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## The Shift Premium: Evidence from a Discrete Choice Experiment

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DISCUSSION PAPER SERIES

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# The Shift Premium: Evidence from a Discrete Choice Experiment

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## ABSTRACT

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# The Shift Premium: Evidence from a Discrete Choice Experiment<sup>1 2</sup>

Shift work is a widespread but understudied phenomenon. This paper examines one specific aspect of shift work: the shift premium. To this end, we included a discrete choice experiment in an online survey targeted at night and shift workers. Respondents chose between a standard 9 am – 5 pm job paying €15 per hour and a job with shift work in which the wage randomly varied between €12 and €20. The results show that respondents demand sizeable shift premiums to prefer shift over daytime work, with higher premiums for more onerous working hours such as night shifts or rotating shifts. We observe substantial heterogeneity in the shift premium across respondents and provide suggestive evidence of labour market sorting.

**JEL Classification:** C91, J31, J48

**Keywords:** shift work, shift premium, Willingness to Pay, discrete choice experiment

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2 Disclosure: The discrete choice experiment was part of a larger project studying the working conditions of shift workers in Belgium. This project was commissioned by the trade union ABVV-FGTB. The project was carried out by HIVA-KU Leuven in collaboration with Ghent University. The questionnaire was primarily prepared by HIVA-KU Leuven. The authors of the paper designed the discrete choice experiment in consultation with researchers at HIVA KU-Leuven, defined the research question, conducted the data analysis, and wrote the paper, independently of the trade union.

# 1. Introduction

Shift work has been a ubiquitous feature of labour markets since at least the Second World War (Marris et al., 1964; Shiells and Wright, 1983). According to Eurostat<sup>3</sup>, in 2021, 18.6% of the employees in the EU-28 worked shifts. Shift work encompasses evening and night shifts, rotating shifts, split shifts, on-call or irregular schedules, and other, non-day schedules (Williams, 2008). Despite its prevalence, labour economists have mostly been silent regarding its underlying drivers.<sup>4</sup>

By contrast, extensive medical and sociological literature has documented the detrimental effects of shift work, particularly night work, on health and well-being (Presser, 2005; Åkerstedt and Wright, 2009; Costa, 2010; Puttonen et al., 2010; Boyd-Swan, 2019; Schneider and Harknett, 2019; Torquati et al., 2019). Given these negative health effects, the intriguing question arises why workers accept shift work and what prevents them from transitioning to more regular working hours.

One explanation for why people are willing to work shifts is the higher wage. The theory of compensating wage differentials predicts that shift workers receive higher wages to compensate them for the onerous working hours (Rosen, 1974, 1986). Empirical studies confirm that most individuals prefer daytime work for various reasons, such as coordinating leisure time with family and friends and avoiding the negative health effects of shift work (Baker et al., 2004). The shift premium ensures an equilibrium between the demand for and the supply of shift workers. According to this theory, the shift premium is the outcome of market forces. An alternative view is that institutions determine premiums for working nonstandard hours (Berg et al., 2014; Hamermesh and Stancanelli, 2015). Trade unions have a history of advocating for shorter workdays and stricter rules on weekend, shift, night, and overtime work (Eurofound, 2016; Pintelon, 2018). Most countries regulate work during nonstandard hours by restricting it to specific sectors and occupations, requiring firms to pay a premium, or exempting the premium from taxes (Burda and Weil, 2004; Yu and Peetz, 2019).

A premium for shift work is so commonplace that Eurostat's Structure of Earnings Surveys (SES) collects data on "special payments for shift work". Our analysis of the three most recent SES waves indicates that the shift premium ranges from 5% to 16% of gross wages in 13 EU countries (Table 1).<sup>5</sup> This observation suggests that employees receive higher wages for working shifts. However, employees with lower earning potential and fewer outside options may self-select into shift work, making it challenging to estimate compensating wage differentials using observational data alone (Bonhomme and Jolivet, 2009; Helliwell and Huang, 2010; Lavetti, 2023).

This paper aims to determine the Willingness to Pay (WTP) to avoid shift work. To this end, we adopt the approach of the influential paper of Mas and Pallais (2017) and included a discrete choice experiment in

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<sup>3</sup> Source: Eurostat – Labour Force Survey (LFS) – online data code LFSA\_EWPSHI (accessed May 2023). Statistics for employees aged 20-64.

<sup>4</sup> A few, older studies describe shift work: Delsen, et al. (2009) for the EU; Golden (2015), McMenamin (2007) and Mayshar and Halevy (1997) for the US; and Williams (2008) for Canada.

<sup>5</sup> Eurostat granted us access to the anonymized microdata of the Structure of Earnings Survey (SES) and the Labour Force Survey (LFS) (research proposal: RPP 348/2021-LFS-SES).

an online survey targeted at night and shift workers in specific industries. Survey respondents chose between a standard daytime job (9 am – 5 pm) and a job with shift work. The gross hourly wage for the daytime job was always €15, but the wage for shift work varied randomly between €12 and €20. This experimental design in combination with the large sample size ( $n=4,619$ ) allows us to establish the relationship between the shift premium and the shift schedule. Furthermore, it permits us to examine the distribution of the WTP to avoid shift work. Following Mas and Pallais (2017), we correct our estimates for inattention among respondents when selecting a job offer, which is arguably an even more critical issue in online surveys than in field experiments.

**Table 1: The shift premium according to the Structure of Earnings Survey (SES)**

Country	2010	2014	2018
Belgium	8.5%	8.7%	
Denmark		7.5%	6.5%
Finland	11.0%	11.0%	11.3%
France	8.9%	8.0%	8.4%
Germany	6.9%	7.6%	7.4%
Greece	15.5%	13.6%	15.3%
Italy	7.2%	4.8%	4.9%
Luxembourg	8.0%	8.8%	8.9%
Poland	11.0%	11.5%	12.8%
Spain	11.6%	10.7%	11.2%
Sweden	9.4%	9.1%	10.1%
The Netherlands		10.7%	
United Kingdom	12.6%	11.5%	

Note: We compute the shift premium as the ratio of “special payments for shift work” to gross wages for employees who received this special payment.

In the experiment, we considered five shift schedules commonly used by continuously-producing firms. Continuous production is typically organised with either three fixed 8-hour shifts, where employees always work the same shift, or a rotating shift system, in which morning, evening and night shifts alternate in a predefined cycle such as weekly rotations. In the experiment, we were interested in all four working schemes. Thus, we included fixed morning, evening, and night shifts, as well as rotating shifts as treatment variations. Additionally, we included a treatment with rotating shifts where the specific schedule is announced only one week in advance. This treatment was based on previous evidence showing that workers dislike scheduling uncertainty (Mas and Palais, 2017; Schneider and Harknett, 2019; Maestas et al., 2023), a finding we aimed to confirm with our experiment. To maintain a coherent experimental design and limit the number of treatment variations, all jobs offered full-time employment without weekend work and shifts lasted exactly eight hours.

Our results demonstrate that most workers demand a shift premium to accept shift work, with particularly large differences between different types of shifts. The median respondent required an hourly premium of 4% for the morning shift, 24% for the evening shift and 36% for the night shift. Rotating shifts

with a predictable schedule required a premium of 22%, whereas rotating shifts with an unpredictable schedule required a much higher premium of 38%.

Furthermore, we observe substantial variation across respondents. For instance, one-fourth of the respondents prefer rotating shifts with a predictable schedule over daytime work when the shift premium exceeds 12% of the base wage, whereas another fourth of the respondents still prefer daytime work when the premium reaches 33%. Correcting for inattention is crucial to obtaining unbiased estimates of the distribution of the shift premium because, without correcting for inattention, the mistakes made by inattentive respondents at the tails of the distribution (e.g. respondents who prefer night work over daytime work even if night work pays much less) increase the variance of the distribution.

The large variation in the WTP across respondents points to substantial heterogeneity across subgroups. We explore treatment heterogeneity to relate our findings to predictions derived from the literature on labour market sorting and the medical literature on shift work. First, we show that younger individuals, those with a lower level of education, and men are more likely to prefer shift work at a given premium. Observational data show that these groups are more likely to work shifts, suggesting that some of the observational data patterns result from labour market sorting. Second, we show that workers who work nights in their current job have a substantially lower WTP to avoid shift work, which we interpret as further evidence of labour market sorting. Third, the medical literature indicates that the detrimental health effects of shift work are individual-specific. In general, older individuals adjust less quickly to shift work and recover more slowly than younger individuals (Saksvik et al., 2011). We observe that older individuals as well as those who report sleeping poorly or being in poor physical condition require much higher shift premiums to accept shift work, suggesting that individuals are aware of the individual-specific costs of shift work.

Our contribution to the literature is threefold. We are the first to provide experimental evidence on the distribution of the WTP to avoid shift work. Previous studies on the shift premium use observational data. Kostiuk (1990) and Lanfranchi et al. (2002) estimate the shift premium for male workers in the US and France using a Heckman selection model, reporting a shift premium of 8% and 16%, respectively. Villanueva (2007) leverages a panel dataset of workers who voluntarily switch jobs to bound the estimates of the compensation for onerous working conditions. While the paper does not focus on shift work, it shows that workers demand a compensating wage differential between 3.3% and 5.1% for bad hours regulation. Felfe (2012) exploits a quasi-natural experiment in Germany where new mothers have the right to return to their previous job up to 36 months after childbirth to estimate the WTP for shift work for this specific population. In (West) Germany, recent mothers are willing to accept sizeable wage cuts to be able to work evenings or rotating shifts because these schedules allow them to combine work and childcare.

