.667*** (0.56)
Salary	− 0.143 (0.28)	0.050 (0.17)	0.433*** (0.17)	− 0.132¥ (0.08)
Age	0.013¥ (0.01)	0.019* (0.01)	− 0.010 (0.01)	− 0.006 (0.01)
Gender (male = 1)	− 0.784*** (0.16)	− 0.030 (0.25)	− 0.217 (0.24)	− 0.406* (0.24)
Family	− 0.060 (0.07)	− 0.095 (0.08)	− 0.026 (0.03)	0.131 (0.11)
Education	− 0.148*** (0.05)	0.069 (0.06)	− 0.056 (0.05)	− 0.022 (0.13)
phealth	0.046 (0.06)	0.136*** (0.04)	0.122* (0.07)	0.006 (0.09)
meq	− 0.024 (0.02)	0.038* (0.02)	− 0.022 (0.02)	0.039 (0.03)
Sleephours	− 0.239 (0.19)	0.135 (0.13)	− 0.032 (0.19)	− 0.051 (0.13)
Sector = 2	1.234*** (0.44)	0.283 (0.37)	− 0.369 (0.28)	0.344 (0.42)
Sector = 3	1.224* (0.69)	− 0.453* (0.26)	− 0.091 (0.36)	− 0.268 (0.42)
Sector = 4	1.080* (0.66)	− 0.659** (0.33)	− 0.255 (0.44)	0.337 (0.40)
Cut1	− 2.719 (2.39)	0.843 (1.83)	− 0.795 (2.20)	− 0.227 (2.06)
Cut2	− 0.530 (2.56)	2.439¥ (1.66)	− 0.109 (2.27)	0.421 (1.98)
Cut3	0.118 (2.52)	3.400** (1.70)	0.743 (2.34)	1.324 (1.99)
Cut4	1.646 (2.74)	5.153*** (1.84)	1.713 (2.23)	
atanhrho *creaimpede*		− 0.519*** (0.13)	0.194¥ (0.13)	0.402*** (0.13)
atanhrho *pace*			− 0.156 (0.15)	− 0.292* (0.16)
atanhrho *worknature*				0.059 (0.11)
Pseudo-log-likelihood	− 595.3***			
No. of obs.	146			

¥ $p < 0.15$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; significance of pseudo-log-likelihood is based on the Wald's chi^2

References

Abbey, A., & Dickson, J. W. (1983). R&D work climate and innovation in semiconductors. *Academy of Management Journal, 26*(2), 362–368.

Adan, A., & Almirall, H. (1991). Horne & Östberg morningness-eveningness questionnaire: a reduced scale. *Personality and Individual Differences, 12*(3), 241–253.

Adan, A., Archer, S. N., Hidalgo, M. P., Di Milia, L., Natale, V., & Randler, C. (2012). Circadian typology: a comprehensive review. *Chronobiology International, 29*(9), 1153–1175.

Ahuja, M., Chudoba, K. M., George, J. F., Kacmar, C. and McKnight, H. (2002). Overworked and isolated? Predicting the effect of work-family conflict, autonomy, and workload on organizational commitment and turnover of virtual workers, *In System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii International Conference on* (pp. 3586-3593). IEEE.

Albion, M. J. (2004). A measure of attitudes towards flexible work options. *Australian Journal of Management, 29*(2), 275–294.

Allvin, M. (2004). The individualization of labour. Learning to be Employable.

Almer, E. D., Cohen, J. R., & Single, L. E. (2003). Factors affecting the choice to participate in flexible work arrangements. *Auditing: A Journal of Practice & Theory, 22*(1), 69–91.

Anttila, T., Nätti, J., & Väisänen, M. (2005). The experiments of reduced working hours in Finland: impact on work–family interaction and the importance of the sociocultural setting. *Community, Work and Family, 8*(2), 187–209.

Aryee, S., & Leong, C. C. (1991). Career orientations and work outcomes among industrial R&D professionals. *Group & Organization Studies, 16*(2), 193–205.

Atkinson, C., & Hall, L. (2009). The role of gender in varying forms of flexible working. *Gender, Work & Organization, 16*(6), 650–666.

Avarmaa, M., Hazak, A., & Männasoo, K. (2013). Does leverage affect labour productivity? A comparative study of local and multinational companies of the Baltic countries. *Journal of Business Economics and Management, 14*(2), 252–275.

