Trends in Effort at Work in the UK

Jose Ignacio Gimenez-Nadal[a] and Almudena Sevilla[b]

[a] Universidad de Zaragoza and IEDIS, Department of Economic Analysis, C/ Gran Via 2 3rd floor, Zaragoza, Spain, ngimenez@unizar.es

[b] The London School of Economics and Political Science, Department of Social Policy, Houghton Street, London, The United Kingdom, A.Sevilla@lse.ac.uk

*Corresponding author: E.mail: ngimenez@unizar.es

Abstract

This paper links detailed 24-hour diary surveys in the United Kingdom (UK) for the last four decades, to provide evidence of an increase in work effort in three specific dimensions: timing, nature, and composition. We rule out certain proposed explanations of these trends, finding that the decrease in the frequency of on-the-job leisure is more pronounced for workers in routine task-intensive occupations. Alternative supply-side and demand-side explanations, such as changes in relative preferences for leisure, or an increase in off-shoring, or competition for jobs, cannot explain our results. Our findings suggest that the amount and frequency of on-the-job leisure can be used as a measure of work effort, and that the routine-biased technological changes experienced during this period lie at the root of the increase in work effort in the UK.

JEL: J22, J23, J24

1. Introduction

In recent decades, labour markets have witnessed an unprecedented polarization of employment, as workers in middle-wage occupations experienced a decrease in their share of overall employment, particularly in the US during the 1980s and 1990s (Autor, et al., 2006; 2008; Acemoglu and Autor, 2011; Autor and Dorn, 2013) and in Europe (Goos and Manning, 2007; Goos et al., 2009; 2014). One reason for the disappearance of many middle-wage occupations has been technological change (e.g. automation of routine job tasks), which reduces the real cost of automating many of the routine tasks characteristic of these jobs, creating strong economic incentives for firms to substitute ever cheaper and more powerful computing power for relatively expensive human labour (Autor et al., 2003; Autor 2015;Acemoglu and Restrepo, 2019,2020). However, while the theoretical predictions and empirical implications of the effects of automation on aggregate employment, wages, inequality, and productivity are well understood, little is known about how automation and technological change affect the work process. This paper looks beyond the aggregate employment effects of technological change/automation to present new empirical evidence on the relationship between technological change and the structure of work, the latter serving as a measure of work effort.

Our proposed economic framework follows the recently developed task-content model for technological change/automation (Acemoglu and Restrepo, 2019, 2020). The economic principles of this framework predict that technological change/automation affects the composition of tasks for those workers who remain employed, reducing the relative contribution of workers to routine tasks – now performed by computers/robots – and increasing the relative contribution of workers to abstract tasks. Given the changing nature of the tasks towards abstraction, with a high degree of complementarity to the tasks done by robots and computers, this may represent a change in the structure of work, affecting the levels of work effort. Prior evidence has shown that technological change/automation leads to a more efficient allocation of job tasks, due to increased efficiency at all stages of the production process, by reducing unscheduled downtime and stoppage periods (Ichniowski et al., 1997), as well as by shortening setup times, run times, and inspection times (Bartel et al., 2007). Furthermore, technological change/automation changes the content of the tasks performed by workers in traditionally routine, task-

intensive occupations, and creates many new tasks (e.g. programming, design, maintenance of high-tech equipment, such as software and app development, database design and analysis, and computer-security-related tasks) that are highly relevant to the functioning of robots/machines.[1] Thus, workers in routine task-intensive occupations may have experienced larger changes in the structure of their work, ending up with a work process characterized by a distribution of work effort that more closely resembles the work process of workers in non-routine, task-intensive occupations.

We collect six UK time-use surveys from the mid-1980s to the late 2010s, containing detailed activity reported during 24-hour periods, and construct two measures of work effort. Despite that total hours of work have been used to measure work effort, normal weekly hours of work can only be a crude proxy for hours actually worked and may miss important information on what workers do while on the job (Hamermesh, 1990). Dickinson (1999) extends the traditional model of work-leisure choice to explicitly consider the consumption of on-the-job leisure, in order to get a better picture of hours of work. Following this line of research, we define the consumption of on-the-job leisure as time spent in non-work-related activities while at work (see Hamermesh, 1990; Giménez-Nadal et al., 2018; Burda et al. 2020). First, we measure the consumption of on-the-job leisure. Second, we measure the frequency of on-the-job leisure, since the sequence information in the diary provides a clear picture of the distribution of effort throughout the work process.

We first demonstrate an increase in the work effort of workers in the UK, as we observe a decrease in both the amount and frequency of on-the-job leisure. This is consistent with the strand of literature analysing the intensification of work in the UK in recent decades (Green, 2001; Green and McIntosh, 2001; Green, 2004; Green et al. 2022). Second, we observe that workers in routine task-intensive occupations experience larger changes in the structure of job tasks, that is, experience greater increases in work effort, measured as the frequency of on-the-job leisure, in comparison to workers in abstract task-intensive occupations. These results are consistent with the task-content model where technological change/automation produces changes in the structure of work, with larger increases for workers in routine task-intensive occupations.

[1] These examples correspond to relatively high-level IT skills. Other new tasks, not so specific with high-level IT skills, include activities such as emailing, and using spreadsheets and word-processing software.

We rule out competing supply-side and demand-side explanations for the decrease in the consumption and frequency of on-the-job leisure, and none of the alternative theories appear to account for the key aspects of the evidence presented. Furthermore, we use the 1986, 1992, 1997, 2001, 2006, 2012, and 2017 Skills and Employment Surveys (SES) from the UK, to link our measures of work effort to indicators of computer use at work, the presence of unions in the workplace, and the proportion of workers with permanent contracts, and our evidence supports the argument that the introduction of computerized and/or automated equipment has been driving the intensification of work effort in the UK.

This paper contributes to recent developments in the literature of routine-biased technological change by moving beyond employment effects and looking at how automation relates to work effort. Prior literature on automation technology and the organization of work processes focuses on the firm's production function and firm-level outcomes, and generally adopts a case-study analysis of one or more workplaces in narrowly defined industries. This literature holds that automation technology leads to a more efficient allocation of job tasks, leading in turn to greater efficiency at all stages of the production process, for example by reducing unscheduled downtime and stoppage periods (Ichniowski et al., 1997), as well as by shortening setup times, run times, and inspection times (Bartel et al. 2007). Furthermore, Green et al. (2022) explain that for more than half (51%) of work intensification in the UK, effort-biased technological change is among the explanatory factors. We use large, worker-level representative surveys to document increases in work effort, following the new and more specialized tasks resulting from technological change/automation.

The remainder of the paper is organized as follows. Section 1 describes the time diary data used in this paper, the conceptualization of work effort, and the evolution of work effort over time. Section 2 describes the data and the work effort indicators and shows the trends in work effort in the UK. Section 3 analyses supply-side and demand-side explanations underlying the observed trends in work effort. Section 4 concludes.

2. Work effort in UK Time Use Surveys

2.1. The data

We employ large-scale, representative time-diary surveys for the UK, where respondents record their activities for consecutive 24-hour periods. Specifically, we use surveys from 1983, 1987, 1995, 2000, 2005, and 2015, which provide a unique opportunity to examine how activities at work vary by occupation and other socio-economic characteristics over extended periods of time.[2] Such surveys have become the preferred method of gathering information on time spent on market work, non-market work, and leisure, in the same way that money expenditure diaries have become the gold standard in the consumption and expenditure literature (see Table A1 in Supplementary Appendix for a detailed description of the surveys used).

We follow the literature and restrict the sample to non-retired/non-student individuals between the ages of 21 and 65, inclusive (see Aguiar and Hurst, 2007; Gimenez-Nadal and Sevilla, 2012) who devote at least one hour to market work activities during the diary day, excluding commuting, and work full-time.

2.1.1. On-the-job leisure (consumption).

Work effort is traditionally measured as the number of hours of work, which is normally gathered from nationally representative labour force surveys that ask respondents about normal work hours per week, month, or year. However, normal weekly/monthly/yearly hours of work can only be a crude proxy for hours actually worked (Barrett and Hamermesh, 2019) and may miss important information regarding what workers do while on the job (Hamermesh, 1990). The concepts of 'extensive' and 'intensive' effort have been developed by Francis Green and colleagues to measure work effort. While 'extensive effort' refers to the number of hours in a day that individuals spend working, 'intensive effort' refers to the intensity of that work (Green, 2001). Recent analyses of the intensification of work in the UK have shown that technological change has played a major role in the observed trends (Green and McIntosh, 2001; Green, 2006; Green et al., 2022).

Given the limitation of hours of work as a measure of work effort, the labour supply literature has extended the traditional model of work-leisure choice to explicitly consider the consumption of on-the-job leisure, to obtain a more accurate picture of hours of work

[2] From the Multinational Time Use Study (MTUS) at https://www.timeuse.org/mtus.

(Dickinson, 1999). Following this approach, we define the consumption of on-the-job leisure as time spent in non-work-related activities while at work (Hamermesh, 1990; Gimenez-Nadal et al., 2018; Burda et al., 2020). [3] We follow Hamermesh (1990) and consider the consumption of on-the-job leisure for leisure-related and other non-work activities.[4]

2.1.2. The frequency of on-the-job leisure

The frequency of on-the-job leisure has not been previously analysed in the literature. We construct two indicators: the number of on-the-job leisure episodes and the amount of working time until consuming on-the-job leisure. A higher number of on-the-job leisure episodes indicates a greater frequency of on-the-job leisure, while a longer working time until consuming on-the-job leisure indicates a lower frequency of on-the-job leisure. This second indicator is calculated by dividing the total amount of time spent working by the number of work spells in the diary day.

Table 1 shows an example of a working day for a worker in the UK.[5] The diarist spent 8 hours and 40 minutes at work, starting at 8:00 am, when the first episode of paid work was recorded in the diary (after commuting), and finishing at 4:40 pm when the last episode of paid work was recorded in the diary. Of the 8 hours and 40 minutes that the respondent spent at work, 7 hours and 30 minutes were spent working. There were three work spells of 3 hours, 2 hours and 10 minutes, and 2 hours and 20 minutes. The first work spell began at 8:00 am and lasted until 11:00 am. From 11:00 am to 11:20 am, the respondent recorded having a snack, followed by relax/do nothing from 11:20 am to 12:00

[3] *While at work* is defined as the time from the moment the respondent first begins work until the moment in which the respondent records the last work episode of the diary day. Commuting episodes are not considered as market work time.

[4] We employ the term 'on-the-job leisure' in a broad sense, referring to activities different from paid work that are undertaken during the time the respondent is at work (i.e. time not spent working while on the job). See Table A2 in the Appendix for a description of the activities considered as 'on-the-job leisure'.

[5] In the current context, diaries are often left behind and individuals can answer them at their discretion in some cases, not necessarily during work breaks, while at other times interviewers ask respondents about their prior data, which may affect how individuals fill in the diary. Consequently, the timeframe to which the diary pertains can vary depending on the survey (see Table A3 in the Appendix). For example, some diary surveys refer to the same days, while others correspond to the previous day. We estimate OLS regressions controlling for three decade dummies (1990s, 2000s, and 2010s), socio-demographic characteristics, and the total number of activities reported by the individual in the diary day. Furthermore, we control for survey methodology, where we include dummy variables to distinguish between data collected through self-completion (1) or by interview (0), as well as whether the diary pertains to the same day of the interview (1) or the preceding day (0). The results are presented in Table A4 of the Appendix and are consistent with ur results.

pm. The respondent went back to work again at 12:00 pm, finishing this second work spell, for lunch, at 2:10 pm. The third work spell began at 2:20 pm and lasted until 4:40 pm.

The consumption of on-the-job leisure was 1 hour and 10 minutes in totalal (1.16 hours). Of this time, the respondent spent 40 minutes in leisure activities (relax/do nothing), while the remaining 30 minutes were spent in meals at work. As for the frequency of on-the-job leisure, there were two on-the-job leisure episodes during the 1 hour and 10 minutes of on-the-job leisure: a first episode between 11:00 and 12:00, with one passive leisure activity and a meal at work, and a second episode between 14:10 and 14:20. Similarly, the respondent worked for an average of two and a half hours before consuming on-the-job leisure, which was calculated by dividing the 7 hours and 30 minutes that the respondent was working by the three work spells recorded in the diary.[6]

2.2. Trends in work effort

Columns 1 to 4 in Table 2 show trends of the time spent at work, split between the time working and the time spent at leisure, and the frequency of on-the-job leisure. Columns 5 and 6 show the changes in the consumption and frequency of on-the-job leisure between the 1980s and the 2010s, and the p-values of the difference, respectively. To ensure a constant representation of types of individuals and days of the week, the demographic weighting used in Aguiar and Hurst (2007) and Gimenez-Nadal and Sevilla (2012) is employed. The demographic composition of workers is likely to differ over time, which could have implications for time-use patterns, including the consumption and frequency of on-the-job leisure.

2.2.1. Trends in working time

Table 2 shows that the amount of time spent working in the UK increased by one hour from the 1980s to the 1990s, from approximately 7 hours and 24 minutes per day, before returning to 1980s levels during the 2000s and 2010s. Our results for trends in work hours

[6] Figure 1 in the Appendix illustrates the percentage of workers in our sample who are either at work or at leisure for every hour of the diary day (see Table A5 in the Appendix for values). For instance, at 1 pm, 90% of full-time workers are present, with 51% working and 39% engaging in on-the-job leisure. Most of the on-the-job leisure activities are taken up by meals at work (see Table A6 in the Appendix).

are in line with prior analyses of survey data based on questions about weekly hours of work. Ohaian et al. (2008) documented an increase in work hours between the 1980s and 2000s in the UK, followed by a smooth decrease in work hours in the 2000s. Rogerson and Shimer (2011) showed a peak in the number of work hours around 1990.

2.2.2. Trends in on-the-job leisure

Against the backdrop of non-increasing working time, workers reduced the amount of time they spent in non-work activities while at work.[7] The consumption of on-the-job leisure declined by 15%, from approximately one hour and 22 minutes per working day at the beginning of the period to one hour and 10 minutes per working day by the end of the period. The frequency of on-the-job leisure also decreased over this period. The number of on-the-job leisure episodes decreased by around 22% in the UK, from 1.69 episodes per working day in the 1980s to 1.31 episodes at the end of the period. The time spent working before the consumption of on-the-job leisure also increased. Whereas in the 1980s, working time until consuming on-the-job leisure was around 3 hours and 19 minutes, by the end of the period workers had increased this measure by 17% (35 minutes).