More recent papers use an experimental setup to estimate the value of job amenities (Eriksson and Kristensen, 2014; Mas and Pallais, 2017; Wiswall and Zafar, 2017; He et al, 2021; Maestas et al., 2023), thereby circumventing the econometric challenges of estimating compensating wage differentials using observational data. However, these papers do not consider shift work. We build on the influential paper of Mas and Pallais (2017), who conducted a discrete choice experiment among telephone interviewers to study

the WTP for scheduling flexibility, and on the paper of Maestas et al. (2023), who conducted stated-preference experiments among a representative sample of US workers to determine the WTP for a range of job amenities. In our experiment, we explicitly study shift work, whereas Mas and Pallais (2017) focused on scheduling flexibility (e.g. working from home, flexible schedules) and Maestas et al. (2023) examined the value of several working conditions such as teamwork, physical job demands and meaningful work. In addition, we have more observations per treatment and more socioeconomic and occupational background information on the respondents, allowing for a more fine-grained heterogeneity analysis.

Our second contribution is to the literature on labour market sorting. The seminal work of Rosen (1974) predicts that, in a frictionless world, workers sort into jobs based on pecuniary and nonpecuniary job dimensions. This sorting behaviour is challenging to test empirically using observational data as it is nearly impossible to observe all relevant job and worker characteristics. Moreover, search costs can prevent workers from sorting into the most desirable job (Hwang et al., 1998; Lang and Majumdar, 2004). The heterogeneity analyses support the view that respondents with a low WTP to avoid shift work sort into these jobs.

Finally, we contribute to the literature on work organisation. A relevant management question for continuous production is deciding between three fixed 8-hour shifts or rotating shifts (Knauth, 1993; Liou and Wang, 1991; Wilkinson, 1992). The shift premium influences this decision. Our estimates show that three fixed shifts or a rotating shift system with a predictable schedule require a similar shift premium—€9.54 vs. €10.08 per day on average. In this regard, the shift premium should not influence the choice between fixed or rotating shifts. This finding helps to explain why both approaches coexist in most industrial countries.

The remainder of the paper is structured as follows. Section 2 explains the data collection, the experimental design, and the methodology. Section 3 presents the main results. Section 4 discusses a heterogeneity analysis by sociodemographic, job, and health characteristics. Section 5 concludes the paper.

## **2. Data and methodology**

### **2.1 Data collection**

We included a discrete choice experiment in an online survey of the Belgian socialist trade union ABVV-FGTB.<sup>6</sup> The survey was commissioned by ABVV-Algemene Centrale (FGTB-Centrale Générale in French), which represents workers in sectors ranging from manufacturing to cleaning and security, and ABVV-Metaal (FGTB-Métal in French), which represents workers in the metal industry. Consequently, the survey did not reach workers in the healthcare, retail, and transport and storage sector.

We designed the questionnaire in consultation with the trade union's sector experts. The questionnaire was drafted in Dutch before being translated into French. A pilot was set up to test the questionnaire's comprehensibility and feasibility. The survey was anonymous and complied with the General Data Protection Regulation (GDPR). Respondents could end the survey at any time. Partially completed surveys

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<sup>6</sup> Algemeen Belgisch Vakverbond (ABVV) - Fédération Générale du Travail de Belgique (FGTB).

were retained and are used in the analyses.

The questionnaire consists of seven sections: (1) sociodemographic characteristics; (2) the discrete choice experiment; (3) current employment; (4) work organisation; (5) workload and participation; (6) health and well-being; and (7) income. Only four questions preceded the choice experiment (year of birth, gender, level of education and family composition). The choice experiment was administered at the start of the questionnaire to ensure that subsequent questions did not affect the responses to the experiment. Detailed descriptive statistics by section are available in a policy report prepared for the trade union (Apostel et. al, 2023).

The online survey was launched on June 1, 2022, on the Facebook pages of the trade union and was included in newsletters sent to trade union members. A reminder was posted on Facebook on June 24, 2022. In addition, posters were distributed to union delegates in relevant firms to promote the survey among their co-workers. One randomly selected respondent who completed the entire questionnaire won a weekend stay in a holiday park. In total, 4,619 respondents completed the choice experiment,<sup>7</sup> of whom half completed the entire survey. The median respondent needed 17 minutes to complete the entire survey and devoted 34 seconds to selecting a job in the experiment.

We deliberately chose to target night and shift workers. Conducting a discrete choice experiment among this population assures that we target respondents who face the trade-off between higher wages and working nonstandard hours in their daily lives. Since the large majority of employees in Belgium have daytime jobs and never face this trade-off, it would be illogical to conduct this experiment among a random sample of Belgian employees. In addition, we target the population relevant to trade unions and employers' organizations, which regularly negotiates over wages, the shift premium and the work organisation. For these negotiations, credible evidence on the shift premium demanded by shift workers is valuable. Furthermore, because we anticipated that most respondents would be night or shift workers, we included detailed questions on their current work arrangements in the survey. This information is exploited to test predictions from the theory of labour market sorting.

For these reasons, the Facebook posts and newsletters explicitly stated that the survey was about night and shift work. As a result, 87% of the respondents reported working nights or shifts.<sup>8</sup> In our experiment night work is considered a type of shift work. However, we explicitly referred to night and shift work in the survey announcement because workers who work a fixed night shift do not always identify themselves as shift workers. In addition, night workers are not necessarily shift workers, as some jobs are only performed at night (e.g. security guards). Similarly, not all shift workers work nights (e.g. some firms only have a

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<sup>7</sup> The survey was opened by 5,418 individuals, of whom 417 did not complete a single question. We discarded 267 respondents who did not participate in the discrete choice experiment and 177 respondents who did not answer the control question.

<sup>8</sup> Questions about the work organisation were included in section 4 of the survey. The specific question allowing us to classify respondents as night, shift or daytime workers was completed by 3,722 respondents. We always present descriptive statistics for those respondents who completed the question, i.e. excluding the missing observations. Because only half of the respondents completed the entire survey, the number of observations per question depends on the question's placement in the survey.

morning and evening shift, but no night shift).

Our sample raises questions about the external validity of our findings for the population of night and shift workers. A first concern is that our survey predominantly reached trade union members who may differ from non-unionised workers. This concern is less relevant in Belgium than elsewhere because half of the employees are unionised and the proportion of unionised workers is even higher among blue-collar workers and in the manufacturing sector, both on which night and shift work is concentrated.

A second concern is that our respondents might differ from the “average” night and shift worker. To partially alleviate this concern, we use the nationally representative 2019 Belgian Labour Force Survey (LFS) to compare the profile of our respondents to (1) the profile of night and shift workers in Belgium and (2) the profile of night and shift workers in sectors targeted by the survey. In the 2019 LFS, 1,671 out of the 47,558 individuals surveyed worked shifts or frequently worked nights.

Column 1 of Table 2 presents the characteristics of shift and night workers in Belgium. One-third of the shift workers are employed in the manufacturing sector, while the health sector, which includes hospitals and nursing homes, the transport and storage sector, and the retail sector also employ many shift and night workers. Column 2 excludes shift and night workers in the health, transport and storage, and retail sector because our survey did not reach these sectors. Excluding these sectors substantially alters the composition of the population of night and shift workers. The principal reason is that night and shift workers in the health sector have a very different profile (i.e. more women and better educated) than night and shift workers in other sectors.

Column 3 of Table 2 displays the profile of the survey respondents. Their profile is comparable to the profile of night and shift workers in the LFS when restricting the population to sectors targeted by our survey (column 2). The majority of the respondents are men (81%), have an average age of 45, have children (55%), completed the survey in Dutch (62%) and have at most a low (35%) or higher secondary education (52%). Half of the respondents reported working in the manufacturing sector, mainly in the chemical and metal sector, whereas the other half worked in other sectors such as the security sector.

In our survey, night and shift workers are slightly older and more likely to have children than in the LFS, but they are equally likely to be men and have a comparable level of education. The main difference between our survey respondents and night and shift workers in the LFS is that night workers are underrepresented in our survey (35% in the LFS vs. 23% in our survey), presumably because night workers are harder to reach than shift workers.

**Table 2: Profile of shift workers in the LFS and in our survey**

	<b>LFS</b>		<b>Own survey</b>
	Night/shift workers	Night/shift workers	Night/shift workers
	All sectors	Selected sectors	
Men	63%	81%	81%
Average age	40	40	45
Age groups			
<35	37%	35%	22%
35-44	24%	25%	25%
45-54	27%	28%	27%
>=55	13%	12%	26%
Has children	48%	47%	55%
Speaks Dutch	67%	67%	62%
Education			
Low	22%	27%	35%
Medium	52%	56%	52%
High	26%	17%	13%
Shift work	71%	71%	80%
Night work	35%	35%	23%
Sectors			
C: Manufacturing	33%	64%	53%
Q: Health	25%		
H: Transport and storage	14%		
G: Retail	8%		
Other sectors	19%	36%	47%
N	1,671	869	Depends on the variable

Note: Column 1 presents the characteristics of night and shift workers in Belgium using the 2019 Labour Force Survey (LFS). We defined “shift workers” as employees who work shifts and night workers as employees who frequently work nights. Employees who sometimes work nights are not classified as night workers. The categories “night” and “shift” workers are not mutually exclusive. Column 2 excludes workers in the health, retail, or transport and storage sector, because our survey did not target these sectors. The number of observations in our survey depends on the variable because some respondents did not complete the entire survey or skipped specific questions, but ranges from 3,722 to 4,619.

## 2.2 Experimental design

Following Mas and Pallais (2017), the survey included a discrete choice experiment that asked the respondent to choose between a standard 9 to 5 job (baseline) and a job with shift work (treatment). The gross hourly wage of the baseline position was always €15.<sup>9</sup> This wage level was chosen because it corresponds to the wage level set by collective bargaining agreements in the sectors targeted by the experiment. In contrast to white-collar workers who typically have a monthly wage, blue-collar workers are typically paid by the hour. The pilot we launched before the experiment confirmed that respondents are familiar with their current hourly wage.