Butler, A. B., Grzywacz, J. G., Ettner, S. L., & Liu, B. (2009). Workplace flexibility, self-reported health, and health care utilization. *Work & Stress, 23*(1), 45–59.

Chang, J. Y., & Choi, J. N. (2007). The dynamic relation between organizational and professional commitment of highly educated research and development (R&D) professionals. *The Journal of Social Psychology, 147*(3), 299–315.

Clarke, T. (2001). The knowledge economy. *Education+ Training, 43*(4/5), 189–196.

De Menezes, L. M., & Kelliher, C. (2017). Flexible working, individual performance, and employee attitudes: comparing formal and informal arrangements. *Human Resource Management, 56*(6), 1051–1070.

Eaton, S. C. (2003). If you can use them: flexibility policies, organizational commitment, and perceived performance. *Industrial Relations: A Journal of Economy and Society, 42*(2), 145–167.

Felstead, A., Jewson, N., & Walters, S. (2003). Managerial control of employees working at home. *British Journal of Industrial Relations, 41*(2), 241–264.

Giannikis, S. K., & Mikhail, D. M. (2011). Flexible work arrangements in Greece: a study of employee perceptions. *The International Journal of Human Resource Management, 22*(02), 417–432.

Golden, L. (2001). Flexible work schedules: which workers get them? *American Behavioral Scientist, 44*(7), 1157–1178.

Golden, L. (2008). Limited access: disparities in flexible work schedules and work-at-home. *Journal of Family and Economic Issues, 29*(1), 86–109.

Golden, L. (2009). Flexible daily work schedules in US jobs: formal introductions needed? *Industrial Relations: A Journal of Economy and Society, 48*(1), 27–54.

Goswami, S., Mathew, M., & Chadha, N. K. (2007). Differences in occupational commitment amongst scientists in Indian defence, academic, and commercial R&D organizations. *Vikalpa, 32*(4), 13–28.

Greer, T. W., & Payne, S. C. (2014). Overcoming telework challenges: outcomes of successful telework strategies. *The Psychologist-Manager Journal, 17*(2), 87.

Hayman, J. R. (2009). Flexible work arrangements: exploring the linkages between perceived usability of flexible work schedules and work/life balance. *Community, Work & Family, 12*(3), 327–338.

Hazak, A. (2009). Companies' financial decisions under the distributed profit taxation regime of Estonia. *Emerging Markets Finance and Trade, 45*(4), 4–12.

Hazak, A., Tint, P., Virkebau, M., Pille, V., Tuulik, V., & Sõõru, E. (2016). Social innovation potential in working arrangements of R&D employees: Repeated employee survey from Estonia. 2016 IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech) (IEEE), pp. 210–213.

Hazak, A., Männasoo, K., & Virkebau, M. (2017). Effects of work arrangements on creative R&D work outcomes. *Eastern European Economics, 55*(6), 500–521.

Hazak, A., Ruubel, R., &Virkebau, M. (2019). When would creative R&D employees like to work? *International Journal of Organizational Analysis*, *27*(3), 596–612.

Janssen, D., & Nachreiner, F. (2004). Health and psychosocial effects of flexible working hours. *Revista de saude publica, 38*, 11–18.

Kalleberg, A. L. (2001). Organizing flexibility: the flexible firm in a new century. *British Journal of Industrial Relations, 39*(4), 479–504.

Kalmbach, D. A., Schneider, L. D., Cheung, J., Bertrand, S. J., Kariharan, T., Pack, A. I., & Gehrman, P. R. (2017). Genetic basis of chronotype in humans: insights from three landmark GWAS. *Sleep, 40*(2), zsw048.

Kauffeld, S., Jonas, E., & Frey, D. (2004). Effects of a flexible work-time design on employee-and company-related aims. *European Journal of Work and Organizational Psychology, 13*(1), 79–100.

Kossek, E. E., Barber, A. E., & Winters, D. (1999). Using flexible schedules in the managerial world: the power of peers. *Human Resource Management, 38*(1), 33–46.

Mann, H. B., & Whitney, D. R. (1947). On a test of whether one of two random variables is stochastically larger than the other. *The annals of mathematical statistics*, 50–60.

McNamara, T. K., Pitt-Catsouphes, M., Brown, M., & Matz-Costa, C. (2012). Access to and utilization of flexible work options. *Industrial Relations: A Journal of Economy and Society, 51*(4), 936–965.