3. Possible explanations for trends in work effort

3.1. Demand-side explanations

We analyse a range of factors that may help to explain the observed trends in work effort in the UK. These demand-side explanations include routine-biased technological change (RBTC), offshoring, and competition for jobs. Additionally, we discuss some other potential channels that we are unable to explain with the current data.

[7] Larger increases in work effort occur particularly during the first half of the period (i.e. between the 1980s and 1990s) coinciding with an intensification of routine-biased technological change. Overall, the trends in on-the-job leisure match the trends in technological changes. Stewart and Atkinson (2013) and Autor, (2015) document a peak of non-residential investments in Information Processing Equipment and Software up until the beginning of the 2000s. In particular, during the 1980s, investments in equipment, software, and structures for business grew by 2.7% per year on average, and by 5.2% per year between 1990 and 1999. Autor (2015) documents similar trends in the demand for information technology capital during the latter half of the 1990s. The falloff in information investment may explain the slowing growth of abstract task-intensive employment, since lower investment in IT dampens both innovative activity and the demand for high-skilled workers. Like any General Purpose Technology (GPT), IT technology experienced a key investment stage, during which demand for cognitive tasks complementary to capital investments increased, but once the new capital was in place there was a reduction in the number of workers performing cognitive tasks - those who were only needed to maintain the new capital. In the maturity stage, IT technology investment slows down, although the levels are higher than at the onset. These authors argue that the turn of the century is the approximate turning point for peak investment.

3.1.1. Routine-biased technological change

Prior literature on work has documented the polarization of employment because of routine-biased technological change in the UK, the US, and Europe. This has led to a decrease in the share of employment of middle-wage occupations, and the explanation commonly given for this phenomenon is the 'Routine-Biased Technological Change' (RBTC) framework proposed by Autor et al. (2003), predicting a displacement of workers engaged in routine, task-intensive occupations as new technologies substitute for traditional tasks. These workers belong to the group of middle-wage occupations.

The existing literature suggests that automation and technological change leads to a more efficient allocation of job tasks, resulting in greater efficiency at all stages of the production process (Ichniowski et al., 1997; Bartel et al., 2007). Additionally, these changes affect the types of tasks that workers in traditionally routine, task-intensive occupations are performing, by introducing many new tasks (e.g. programming, design, maintenance of high-tech equipment, software and app development, database design and analysis, and computer-security-related tasks). This has the potential to increase work effort. Thus, to investigate the relationship between automation and work effort, we analyse the composition of the changes in work effort, comparing the consumption and frequency of on-the-job leisure for workers in routine task-intensive and non-routine task-intensive occupations. Specifically, we examine whether the proportion of routine tasks for a given occupation is correlated with changes in work effort. (Autor, 2015; Acemoglu and Restrepo, 2020).

We link the diary information to a worker's occupation-specific Routine Task Intensity (RTI) index, originally developed by Autor and Dorn (2013) and Autor et al. (2015) and adapted by Goos et al. (2014) to the UK context.[8] In particular, Goos et al. (2014) report the RTI index for 21 two-digit ISCO88 occupational codes. We use the 1983, 2000, and 2015 UK TUS samples that have information on a worker's occupation.[9] Supplementary

[8] The RTI Index makes use of the O*NET program to collect data on occupations. However, the RTI employs a two-digit classification system of occupations, which may obscure many job-level distinctions. There are other task measures collected at the individual worker level, as demonstrated by DiNardo and Pischke (1997), Spitz-Oener (2006), Dustmann et al. (2009), Gathmann and Schönberg (2010), and others. Francis Green and colleagues have used indicators of workplace computing, automated equipment, and repetitive tasks obtained from the Skills and Employment Survey (SES) series to measure the degree of automation and ICT use in the workplace (Green et al., 2022).

[9] For our analysis, the 1995 and 2005 surveys cannot be used as they do not provide information on occupation. An in-depth description of the RTI index can be found in Appendix B. In Table B5 of the Appendix, we compare the three

Appendix B shows summary statistics of market-work time and on-the-job leisure indicators by occupation, according to their values on the RTI index. Workers in non-routine, task-intensive occupations spend comparatively more time working before consuming on-the-job leisure (see Table B5 in the Supplementary Appendix).

We estimate ordinary least squares (OLS) regression models for each measure of on-the-job leisure, as follows:

$$E_i = \mu + \beta_1 X_i + \beta_2 RTI_i + \beta_3 D_{t,i} + \beta_4 D_{t,i} * RTI_i + \varepsilon_i \qquad (1)$$

where E_i represents our measures of the consumption and frequency of on-the-job leisure for respondent *i*. The vector X_i includes person-specific, socio-demographic characteristics such as gender (ref. male), age, a dummy variable for secondary and university education (ref. primary education), a dummy variable for living in couple (ref. not in couple), the number of children under 18 in the household, and the total number of activities reported by the individual in the diary day.[10] We also control for hours worked during the diary day. Once hours of work are constant, we expect to see similar effects of RTI on the two frequency measures. Additionally, we control for the RTI index of the worker's occupation (β_2). β_3 is a vector of dummy variables for the years 2000 and 2015, to capture changes in the on-the-job leisure measures between the two surveys, and β_4 is the interaction between the vector of year dummies and the RTI index. ε_i is the error term. The coefficient of interest is β_4, which covers the interactions between the year dummies and the RTI index. The higher the values of the RTI index, the more routine-intensive an occupation is. Consequently, a greater magnitude in these coefficients indicates a larger decrease in work effort for workers in routine task-intensive occupations, compared to those in non-routine, task-intensive occupations during this period.

Table 3 displays the results of estimating Equation (1) on the consumption and frequency of on-the-job leisure, respectively. The coefficients on the 2000 and 2015 dummies in Table 3 indicate trends in the consumption of on-the-job leisure that are consistent with the results in Table 2. There is a decrease in the consumption and

measures of on-the-job leisure, as well as socio-demographic characteristics of workers. This table highlights some differences between the two samples, although one cannot assume that diaries with RTI information are inferior to diaries without RTI information.

[10] For the regression on the working time until on-the-job leisure, we exclude the hours of market work in the day, given the high correlation between the indicator and this variable. Results are consistent with the inclusion of this variable.

frequency of on-the-job leisure, given that the decade dummies are statistically significant at the 99% level. The decade dummies are negative in the case of the consumption of on-the-job leisure and the number of breaks for on-the-job leisure, and positive for time working before consuming on-the-job leisure.

The regression results in Table 3 suggest that the decline in on-the-job leisure is predominantly a period effect, but that for high-RTI occupations, on-the-job leisure spells are less frequent and thus more chunky. The coefficients on the interactions between the RTI index and the decade dummies show that there are important differences of this period effect across occupations, indicating that workers in routine task-intensive occupations decreased the frequency of on-the-job leisure to a greater extent than workers in non-routine task-intensive occupations.[11]

In the 1980s, routine task-intensive occupations had a higher frequency of on-the-job leisure than non-routine task-intensive occupations, although by the end of the period, differences across occupations had diminished, or even reversed, in terms of the frequency of on-the-job leisure. In particular, the coefficient on the RTI index indicates that at the beginning of the period, 'office clerks' (RTI=2.24), the occupation with the highest RTI index, had 0.71 more on-the-job leisure episodes and spent one hour and 39 fewer minutes at work before consuming on-the-job leisure than 'managers of small enterprises' (RTI=-1.52), the occupation with the lowest RTI index. During this period, the coefficients on the interaction of the 2000 and 2015 dummies with the RTI index, in Table 3, indicate that office clerks experienced a monotonic decrease in the frequency of on-the-job leisure, relative to managers.

In particular, the interaction coefficient between the 2015 dummy and the RTI index shows that office clerks experienced a decrease of 0.83 (3.76*0.22) more in the number of on-the-job leisure episodes than managers, and the time spent working before consuming on-the-job leisure increased by one hour and 39 minutes (3.76*0.44) compared to managers.[12] Thus, at the end of the period, office clerks were relatively worse

[11] One factor that may explain the increase in work effort as part of technological change is the monitoring of jobs. Technological change has allowed a reduction in the costs of monitoring jobs via computers, which can affect the effort of workers because greater monitoring reduces the chances of workers shying away from their tasks. However, we have found no statistical information on the level of monitoring of different occupations, and we cannot explore what part of the observed trends in work effort is due to greater monitoring.

[12] The difference in the RTI index values for 'office clerks' and 'managers of small enterprises' is 3.76 [2.24 - (-1.52)]. Multiplying this figure by the RTI index coefficient in Table 3 yields a difference at the beginning of the period between workers in the two occupations of 0.71 (3.76*0.19) in the number of on-the-job leisure episodes and of one hour and

off than managers, as they had 0.12 fewer on-the-job leisure episodes, and worked the same amount of time before consuming on-the-job leisure.

Overall, our results show that the decreases in the frequency of on-the-job leisure were comparatively larger for workers in routine task-intensive occupations, with higher values of the RTI index. These results support the notion that technological change may underlie the observed trends in work effort in the UK. Equation (1) resembles a difference-in-differences model, in which the primary focus of analysis centers on the systematic bias stemming from technological changes.

3.1.2. Competition for jobs, offshoring of jobs and labour market conditions

We alternatively test whether it is the mere threat of losing the job (because of automation) that affects on-the-job leisure. To test this hypothesis, we use the occupational change in employment for each occupation, computed as the percentage change in the share of employment that each occupation represents in comparison to the reference year (1985), and estimate Equation (1), adding the change in employment and its interaction with the RTI measure. Table 4 shows that the interaction terms between the RTI and the change in employment are not statistically significant for the consumption or frequency of on-the-job leisure, indicating that this channel is not behind the observed trends in work effort.

Prior literature has argued that offshoring of jobs could also explain employment losses for middle-wage occupations, since their job tasks are outsourced to workers in countries with lower labour costs (Acemoglu and Autor, 2011; Goos et al., 2014).[13] The fear that their work will be outsourced to other places with lower labour costs can make workers increase their effort in order to increase their productivity, and thus avoid such outsourcing. In those jobs that are more likely to be outsourced, we should expect to find larger increases in work effort, in comparison to jobs at lower risk of being outsourced. We analyse trends in the consumption and frequency of on-the-job leisure, using an occupation-specific offshoring index (BK index) obtained from Blinder and Krueger

39 minutes (3.76*0.44=1.65 hours per day) in the time working before consuming on-the-job leisure. Similarly, given the coefficient on the interaction between the 2015 dummy and the RTI index in Table 3, the relative decrease in the consumption and frequency of on-the-job leisure for office clerks, with respect to managers, is calculated as follows: 0.83 (3.76*0.22) fewer on-the-job leisure episodes and one hour and 39 more minutes (3.76*0.44=1.65 hours per day) of working before consuming on-the-job leisure.

[13] See Hummels et al. (2018) for a review of the effects of offshoring on labor markets.

(2013) and adapted to the ISCO-88 occupational classification by Goos et al. (2014). Higher values of the offshoring index indicate a higher probability of being offshored (see Suplementary Appendix B for a description of the values of the offshoring index for all occupations). We estimate Equation (1) but using the BK index instead of the RTI index.[14] Table A8 in Supplementary Appendix shows that offshoring cannot explain the observed trends.

An alternative explanation is related to local labour market conditions and the business cycle, both of which, generally, exert effects on the incentives to engage in non-work at work (Burda et al., 2020). Lazear et al. (2013) show that lower worker bargaining power, as a result of the recent financial crisis in the US, resulted in increases in work effort (measured as output per hour on the job) of those who remained employed. This may represent cyclical tolerance of the employer (labour hoarding) or local unemployment (efficiency wages). One way to analyse this factor would be to control for labour market slack using detailed local information and pooling the data. Some of the surveys used here do not contain detailed information on the location of the worker, and thus we cannot explore this channel.

3.2. Supply-side explanations

We now rule out supply-side explanations related to worker characteristics that may have led to the observed changes in the consumption and frequency of on-the-job leisure. In doing so, we consider education and the presence of children as possible driving forces of the observed patterns in work effort. Furthermore, we explore the composition of leisure outside the workplace to see if the observed trends in on-the-job leisure contrast with the trends in out-of-job leisure, and whether they may be related to changing preferences.

3.2.1. The role of education of workers

[14] We examine a more comprehensive model that contains interactions between possible confounding factors (e.g., education, presence of children, the Offshoring index) and dummy variables for time decades, based on Goos et al. (2015). We find that the RTI index and its related time interactions are statistically significant and demonstrate the expected behavior, whereas the other interaction terms do not (as seen in Table A7 of the Appendix). For the purpose of simplification, we utilize the results of Equation (1).

We explore whether the decreases in the consumption and frequency of on-the-job leisure stem from changes in the educational level of workers. Aguiar and Hurst (2007) and Gimenez-Nadal and Sevilla (2012) show increases in leisure time across industrialized countries, particularly for the least educated. Increases in leisure on the part of less educated workers, who tend to work in middle-wage occupations, are consistent with those workers decreasing their consumption and frequency of on-the-job leisure, in order to have more leisure outside their workplaces.

To test this hypothesis, we estimate OLS equation models as follows:

$$E_i = \mu + \beta_1 X_i + \beta_2 Educ_i + \beta_3^{'} D_{t,i} + \beta_4^{'} D_{t,i} * Educ_i + \varepsilon_i \quad (2)$$

where E_i is a measure of work effort (either the consumption or frequency of on-the-job leisure) for respondent i, and $Educ_i$ represents dummy variables to control for the education of workers. $\beta_3^{'}$ is a vector of dummy variables for decade. The coefficients of interest are the vector $\beta_4^{'}$ on the interaction of survey dummies $D_{t,i}$ with the dummy variables of education. We consider three levels of education: workers with primary education (less than 12 years of education) as reference group, comparing them with workers with secondary education (12-15 years of education) and university education (16 and more years of education).

Panel A of Table 5 presents the results of estimating Equation (2) for individuals based on differences in educational attainment. Although we find that some of the interaction terms are statistically significant, the results do not help to explain the documented trends in on-the-job leisure during this period, since if we are to explain these observed trends we should expect the interaction terms to be statistically significant throughout the period.