The gross hourly wage in the job offer with shift work ranged from €12 to €20 in steps of one euro. This range implies that, for five out of nine respondents, shift work paid a premium. We opted for an

<sup>9</sup> The average hourly wage, excluding premiums, reported by the survey respondents is €19.6. This is €4.6 higher than in the baseline job in the experiment. Nearly one out of five respondents report an hourly wage of at most €15, demonstrating that a hourly wage of €15 is not uncommon. Fortunately, the WTP does not differ by the respondents' current wage (results not reported, but available on request), thereby alleviating the concern that respondents prefer shift work at relatively low premiums because they are not willing to earn less than in their current job.

asymmetric wage range since we did not expect that respondents would accept a much lower wage to work shifts. In contrast, some respondents might demand substantial premiums (€5 per hour or a premium of 33%) to accept shift work. To eliminate ordering effects of baseline and treatment, the order in which the jobs appeared on the screen was randomized.

In Appendix A, we provide a screenshot of the original choice experiment. The wording of the discrete choice experiment was as follows:

*Suppose you are looking for a new job within your current industry. You have received two job offers. Both jobs are the same, but the working hours and wages differ.*

*Read the offers carefully and answer the question below.*

*[Baseline] Job 1*

*You work from Monday – Friday, 9 am – 5 pm. The gross hourly wage is €15.*

*[Treatment] Job 2*

*You work from Monday – Friday, [treatment, see Table 3]. The gross hourly wage is [€12 - €20] Which job do you prefer? Job 1 / Job 2*

Table 3 shows our five treatments. First, we distinguish fixed shifts, in which workers always have the same shift (morning, evening or night), from rotating shifts, in which morning, evening and night shifts alternate by week. Both systems are frequently used in the industry to organise continuous production. We then contrasted rotating shifts with a predictable schedule to rotating shifts with an unpredictable schedule, in which the employer announces the schedule one week in advance. Every treatment had the same probability to appear and was drawn randomly at the start of the survey.

**Table 3: The five treatments**

<b>Treatment</b>	<b>Phrased in the experiment as:</b>	<b>N</b>
Morning shift	6 am – 2 pm (fixed morning shift)	952
Evening shift	2 am – 10 pm (fixed evening shift)	873
Night shift	10 pm – 6 am (fixed night shift)	918
Rotating shifts - predictable schedule	alternating weeks with morning, evening and night shifts	917
Rotating shifts - unpredictable schedule	alternating weeks with morning, evening and night shifts. The employer decides one week in advance which shift you will do next week.	959

Note: A Pearson's chi-squared test (p-value = 0.28) confirms that the respondents are uniformly distributed over the treatments.

Online surveys are prone to 'inattention' errors as some respondents will be inattentive and randomly select a job offer. Inattention leads to misclassifications and, as a result, biased estimates of the WTP distribution (Card, 1996). To quantify inattention, we included a mandatory control question that inquired if respondents had selected the baseline position in the choice experiment. This question was included immediately following the choice experiment (see Appendix A for a screenshot), and respondents were

unable to verify or change their previous response. Following Mas and Pallais (2017), we will use the control question to estimate the inattention rate and we will correct the WTP estimates for inattention.

Respondents could also indicate why they selected a specific job offer by checking at most two out of six options (higher wage, better work-life balance, good atmosphere among co-workers, being your own boss, a higher chance of getting promoted, better for your health) or by entering a different reason in a text box. This information will be exploited to gain insights into why workers prefer certain job offers.

### 2.3 Estimation strategy

We closely follow Mas and Pallais (2017) to estimate the distribution of the WTP by treatment. In a perfect world without inattention, respondents would select shift work over the daytime job if the monetary and non-monetary benefits of shift work outweigh those of the daytime job. In our experiment, the costs and benefits of shift work depend on (1) the exact schedule, (2) the wage, and (3) individual preferences.

Since preferences are individual-specific, the premium at which individuals prefer shift work over the standard job follows a distribution. Assuming successful randomization, the WTP distribution can be retrieved by estimating a logistic regression that regresses the binary indicator taking the value one if the individual prefers shift work and zero otherwise on the shift premium. The shift premium,  $p$ , is defined as the difference between the wage in the job with shift work and the wage in the job without shift work.

More formally, in an ideal world without inattention, the probability that individual  $i$  prefers shift work given a shift premium  $p$  is modeled as:

$$\Pr(Y_i = 1 | w) = \varphi(\beta_0 + \beta_1 p) \quad (1)$$

where  $\varphi$  represents the cumulative density function of the logistic distribution. The WTP of the median respondent is equal to  $-\beta_0/\beta_1$ . The WTP of the 25<sup>th</sup> and 75<sup>th</sup> percentiles are computed as  $[\ln(\frac{0.25}{0.75}) - \beta_0]/\beta_1$  and  $[\ln(\frac{0.75}{0.25}) - \beta_0]/\beta_1$ , respectively.

However, in the real world inattention in online surveys is rife. Inattention creates a gap between the job individuals prefer,  $Y_i$ , and the job they actually select in the experiment,  $S_i$ . Some respondents will mistakenly select shift work when they would have chosen the daytime job if they had paid close attention, and vice versa. Inattention leads to classification errors in our binary outcome which bias the estimates of  $\beta_0$  and  $\beta_1$ .

A major innovation of Mas and Pallais (2017) is the intuitive procedure to correct for inattention in a discrete choice experiment. Let  $2\alpha$  denote the share of respondents not paying attention. This implies that a share  $\alpha$  of the respondents will select the wrong job. The probability of selecting shift work,  $\Pr(S_i = 1)$ , is determined by the inattention rate,  $\alpha$ , as well as the probability of preferring shift work over the daytime job given the shift premium,  $\Pr(Y_i = 1|p)$ :

$$\begin{aligned} \Pr(S_i = 1 | p) &= (1 - \alpha)\Pr(Y_i = 1|p) + (1 - \Pr(Y_i = 1|p))\alpha \\ &= \alpha + (1 - 2\alpha)\Pr(Y_i = 1|p) \end{aligned} \quad (2)$$

This equation shows that, even if no one prefers shift work over the baseline ( $\Pr(Y_i = 1) = 0$ ), a share  $\alpha$  of the respondents will still select the job with shift work due to inattention. Similarly, when everyone prefers shift work ( $\Pr(Y_i = 1) = 1$ ), only a share of  $1 - \alpha$  will effectively select this job offer.

We estimate equation (2) by maximum likelihood for each treatment taking  $\alpha$  as given. This approach yields consistent estimates of  $\beta_0$  and  $\beta_1$  and, consequently, of the distribution of the WTP. To compute standard errors, we use bootstrapping with 500 replications.

We set  $\alpha$  as the share of respondents who incorrectly responded to the control question, which asked them to report whether they selected the daytime job. Here we slightly deviate from Mas and Pallais (2017), who estimate  $\alpha$  as the share of respondents who choose the baseline position when the alternative position pays a higher wage and offers more flexibility. In our setting, this approach corresponds with, for instance, setting  $\alpha$  as the share of respondents who still prefer night shifts over the daytime job even when night shifts pay €3 less. We do not follow this approach because we do not always have a scenario where the daytime job clearly dominates shift work. For instance, some individuals may still prefer the morning shift even if it pays €3 less. Table C.1 in Appendix C demonstrates that our estimates remain robust to following the approach of Mas and Pallais (2017).

Following Mas and Pallais (2017), we also plot the WTP distribution to assess the goodness-of-fit. We plot both the raw share and the inattention-corrected share of respondents preferring shift work as a function of the shift premium. Using equation (2), the inattention-corrected share can be derived as:

$$\Pr(Y_i = 1 | p) = \frac{\Pr(S_i = 1 | p) - \alpha}{1 - 2\alpha} \quad (3)$$

This equation demonstrates that the inattention correction will matter most for the tails of the WTP distribution and will have modest effects on the median WTP. To understand this, consider the shift premium,  $p_m$ , where half of the respondents prefer shift work. At this premium,  $\Pr(Y_i = 1 | p_m) = 1/2$ . In this case, equation (3) implies that  $\Pr(S_i = 1 | p_m) = \Pr(Y_i = 1 | p_m) = 1/2$ . Now, consider a shift premium,  $p_q$ , where only a minority prefer shift work, i.e.  $\Pr(Y_i = 1 | p_q) < 1/2$ . The difference between the probability of revealing the true preference and the actual job choice equals  $\Pr(Y_i = 1 | p_q) - \Pr(S_i = 1 | p_q) = \alpha[2\Pr(Y_i = 1 | p_q) - 1]$ . The smaller the proportion of respondents who prefer shift work, the larger the difference between true and stated preferences.

### 3. Results

#### 3.1 Randomization and the inattention rate

Treatments and wage offers were successfully randomized across respondents. Overall, we do not observe significant differences with regard to respondents' socioeconomic, job and health characteristics by treatment or by the wage offered in the job with shift work. Most F-tests reject significant differences across treatments and wage offers. Out of 68 F-tests, six are significant at the 10% level, which is in line with expectations. In addition, there is no significant association between the treatment and the wage offer.

Detailed results are included in Appendix B.