Moen, P., Kelly, E. L., Tranby, E., & Huang, Q. (2011). Changing work, changing health: can real work-time flexibility promote health behaviors and well-being? *Journal of Health and Social Behavior, 52*(4), 404–429.

Mumford, M. D. (2000). Managing creative people: strategies and tactics for innovation. *Human Resource Management Review, 10*(3), 313–351.

Powell, W. W., & Snellman, K. (2004). The knowledge economy. *Annual Review of Sociology, 30*, 199–220.

Ruubel, R., & Hazak, A. (2018). Disparities in knowledge employees, actual, contractual and desired working schedules. *Knowledge Management: An International Journal, 18*(1), 17–30.

Saragih, S. (2015). The effects of job autonomy on work outcomes: self efficacy as an intervening variable. *International Research Journal of Business Studies, 4*(3).

Sarbu, M. (2014). Determinants of flexible work arrangements. *ZEW-Centre for European Economic Research Discussion Paper, (14-028).*

Sharpe, D. L., Hermsen, J. M., & Billings, J. (2002). Factors associated with having flextime: a focus on married workers. *Journal of Family and Economic Issues, 23*(1), 51–72.

Shih, S. P., Jiang, J. J., Klein, G., & Wang, E. (2011). Learning demand and job autonomy of IT personnel: impact on turnover intention. *Computers in Human Behavior, 27*(6), 2301–2307.

Sõõru, E., Hazak, A., & Rebane, M. (2018). Does chronotype restrict the employment options of creative R&D professionals? *Biological Rhythm Research*. https://doi.org/10.1080/09291016.2018.1528681.

Tausig, M., & Fenwick, R. (2001). Unbinding time: alternate work schedules and work-life balance. *Journal of Family and Economic Issues, 22*(2), 101–119.

Viñas-Bardolet, C., Torrent-Sellens, J., & Guillen-Royo, M. (2018). Knowledge workers and job satisfaction: evidence from Europe. *Journal of the Knowledge Economy*, 1–25.

Virkebau, M., & Hazak, A. (2017). What type of research and development employees use flextime? *International Journal of Organizational Diversity, 17*(2), 1–9.

Wang, A. C., & Cheng, B. S. (2010). When does benevolent leadership lead to creativity? The moderating role of creative role identity and job autonomy. *Journal of Organizational Behavior, 31*(1), 106–121.

Wenjing, C. A. I., Wei, S. O. N. G., & Shuliang, Z. H. A. O. (2013). An empirical study on the effects of creative personality and job autonomy on individual innovation performance of knowledge workers. *International Business and Management, 6*(2), 24–30.

Zampetakis, L. A., Bouranta, N., & Moustakis, V. S. (2010). On the relationship between individual creativity and time management. *Thinking Skills and Creativity, 5*(1), 23–32.

Curriculum Vitae

Personal data

Name:	Raul Ruubel
Date of birth:	04.08.1986
Place of birth:	Estonia
Citizenship:	Estonian

Contact data

Email:	raulruubel@hotmail.com

Education

2014 to date	Tallinn University of Technology – Financial Economics, PhD
2009–2011	Tallinn University of Technology – Finance, Master of Arts
2006–2009	Tallinn University of Technology – Business Administration, Bachelor of Arts
2004–2006	Audentes Sports School – Secondary education