3.2.2. The role of children

Another explanation of the patterns observed for on-the-job leisure is the rise in parental time investments (Guryan et al., 2008). Increases in parental time spent in human capital-enhancing activities are mainly viewed as a result of increases in returns to investment in children over time (Chiappori et al., 2017; Doepke and Zilibotti, 2017). Parents may have experienced larger decreases in the consumption and frequency of on-the-job leisure, compared to non-parents, because they are likely to strive to have more time available to spend with their children. This could mean that they are working harder, resulting in less

on-the-job leisure, since they are trying to finish their work obligations sooner in order to maximize the time spent with their children.

To test this hypothesis, we estimate OLS equation models as follows:

$$E_i = \mu + \beta_1 X_i + \beta_2 Children_i + \beta_3^{'} D_{t,i} + \beta_4^{'} D_{t,i} * Children_i + \varepsilon_i \qquad (3)$$

where E_i is a measure of work effort (either the consumption or frequency of on-the-job leisure) for respondent *i*, and $Children_i$ is a dummy variable to control for the presence of children in the worker's household (value '1' if there is a child under age 5 in the household and value '0' otherwise). $\beta_3^{'}$ is a vector of dummy variables for decades. The coefficients of interest are the vector $\beta_4^{'}$ on the interaction of survey dummies $D_{t,i}$ with the dummy variable controlling for the presence of children.

Panel B of Table 5 presents the results of estimating Equation (3) for individuals based on the presence of children. Again, although we find that some of the interaction terms are statistically significant, the results do not help to explain the documented trends in on-the-job leisure during this period, since the interaction terms should be statistically significant across the whole period.

3.2.3. Changes in the composition of leisure outside the job place

We also test whether our results are driven by secular declines in leisure outside of work, particularly for those in routine task-intensive occupations. We develop a more comprehensive picture of how workers allocate their work and leisure, and we consider whether there are any potential offsetting effects of work during leisure hours. These offsetting effects of work during leisure hours could have increased more for workers in some high-paying, non-routine professional occupations, which could have affected work satisfaction differently. Sevilla et al. (2012) show decreases in leisure overall in the US between the 1960s and the 2000s, but more so for the highly educated. Thus, we look at whether declines in leisure outside of work have been less so for routine task-intensive occupations.

To that end, we compute the time devoted to off-the-job leisure, which is defined as the period before and after work. The definition of leisure is similar to the definition of on-the-job leisure (social leisure, active leisure, and passive leisure), although restricted

to activities that are done before or after work. Table 6 shows the evolution of the time devoted to off-the-job leisure, off-the-job meals, and off-the-job leisure and meals. We observe a decrease in off-the-job leisure and meals between the 1980s and the 2000s, consistent with prior research showing decreases in leisure time in the UK (Giménez-Nadal and Sevilla, 2012; Fang and McDaniel, 2017). We have evidence that leisure has decreased both in and outside of the workplace, indicating that lost leisure in the workplace is not being made up for outside of work.

In Table 7, we examine the relationship between the routine task-intensity of an occupation and the time devoted to off-the-job leisure and/or meals, as estimated by Equation (1), with the dependent variable being the time devoted to off-the-job leisure during working days. Our results show that the decrease in off-the-job leisure and/or meals is not linked to the routine task-intensity of the occupation. We also focus on the time devoted to off-the-job meals, looking at whether declines in off-the-job meals have been less so for routine task-intensive occupations. We estimate the time devoted to off-the-job meals as in Equation (1), and Column (2) shows that neither the amount nor the decrease in off-the-job meals are affected by non-routine task-intensity. Finally, we combine both off-the-job leisure and meals (Column (3)), and results are consistent with the use of this alternative definition of off-the-job free time (leisure and meals). Thus, we find that the routine task-intensity of the occupation is not related to the amount of leisure outside of work nor to the reported decrease in this leisure.

One issue that remains from this analysis relates to part-time work, since some workers may choose to go part-time in response to increasing work intensification. We have replicated the results shown in Tables 6 and 7 with a sample of both full-time and part-time workers and results are robust (see Tables A8 and A9 of the Supplementary Appendix).[15]

Another question that emerges from our analysis is that of the location of work. The adoption of ICT technologies has allowed for a relocation of jobs from workplaces to other places, including working from home and working while travelling. The analysis of the current data shows that the proportion of work done in the workplace has decreased

[15] The analysis of the sample shows that the percentage of part-time workers has decreased decade by decade, with 37% of the workers in the sample working part-time in the 1980s, while only 18% of the workers in the sample worked part-time in the 2010s. These figures differ from those reported by official statistics, which may indicate that the sample of part-time workers is not representative, and thus results must be taken with caution.

from 89.67% in the 1980s to 79.32% in 2010, while the proportion of work done at home or travelling has decreased by 8.41% and 3.37%, respectively (see Table A10 in Supplementary Appendix). These trends may indicate that ICT technology adoption may be behind the observed trends in the consumption and frequency of on-the-job leisure, especially for those whose work entails moving between multiple locations in a day, or spending time in vehicles while working. However, additional analyses excluding workers working from home (Table A11 in Supplementary Appendix) indicate that ICT is not the only factor at the root of the evolution of on-the-job leisure.

3.3. The Skills and Employment Surveys

Drawing on the Skills and Employment Survey Series, Green et al. (2022) analyse the evolution of work effort in the UK. This survey series contains data on the skills and employment experiences of Britons aged 20-65 for the years 1986, 1992, 1997, 2001, 2006, 2012, and 2017. The authors use this data to calculate several indicators related to work intensification in the UK, such as technological change (e.g. computerized and/or automated technology), the closer control and discipline afforded by modern forms of management (e.g. Just In Time (JIT) and Total Quality Management (TQM)), and team cooperation and discipline, together with incentive pay, target-setting, and other elements of the high-involvement package, such as upskilling, the organization's changing environment (e.g. greater external competitive pressure), and the type of employment.

However, only three indicators can be computed in all the decades. These are: 'New automated equipment' (the proportion of workers answering 'yes' to the question about new computerized equipment during the previous five years), the presence of unions at the workplace (the percentage of workers answering 'yes' to the question about unions or staff associations), and the proportion of workers with permanent contracts. We compute the average value for the different SES years and link them to the Time Use Survey data. Specifically, the average value of the SES 1986 is linked to the TUS 1983 and TUS 1986 data, the average value of the SES 1992 and SES 1997 is linked to the TUS 1995, the average value of the SES 2001 is linked to the 2000 TUS, the average value of the SES 2006 is linked to the TUS 2005, and the average value of the SES 2012 and SES 2017 is linked to the TUS 2015. We estimate OLS regressions to examine the consumption and frequency of on-the-job leisure, controlling for the socio-demographic factors used in

Equation (1), and the three variables obtained from SES series. Our proxy variable for automation/technological change (i.e. computer use at work) is computed for each period of time, and given that it changes over time we estimate an OLS model, where the variable is introduced directly as an explanatory variable.

Table 8 shows that the introduction of computerized and/or automated equipment is associated with a decrease in the consumption and frequency of on-the-job leisure (less consumption of on-the-job leisure, fewer number of breaks for on-the job leisure, and more time working until consuming on-the-job leisure).

The empirical evidence indicates that the introduction of computerized and automated equipment is linked to reduced leisure and increased work effort, supporting the hypothesis that technological change drives higher work dedication. Conversely, stronger labor unions, staff associations, and permanent contracts are associated with increased leisure and consumption. This implies that declining union influence intensifies work effort in the UK, while permanent contracts signal job security and greater leisure, suggesting that temporary contracts signify job insecurity and higher work pressure.

4. Conclusions

This paper, using detailed diary information on what workers do while at work, documents a decrease in the daily amount of time spent in the consumption of on-the-job leisure in the UK since the 1980s. The number of on-the-job leisure spells also decreased, and workers worked for longer before taking a break. We also show that the decrease in the frequency of on-the-job leisure is much greater for workers in routine task-intensive occupations. All in all, the results are consistent with the automation of job tasks as a factor underlying the increase in workers' effort during the analysed period. By revealing increases in work effort, our results add to the losses from routine-biased technological change for workers in middle-wage occupations, beyond the increases in wage inequality and unemployment, and posit routine-biased technological change as a factor behind the trends in work intensification in the UK.

One question that emerges from this analysis is why this channel contributes to work intensification in jobs high in routine-task content, such as office clerks. These jobs can be characterized as having easy-to-monitor task performance from the outset. Thus, it

could be that the RBTC also affects the task content of the occupations (Autor et al., 2003; Acemoglu and Autor, 2011), changing its composition (Acemoglu and Restrepo, 2019,2020). The current analysis and data do not allow us to test whether work intensification in the UK comes from a more efficient allocation of job tasks, from the changing composition of job tasks, or from both. We leave this issue for future research.

One limitation of the current analysis is that old time-use surveys do not include enough information about workers, such as the type of contract. It would be interesting to analyse whether the findings could be different for workers on permanent contracts compared to those with fixed-term or zero-hours contracts, since effort and routinization may affect these workers differently. The analysis using the SES series indicates that a higher proportion of workers with permanent contracts is related to a higher frequency of on-the-job leisure. Furthermore, there are uneven time gaps between the time use surveys used (the shortest is 4 years and the longest is 10 years), and while these gaps may appear relatively short, many things may have happened that are relevant for our analysis. For instance, in the period between 1987 and 1995, many workplaces in the UK adopted personal desktop computers, and in the decade between surveys in 2005 and 2015 the use of smartphones may have transformed how people perform their jobs, for instance by having access to email on a 24/7 basis. These are only two examples of technological and societal changes that took place in the periods between the surveys. Unfortunately, time use surveys are costly to implement, and their availability is scarce.

Moreover, wages of workers, or the pay structure, may also be relevant in the current context, as the consumption of on-the-job leisure probably depends on pay. However, the surveys used here do not contain information on wages or pay structure, and thus we leave this issue for future research. Additionally, it is possible that other unobserved person-fixed-effects within occupation–industry cells, which are not controlled for, may induce biases, and no appropriate instruments for the explanatory variables are available. Finally, the COVID-19 pandemic has led to an increase in the proportion of individuals who work from home (Aksoy et al. 2021), which may affect worker effort as we measure it in the current context, and thus it would be interesting to analyse this. However, this cannot be accomplished from the current data, since surveys do not cover the COVID-19 period, and the topic must, again, be left for future research.

In the future, investing in human capabilities and new capital is a more effective growth strategy than attempting to get people to work harder, though this has had unequal effects for workers (Green et al., 2022). Nevertheless, there is still room for work intensification, so policymakers and researchers must be vigilant in monitoring this aspect of job quality. A more positive outcome could be achieved if there was a move to allow trade unions to bargain over working conditions, or if employers embraced job re-design. Additionally, providing workers with better social support, giving them more task discretion, and offering opportunities for organizational participation could reduce the detrimental effects of work intensification on well-being.

Supplementary material

Supplementary material is available on the OUP website. These are the replication files and the online appendices.

Funding

This work was supported by the European Research Council [CoG PARENTIME-770839 to A.S.]; the Ministry of Science and Innovation [PID2019-108348RA-I00 to J.I.G.N.]; and the Gobierno de Aragón [S32_20R to J.I.G.N.].

Conflict of interest

The authors declare no conflicts of interest.

Acknowledgments

We thank Alex Bryson, Juan José Dolado, Andrea Ichino and Anne Salomons for their comments, three anonymous referees for useful feedback, and participants in the Quantitative Research Workshop at the London School of Economics, the workshop on Recent Developments in Labour Economics at Queen Mary University of London, the SOLE/EALE 4th World Meeting, and seminars in the European University Institute (Florence, Italy), University of Reading, Queen Mary University of London (UK), the

University of Zaragoza (Spain), and the School of Economics and Business of the University of Navarra (Spain).

References

Acemoglu, D., and Autor, D.H. (2011) Skills, Tasks and Technologies: Implications for Employment and Earnings, in O. Ashenfelter and D.E. Card (eds.) *Handbook of Labor Economics*, Vol 4B, Elsevier, Amsterdam, The Netherlands, 1043-71.

Acemoglu, D. and Restrepo, P. (2019) Automation and New Tasks: How Technology Displaces and Reinstates Labor, *Journal of Economic Perspectives,* 33, 3-30.

Acemoglu, D. and Restrepo, P. (2020) Unpacking Skill Bias: Automation and new Tasks, *American Economic Review Papers and Proceedings,* 110, 356-61.

Aguiar, M. and Hurst, E. (2007) Measuring Trends in Leisure: The Allocation of Time over Five Decades, *Quarterly Journal of Economics,* 115, 969-1006.

Aksoy, C.G., Barrero, J.M., Bloom, N., Davis, S.J., Dolls, M., and Zarate, P. (2022) Working from Home Around the World, *EconPol Forum CESifo,* 23, 38-41,

Autor, D.H. (2015) Why Are There Still So Many Jobs? The History and Future of Workplace Automation, *Journal of Economic Perspectives,* 29, 3-30.

Autor, D.H. and Dorn. D. (2013) Inequality and Specialization: The Growth of Low-Skill Service Jobs in the United States, *American Economic Review,* 103, 1553-1597.

Autor, D.H., Dorn. D., and Hanson, G.H. (2015) Untangling Trade and Technology: Evidence from Local Labor Markets, *Economic Journal,* 125, 621-646.

Autor, D.H., Katz, L.F., and Kearney, M.S. (2006) The Polarization of the U.S. Labor Market, *American Economic Review,* 96, 189–194.

Autor, D.H., Katz, L.F., and Kearney, M.S. (2008) Trends in U.S. Wage Inequality: Revising the Revisionists, *Review of Economics and Statistics*, 90, 300-323.

Autor, D.H., Levy, F., and Murnane, R.J. (2003) The Skill-Content of Recent Technological Change: An Empirical Investigation, *Quarterly Journal of Economics,* 118, 1279-1333.

Barret, G.F. and Hamermesh, D. (2019). Labor Supply Elasticities: Overcoming Nonclassical Measurement Error Using More Accurate Hours Data, *Journal of Human Resources,* 54, 255-265.

Bartel, A., Ichniowsky, C., and Shaw, K. (2007) How does information technology affect productivity? Plant-level comparisons of product innovation, process improvement, and worker skills, *Quarterly Journal of Economics,* 122, 1721-1758.