The inattention rate plays a crucial role in obtaining unbiased estimates of the WTP. The inattention rate is measured by asking respondents to indicate whether they opted for the daytime job. This control question followed immediately after the discrete choice decision. 17.9% of the respondents answered the control question incorrectly, indicating that 35.8% of the respondents were not paying attention to the choice experiment. The inattention rate has a same order of magnitude when it is defined as the share of respondents who prefer shift work when this job pays €3 per hour less than the daytime job, which is the approach preferred by Mas and Pallais (2017). For instance, 15% of the respondents prefer night work over daytime work when night work pays €3 per hour *less* than daytime work.

The inattention rate in our survey is consistent with findings reported in other papers. Mas and Pallais (2017) report an inattention rate of 13.3% in a field experiment in which respondents applied for real jobs. In the online survey of Maestas et al. (2023), 65% of the respondents correctly responded to at least one of the two trick questions.

### 3.2 Shift premium

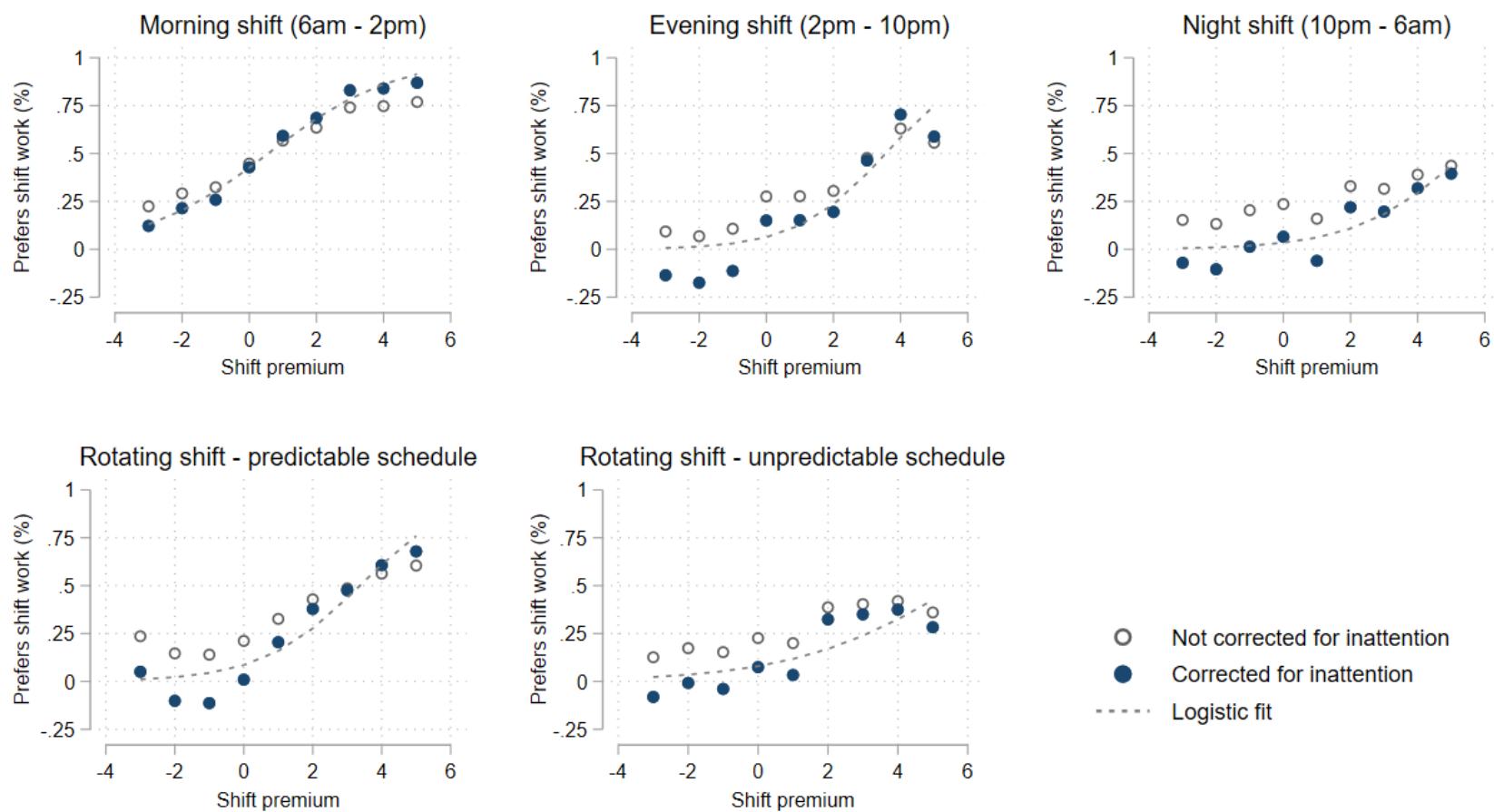
We start by discussing the distribution of the shift premium by treatment. Some respondents demand a high premium to work shifts, whereas others are satisfied with a modest premium or even accept a lower wage. Figure 1 shows the distribution of the shift premium by treatment. Table 4 shows the shift premium (and the bootstrapped standard errors) by treatment at the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> percentiles of the distribution.

The white dots in Figure 1 show, for a given shift premium, the share of respondents who selected the job with shift work over the 9 am – 5 pm position. These white dots represent the raw data without correction for inattention. The share of individuals selecting shift work rather than the daytime job increases with the premium, across all treatments. However, the strength of this relationship differs by treatment. For instance, when the shift premium is €5, 77% of the respondents prefer the morning shift, but just 44% opt for the night shift.

The white dots in Figure 1 also reveal that a substantial proportion of the respondents still select the job with shift work even if the hourly wage was €3 *lower* than in the daytime position. For instance, 23% (15%) selected the morning (night) shift over the 9 am – 5 pm position if the hourly wage was €3 *lower* than in the daytime position. While some respondents might genuinely prefer the morning shift even if it pays less than 9 am – 5 pm position, the observation that many respondents still select night work if wages are actually lower than in the daytime job is likely due to inattention. Given an inattention rate of 18%, we expect that 18% of the individuals would select shift work even if all individuals actually prefer daytime work.

Following Mas and Pallais (2017), we estimate the inattention rate by treatment to correct our estimates for inattention error. The inattention-corrected share of individuals preferring shift work is shown by the blue dots in Figure 1. Due to the high inattention rate, the correction for inattention substantially reduces the share of individuals preferring shift work if it pays less than daytime work.

**Figure 1: The distribution of the shift premium, by treatment**



Finally, the dotted line in Figure 1 shows the results of estimating equation (2), which accounts for inattention. This regression consists in fitting a logistic distribution to the blue dots. The logistic regression fits the data well for all treatments, although the fit appears less good for rotating shifts with unpredictable schedules.

Note that, for many treatments, the correction for inattention leads to a negative share of individuals preferring shift over daytime work at negative shift premiums. This is a direct consequence of the approach used to correct for inattention (see equation (3)). This observation may indicate that we overestimate the inattention rate. As a robustness check, presented in Table C.1 in Appendix, we follow Mas and Pallais (2017) and estimate the WTP using an alternative definition of the inattention rate. Instead of using the control question, we determine the inattention rate as the share of respondents who selected shift work when this job paid €3 less than daytime work. This approach slightly changes the estimates, but the results remain qualitatively similar.

**Table 4: The distribution of the shift premium, by treatment**

	p25	p50	p75
Morning shift	-1.49 (0.35)	0.56 (0.22)	2.62 (0.32)
Evening shift	2.11 (0.25)	3.56 (0.26)	5.00 (0.37)
Night shift	3.64 (0.40)	5.42 (0.49)	7.21 (0.84)
Rotating shifts – predictable schedule	1.80 (0.31)	3.36 (0.28)	4.92 (0.41)
Rotating shifts - unpredictable schedule	3.14 (0.44)	5.71 (0.60)	8.27 (0.95)

Note: Bootstrapped standard errors using 500 replications are in parentheses

The treatments consider both fixed shifts (morning, evening and night shifts) and rotating shifts, with or without scheduling unpredictability. We first focus on the results for the fixed shifts. Figure 1 (top panel) and Table 4 show that the median respondent is willing to accept the morning shift for a shift premium of €0.56 (+3.8% of the baseline wage), but expects higher premiums for evening and night shifts. The premium amounts to €3.56 (+23.7%) for evening and €5.42 (+36.2%) for night shifts.

Turning to rotating shifts (Figure 1 (bottom panel) and Table 4), we estimate the median WTP to avoid rotating shifts with a predictable schedule at €3.36 (+22.4%). The premium for rotating shifts is in-between those for morning, evening and night shifts. This observation makes the WTP of the different treatments consistent with each other since workers in a rotating shift system alternate morning, evening and night shifts. It implies that the cost of continuous 24-hour production using three fixed 8-hour shifts or a rotating shift system with a predictable schedule is very similar. Firms with three fixed 8-hour shifts paying the median shift premium will pay a total premium over 24 hours of €9.54 compared to €10.08 for firms operating with rotating shifts.

The shift premium for rotating shifts is much higher when the schedule is unpredictable (€5.71, +38.1%). This finding is in line with previous studies, which also conclude that workers dislike employer discretion and require substantially higher wages to be (very) flexible (Mas and Pallais (2017); Schneider and Harknett, 2019).

Across all treatments, we observe substantial variation in the WTP across respondents. The difference in the WTP for the 25<sup>th</sup> and 75<sup>th</sup> percentiles ranges from €3 to €5, depending on the treatment. For instance, one quarter of the respondents accepts night shifts if the shift premium exceeds €3.64, while another quarter still prefers the daytime job if the shift premium surpasses €7.21. The substantial variation in the WTP already suggests that labour market sorting could be an important feature of the labour market. This means individuals with a low WTP will sort into shift work, while individuals with a high WTP will sort into daytime jobs. The heterogeneity analysis, presented in Section 4, explores this issue more thoroughly.