Language competence

Estonian	Mother tongue
English	Fluent

Professional employment

2010 to date	AS PricewaterhouseCoopers Advisors

Publications

- Ruubel, R., 2020. Time dimensions of job autonomy in Estonian R&D institutions. *Journal of the Knowledge Economy*.
- Hazak, A., Ruubel, R. and Virkebau, M., 2019. When would creative R&D employees like to work? *International Journal of Organizational Analysis*, 27 (3), 596−612.
- Ruubel, R. and Hazak, A., 2018. Disparities in Knowledge Employees' Actual Contractual and Desired Working Schedules. *Knowledge Management: An International Journal*, 18 (1), 17−30.
- Männasoo, K., Hein, H. and Ruubel, R., 2018. The contributions of human capital, R&D spending and convergence to total factor productivity growth. *Regional Studies*, 52(12), 1598–1611.
- Männasoo, K., Hein, H. and Ruubel, R., 2017. Tootlikkuse kasvutegurid Euroopa regioonides. *Riigikogu Toimetised*, 35.
- Ruubel, R. and Hazak, A., 2017. Does anyone want to work 5 days per week and 8 hours per day? Issues in R&D work efficiency. In: *Tallinn University of Technology Economic Research Series* (TUTECON Research Briefs; No. RB-2017/9).
- Männasoo, K., Hein, H. and Ruubel, R., 2016. Regional Productivity Convergence in Advanced and Emerging European Economies. *European Policy Analysis*, 12, 1−12.
- Hazak, A. and Ruubel, R., 2014. Contribution of R&D services to added economic value in Estonia. *Proceedings of the 11th International Academic Conference: IISES 11th International Academic Conference*, Reykjavik, Iceland, 24-27 June 2014.

- Ruubel, R. and Hazak, A., 2011. Is There a Relationship between Company Profitability and Salary Level? A Pan-European Empirical Study. *Innovation, Management and Service* (332−337). Singapore: IACSIT Press (IPEDR No. 14). (Indexed in Web of Science)
- Ruubel, R. and Hazak, A., 2011. Company Profitability and Labour Intensity under Different Phases of the Economic Cycle: A Pan-European Empirical Study. *Economics, Business and Management* (178−182). Singapore: IACSIT Press (IPEDR No. 22). (Indexed in Web of Science)

Elulookirjeldus

Isikuandmed

Nimi:	Raul Ruubel
Sünniaeg:	04.08.1986
Sünnikoht:	Eesti
Kodakondsus:	Eesti

Kontaktandmed

E-post:	raulruubel@hotmail.com

Hariduskäik

Alates 2014	Tallinna Tehnikaülikool – Finantsökonoomika, PhD
2009–2011	Tallinna Tehnikaülikool – Ärirahandus, teadusmagister
2006–2009	Tallinna Tehnikaülikool – Ärikorraldus, bakalaureus
2004–2006	Audentese Spordikool – Keskharidus

Keelteoskus

Eesti keel	Emakeel
Inglise keel	Kõrgtase

Teenistuskäik

Alates 2010	AS PricewaterhouseCoopers Advisors

Publikatsioonid

- Ruubel, R., 2020. Time dimensions of job autonomy in Estonian R&D institutions. *Journal of the Knowledge Economy*
- Hazak, A., Ruubel, R. and Virkebau, M., 2019. When would creative R&D employees like to work? *International Journal of Organizational Analysis*, 27 (3), 596−612.
- Ruubel, R. and Hazak, A., 2018. Disparities in Knowledge Employees' Actual Contractual and Desired Working Schedules. *Knowledge Management: An International Journal*, 18 (1), 17−30.
- Männasoo, K., Hein, H., and Ruubel, R., 2018. The contributions of human capital, R&D spending and convergence to total factor productivity growth. *Regional Studies*, 52(12), 1598–1611.
- Männasoo, K., Hein, H. and Ruubel, R., 2017. Tootlikkuse kasvutegurid Euroopa regioonides. *Riigikogu Toimetised*, 35.
- Ruubel, R. and Hazak, A., 2017. Does anyone want to work 5 days per week and 8 hours per day? Issues in R&D work efficiency. In: *TUT Economic Research Series.* (TUTECON Research Briefs; No. RB-2017/9).
- Männasoo, K., Hein, H. and Ruubel, R., 2016. Regional Productivity Convergence in Advanced and Emerging European Economies. *European Policy Analysis*, 12, 1−12.
- Hazak, A. and Ruubel, R., 2014. Contribution of R&D services to added economic value in Estonia. *Proceedings of the 11th International Academic Conference: IISES 11th International Academic Conference*, Reykjavik, Iceland, 24-27 June 2014.

- Ruubel, R. and Hazak, A., 2011. Is There a Relationship between Company Profitability and Salary Level? A Pan-European Empirical Study. *Innovation, Management and Service* (332−337). Singapore: IACSIT Press (IPEDR; 14) (Web of Science).
- Ruubel, R. and Hazak, A., 2011. Company Profitability and Labour Intensity under Different Phases of the Economic Cycle: A Pan-European Empirical Study. In: Zhang, M. (Ed.). *Economics, Business and Management* (178−182). Singapore: IACSIT Press (IPEDR; 22) (Web of Science).