Blinder, A.S. and Krueger, A.B. (2013). Alternative Measures of Offshorability: A Survey Approach, *Journal of Labor Economics,* 31, S97–S128.

Burda, M., Genadek, K.R., and Hamermesh, D.S. (2020) Unemployment and Effort at Work, *Economica,* 87, 662-681.

Chiappori, P.A., Salanié, B., and Weiss, Y. (2017) Partner Choice, Investment in Children, and the Marital College Premium, *American Economic Review,* 107, 2109-2167.

Dickinson, D.L. (1999) An Experimental Examination of Labor Supply and Work Intensities, *Journal of Labor Economics*, 17, 638-670.

DiNardo, J.E. and Pischke, J.S. (1997) The returns to computer use revisited: Have pencils changed the wage structure too? *Quarterly Journal of Economics,* 112, 291-303.

Doepke, M. and Zilibotti, F. (2017) Parenting with Style: Altruism and Paternalism in Intergenerational Preference Transmission, *Econometrica,* 85, 1331-1371.

Dustmann, C., Ludsteck, J., and Schönberg, U. (2009) Revisiting the German Wage Structure, *Quarterly Journal of Economics,* 124, 809-842.

Fang, L. and McDaniel, C. (2017) Home Hours in the United States and Europe, *The BE Journal of Macroeconomics,* 17, 1-27.

Gathmann, C. and Schönberg, U. (2010) How General is Human Capital? A Task-Based Approach, *Journal of Labor Economics,* 28, 1-49.

Gimenez-Nadal, J.I., Molina, J.A., and Velilla, J. (2018) Spatial distribution of US employment in an urban efficiency wage setting, *Journal of Regional Science,* 58, 141-158.

Gimenez-Nadal, J.I. and Sevilla, A. (2012) Trends in time allocation: A cross-country analysis, *European Economic Review,* 56, 1338-1359.

Goos, M. and Manning, A. (2007) Lousy and Lovely Jobs: The Rising Polarization of Work in Britain, *Review of Economics and Statistics,* 89, 118-133.

Goos, M., Manning, A., and Salomons, A. (2009) The Polarization of the European Labor Market, *American Economic Review Papers and Proceedings*, 99, 58-63.

Goos, M., Manning, A., and Salomons, A. (2014) Explaining Job Polarization: Routine-Biased Change and Offshoring, *American Economic Review,* 104, 2509-2526.

Green, F. (2001) It's been a hard day's night: The concentration and intensification of work in late twentieth-century Britain, *British Journal of Industrial Relations,* 39, 53–80.

Green, F. (2004) Why Has Effort at work Become More Intense, *Industrial Relations,* 43, 709-741.

Green, F. (2006) *Demanding Work. The Paradox of Job Quality in the Affluent Economy*, Woodstock, UK: Princeton University Press.

Green, F. and McIntosh, S. (2001) The intensification of work in Europe, *Labour Economics,* 8, 291–308.

Green, F., Felstead, A. Gallie, D., and Henseke, G. (2022) Working still harder,' *Industrial and Labor Relations Review,* 75, 458-487.

Guryan, J., Hurst, E., and Kearney, M. (2008). Parental Education and Parental Time with Children, *Journal of Economic Perspectives,* 22, 23–46.

Hamermesh, D.S. (1990) Shirking or Productive Schmoozing: Wages and the Allocation of Time at Work, *Industrial and Labor Relations Review,* 43, 121s-133s.

Hummels, D., Munch, J.R., and Xiang, C. (2018) Offshoring and Labor Markets, *Journal of Economic Literature,* 56, 981-1028.

Ichniowsky, C., Shaw, K.. and Prennushi, G. (1997) The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines, *American Economic Review,* 87, 291-313.

Lazear, E.P., Shaw, K.L., and Stanton, C. (2013) Making do with less: working harder during recessions, *Journal of Labor Economics,* 34, S333-S360.

Ohanian, L., Raffo, A., and Rogerson, R. (2008) Long-term changes in labour supply and taxes: Evidence from OECD countries, 1956-2004, *Journal of Monetary Economics,* 55, 1353-1362.

Rogerson, R. and Shimer, R. (2011). Search in Macroeconomic Models of the Labor Market, in O. Ashenfelter and D.E. Card (eds.) *Handbook of Labor Economics*, Vol 4A, Elsevier, Amsterdam, The Netherlands, 619-700.

Sevilla, A., Gimenez-Nadal, J.I., and Gershuny, J. (2012) Leisure Inequality in the United States: 1965-2003, *Demography,* 49, 939-964.

Spitz-Oener, A. (2006) Technical Change, Job Tasks, and Rising Educational Demands: Looking Outside the Wage Structure, *Journal of Labor Economics,* 24, 235-270.

Stewart, L.A., and Atkinson, R.D. (2013) Restoring America's Lagging Investment in Capital Goods, *The Information Technology & Innovation Foundation*, October 2013. https://www2.itif.org/2013-restoring-americas-lagging-investment.pdf (last accessed 13 September 2023).

Table 1. Example of the consumption and frequency of on-the-job leisure

(1)	(2)	(3)	(4)
Start time	**Finish time**	**Activity type**	**Duration**
8:00 a.m.	11:00 a.m.	Paid work	3.00
11:00 a.m.	11:20 a.m.	Meals or snacks in other places	0.33
11:20 a.m.	12:00 p.m.	Relax/do nothing	0.66
12:00 p.m.	2:10 p.m.	Paid work	2.16
2:10 p.m.	2:20 p.m.	Work breaks	0.16
2:02 p.m.	4:40 p.m.	Paid work	2.33
Time at work (hours)			8.67
Time working (hours)			7.50
Consumption of on-the-job leisure (hours)			1.16
Number of on-the-job leisure episodes			2.00
Working time until consuming on-the-job leisure (hours)			2.50

Notes: *Time at work* measures the time from the moment a worker begins work until the time a worker stops working on a given diary day. *Time working* measures the time that the worker spends in market work activities while at work. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells of non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day.

Table 2. Consumption and frequency of on-the-job leisure over time, the UK

	(1)		(2)		(3)		(4)		(5)	(6)
	Decade 1980s		**Decade 1990s**		**Decade 2000s**		**Decade 20010s**		**Diff 2010s-1980s**	**P-value diff**
Time at work	8.76	(0.06)	9.44	(0.14)	8.81	(0.05)	8.39	(0.08)	-0.37	(<0.01)
Working Time	7.40	(0.04)	8.43	(0.12)	7.80	(0.04)	7.23	(0.07)	-0.17	(0.05)
Consumption of on-the-job leisure	1.36	(0.03)	1.00	(0.07)	1.00	(0.02)	1.16	(0.04)	-0.20	(<0.01)
Frequency of on-the-job-leisure										
Number of on-the-job leisure episodes	1.69	(0.02)	1.08	(0.05)	1.10	(0.02)	1.31	(0.03)	-0.38	(<0.01)
Working time until consuming on-the-job leisure	3.31	(0.04)	5.03	(0.14)	4.62	(0.04)	3.89	(0.07)	0.58	(<0.01)
Number of diaries	2,836		494		4,810		1,692			
Number of workers	618		494		4,138		1,381			

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Time at work* measures the time from the moment a worker begins work until the time a worker stops working in a given diary day. *Time working* measures the time that the worker spends in market work activities while at work. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day.

Table 3. Consumption and frequency of on-the-job leisure over time: the role of RBTC

	(1)	(2)	(3)
	Amount	*Frequency*	
	Consumption of on-the-job leisure	*Number of breaks for on-the-job leisure*	*Working time until consuming on-the-job leisure*
RTI	0.03	0.19***	-0.44***
	(0.05)	(0.05)	(0.08)
Decade's 2000's	-0.37***	-0.60***	1.32***
	(0.07)	(0.06)	(0.12)
Decade's 2010's	-0.27***	-0.35***	0.64***
	(0.08)	(0.06)	(0.13)
RTI *Decade 2000's	-0.08	-0.15***	0.27***
	(0.06)	(0.05)	(0.09)
RTI*Decade 2010's	-0.09	-0.22***	0.44***
	(0.07)	(0.06)	(0.11)
Number of observations	4,926	4,926	4,926
Number of workers	3,817	3,817	3,817
R-Squared	0.03	0.11	0.20

Notes: Robust standard errors in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 RTI_i + \beta_3 D_{t,i} + \beta_4 D_{t,i} * RTI_i + \varepsilon_i$, where E_i represents either the consumption or the frequency of on-the-job leisure (either the number of on-the-job leisure episodes or work time before consuming on-the-job leisure) for respondent i. The vector X_i includes person-specific socio-demographic characteristics. RTI_i is the Routine Task index measure. *Significant at the 10% level; **significant at the 5% level; ***Significant at the 1% level.

Table 4. Consumption and frequency of on-the-job leisure over time: RBTC and change in employment

	(1)	(2)	(3)
	Amount	*Frequency*	
	Consumption of on-the-job leisure	*Number of breaks for on-the-job leisure*	*Working time until consuming on-the-job leisure*
RTI	0.03	0.19***	-0.27***
	(0.05)	(0.05)	(0.08)
Change in Employment	-0.73	-1.16*	1.58
	(0.91)	(0.66)	(1.35)
Decade 2000s	-0.35***	-0.58***	1.05***
	(0.07)	(0.06)	(0.11)
Decade 2010s	-0.24***	-0.30***	0.58***
	(0.09)	(0.07)	(0.13)
RTI *Decade 2000s	-0.08	-0.15***	0.16*
	(0.06)	(0.05)	(0.09)
RTI *Decade 2000s*Change in Employment	2.01	1.01	-2.56
	(1.53)	(1.01)	(2.37)
RTI*Decade 2010s	-0.11	-0.26***	0.29***
	(0.08)	(0.06)	(0.11)
RTI*Decade 2010s*Change in Employment	0.61	0.78	-0.84
	(0.82)	(0.56)	(1.06)

Notes: Robust standard errors in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 RTI_i + \beta_3 D_{t,i} + \beta_4 D_{t,i} * RTI_i + \beta_5 D_{t,i} * RTI_i * Change\ in\ Employment_i + \varepsilon_i$, where E_i represents either the consumption or the frequency of on-the-job leisure (either the number of on-the-job leisure episodes or work time before consuming on-the-job leisure) for respondent i. The vector X_i includes person-specific socio-demographic characteristics. RTI_i is the Routine Task index measure for occupation 'i', and *Change in Employment*$_i$ measures the percent change in employment share for occupation 'i' in comparison to 1985 *Significant at the 10% level; **significant at the 5% level; ***Significant at the 1% level

Table 5. Consumption of on-the-job leisure over time, by educational attainment and presence of children <5

	(1)	(2)	(3)
	Amount	*Frequency*	
	Consumption of on-the-job leisure	*Number of breaks for on-the-job leisure*	*Working time until consuming on-the-job leisure*
	Panel A: Analysis by education		
Secondary education	0.05	-0.05	-0.05
	(0.07)	(0.05)	(0.10)
University education	0.27***	-0.06	0.11
	(0.08)	(0.05)	(0.10)
Decade 1990s	-0.59***	-0.61**	1.51**
	(0.19)	(0.29)	(0.76)
Decade 2000s	-0.51***	-0.69***	1.48***
	(0.07)	(0.05)	(0.11)
Decade 2010s	-0.47**	-0.51***	0.28
	(0.19)	(0.16)	(0.33)
Secondary education*Decade 1990s	(0.33)	(0.06)	(0.50)
	(0.21)	(0.30)	(0.78)
Secondary education*Decade 2000s	0.11	0.02	0.06
	(0.09)	(0.07)	(0.14)
Secondary education*Decade 2010s	0.02	-0.09	0.98***
	(0.20)	(0.17)	(0.35)
University education*Decade 1990s	0.53**	(0.21)	(0.63)
	(0.26)	(0.31)	(0.81)
University education*Decade 2000s	0.15	0.07	-0.25*
	(0.10)	(0.07)	(0.14)
University education*Decade 2010s	0.23	0.17	0.35
	(0.21)	(0.17)	(0.34)
Number of observations	9,832	9,832	9,832
Number of workers	6,631	6,631	6,631
R-Squared	0.04	0.13	0.35
	Panel B: Analysis by the presence of children <5		
Children <6	0.05	-0.13*	0.22
	(0.04)	(0.05)	(0.21)
Decade 1990s	-0.19***	-0.54***	1.00***
	(0.02)	(0.05)	(0.16)
Decade's 2000s	-0.39***	-0.66***	1.38***
	(0.04)	(0.06)	(0.18)
Decade's 2010s	-0.26***	-0.43***	0.92***
	(0.01)	(0.04)	(0.10)
Decade 1990s *Children <6	-0.07*	0.32***	-0.55**
	(0.03)	(0.04)	(0.20)
Decade's 2000s *Children <6	-0.06	0.02	0.12
	(0.10)	(0.07)	(0.23)
Decade's 2010s *Children <6	-0.30***	-0.01	-0.20
	(0.04)	(0.05)	(0.21)
Number of observations	9,832	9,832	9,832
Number of workers	6,631	6,631	6,631
R-Squared	0.04	0.13	0.20

Notes: Robust standard errors in parenthesis. Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65, and in working days defined as those with at least 60 minutes to market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 SF_i + \beta_3' D_{t,i} + \beta_4' D_{t,i} * SF_i + \varepsilon_1$, where E_i represents either the consumption or the frequency of on-the-job leisure (either the number of on-the-job leisure episodes or work time before consuming on-the-job leisure) for respondent i in period t. The vector $X_{i,t}$ includes person-specific socio-demographic characteristics. SF refers to the supply factor analysed. *Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Table 6. Trends in off-the-job leisure and eating

	(1)		(2)		(3)		(4)		(5)	(6)
	Decade 1980s		**Decade 1990s**		**Decade 2000s**		**Decade 2010s**		**Diff 2010s-1980s**	**P-value diff**
Leisure outside of work	3.98	(2.23)	3.78	(2.44)	3.76	(2.23)	3.51	(2.24)	-0.47	(<0.01)
Meals outside of work	0.77	(0.67)	0.62	(0.52)	0.72	(0.61)	0.79	(0.78)	0.02	(0.46)
Leisure + meals outside of work	4.75	(2.34)	4.40	(2.57)	4.48	(2.35)	4.30	(2.45)	-0.45	(<0.01)
Number of diaries	2,836		512		4,810		1,692			
Number of workers	618		495		4,138		1,380			

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Leisure in non-work time* includes the time devoted to social leisure, active leisure, and passive leisure, but outside the job.