The majority of respondents demand a positive shift premium to accept shift work. The only exception is the morning shift: 25% of the workers prefer the morning shift if this shift pays €1.49 less (−10.0%) than the daytime job. This result corroborates the findings of Mas and Pallais (2017) who also find that some workers are willing to accept substantially lower wages in exchange for morning shifts (7 am – 3 pm in their paper vs. 6 am – 2 pm in our paper).

Correcting for inattention has modest effects on the median WTP but it is crucial to obtain unbiased estimates of the distribution of the WTP. Around the median of the distribution, the mistakes due to inattention go in both directions, thereby cancelling each other out. However, at the tails of the distribution, the mistakes distort the share of respondents who prefer shift work. In Table C.2 in Appendix, we show the 25<sup>th</sup>, 50<sup>th</sup> and 75<sup>th</sup> percentiles of the distribution of the WTP without correcting for inattention. This confirms the intuition that, without correcting for inattention, the variation in the distribution of WTP increases substantially. For instance, without correcting for inattention, 25% of the individuals are willing to work night shifts if the premium exceeds €0.97. In contrast, the inattention-corrected estimate of the premium at the 25<sup>th</sup> percentile of the distribution is, at €3.64, much higher.

To benchmark our findings, we contrast them to those of Mas and Pallais (2017) and Maestas et al. (2023). These papers do not focus on shift work, but do consider treatments with atypical hours or with flexible/unpredictable schedules. Mas and Pallais (2017) find that workers are willing to give up 20% of their wage in order to avoid jobs where the employers sets the schedule and which can include afternoon and weekend work but no night work. They show that this large wage differential occurs because workers demand a premium of 14% for afternoon work (12 pm – 8 pm) and of 19% for weekend work rather than aversion to changes in their schedule on short notice. In line with Mas and Pallais (2017), we also find that respondents demand a sizeable premium of 24% for evening work (2 pm – 10 pm). By contrast, in our setting, respondents demand much higher premiums for rotating shifts with unpredictable (+38%) than predictable schedules (+22%), indicating that respondents prefer consistent schedules. Like us, Maestas et al. (2023) include a discrete choice experiment in a survey, but vary several job attributes simultaneously. In their setting, the average worker is willing to give up 9% of their wage to set their own schedule.

### 3.3 Qualitative motives

We analyse the reasons respondents selected to motivate their choice to gain some insight into why they prefer daytime or shift work, and vice versa. Respondents could select a maximum of two reasons from a list of six or provide a different reason by filling out a text field. We use this information to investigate why some respondents prefer daywork when shift work pays more (Table 5), while others prefer shift work when it pays a premium (Table 6).<sup>10</sup>

**Table 5: Reasons to prefer daytime work over shift work, when shift work pays more**

	Higher wages	Work-life balance	Health	Job autonomy	Other reasons
Morning shift	10.1%	63.3%	65.2%	3.8%	15.8%
Evening shift	9.6%	74.9%	66.9%	4.2%	12.6%
Night shift	8.3%	70.3%	66.2%	3.0%	13.4%
Rotating shifts – predictable schedule	9.5%	69.6%	74.4%	4.4%	10.3%
Rotating shifts - unpredictable schedule	8.6%	72.9%	70.2%	3.5%	12.1%

Note: The shares do not sum to 100% across rows because respondents could choose two reasons. ‘Other reasons’ equals the sum of the share of respondents who selected “good atmosphere among co-workers”, “more promotion opportunities” or provided a different reason (open question). Note that 8.3% to 10.1% of the respondents report choosing the daytime job because it pays higher wages, despite the fact that it offered a lower wage. This finding again shows how important inattention is in our online survey. The number of observations ranges from 158 (morning shift) to 339 (rotating shift – unpredictable schedule).

Across all treatments, respondents prefer daytime work over shift work for two primary reasons: a better work-life balance and the health risks associated to shift work (Table 5). Respondents are especially likely to highlight concerns about the work-life balance for the evening shift (2 pm – 10 pm), while the morning shift (6 am – 2 pm) appears to pose fewer conflicts in the work-life balance. This latter observation might explain the earlier finding that some respondents are willing to sacrifice some income in return for the morning shift.

Health risks are equally likely to be cited as a reason to avoid morning, evening, and night shifts. This is surprising since the medical literature has demonstrated that night shifts are more detrimental to one’s health than evening or morning shifts. Health risks are more often reported as a reason for preferring the daytime job over rotating shifts than for preferring the daytime job over a fixed morning, evening, or night shift. This result signals that respondents believe that rotating shifts are more dangerous to their health than fixed shifts.

When we analyse the reported reasons why respondents chose shift work over daytime work, we find different results. Across all treatments, roughly 80% of the individuals cite the higher wage as a reason to prefer shift work over daytime work (Table 6). Interestingly, across all treatments, at least one in five

<sup>10</sup> Cases in which respondents prefer shift work job despite the fact that the wage offered in the daytime job is higher and the case in which respondents prefer daywork when it provides a higher wage are less informative. Few respondents choose shift work when the wage in the daytime job is higher (except for the morning shift) and those that do were most likely not paying attention to the job offers; choosing daywork when this jobs offers the highest wage does not force respondents to trade off wages for less attractive working hours.

respondents opt for shift work because it improves work-life balance. This observation is even more pronounced for the morning shift (54% report that the morning shift improves the work-life balance) and night shift (33%). Job autonomy is a reason to prefer evening and night work for 16% and 17% of the respondents, respectively, suggesting that workers expect less supervision during these shifts than during regular daytime jobs.

**Table 6: Reasons to prefer shift work over daytime work, when shift work pays more**

	<b>Higher wages</b>	<b>Work-life balance</b>	<b>Health</b>	<b>Job autonomy</b>	<b>Other reasons</b>
Morning shift	71.3%	54.0%	11.6%	6.1%	15.7%
Evening shift	82.1%	26.4%	8.0%	16.4%	18.9%
Night shift	84.5%	32.7%	3.0%	17.3%	19.0%
Rotating shifts – predictable schedule	78.5%	23.8%	3.8%	12.3%	26.4%
Rotating shifts – unpredictable schedule	82.0%	25.4%	2.1%	11.1%	25.9%

Note: The shares do not sum to 100% across rows because respondents could choose two reasons. ‘Other reasons’ equals the sum of the share of respondents who selected “good atmosphere among co-workers”, “more promotion opportunities” or provided a different reason (open question). The number of observations ranges from 168 (night shift) to 363 (morning shift).

## 4. Labour market sorting

In this section, we exploit data on the respondents’ (1) socioeconomic characteristics, (2) current job, and (3) health conditions to relate our findings to the literature on labour market sorting and to the medical literature on shift work. Specifically, we first derive two predictions from the theory of labour market sorting and one from the medical literature, which we then test empirically.

The theory of labour market sorting predicts that workers will sort into jobs that offer the highest utility. In our setting, this theory predicts that individuals with a lower WTP to avoid shift work should sort into these types of jobs. We test two implications of this theory. First, according to observational data, shift workers in sectors targeted by our survey are generally younger, lower-educated men. Labour market sorting predicts that these patterns will emerge if these socioeconomic groups are less averse to working shifts and self-select into shift work. This prediction can be tested by estimating the WTP for each socioeconomic group.

Second, a necessary consequence of labour market sorting is that individuals who are working shifts in their current job should demand lower shift premiums. Since 87% of the survey respondents are night or shift workers, we cannot directly test whether shift workers demand lower premiums than similar individuals who decided not to work shifts. However, we can test whether respondents who are working nights in their current jobs, which is the most onerous shift, demand lower shift premiums. Furthermore, we can test whether respondents who work rotating shifts demand lower premiums than respondents who work fixed shifts. We attempt to disentangle the “sorting” from the “endowment hypothesis”. The endowment hypothesis refers to the idea that individuals who are currently working nights or rotating shifts are more likely to prefer this type of work over daytime work because they are used to it (Franciosi et al., 1996).

We then relate our findings to the medical literature. This literature argues that certain individuals adjust more easily to working nonstandard hours, particularly nights (Saksvik et al., 2011). Chronobiology, which studies circadian rhythms, points out that younger individuals (Blok and De Looze, 2011) and evening persons (Vetter et al., 2015) adjust more easily to night shifts. Sleeping disorders are the most prevalent health issue among shift workers (Åkerstedt, 2003; Åkerstedt and Wright, 2009). We test whether older respondents, those who report poor sleep quality and those in poor physical condition require higher shift premiums to accept shift work. If this is the case, it suggests that individuals are aware of the individual-specific health risks of shift work and, therefore, request a higher premium.

To test the aforementioned predictions from the literature, we conduct a heterogeneity analysis. To this end, we pool all treatments and compare the choice between a job with shift work and the daytime job. The underlying idea is that respondents who dislike shift work will always have a higher WTP to avoid these types of jobs, regardless of the specific treatment. In other words, we assume that individuals who, for example, request a higher premium for evening shifts also request higher premiums for night shifts and rotating shifts. The main advantage of pooling observations across all treatments instead of conducting a heterogeneity analysis by treatment is that we have more observations per subgroup and, consequently, smaller standard errors.

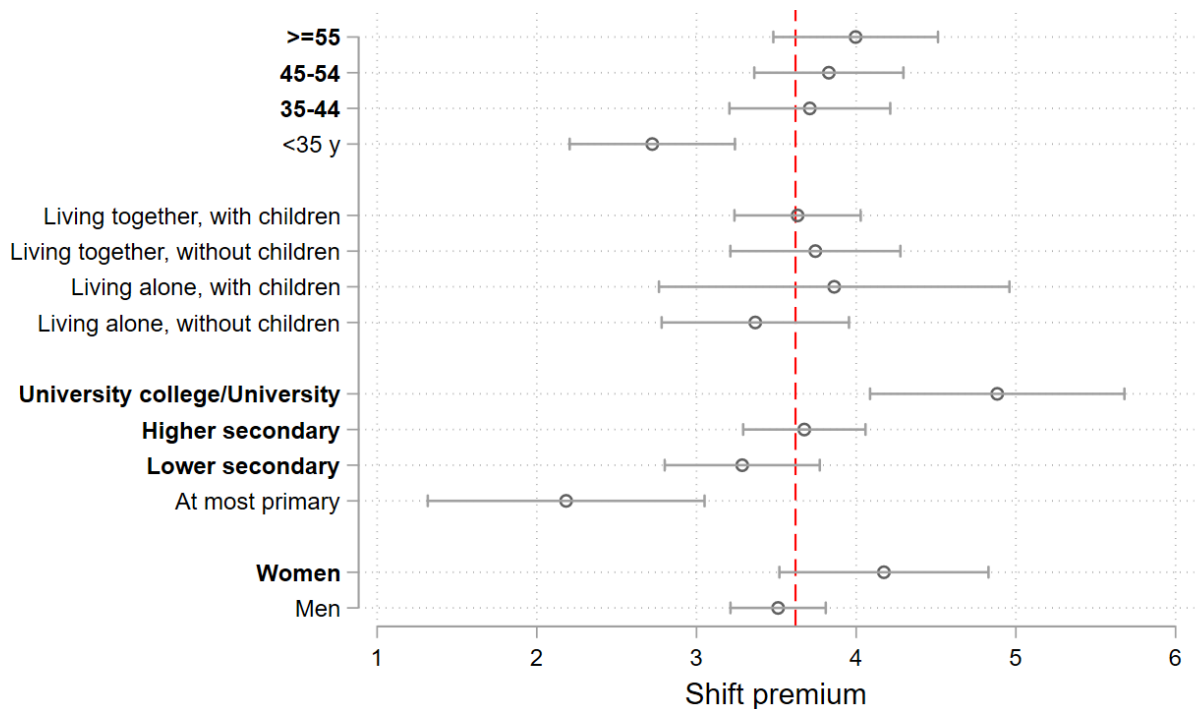
The baseline estimates stem from regressing the outcome on the shift premium and a dummy indicating the subgroup (e.g. men vs. women), taking into account the inattention rate. A concern with this approach is that socioeconomic, job and health characteristics might be correlated. For instance, older workers are more likely to suffer health issues than younger workers so age dummies may partly capture the effect of poor health rather than a genuine differences in the WTP between young and older workers. In Appendix C, we show that our findings are robust to controlling for worker, job and health characteristics.

#### **4.1 Socioeconomic Groups**

Figure 2 shows the shift premium by age, family composition, level of education and gender. The labels are printed in bold when the difference with the reference category is statistically significant at the 10% level. The dotted red line highlights the median shift premium in the sample: half of the respondents accept shift work (pooling all treatments) if the shift premium exceeds €3.62 (+24.1% of the baseline wage).

Socioeconomic groups that are, according to observational data, more likely to work shifts demand a lower premium. Half of the individuals younger than 35 accept shift work if the shift premium exceeds €2.72 (+18.1%); half of the individuals with at most primary education are satisfied with a premium of €2.18 (+14.5%); and men accept lower premiums than women (€3.51 vs. €4.17), although the latter difference is only significant at the 10% level. We do not observe that individuals living with children have a higher WTP, perhaps because our sample consists primarily of men who might not be in charge of domestic work and childcare.

Figure 2: Shift premium across socioeconomic groups



Note: The figure shows the shift premium and the 95% CI (bootstrapped standard errors based on 500 replications) required by the median respondent to prefer shift work (pooling all treatments) over daytime work paying a gross hourly wage of €15. The red dotted line shows the shift premium for the entire sample: the median respondent in the sample accepts shift work if the shift premium exceeds €3.62 (+24.1% of the baseline wage). The labels are printed in bold when the difference with the reference category (i.e. respondents younger than 35; living alone without children; at most primary education; and men) is statistically significant at the 10% level. The exact point estimates and p-values are reported in Appendix C.

We conduct a thought experiment to illustrate that labour market sorting due to heterogeneity in compensating wage differentials can explain a sizeable part of the patterns observed in the observational data. For instance, the LFS indicates that, in the sectors targeted by the survey, 81% of the shift workers are men and 19% are women. To what extent can this gap be explained by labour market sorting? Suppose that men and women are equally likely to apply for shift work, but only accept the job if the shift premium is sufficiently high to compensate them. Let us further suppose that employers offer the median shift premium (€3.62). Given these assumptions, 52% of the male applicants and 43% of the female applicants will accept shift work. Consequently, if workers sort perfectly into jobs, 54% of the shift workers would be men and 46% women, a difference of 8 percentage points. In this specific example, labour market sorting explains about 10% of the gender gap.

The explanatory power of labour market sorting to explain the gender gap is limited because the difference in the shift premium demanded by men and women is small (€0.66). Labour market sorting is more important for socioeconomic groups for which we observe more heterogeneity. For instance, repeating the same computations by age group assuming that the number of applicants is proportional to their share in the population<sup>11</sup> shows that perfect labour market sorting would imply that 41% of the shift workers would

<sup>11</sup> In Belgium, 35% of the population is between 18 and 34 years old; 22% is between 35 and 44 years old; 22% is between 45 and 54 years old; and 22% is between 55 and 64 years old. We assume that, in the absence of labour market sorting, the share of shift workers by age group would be equal to the share in the population.

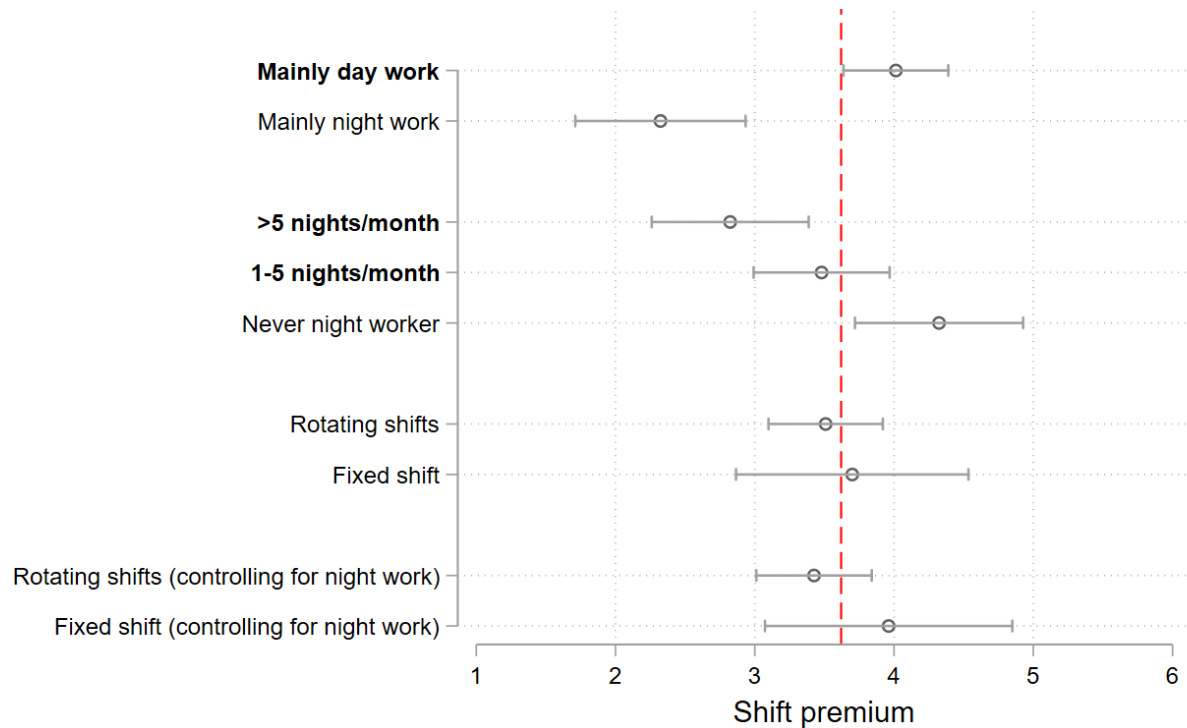
be younger than 35, while the three remaining age groups would each account for about 20% of the shift workers. Similarly, with perfect sorting, 9% of the shift workers would have at most a primary education, 13% a lower secondary education, 43% a higher secondary and 34% a university(college) education.<sup>12</sup>

While these computations should not be taken at face value, they do illustrate that differences in shift work preferences across socioeconomic groups have the potential to partly explain the patterns in observational data.

## 4.2 Job Characteristics of the Current Job

Figure 3 examines whether respondents who are currently working more onerous shifts demand lower shift premiums. We first test whether night workers demand lower premiums and then examine whether respondents working rotating shifts demand lower premiums than respondents working fixed shifts.

**Figure 3: Median shift premium across all treatments for shift and night workers**



Note: The Figure shows the shift premium and the 95% CI (bootstrapped standard errors based on 500 replications) required by the median respondent to prefer shift work (pooling all treatments) over daytime work paying a gross hourly wage of €15. Respondents who report mainly working nights work more hours during the night than during the day. We do not include control variables in the regression except in the last regression where we control for night work. In this case, the shift premium demanded by respondents working fixed vs. rotating shifts is estimated at the average value of the control variable. The red dotted line shows the median WTP for the entire sample: the median respondent in the sample accepts shift work if the premium exceeds €3.62 (+24.1% of the baseline wage). The labels are printed in bold when the difference with the reference category (i.e. mainly night work, never night work, fixed shift) is statistically significant at the 10% level. The exact point estimates and p-values are reported in Appendix C.