Table 7. Consumption of off-the-job leisure over time

	(1)	(2)	(3)
	Leisure	*Meals*	*Leisure+Meals*
RTI	-0.01	0.00	-0.01
	(0.09)	(0.03)	(0.08)
Decade 2000s	-0.11	-0.07**	-0.19**
	(0.10)	(0.04)	(0.09)
Decade 2010s	-0.39***	-0.08**	-0.47***
	(0.11)	(0.04)	(0.11)
RTI *Decade 2000s	0.05	-0.03	0.02
	(0.09)	(0.03)	(0.09)
RTI*Decade 2010s	0.12	-0.02	0.10
	(0.11)	(0.04)	(0.10)
Number of observations	4,926	4,926	4,926
Number of workers	3,817	3,817	3,817
R-Squared	0.326	0.106	0.379

Notes: Robust standard errors in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 RTI_i + \beta_3 D_{t,i} + \beta_4 D_{t,i} * RTI_i + \varepsilon_i$, where E_i represents either off-the-job leisure or off-the-jog meals, or the sum of the two categories for respondent i. The vector X_i includes person-specific socio-demographic characteristics. RTI_i is the Routine Task Index measure. *Significant at the 10% level; **significant at the 5% level; ***Significant at the 1% level.

Table 8. Results using SES surveys

	(1)	(2)	(3)
	Amount	*Frequency*	
	Consumption of on-the-job leisure	*Number of breaks for on-the-job leisure*	*Working time until consuming on-the-job leisure*
Introduction of computers/automated equipment	-1.14***	-2.95***	4.67***
	(0.37)	(0.26)	(0.53)
Unions or staff associations at workplace	1.52**	2.96***	-4.65***
	(0.77)	(0.55)	(1.12)
Permanent contracts	0.67	12.80***	-15.31***
	(3.77)	(2.64)	(5.93)
Observations	9850	9850	9850
R-squared	0.042	0.125	0.348

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. Consumption of on-the-job leisure is the amount of time the respondent spends not working while at work. The number of on-the-job leisure episodes is constructed as the number of spells spent on non-work activities while at work. Working time until consuming on-the-job leisure is computed by dividing the total amount of time spent working by the number of work spells in a given diary day. SES data includes the years the years 1986, 1992, 1997, 2001, 2006, 2012 and 2017. *Introduction of computers/automated equipment* is obtained from the question that asked whether, over the previous five years, 'new computerised or automated equipment was introduced into the workplace' and computed as the proportion of workers answering 'yes' to this question. *Unions or staff associations at workplace* is measured as the percentage of workers answering 'yes' to the question 'whether are unions or staff associations at workplace'. *Permanent contracts* is measured as the proportion of workers with permanent contracts. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 D_{t,i} + \varepsilon_i$, where E_i represents either the consumption or the frequency of on-the-job leisure (either the number of on-the-job leisure episodes or work time before consuming on-the-job leisure) for respondent i in period t. The vector X_i includes person-specific socio-demographic characteristics. *Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Appendix for
"Trends in Effort at Work in the UK"

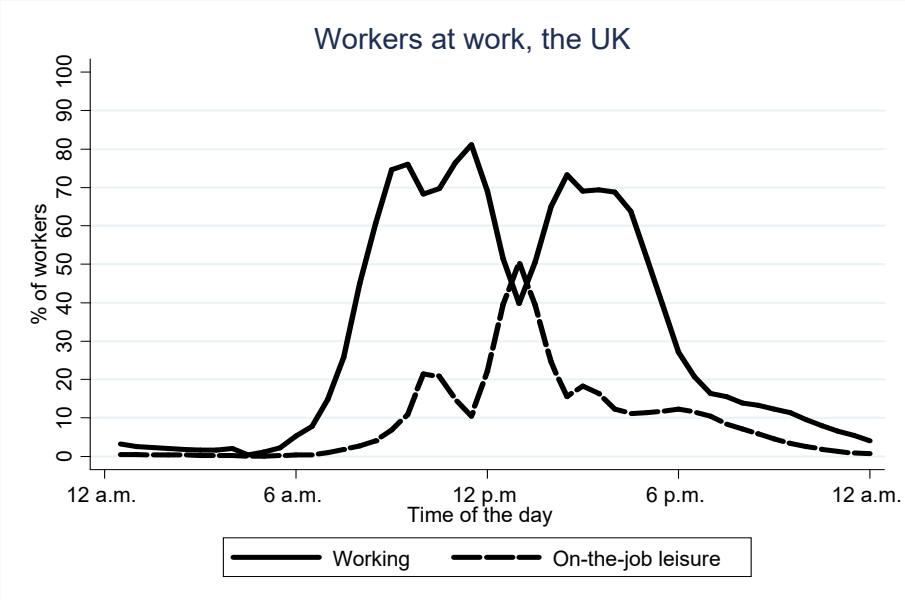
Jose Ignacio Gimenez-Nadal[§§§§]
Almudena Sevilla[*****]

[§§§§] University of Zaragoza (Spain): ngimenez@unizar.es

[*****] The London School of Economics (The UK): A.Sevilla@lse.ac.uk

Appendix A: Data information and additional analyses

Figure 1. Frequency of on-the-job leisure



Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Time at work* measures the time from the moment a worker begins work until the time a worker stops working on a given diary day. *Time working* measures the time that the worker spends in market work activities while at work. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. See Appendix Table A2 in Appendix A for a description of the activities included in the variables of on-the-job leisure. See Table A3 in Appendix A for the percentage of workers in each activity at every point in time that generates this figure.

Table A1. Survey description

Study aims, target populations, and sample restrictions

Survey years	*Organizing Aims and Considerations*	*Target Population*	*Sampling Restrictions*
1983-87	Aimed to monitor time use by people aged 14+ living in randomly sampled households in the UK	People aged 14+ living in randomly sampled households in the UK.	None
1995	Aimed to facilitate future studies using time budgets which would not unduly burden respondents	Multi- purpose survey for the people in age 16 or over	None
2000	This study collects the UK contribution to the Harmonized European Time Use Studies (HETUS) data. The results of the main survey will be used by government departments, academics, and other policy makers to monitor how people use their time and help shape policies	Multi- purpose survey for the people in age 8+	The survey aimed to collect 24,000 diaries (2 diaries for each of the 12,000 individuals taking part). Each participant was asked to complete two diaries. Children aged 8 to 13 completed child diaries. Child diaries covered one day.
2005	This study builds on lessons for collecting national time use data from the UK HETUS study in 2000-2001	One person aged 16 or older was selected for the interview and the diary	None
2015	The survey follows the Harmonized European Time Use Survey (HETUS) guidelines, with a few alterations. While the HETUS guidelines recommend collecting diaries from all household members age 10 and older, this survey, like the 2000-01 first UK HETUS contribution, collects diaries from all household members aged 8 and older.	One household member will complete the household roster and questionnaire, then each individual member aged 8 and older will be asked to complete a separate personal interview, as well as two diaries (one week day, one weekend day) covering 24 hour periods from 4AM until 4AM the next day	None

Relevant points in time from the sample designs

Survey years	*Fieldwork Period*	*Sampling of Days of the Week*	*When Activities Were Recorded*
1983-87	November-December 1983, January-February 1984; 6 March-29 June 1987	All household members aged 14+ asked to complete a 7-day diary, specifying main activity and secondary activities	On the day of observed activities
1995	May-95	All household members aged 16+ asked to complete 1 diary, specifying main activity and secondary activities	Respondents completed the diaries themselves with the assistance of interviewer. Recall
2000	June 2000 - August 2001	2 days, 1 weekend and 1 weekday	Self-completed in own words with pen and paper. Same day as activities
2005	21 March - 13 April 2005; 20 June - 16 July 2005; 19 September - 15 October 2005; 21 November - 17 December 2005	1 day	Previous day (with some diaries covering up to three days previously)
2015	April 2014-March 2015	2 diaries (one weekday, one weekend day) covering 24-hour periods from 4AM until 4AM the next day	Self-completed in own words with pen and paper. Same day as activities

Sample designs and response rates

Survey years	*Sample Frame*	*How Sample Drawn*	*Response Rate*
1983-1987	Private households	Stratified national random sample of addresses; prior to diaries commencing, one household member interviewed with extensive household questionnaire	40%
1995	Private households	OPCS Omnibus sample frame: interview 2,000 households per month randomly selected from 100 post code sectors, stratified by region, proportion of households renting from local authorities and proportion of heads of households in	93%

		SEGs 1-5 (professionals, employers, and managers)	
2000	Private households	The sample of addresses is selected from the Postcode Address File (PAF). One household per address is randomly selected	45%
2005	Private households	An independent cross-sectional multi-stage stratified random sample of private households in Great Britain (England, Wales and Scotland) is drawn for each month of the Omnibus survey, and the diary served as the module accompanying the core of basic survey details collected with every Omnibus survey.	59% across the four waves
2015	Private households	The survey draws a random national sample of households across the United Kingdom	61% for households, 81% for individuals

Source: Authors' compilation.

Table A2. Classification of on-the-job leisure activities

Commuting	Travel to/from work
Leisure-related activities	
Meals at work	meals at work
Meal Related activities	meals or snacks in other places
Social leisure	voluntary, civic, organizational act; worship and religion; other public event, venue; restaurant, café, bar, pub; party, social event, gambling; receive or visit friends; voluntary/civic/religious travel
Active leisure and exercise	work breaks, leisure & other education or training; pet care (not walk dog); general out-of-home leisure; attend sporting event; cinema, theatre, opera, concert; general sport or exercise; walking; cycling; other outside recreation; gardening/pick mushrooms; walk dogs; general indoor leisure; art or music; knit, crafts or hobbies; no activity, imputed or recorded transport; other travel; no recorded activity
Passive leisure	conversation (in person, phone); games (social & solitary)/other in-home social; correspondence (not e-mail); relax, think, do nothing; read; listen to music or other audio content; listen to radio; watch TV, video, DVD; computer games; e-mail, surf internet, computing; travel to and from work
Other non-work activities	
Personal Care	imputed personal or household care; sleep and naps; imputed sleep; wash, dress, care for self; consume other services
Housework	regular schooling, education; homework; food preparation, cooking; set table, wash/put away dishes; cleaning; laundry, ironing, clothing repair; maintain home/vehicle, including collect fuel; other domestic work; purchase goods; consume personal care services; physical, medical child care; teach, help with homework; read to, talk or play with child; supervise, accompany, other child care; adult care; education travel; child/adult care travel; shop, person/hhld care travel

Notes: Data come from 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys

Table A3. Methodology of surveys

Survey	Time Interval in the diary	Mode of data collection	Time period
UK 1983	15-minutes	Interview/self completed diary	On the day of observed activities
UK 1995	15-minutes	Interview/self completed diary	Recall
UK 2000	10 minutes	Self-completed in own-words with pen and paper	Same day as activities
UK 2005	10 minutes	Interviewer completed during face-to-face interview	Previous day (with some diaries covering up to three days previously)
UK 2015	10 minutes	Self-completed in own-words with pen and paper	Same day as activities

Source: Authors' compilation.

Table A4. Trends in on-the-job leisure, controlling for survey methodology

	(1)	(2)	(3)
	Amount	*Frequency*	
	Consumption of on-the-job leisure	*Number of breaks for on-the-job leisure*	*Working time until consuming on-the-job leisure*
Decade's 1990	-0.19***	-0.52***	0.82***
	(0.02)	(0.03)	(0.08)
Decade's 2000's	-0.28***	-0.54***	0.93***
	(0.02)	(0.02)	(0.05)
Decade's 2010's	-0.18***	-0.27***	0.48***
	(0.03)	(0.02)	(0.04)
Diary self-completed	-0.18***	-0.13***	0.25**
	(0.04)	(0.03)	(0.06)
Diary refers to same day	0.03	-0.07***	0.17***
	(0.02)	(0.01)	(0.03)
Constant	-0.37	-0.26**	2.13***
	(0.29)	(0.09)	(0.06)
Number of observations	9,832	9,832	9,832
R-Squared	0.04	0.13	0.35

Notes: Robust standard errors in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 D_{t,i} + \varepsilon_i$ where E_i represents our measures of the consumption and frequency of on-the-job leisure for respondent i. The vector X_i includes person-specific, socio-demographic characteristics: gender (ref.: male), age, dummy for living in couple (ref.: not in couple), the number of children under 18 in the household, hours worked during the diary day, the total number of activities reported by the individual in the diary day, whether the diarist self-reported the diary and whether the survey day refers to the same day than the interview day. *Significant at the 10% level; **significant at the 5% level; ***Significant at the 1% level.