<sup>12</sup> In 2022, 6%, 11%, 39% and 44% of the population aged 20-64 has at most primary, lower secondary, higher secondary and university (college) education.

We find compelling evidence that respondents who mainly work nights (23% of the respondents) require substantially lower premiums than respondents who mainly perform daytime work. Night workers accept shift work if the shift premium exceeds €2.32 (+15.4%), while daytime workers demand at least €4.01 (+26.7%). We obtain similar results when classifying respondents into three groups based on the number of nights worked in a typical month. Respondents who never work nights demand a premium of €4.32 (+28.8%), whereas respondents who work 1-5 nights and more than 5 nights per month demand a premium of €3.48 (+23.2%) and €2.82 (+18.8%), respectively.

An alternative explanation for the observation that night workers demand lower premiums for shift work is that these workers are accustomed to this type of work. This is called the endowment effect. In Table 7, we examine whether night workers only accept lower premiums for night work—which would suggest that the endowment effect explains the results—or accept lower premiums for all types of shifts—which would suggest genuine preferences for nonstandard working hours.

The most striking observation is that night workers demand a much lower premium (€1.26, +8.4% of the baseline wage) for the fixed night shift than daytime workers (€7.27, +48.4%). This strongly suggests that the endowment effect plays a critical role. At the same time, night workers also accept lower premiums for all the other types of shifts, with the exception of the morning shift. This finding suggests that night workers have genuine preferences for nonstandard working hours, and might sort into these types of jobs.

**Table 7: The shift premium by treatment, daytime versus night workers**

Treatment	Daytime workers	Night workers	Difference
Morning shift	0.58 [0.05; 1.11]	0.81 [−0.41; 2.06]	− 0.23 [− 1.63; 1.11]
Evening shift	3.93 [3.37; 4.62]	2.37 [1.34; 3.57]	1.56 [0.27; 2.65]
Night shift	7.27 [5.43; 13.81]	1.26 [−0.30; 3.20]	6.01 [3.41; 12.51]
Rotating shifts - predictable schedule	3.79 [3.09; 4.55]	2.45 [1.35; 3.67]	1.34 [−0.04; 2.64]
Rotating shifts – unpredictable schedule	5.91 [4.77; 7.61]	4.12 [2.58; 6.04]	1.78 [−0.04; 3.70]

Note: Night workers are defined as respondents who reported mainly working nights. Because not all respondents answered this question, the sample contains 2,859 daytime workers and 863 night workers. In the analyses in the table, the number of observations ranges from 709 to 761, depending on the treatment. Due to the low number of observations and the high inattention rate, the bootstrapped estimates contained outliers. For this reason, we could not use the normal approximation to compute the standard deviation of the bootstrapped estimates (as in the main analyses), but used percentile methods to construct 95% CI (2,000 replications). The 95% CI are reported below the point estimates.

We then compare the shift premium between respondents working fixed shifts versus respondents working rotating shifts. Almost half of fixed shift workers mainly work nights, indicating that a fixed shift is typically a fixed night shift. For this reason, comparing respondents with a fixed shift to respondents with a rotating shift is confounded by night work. Figure 3 shows that, without controlling for night work, respondents working fixed shifts or rotating shifts demand a similar premium. However, once we control for

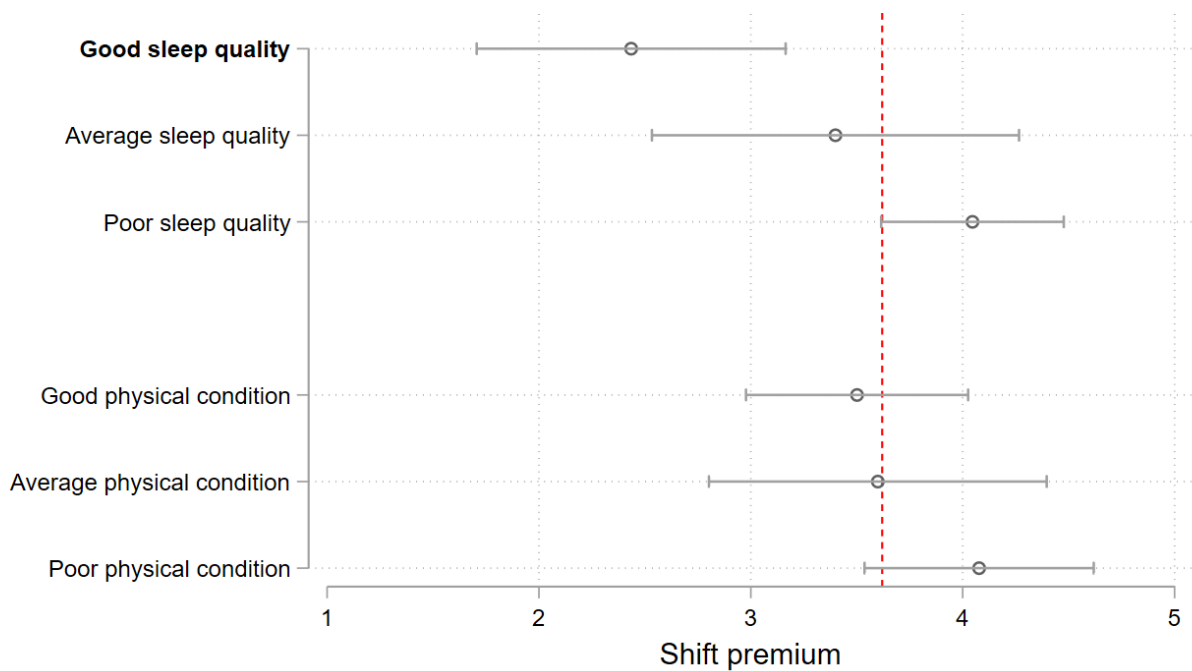
night work, the premium demand by rotating shift workers is €0.53 lower than the premium demanded by respondents working fixed shifts, although the difference is not statistically significant at the 10% level.

### 4.3 Health Characteristics

Figure 4 relates our WTP estimates to the medical literature, which points out that certain individuals are more suited for night and shift work than others. Descriptive evidence presented earlier already shows that respondents are aware of the negative health effects of shift work. In addition, Figure 2 shows that the WTP increases with age, which is consistent with the medical literature pointing out that night and shift work is more harmful to older workers (e.g. Abrams et al., 2022).

Figure 4 shows that respondents who report being in excellent physical condition or sleeping well are more likely to accept shift work, even if the shift premium is modest. This finding further confirms that individuals are aware of the impact of shift work on their health and only accept these jobs when the individual-specific costs remain limited.

**Figure 4: Median shift premium across all treatments by health characteristics**



Note: The Figure shows the WTP (and the 95% CI using the bootstrapped standard errors) to prefer shift work (pooling all treatments) over daytime work paying a gross hourly wage of €15. We estimate the WTP by self-reported physical condition and sleep quality, correcting for the group-specific inattention rate. The red dotted line shows the median for the entire sample: the median respondent in the sample accepts shift work if the shift premium exceeds €3.62 (+24.1% of the baseline wage). The labels are printed in bold when the difference with the reference category (i.e. poor sleep quality, poor physical condition) is statistically significant at the 10% level. The exact point estimates and p-values are reported in Appendix C.

## 5. Conclusion

This study set up a discrete choice experiment among shift and night workers to investigate the distribution of the shift premium. Workers chose between a daytime job that paid €15 per hour and a job with shift work that paid a wage that randomly varied between €12 and €20. We corrected the WTP estimates for

classification errors due to inattention.

Our results show that respondents demand a premium for shift work but with large differences between the types of shifts. Generally, respondents require higher premiums for more onerous working hours. The median shift premium for the morning shift (6 am - 2 pm) is 4%, whereas it is 24% for the evening shift (2 pm – 10 pm) and further increases to 36% for the night shift (10 pm – 6 am). The premium for rotating shifts amounts to 22%. These estimates demonstrate that setting up continuous 24-hour production systems using three fixed 8-hour shifts or rotating shifts is equally expensive, which might explain why both approaches coexist.

We show that workers dislike scheduling uncertainty, thereby confirming a robust finding in the literature (e.g. Schneider and Harknett, 2019; Maestas et al, 2023). When the rotating shifts follow an unpredictable schedule, the shift premium increases to 38% compared to a premium of 22% for rotating shifts with a predictable schedule. At the same time, descriptive statistics reveal that last-minute changes to the schedule are common. In our sample, one quarter of the respondents experiences last-minute changes in their schedule at least once a month. Therefore, preparing schedules well ahead and preventing last-minute changes would improve workers' welfare.

The variation in WTP between individuals is substantial. The difference between the premium demanded by the 25% of the respondents with the lowest and highest WTP ranges from 20% to 40% of the base wage, depending on the treatment. The considerable variation across respondents implies that there is room for labour market sorting, in which individuals with the lowest WTP sort into shift work.

We leverage the rich information on individuals' socioeconomic backgrounds and current jobs to investigate labour market sorting. We find that younger individuals, those with a lower level of education, and men require lower premiums for shift work, which may explain why these groups are overrepresented in shift work. Interestingly, Maestas et al. (2023) examining the WTP for several job amenities observe heterogeneity along the same dimensions. By contrast, Mas and Pallais (2017) find differences in the WTP for scheduling flexibility by gender, but do not find consistent differences by age or education.

We also find that workers currently engaged in night work accept much lower premiums, particularly for the fixed night shifts—which suggests that the shift premium decreases once workers are used to the job—but they also accept lower premiums for other types of shifts—which suggests that some night workers have genuine preferences for nonstandard working hours. Overall, our findings are in line with predictions from the theory of labour market sorting.