Table A5. Timing of market work episodes and on-the-job leisure consumption

Time of the day	Working	On-the-job leisure
12:00 am-12:30 am	3.26%	0.49%
12:30 am-1:00 am	2.54%	0.43%
1:00 am-1:30 am	2.32%	0.33%
1:30 am-2:00 am	2.00%	0.30%
2:00 am-2:30 am	1.84%	0.32%
2:30 am-3:00 am	1.69%	0.27%
3:00 am-3:30 am	1.67%	0.16%
3:30 am-4:00 am	2.01%	0.14%
4:00 am-4:30 am	0.39%	0.02%
4:30 am-5:00 am	1.16%	0.08%
5:00 am-5:30 am	2.14%	0.15%
5:30 am-6:00 am	5.38%	0.30%
6:00 am-6:30 am	7.77%	0.36%
6:30 am-7:00 am	14.72%	0.93%
7:00 am-7:30 am	25.75%	1.78%
7:30 am-8:00 am	44.97%	2.72%
8:00 am-8:30 am	60.69%	4.05%
8:30 am-9:00 am	74.55%	6.86%
9:00 am-9:30 am	75.94%	10.88%
9:30 am-10:00 am	68.20%	21.40%
10:00 am-10:30 am	69.72%	20.86%
10:30 am-11:00 am	76.43%	14.90%
11:00 am-11:30 am	81.09%	10.44%
11:30 am-12:00 am	69.08%	22.28%
12:00 pm-12:30 pm	51.45%	39.52%
12:30 pm-1:00 pm	39.85%	50.46%
1:00 pm-1:30 pm	50.53%	39.46%
1:30 pm-2:00 pm	65.01%	24.57%
2:00 pm-2:30 pm	73.24%	15.53%
2:30 pm-3:00 pm	69.00%	18.25%
3:00 pm-3:30 pm	69.38%	16.29%
3:30 pm-4:00 pm	68.80%	12.32%
3:00 pm-4:30 pm	63.77%	11.14%
4:30 pm-5:00 pm	51.58%	11.35%
5:00 pm-5:30 pm	39.48%	11.73%
5:30 pm-6:00 pm	27.12%	12.33%
6:00 pm-6:30 pm	20.72%	11.55%
6:30 pm-7:00 pm	16.38%	10.48%
7:00 pm-7:30 pm	15.55%	8.42%
7:30 pm-8:00 pm	13.85%	7.14%
8:00 pm-8:30 pm	13.28%	5.84%
8:30 pm-9:00 pm	12.22%	4.51%
9:00 pm-9:30 pm	11.37%	3.39%
9:30 pm-10:00 pm	9.53%	2.53%
10:00 pm-10:30 pm	8.01%	1.83%
10:30 pm-11:00 pm	6.51%	1.27%
11:00 pm-11:30 pm	5.45%	0.82%
11:30 pm-12:00 pm	4.03%	0.69%

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65, and in working days defined as those with at least 60 minutes of market work activities, excluding commuting. *Working* includes the proportion of the workers that report doing market work activities. *On-the-job leisure* includes the proportion of workers that report consuming of on-the-job leisure. See Table A2 xfor a description of the activities included in the variable of on-the-job leisure

Table A6. Consumption of on-the-job leisure

	(1)	(2)	(3)
	Mean (hours per day)	**Standard Deviation**	**% of on-the-job consumption of leisure**
Time at work	8.75	(2.94)	
Time working	7.62	(2.47)	
On-the-job consumption of leisure	1.13	(1.58)	
Leisure	0.32	(0.84)	29.09%
Social leisure	0.14	(0.37)	11.96%
Active leisure and exercise	0.03	(0.23)	3.53%
Passive leisure	0.15	(0.51)	13.31%
Meals at work and related	0.45	(0.55)	39.45%
Other non-work	0.24	(0.74)	20.88%
Housework	0.05	(0.38)	4.47%
Personal Care	0.19	(0.58)	16.41%
Commuting	0.11	(0.44)	10.58%
Number of observations	9,832		
Number of workers	6,631		

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. Means and standard deviations are computed for the pool of data. *Time at work* measures the time from the moment a worker begins work until the time a worker stops working on a given diary day. *Time working* measures the time that the worker spends in market work activities while at work. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. See Table A2 for a description of the activities included in the variables of on-the-job leisure.

Table A7. Consumption and frequency of on-the-job leisure over time: RBTC and cofounding factors

	(1)	(2)	(3)
	Amount	*Frequency*	
	Consumption of on-the-job leisure	*Number of breaks for on-the-job leisure*	*Working time until consuming on-the-job leisure*
Variables			
RTI	0.04	0.16***	-0.26***
	(0.06)	(0.05)	(0.09)
Offshoring (BK)	-0.02	0.07	0.05
	(0.11)	(0.07)	(0.11)
Secondary education	-0.21	-0.10	0.15
	(0.16)	(0.12)	(0.22)
University education	0.10	-0.17	0.26
	(0.19)	(0.13)	(0.24)
Child <6 in household	0.12	-0.12	-0.11
	(0.18)	(0.13)	(0.29)
Year Dummies			
Decade's 2000's	-0.49***	-0.62***	1.10***
	(0.15)	(0.09)	(0.17)
Decade's 2010's	-0.44*	-0.39**	0.41
	(0.24)	(0.17)	(0.31)
Variables*Year Dummies			
RTI *Decade 2000's	-0.09	-0.12**	0.17*
	(0.07)	(0.05)	(0.10)
RTI*Decade 2010's	-0.10	-0.21***	0.27**
	(0.08)	(0.06)	(0.11)
Offshoring (BK)*Decade 2000's	0.02	-0.04	-0.13
	(0.12)	(0.07)	(0.13)
Offshoring (BK)*Decade 2010's	0.08	0.06	-0.21
	(0.13)	(0.08)	(0.14)
Secondary education*Decade 2000's	0.32*	0.00	-0.04
	(0.17)	(0.13)	(0.25)
Secondary education*Decade 2010's	0.33	-0.03	0.31
	(0.26)	(0.20)	(0.36)
University education*Decade 2000's	0.15	0.08	-0.24
	(0.21)	(0.14)	(0.27)
University education*Decade 2010's	0.36	0.23	-0.02
	(0.28)	(0.21)	(0.37)
Child <6 in household*Decade 2000's	-0.36*	-0.03	0.44
	(0.19)	(0.14)	(0.32)
Child <6 in household*Decade 2010's	-0.42**	0.01	0.11
	(0.20)	(0.15)	(0.31)
Number of observations	4,926	4,926	4,926
Number of workers	3,817	3,817	3,817
R-Squared	0.03	0.11	0.20

Notes: Robust standard errors in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 RTI_i + \beta_3 D_{t,i} + \beta_4 D_{t,i} * RTI_i + \beta_5 Cofounders_i + \beta_6 D_{t,i} * Cofounders_i + \varepsilon_i$ where E_i represents our measures of the consumption and frequency of on-the-job leisure for respondent i. The vector X_i includes person-specific, socio-demographic characteristics: gender (ref.: male), age, dummy for living in couple (ref.: not in couple), the number of children under 18 in the household, hours worked during the diary day, and the total number of activities reported by the individual in the diary day. We control for the RTI index of the worker's occupation (β_2). β_3 is a vector of dummy variables for the years 2000 and 2015, and β_4 is the interaction between the vector of year dummies and the RTI index. ε_i is the error term. β_5 is a vector of potential cofounders, which includes the BK index, dummy variables for secondary and university education (ref.: primary education) and a dummy variable to control for the presence of a child under 6 in the household (1) or not (0). β_6 represents the interaction between these potential cofounders and the year dummy variable for 2000 and 2015. *Significant at the 10% level; **significant at the 5% level; ***Significant at the 1% level.

Table A8. Consumption and frequency of on-the-job leisure over time: the role of offshoring

	(1)	(2)	(3)
	Amount	*Frequency*	
	Consumption of on-the-job leisure	*Number of breaks for on-the-job leisure*	*Working time until consuming on-the-job leisure*
Offshoring Index	-0.01	0.13**	-0.11
	(0.11)	(0.06)	(0.11)
Decade's 2000's	-0.36***	-0.57***	1.25***
	(0.07)	(0.06)	(0.12)
Decade's 2010's	-0.22***	-0.26***	0.50***
	(0.08)	(0.07)	(0.14)
Offshoring Index*Decade 2000's	-0.02	-0.09	-0.06
	(0.11)	(0.07)	(0.13)
Offshoring Index*Decade 2010's	0.07	0.00	-0.08
	(0.12)	(0.08)	(0.14)
Number of observations	4,926	4,926	4,926
Number of workers	3,817	3,817	3,817
R-Squared	0.03	0.11	0.20

Notes: Robust standard errors in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_1 + \beta_2 BK_i + \beta_3 D_{t,i} + \beta_4 D_{t,i} * BK_i + \varepsilon_i$, where E_i represents either the consumption or the frequency of on-the-job leisure (either the number of on-the-job leisure episodes or work time before consuming on-the-job leisure) for respondent i in period t. The vector X_i includes person-specific socio-demographic characteristics. BK_i is the offshorability index. *Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Table A9. Trends in off-the-job leisure and eating, including part-time workers

	(1)		(2)		(3)		(4)		(5)	(6)
	Decade 1980s		**Decade 1990s**		**Decade 2000s**		**Decade 2010s**		**Diff 2010s-1980s**	**P-value diff**
Leisure in non-work time	4.07	(2.22)	3.81	(2.41)	3.77	(2.22)	3.64	(2.31)	-0.42	(<0.01)
Meals in non-work time	0.84	(0.72)	0.66	(0.58)	0.75	(0.62)	0.82	(0.80)	-0.03	(0.20)
Leisure + meals in non-work time	4.91	(2.33)	4.47	(2.57)	4.53	(2.35)	4.46	(2.51)	-0.45	(<0.01)
Number of diaries	4,493		632		6,107		2,070			
Number of workers	1036		632		5,283		1,713			

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Leisure in non-work time* includes the time devoted to social leisure, active leisure, and passive leisure, but outside the job.

Table A10. Consumption of off-the-job leisure over time, including part-time workers

	(1)	(2)	(3)
	Leisure	*Meals*	*Leisure+Meals*
RTI	0.04	0.00	0.04
	(0.05)	(0.02)	(0.05)
Decade's 2000's	-0.18***	-0.05**	-0.24***
	(0.07)	(0.02)	(0.07)
Decade's 2010's	-0.41***	-0.04	-0.46***
	(0.08)	(0.03)	(0.09)
RTI *Decade 2000's	0.01	-0.02	-0.02
	(0.06)	(0.02)	(0.06)
RTI*Decade 2010's	0.08	-0.01	0.07
	(0.08)	(0.03)	(0.08)
Number of observations	6,607	6,607	6,607
Number of workers	4,870	4,870	4,870
R-Squared	0.308	0.115	0.364

Notes: Robust standard errors in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. See Table A3 in Appendix A for a description of the activities included in the consumption of off-the-job leisure. We estimate the following OLS regression: $E_i = \mu + \beta_1 X_i + \beta_2 RTI_i + \beta_3 D_{t,i} + \beta_4 D_{t,i} * RTI_i + \varepsilon_i$, where E_i represents either off-the-job leisure or off-the-jog meals, or the sum of the two categories for respondent i. The vector X_i includes person-specific socio-demographic characteristics: gender (ref.: male), age, dummy for secondary and university education (ref.: primary education), dummy for living in couple (ref.: not in couple), the number of children under 18 in the household, hours at work during the diary day, and the total number of activities reported by the individual in the diary day. RTI_i is the Routine Task Index measure. *Significant at the 10% level; **significant at the 5% level; ***Significant at the 1% level.

Table A11. Location while working

	(1)		(2)		(3)		(4)		(5)	(6)
	Decade 1980s		**Decade 1990s**		**Decade 2000s**		**Decade 2010s**		**Diff 2010s-1980s**	**P-value diff**
Percentage work at workplace	89.67%	(0.55)	91.86%	(1.10)	82.90%	(0.52)	79.32%	(1.00)	-10.35	(<0.01)
Percentage work from home	7.59%	(0.48)	5.45%	(0.91)	11.62%	(0.45)	16.00%	(0.90)	8.41	(<0.01)
Percentage work while travelling	1.47%	(0.19)	0.00%	(0.00)	0.26%	(0.05)	0.05%	(0.04)	-1.42	(0.21)
Percentage work at other locations	1.26%	(0.18)	2.69%	(0.60)	5.22%	(0.30)	4.63%	(0.50)	3.37	(0.01)
Number of diaries	2,836		494		4,810		1,692			
Number of workers	618		494		4,138		1,381			

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Time at work* measures the time from the moment a worker starts to work until the time a worker stops working in a given diary day. Location of work based on survey location and travelling codes. The variables are measured in percentage points.

Table A12. Consumption and frequency of on-the-job leisure over time, excluding workers working from home

	(1)		(2)		(3)		(4)		(5)	(6)
	Decade 1980s		Decade 1990s		Decade 2000s		Decade 20010s		Diff 2010s-1980s	P-value diff
Time at work	8.51	(0.05)	9.25	(0.13)	8.63	(0.04)	8.55	(0.07)	0.04	(001)
Working Time	7.44	(0.04)	8.44	(0.11)	7.92	(0.04)	7.74	(0.07)	0.30	(<0.01)
Consumption of on-the-job leisure	1.07	(0.02)	0.80	(0.06)	0.71	(0.02)	0.81	(0.04)	-0.26	(<0.01)
Frequency of on-the-job-leisure										
Number of on-the-job leisure episodes	1.63	(0.02)	0.99	(0.05)	0.99	(0.02)	1.23	(0.04)	-0.40	(<0.01)
Working time until consuming on-the-job leisure	3.44	(0.05)	5.28	(0.15)	4.93	(0.05)	4.39	(0.08)	0.95	(<0.01)
Number of diaries	2,416		429		3,890		1,223			
Number of workers	594		429		3,498		1,059			

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65 and do not report any work done from home. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Time at work* measures the time from the moment a worker begins work until the time a worker stops working on a given diary day. *Time working* measures the time that the worker spends in market work activities while at work. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. See Table A2 in Appendix A for a description of the activities included in the consumption of on-the-job leisure. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day.

APPENDIX B: ON-THE-JOB LEISURE AND RBTC

Original occupation codes for the UK TUS use the SOC80 and SOC90 codes, while we use the Camsis Project to do the cross-walk between the SOC codes and ISCO88 codes (http://www.camsis.stir.ac.uk/). The final samples are 186, 2,382 and 1,249 workers for the years 1983, 2000, and 2014 respectively, selected using the same criteria as in Section 1. In the conversion of the SOC codes to the ISCO88 codes, we lose 1,815 observations, representing 19.69% of the observations used in Table 2, because ISCO08 codes are not as detailed as SOC codes. The RTI covers 21 occupations out of the 26 occupations in the ISCO88. We thus additionally lose 532 observations belonging to these occupations, representing 5.77% of our main sample in Table 2. Table B1 shows detailed information on RTI values assigned to each occupation code.

Table B2 shows the values of the RTI index for each two-digit ISCO88 code, where occupations are sorted in ascending values of the RTI index. Following Acemoglu and Autor (2011) and the classification in Goos, Manning and Salomons (2014), the RTI index of workers in occupations such as managers, professionals, and services is low, suggesting that these are non-routine, task-intensive occupations. In contrast, workers in other occupations such as clerks, sales, and laborers in mining, construction and manufacturing have relatively high values of the RTI index, suggesting that workers in these occupations perform a majority of routine tasks.

To see the validity of the RTI index for our sample of UK workers, Table B3 uses the 1983, 2000, and 2015 UK sample to replicate Table 1 in Goos, Manning and Salomons (2014), who employ the 1993-2010 European Labor Force Survey to show that RBTC decreased the share of employment in middle-paying occupations, while increasing the share of employment in high-paying and low-paying occupations in the UK, also documented by Acemoglu and Autor (2011) using the May/ORG Current Population Survey for the years 1979-2009.

There is a strong resemblance between the figures shown in Table B3 and those obtained in Goos, Manning and Salomons (2014) for the UK. In particular, whereas at the beginning of the period the share of employment of workers in middle occupations was 17 percentage points higher than the share of employment of workers in high-paying occupations, by the end of the period, the share of employment for workers in middle occupations was 17 percentage points lower than the share of employment of workers in high-paying occupations. The reason for this reversal is that, while the percentage of workers in high- and low-paying occupations increased during this period, the percentage of workers in middle-paying occupations decreased. In particular, between 1983 and 2000 the percentage of workers in high-paying occupations increased from 34.95% to 44.71%, and to 49.08% in 2015. Similarly, the percentage of workers in low-paying occupations increased by 5.77% between 1983 and 2000, and by an additional 3.51% between 2000 and 2015. In contrast, the percentage of workers in middle-paying occupations decreased from 51.61% in 1983 to 39.59% in 2000, and to 31.71% in 2015.

Panel A of Table B4 compares the occupations in the lowest 10% and the highest 90% percentiles of the RTI index distribution, and Panel B compares occupations in the lowest 25% and the highest 75% percentiles of the RTI index distribution. It is evident that workers in non-routine, task-intensive occupations (i.e., higher RTI) spend more time in market-work time and work longer before consuming on-the-job leisure. Workers in the 25 (10) percentiles of the RTI index distribution devote 0.24 more hours per day to market work than those in the 75 (90) percentiles of the RTI index distribution, with this

difference being statistically significant. Additionally, workers in the 25(10) percentiles of the RTI index distribution work 4.54 (4.36) hours before consuming on-the-job leisure, whereas workers in the 75 (90) percentiles of the RTI index distribution work about 7% less before consuming on-the-job leisure (i.e. 4.23 (4.02) hours).

1. Classification of occupations according to the RTI index, UKTUS 1983, 2000 and 2015

	RTI index		*UK SOC 2000 codes*	*RTI index*
ment (HEO to Seni	-0.732465	1112	Directors and chief executives of major organizations	-0.7469759
nagers	-0.7469759	1121	Production, works and maintenance managers	-0.7469759
ies	-0.7469759	1122	Managers in construction	-0.7469759
gers	-0.7469759	1131	Financial managers and chartered secretaries	-0.7469759
	-0.7469759	1132	Marketing and sales managers	-0.7469759
	-0.7469759	1133	Purchasing managers	-0.7469759
dy managers	-0.7469759	1134	Advertising and public relations managers	-0.7469759
managers	-0.7469759	1135	Personnel, training and industrial relations managers	-0.7469759
ment	-0.732465	1136	Information and communication technology managers	-0.7469759
	-0.7469759	1137	Research and development managers	-0.7469759
	-0.7469759	1141	Quality assurance managers	-0.7469759
terials handling	-0.7469759	1142	Customer care managers	-0.7469759
d fishing N.E.C.	-1.522734	1151	Financial institution managers	-0.7469759
	-0.4424283	1152	Office managers	-0.7469759
	-1.522734	1161	Transport and distribution managers	-0.7469759
	-1.522734	1162	Storage and warehouse managers	-0.7469759
	-1.522734	1163	Retail and wholesale managers	-0.7469759
ustries N.E.C.	-1.522734	1172	Police officers (inspectors and above)	-0.4424283
	-1.000168	1174	Security managers	-0.7469759
sts	-0.8220372	1181	Hospital and health service managers	-0.7469759
d quarrying engine	-0.8220372	1183	Healthcare practice managers	-1.522734
	-0.8220372	1184	Social services managers	-0.7469759
	-0.8220372	1185	Residential and day care managers	-1.522734
	-0.8220372	1211	Farm managers	-1.522734
	-0.8220372	1219	Managers in animal husbandry, forestry, and fishing N.E.C.	-1.522734
C.	-0.8220372	1221	Hotel and accommodation managers	-1.522734
	-1.000168	1222	Conference and exhibition managers	-0.7469759
	-1.000168	1223	Restaurant and catering managers	-1.522734
	-0.732465	1224	Publicans and managers of licensed premises	-1.522734
	-0.732465	1225	Leisure and sports managers	-1.522734
	-0.732465	1226	Travel agency managers	-1.522734
	-0.732465	1231	Property, housing, and land managers	-1.522734

290	Psychologists	-0.732465
293	Social workers, probation officers	-0.732465
300	Laboratory technicians	-0.3973301
301	Engineering technicians	-0.3973301
303	Architectural and town planning technicians	-0.3973301
310	Draughts persons	-0.3973301
312	Quantity surveyors	-0.8220372
342	Medical radiographers	-0.3973301
345	Dispensing opticians	-0.3327664
360	Estimators, valuers	-0.4424283
361	Underwriters, claims assessors, brokers, investment anal	-0.4424283
380	Authors, writers, journalists	-0.732465
384	Actors, entertainers, stage managers, producers and dire	-0.732465
386	Photographers, camera, sound, and video equipment operator	-0.3973301
387	Professional athletes, sports officials	-0.4424283
390	Information officers and technical librarians	-0.732465
400	Civil administrative assistants taxation	2.240688
421	Library assistants/clerks press	2.240688
440	Stores dispatch production control clerks warehouse	2.240688
441	Storekeepers, warehousemen/women	2.240688
451	Legal secretaries	2.240688
452	Typists and word processor operators	2.240688
460	Receptionists general office dental	1.406782
461	Receptionists/telephonist	1.406782
462	Telephone operators exchange	1.406782
463	Radio and telegraph operators, other office communication	-0.3973301
490	Computer operators, data processing operators, other off	2.240688
500	Bricklayers, masons fixer	-0.1854081
501	Roofers, slaters, tilers, sheeters, cladders	-0.1854081
504	Builders, building contractors	-0.1854081
507	Painters and decorators	-0.1854081
509	Other construction trades N.E.C. building	-0.1854081
510	Centre, capstan, turret and other lathe setters and sett	0.4568464
515	Tool makers tool fitters markers out metal foreman	0.4568464
516	Metal working production and maintenance fitters	0.4568464
517	Precision instrument makers and repairers	1.588948
1234	Shopkeepers and wholesale/retail dealers	-1.522734
1239	Managers and proprietors in other services N.E.C.	-1.522734
2111	Chemists	-0.8220372
2112	Chemists	-1.000168
2113	Physicists, geologists, and meteorologists	-0.8220372
2121	Civil engineers	-0.8220372
2122	Mechanical engineers	-0.8220372
2123	Electrical engineers	-0.8220372
2124	Electronics engineers	-0.8220372
2126	Design and development engineers	-0.8220372
2128	Planning and quality control engineers	-0.8220372
2129	Engineering professionals N.E.C.	-0.8220372
2131	IT strategy and planning professionals	-0.8220372
2132	Software professionals	-0.8220372
2211	Medical practitioners	-1.000168
2212	Medical practitioners	-0.732465
2213	Pharmacists/pharmacologists	-1.000168
2214	Ophthalmic opticians	-1.000168
2215	Dental practitioners	-1.000168
2321	Scientific researchers	-0.8220372
2322	Social science researchers	-0.732465
2411	Solicitors and lawyers, judges, and coroners	-0.732465
2421	Chartered and certified accountants	-0.732465
2422	Management accountants	-0.732465
2423	Management consultants, actuaries, economists and statiscians	-0.732465
2431	Architects	-0.8220372
2433	Quantity surveyors	-0.8220372
2434	Chartered surveyors (not quantity surveyors)	-0.8220372
2442	Social workers	-0.732465
2443	Probation officers	-0.732465
2444	Clergy	-0.732465
2451	Librarians	-0.732465
3111	Laboratory technicians	-0.3973301
3112	Electrical/electronics technicians	-0.3973301
3113	Engineering technicians	-0.3973301
3114	Building and civil engineering technicians	-0.3973301

519 Other tool setters operators shaper foreman auto	0.4568464
520 Production fitters (electrical/electronic)	0.4568464
521 Electricians, electrical maintenance fitters	0.4568464
523 Telephone fitters	0.4568464
526 Computer engineers, installation, and maintenance	0.4568464
532 Plumbers, heating, and ventilating engineers and related	-0.1854081
534 Metal plate workers, shipwrights, riveters	0.4568464
535 Steel erectors	0.4568464
537 Welding trades	0.4568464
540 Motor mechanics, auto engineers (inc. road patrol engine	0.4568464
544 Tyre and exhaust fitters	0.4568464
552 Warp preparers, bleachers, dyers, and finishers	0.4925116
553 Sewing machinists, menders, darners, and embroiderers	1.237669
555 Shoe repairers, leather cutters and sewers, footwear las	1.237669
557 Clothing cutters, milliners, furriers	1.237669
560 Originators, compositors, and print preparers	1.588948
562 Book binders and print finishers specialized	1.588948
563 Screen printers	1.588948
570 Carpenters and joiners	-0.1854081
610 Police officers (sergeant and below)	-0.5976907
620 Chefs, cooks hotel supervisor	-0.5976907
621 Waiters, waitresses	-0.5976907
622 Bar staff	-0.5976907
640 Assistant nurses, nursing auxiliaries	-0.3327664
641 Hospital ward assistants	-0.5976907
642 Ambulance staff	-0.5976907
651 Playgroup leaders	-0.5976907
652 Educational assistants	-0.5976907
660 Hairdressers, barbers coiffeur	-0.5976907
670 Domestic housekeepers and related occupations	-0.5976907
672 Caretakers school	0.027381
691 Bookmakers manager	1.406782
710 Technical and wholesale sales representatives	-0.4424283
719 Other sales representatives N.E.C.	-0.4424283
720 Sales assistants merchants car	0.0534066
722 Petrol pump forecourt attendants	0.0534066

3119 Science and engineering technicians N.E.C..	-0.3973301
3122 Draughts persons	-0.3973301
3131 IT operations technicians	-0.3973301
3211 Nurses	-0.3327664
3212 Midwives	-0.3327664
3213 Paramedics	-0.3327664
3214 Medical radiographers	-0.3973301
3218 Medical and dental technicians	-0.3327664
3221 Physiotherapists	-0.3327664
3222 Occupational therapists	-0.3327664
3229 Therapistsn.e.c.	-0.3327664
3231 Youth and community workers	-0.4424283
3232 Housing and welfare officers	-0.4424283
3312 Police officers (sergeant and below)	-0.5976907
3313 Fire service officers (leading fire officer and below)	-0.5976907
3314 Prison service officers (below principal officer)	-0.5976907
3319 Protective service associate professionals N.E.C.	-0.5976907
3411 Artists	-0.732465
3412 Authors, writers	-0.732465
3414 Dancers and choreographers	-0.4424283
3415 Musicians	-0.4424283
3421 Graphic designers	-0.4424283
3422 Product, clothing, and related designers	-0.4424283
3431 Journalists, newspaper, and periodical editors	-0.732465
3432 Broadcasting associate professionals	-0.4424283
3434 Photographers and audio-visual equipment operators	-0.3973301
3441 Sports players	-0.4424283
3442 Sports coaches, instructors, and officials	-0.4424283
3513 Ship and hovercraft officers	-0.3973301
3520 Legal associate professionals	-0.4424283
3531 Estimators, valuers, and assessors	-0.4424283
3533 Insurance underwriters	-0.4424283
3534 Finance and investment analysts/advisers	-0.4424283
3536 Importers, exporters	-0.4424283
3539 Business and related associate professionals N.E.C..	-0.4424283
3541 Buyers and purchasing officers	-0.4424283

731 Roundsmen/women and van salespersons	0.027381
800 Bakery confectionery process hand foreman	0.4925116
809 Other food, drink, and tobacco process operatives N.E.C..	0.4925116
812 Spinners, doublers, twisters fly	0.4925116
814 Other textiles processing operatives hydro	0.4925116
820 Chemical, gas and petroleum process plant operatives	0.3230704
825 Plastic process operatives, moulders extruders goods	0.4925116
829 Other chemicals, paper, plastics, and related operatives	0.3230704
842 Metal polishers	0.4568464
850 Assemblers/lineworkers (electrical/electronic goods)	0.4925116
851 Assemblers/lineworkers vehicles metal nutter	0.4925116
860 Inspectors, viewers testers examiners insulation	0.4925116
862 Packers, bottlers, canners, fillers	0.4486654
864 Rutine laboratory testers paint soil	0.4925116
872 Drivers of road goods vehicles	-1.495965
873 Bus and coach drivers	-1.495965
874 Taxi, cab drivers and chauffeurs	-1.495965
885 Mechanical plant drivers and operatives (earth moving an	-1.495965
891 Printing machine minders and assistants	0.4925116
896 Construction and related operatives insulator foreman	-0.1854081
897 Woodworking machine operatives	0.4925116
899 Other plant and machine operatives N.E.C.	0.4925116
910 Coal mine laborers	0.4486654
912 Laborers in engineering and allied trades	0.4486654
919 Other laborers in making and processing industries N.E.C.	0.4486654
923 Road construction and maintenance workers	0.4486654
929 Other building and civil engineering laborers N.E.C.	0.4486654
930 Stevedores, dockers	0.4486654
933 Refuse and salvage collectors	0.027381
940 Postal workers, mail sorters	2.240688
952 Kitchen porters, hands	0.027381
953 Counterhands, catering assistants help	-0.5976907
954 Shelf fillers	0.0534066
956 Window cleaners	0.027381
959 Other occupations in sales and services N.E.C.	0.027381
990 All other laborers and related workers	0.4486654
3542 Sales representatives	-0.4424283
3543 Marketing associate professionals	-0.4424283
3544 Estate agents, auctioneers	-0.4424283
3551 Conservation and environmental protection officers	-0.3327664
3552 Countryside and park rangers	-0.3327664
3561 Public service associate professionals	-0.4424283
3562 Personnel and industrial relations officers	-0.732465
3564 Careers advisers and vocational guidance specialists	-0.732465
3565 Inspectors of factories, utilities, and trading standards	-0.3973301
3567 Occupational hygienists and safety officers (health and safety)	-0.3973301
3568 Environmental health officers	-0.3973301
4111 Civil Service executive officers	2.240688
4112 Civil Service administrative officers and assistants	2.240688
4113 Local government clerical officers and assistants	2.240688
4121 Credit controllers	2.240688
4122 Accounts and wages clerks, book-keepers, other financial clerks	2.240688
4123 Counter clerks	1.406782
4131 Filing and other records assistants/clerks	2.240688
4132 Pensions and insurance clerks	2.240688
4133 Stock control clerks	2.240688
4134 Transport and distribution clerks	2.240688
4135 Library assistants/clerks	2.240688
4136 Database assistants/clerks	2.240688
4141 Telephonists	1.406782
4150 General office assistants/clerks	2.240688
4211 Medical secretaries	2.240688
4212 Legal secretaries	2.240688
4213 School secretaries	2.240688
4215 Personal assistants and other secretaries	2.240688
4216 Receptionists	1.406782
4217 Typists	2.240688
5211 Smiths and forge workers	0.4568464
5213 Sheet metal workers	0.4568464
5214 Metal plate workers, shipwrights, riveters	0.4568464
5215 Welding trades	0.4568464
5216 Pipe fitters	-0.1854081

5221	Metal machining setters and setter-operators	0.4568464
5222	Tool makers, tool fitters and markers-out	0.4568464
5223	Metal working production and maintenance fitters	0.4568464
5224	Precision instrument makers and repairers	1.588948
5231	Motor mechanics, auto engineers	0.4568464
5232	Vehicle body builders and repairers	0.4568464
5234	Vehicle spray painters	-0.1854081
5241	Electricians, electrical fitters	-0.1854081
5242	Telecommunications engineers	0.4568464
5243	Lines repairers and cable jointers	0.4568464
5245	Computer engineers, installation, and maintenance	0.4568464
5249	Electrical/electronics engineers N.E.C.	0.4568464
5311	Steel erectors	0.4568464
5312	Bricklayers, masons	-0.1854081
5313	Roofers, roof tilers and slaters	-0.1854081
5314	Plumbers, heating, and ventilating engineers	-0.1854081
5315	Carpenters and joiners	-0.1854081
5316	Glaziers, window fabricators and fitters	-0.1854081
5319	Construction trades N.E.C.	-0.1854081
5321	Plasterers	-0.1854081
5322	Floorers and wall tillers	-0.1854081
5323	Painters and decorators	-0.1854081
5411	Weavers and knitters	1.237669
5412	Upholsterers	1.237669
5413	Leather and related trades	1.237669
5414	Tailors and dressmakers	1.237669
5419	Textiles, garments, and related trades N.E.C.	1.237669
5422	Printers	1.588948
5423	Bookbinders and print finishers	1.588948
5424	Screen printers	1.588948
5431	Butchers, meat cutters	1.237669
5432	Bakers, flour confectioners	1.237669
5433	Fishmongers, poultry dressers	1.237669
5434	Chefs, cooks	-0.5976907
5491	Glass and ceramics makers, decorators, and finishers	1.588948
5492	Furniture makers, other craft woodworkers	1.237669

5493	Pattern makers (moulds)	1.237669
5496	Floral arrangers, florists	-0.4424283
5499	Hand craft occupations N.E.C.	1.588948
6111	Nursing auxiliaries and assistants	-0.5976907
6113	Dental nurses	-0.5976907
6114	Houseparents' and residential wardens	-0.5976907
6115	Care assistants and home carers	-0.5976907
6121	Nursery nurses	-0.5976907
6122	Childminders and related occupations	-0.5976907
6123	Playgroup leaders/assistants	-0.5976907
6124	Educational assistants	-0.5976907
6131	Veterinary nurses and assistants	-0.3327664
6139	Animal care occupations N.E.C.	-0.3327664
6211	Sports and leisure assistants	-0.5976907
6212	Travel agents	1.406782
6213	Travel and tour guides	-0.5976907
6214	Air travel assistants	-0.5976907
6221	Hairdressers, barbers	-0.5976907
6222	Beauticians and related occupations	-0.5976907
6231	Housekeepers and related occupations	-0.5976907
6232	Caretakers	0.027381
6291	Undertakers and mortuary assistants	-0.5976907
6292	Pest control officers	-0.1854081
7111	Sales and retail assistants	0.0534066
7112	Retail cashiers and check-out operators	0.0534066
7113	Telephone salespersons	0.027381
7121	Collector salespersons and credit agents	0.027381
7122	Debt, rent and other cash collectors	0.027381
7123	Roundsmen/women and van salespersons	0.027381
7124	Market and street traders and assistants	0.0534066
7125	Merchandisers and window dressers	-0.4424283
7129	Sales related occupations N.E.C.	-0.4424283
7212	Customer care occupations	1.406782
8111	Food, drink, and tobacco process operatives	0.4925116
8112	Glass and ceramics process operatives	0.3230704
8113	Textile process operatives	0.4925116

8114	Chemical and related process operatives	0.3230704
8115	Rubber process operatives	0.4925116
8116	Plastics process operatives	0.4925116
8117	Metal making and treating process operatives	0.3230704
8118	Electroplaters	0.4925116
8119	Process operatives N.E.C.	0.3230704
8121	Paper and wood machine operatives	0.3230704
8124	Energy plant operatives	0.3230704
8125	Metal working machine operatives	0.4925116
8126	Water and sewerage plant operatives	0.3230704
8129	Plant and machine operatives N.E.C.	0.4925116
8131	Assemblers (electrical products)	0.4925116
8132	Assemblers (vehicles and metal goods)	0.4925116
8133	Rutine inspectors and testers	0.4925116
8134	Weighers, graders, sorters	0.4925116
8135	Tyre, exhaust and windscreen fitters	0.4568464
8136	Clothing cutters	0.4925116
8137	Sewing machinists	0.4925116
8139	Assemblers and routine operatives N.E.C.	0.4925116
8141	Scaffolders, stagers, riggers	-0.1854081
8149	Construction operatives N.E.C.	0.4486654
8211	Heavy goods vehicle drivers	-1.495965
8212	Van drivers	-1.495965
8213	Bus and coach drivers	-1.495965
8214	Taxi, cab drivers and chauffeurs	-1.495965
8215	Driving instructors	
8216	Rail transport operatives	-1.495965
8217	Seafarers (merchant navy); barge, lighter and boat operatives	-1.495965
8218	Air transport operatives	0.4486654
8221	Crane drivers	-1.495965
8222	Fork-lift truck drivers	-1.495965
8223	Agricultural machinery drivers	-1.495965
8229	Mobile machine drivers and operatives N.E.C.	-1.495965
9121	Laborers in building and woodworking trades	0.4486654
9132	Industrial cleaning process occupations	0.027381
9133	Printing machine minders and assistants	0.4486654

9134	Packers, bottlers, canners, fillers	0.4486654
9139	Laborers in process and plant operations N.E.C.	0.4486654
9149	Other goods handling and storage occupations N.E.C.	0.4486654
9211	Postal workers, mail sorters, messengers, couriers	0.027381
9221	Elementary office occupations N.E.C.	0.027381
9222	Hotel porters	0.027381
9223	Kitchen and catering assistants	0.027381
9224	Waiters, waitresses	-0.5976907
9225	Bar staff	-0.5976907
9226	Leisure and theme park attendants	0.027381
9229	Elementary personal services occupations N.E.C.	0.027381
9231	Window cleaners	0.027381
9233	Cleaners, domestics	0.027381
9234	Launderers, dry cleaners, pressers	0.027381
9235	Refuse and salvage occupations	0.027381
9241	Security guards and related occupations	0.027381
9244	School mid-day assistants	-0.5976907
9251	Shelf fillers	0.0534066
9259	Elementary sales occupations N.E.C.	0.027381

Source: Authors' compilation. See http://www-2009.timeuse.org/information/studies/

Table B2. RTI and offshoring measures by occupation in the UK

	(1)	(2)	(3)	(4)
	ISCO 88 2-digit code	**Number of workers**	**RTI measure**	**BK index**
Managers of small enterprises	13	312	-1.52	-0.63
Drivers and mobile plant operators	83	190	-1.50	-1.00
Life science and health professionals	22	71	-1.00	-0.76
Physical, mathematical and engineering	21	204	-0.82	1.05
Corporate manager	12	429	-0.75	-0.32
Other professionals	24	296	-0.73	0.21
Personal and protective service workers	51	269	-0.60	-0.94
Other associate professionals	34	254	-0.44	0.10
Physical, mathematical and engineering	31	102	-0.40	-0.12
Life science and health associate professionals	32	75	-0.33	-0.75
Extraction and building trades workers	71	327	-0.19	-0.93
Sales and service elementary occupation	91	153	0.03	-0.81
Models, salespersons and demonstrators	52	112	0.05	-0.89
Stationary plant and related operators	81	33	0.32	1.59
Laborers in mining, construction, manufacturing	93	105	0.45	-0.66
Metal, machinery, and related trade work	72	191	0.46	-0.45
Machine operators and assemblers	82	141	0.49	2.35
Customer service clerks	42	122	1.24	-0.25
Other craft and related trade workers	74	36	1.24	1.15
Precision, handicraft, craft printing a	73	34	1.59	1.66
Office clerks	41	361	2.24	0.40
Number of diaries		4,926		
Number of workers		3,817		

Notes: Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65, and in working days defined as those with at least 60 minutes to market work activities, excluding commuting. The RTI index in column (3) is based on the five original DOT task measures in Autor, Levy and Murnane (2003). See footnotes 10 and 11 for a description of how the index is constructed using the UK TUS occupation classification. The offshoring index in column (4) is taken from Blinder and Krueger (2013) and is based on professional coders' assessment of the ease with which an occupation could potentially be offshored. Both indices are rescaled to mean 0 and standard deviation 1. A higher value means an occupation is more routine-intense (column (3)) or more offshorable (column (4)). Occupations are ranked from the lowest to the highest value of the RTI.

Table B3. Changes in the share of employment by occupation category in the UK

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	Share of employment			*Change*	
	1983	*2000*	*2015*	*2000-1983*	*2015-2000*
High-paying occupations	34.95%	44.71%	49.08%	14.13%	4.37%
Middle-paying occupations	51.61%	39.59%	31.71%	-19.91%	-7.88%
Low-paying occupations	13.44%	15.70%	19.22%	5.77%	3.51%
Number of diaries	540	2,865	1,521		

Notes: Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. Classification of occupations follows Table 1 in Goos, Manning and Salomons (2014). *High-paying occupations* include occupations with ISCO88 codes 12, 13, 21, 22, 24, 31, 32 and 34. *Middle-paying occupations* include occupations with ISCO88 codes 41, 42, 71, 72, 73, 74, 81, 82 and 83. *Low-paying occupations* include occupations with ISCO88 codes 51, 52, 91 and 93. See footnotes 6 and 7 in Section 4 for a description of how the RTI index is computed using the UK TUS occupation classification.

Table B4. Sum Stats of work hours and on-the-job leisure occupations, by RTI

	(1)		(2)		(3)	(4)
	Panel A: The UK 1985-2000-2015 (Low 10 % pct-High 90% pct)					
	Low 10% percentile		**High 90% percentile**		**Diff low-high**	**p-value Diff**
Market work	7.54	(2.94)	7.33	(1.93)	0.22	(0.18)
Consumption of on-the-job leisure	1.14	(1.81)	0.92	(1.07)	0.23	(0.02)
Number of breaks for on-the-job leisure	1.12	(1.11)	1.15	(0.90)	-0.03	(0.68)
Working time until consuming on-the-job leisure	4.36	(2.87)	4.02	(2.23)	0.34	(0.05)
Number of Observations	415		486			
	Panel B: The UK 1985-2000-2015 (Low 25% pct-High 75% pct)					
	Low 25% percentile		**High 25% percentile**		**Diff low-high**	**p-value Diff**
Market work	7.82	(2.89)	7.58	(2.13)	0.24	(0.02)
Consumption of on-the-job leisure	1.13	(1.74)	0.86	(1.21)	0.28	(<0.01)
Number of breaks for on-the-job leisure	1.15	(1.14)	1.22	(1.07)	-0.07	(0.14)
Working time until consuming on-the-job leisure	4.54	(2.96)	4.23	(2.54)	0.31	(<0.01)
Number of Observations	1,041		1,272			

Notes: Data come from the 1983, 1987, 1995, 2000, 2005 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. Consumption of on-the-job leisure is the amount of time the respondent spends not working while at work. See Table A2 in Appendix for a description of the activities included in the consumption of on-the-job leisure. The number of on-the-job leisure episodes is constructed as the number of spells spent on non-work activities while at work. Working time until consuming on-the-job leisure is computed by dividing the total amount of time spent working by the number of work spells in a given diary day.

Table B5. Comparison of diaries with and without RTI information

	With RTI Information		Without RTI Information	
	Mean	**SD**	**Mean**	**SD**
Time at work	8.642	(2.930)	8.796	(2.928)
Working time	7.633	(2.563)	7.513	(2.343)
Consumption of on-the-job leisure	1.008	(1.526)	1.283	(1.631)
Number of on-the-job leisure episodes	1.176	(1.130)	1.470	(1.167)
Working time until consuming on-the-job leisure	4.386	(2.786)	3.772	(2.383)
Number of total episodes in diary	26.300	(11.275)	22.566	(7.805)
Number of different activities in diary	11.678	(3.126)	11.164	(2.792)
Male worker	64.892	(47.736)	41.938	(49.351)
Secondary education	45.366	(49.790)	44.320	(49.682)
University education	42.233	(49.398)	64.315	(47.912)
in couple	74.175	(43.772)	73.015	(44.393)
At least one child in household	45.135	(49.768)	46.645	(49.893)
number of household children	0.821	(1.057)	0.833	(1.032)
Number of observations	4,952		4,386	

Notes: Standard deviations in parenthesis. Data come from the 1983, 2000 and 2015 UK time diary surveys. The sample are full-time workers aged 21-65. We select working days in which there are at least 60 minutes of market work activities, excluding commuting. *Consumption of on-the-job leisure* is the amount of time the respondent spends not working while at work. The *number of on-the-job leisure episodes* is constructed as the number of spells spent on non-work activities while at work. *Working time until consuming on-the-job leisure* is computed by dividing the total amount of time spent working by the number of work spells in a given diary day.