Finally, we document that respondents in poor physical condition or suffering from sleeping disorders require much larger premiums. We interpret this finding as evidence that workers are aware of the individual-specific negative health effects of shift work. Individuals who experience difficulties adjusting to shift work avoid these jobs.

The large heterogeneity in the WTP to avoid shift work points to opportunities to organise shift work so that workers who strongly dislike it can opt out. The security sector, for instance, has a pool of workers who volunteer (and get compensated) to be on-call to respond to unexpected demands from clients. This approach is sensible, as workers with a low WTP can choose to join the flexible pool, while workers with a

stronger distaste for nonstandard hours do not have to accept more flexibility. Furthermore, someone's WTP is likely to change over time. Older individuals demand much higher premiums than younger individuals. This observation calls for policies allowing (older) workers to transition from shift to daytime work within the same company so that (older) individuals do not become trapped in shift work.

Finally, it is worth emphasising that we capture the distribution of the shift premium demanded by individuals, most of whom are currently working nights or shifts in specific industries, rather than the distribution among the entire population of workers. This is a critical difference from the recent studies of Mas and Pallais (2017) and Maestas et. al (2023) who determine compensating wage differentials for several job amenities for a representative sample of US (telephone) workers. By contrast, our population consists of individuals who self-selected into night and shift work. If preferences partly drive occupational choices, our estimates present lower bounds of the WTP to avoid shift work in the population, as individuals who are less averse to shift work will sort into shift work and will demand lower premiums.

Our approach has the practical advantage that we can focus on specific, yet highly prevalent job disamenities, such as rotating shifts, that are hard to examine when targeting the entire population. Moreover, having reliable estimates of the shift premium demanded by workers who are currently working nights or shifts is more relevant for trade unions and employers' organizations than having estimates for the entire population, most of whom will never engage in shift work in the first place.

From an academic point of view, the theory of compensating wage differentials predicts that, in equilibrium, the wage differential for a job (dis)amenity is determined by the marginal worker (and firm). Neither targeting a representative sample of the entire population of workers nor the subpopulation of workers who accepted jobs with the specific disamenity allows determining the sensitivity of the premium to improving working conditions. To this end, other approaches, such as those that exploit quasi-random variation in the provision of amenities (Lavetti, 2020; Lee and Taylor, 2019), are required.

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## Appendix A: The design of the experiment

Figure A.1: Example of the choice experiment (French version)

**Exercice – offre d'emploi**

Imaginez que vous êtes à la recherche d'un nouvel emploi dans votre secteur actuel. Vous avez reçu deux offres d'emploi. Les deux emplois sont identiques, mais les heures de travail et les salaires sont différents.

*Lisez attentivement les offres et répondez aux questions ci-dessous.*

**Emploi 1**

Vous travaillez du lundi au vendredi en alternant les semaines avec des équipes du matin, d'après-midi et de nuit. Le salaire horaire brut est de 18 € (y compris toutes les primes d'équipes).

**Emploi 2**

Vous travaillez du lundi au vendredi, de 9h00 à 17h00. Le salaire horaire brut est de 15 €.

**\*Quel emploi préférez-vous ?**

📌 Veuillez sélectionner une réponse ci-dessous

☒ Emploi 1

☐ Emploi 2

Figure A.2: Reasons to choose a job and the control question (French version)

**Exercice – offre d'emploi**

Quelles sont les raisons les plus importantes pour lesquelles vous avez choisi l'emploi 1 ?

📌 Cochez la ou les réponses

📌 Veuillez sélectionner 2 réponses maximum

☐ 1. Un salaire plus élevé

☐ 2. Meilleur équilibre avec ma vie privée

☐ 3. Bonne ambiance entre collègues

☐ 4. Plus d'autonomie

☐ 5. Meilleures chances de promotion

☐ 6. Mieux pour ma santé

☐ 7. Autre, à savoir

**\*Avez-vous choisi un emploi avec des horaires fixes de 9h à 17h ?**

📌 Veuillez sélectionner une réponse ci-dessous

☐ 1. Oui

☐ 2. Non

Note: This page immediately followed the discrete choice experiment. Respondents could not, however, check their previous response.

## Appendix B: Randomization

Table B.1: Worker, job and health characteristics by treatment

	All respondents	Morning	Evening	Night	Rotating – predictable	Rotating – unpredictable	F-test (p-value)
<b><u>WORKER</u></b>							
<b><u>CHARACTERISTICS</u></b>							
<b>Men</b>	81.4%	80.5%	83.6%	81.3%	82.7%	78.9%	0.08**
<b>Age</b>							
<35 y	21.9%	22.7%	21.2%	21.8%	23.1%	20.9%	0.73
35-44y	25.2%	23.8%	25.0%	26.8%	24.0%	26.6%	0.42
45-54	26.8%	28.2%	28.3%	26.4%	26.4%	24.7%	0.38
>=55	26.1%	25.3%	25.5%	25.1%	26.5%	27.8%	0.64
<b>Survey in Dutch</b>	62.0%	62.5%	62.3%	61.8%	58.8%	64.7%	0.13
<b>Education</b>							
At most primary	6.6%	6.2%	7.4%	6.0%	7.1%	6.4%	0.74
Lower secondary	28.1%	28.0%	25.7%	28.6%	29.2%	29.0%	0.45
Higher secondary	52.4%	53.5%	52.7%	52.5%	51.9%	51.5%	0.92
University/University college	12.8%	12.3%	14.3%	12.8%	11.7%	13.1%	0.57
<b>Family composition</b>							
Single, without children	18.0%	16.7%	16.4%	20.4%	17.7%	18.9%	0.15
Single with children	6.0%	4.9%	5.4%	6.8%	6.0%	6.8%	0.30
Partner, without children	27.3%	28.4%	27.0%	25.5%	27.4%	28.0%	0.69
Partner, with children	48.7%	50.1%	51.2%	47.3%	48.9%	46.3%	0.21
<b><u>JOB CHARACTERISTICS</u></b>							
<b>Shift or night work</b>	87.7%	87.9%	87.2%	86.9%	87.9%	88.6%	0.86
<b>Mainly shift work</b>	79.5%	79.8%	80.0%	78.6%	79.5%	79.6%	0.97
Fixed shift	16.1%	14.5%	16.1%	15.2%	17.4%	17.6%	0.65
<b>Mainly night work</b>	23.2%	22.3%	23.1%	24.2%	22.8%	23.5%	0.93
<b>Frequency of night work</b>							
Never night work	32.0%	30.6%	33.2%	31.0%	33.1%	31.9%	0.84
1 - 5 nights/month	40.3%	40.9%	39.5%	41.3%	40.9%	38.9%	0.91
>5 nights/month	27.7%	28.5%	27.3%	27.7%	26.0%	29.2%	0.79
<b>Mainly weekend work</b>	12.1%	11.5%	11.5%	12.6%	12.1%	12.4%	0.95
<b>Gross hourly wage</b>	19.64	19.64	19.93	19.36	19.36	19.87	0.46
<b>wage &lt;=15</b>	16.7%	17.6%	15.3%	17.3%	19.8%	13.6%	0.24
<b>Sector</b>							
Chemical	26.3%	27.0%	25.3%	25.7%	27.0%	26.6%	0.89
Security	8.0%	8.9%	5.4%	7.5%	8.1%	10.0%	0.01***
Metal	8.5%	8.4%	8.9%	8.6%	9.3%	7.3%	0.61
Other	57.1%	55.7%	60.4%	58.2%	55.6%	56.1%	0.18
<b><u>HEALTH</u></b>							
<b><u>CHARACTERISTICS</u></b>							
<b>Sleeping pattern</b>							
Poor	67.1%	66.0%	64.9%	66.4%	69.1%	69.0%	0.47
Neutral	18.5%	18.2%	18.9%	19.4%	18.0%	17.9%	0.96
Good	14.5%	15.8%	16.2%	14.2%	12.9%	13.1%	0.38
<b>Physical condition</b>							
Poor	40.0%	40.7%	40.1%	40.7%	39.5%	39.0%	0.97
Neutral	23.2%	25.0%	22.4%	23.4%	22.2%	22.8%	0.82
Good	36.8%	34.3%	37.5%	35.9%	38.3%	38.3%	0.58

Note: \*\*\* \*\*, \* indicate significance at the 1%, 5% and 10% level, respectively. The number of observation differs per variable because the half of the respondents did not complete the entire survey.

**Table B.2: Worker, job and health characteristics by wage offered in the job with shift work**

	Hourly wage offered in job with shift work									F-test (p-value)
	€ 12	€ 13	€ 14	€ 15	€ 16	€ 17	€ 18	€ 19	€ 20	
<b><u>WORKER CHARACTERISTICS</u></b>										
Men	79.3%	83.5%	81.6%	83.1%	76.9%	81.2%	81.4%	83.8%	81.0%	0.12
Age										
<35 y	24.3%	23.5%	23.4%	22.1%	20.9%	20.3%	22.9%	18.8%	21.1%	0.45
35-44y	25.8%	22.4%	24.2%	27.8%	27.2%	26.4%	24.3%	25.7%	23.9%	0.58
45-54	27.6%	28.4%	27.3%	25.0%	24.9%	25.3%	26.3%	27.4%	28.1%	0.88
>=55	22.4%	25.7%	25.0%	25.0%	27.0%	28.1%	26.5%	28.1%	27.0%	0.54
Survey in Dutch	61.7%	61.9%	62.0%	61.1%	65.0%	61.7%	60.4%	65.5%	59.0%	0.49
Education										
At most primary	5.6%	5.3%	8.2%	7.5%	5.1%	5.9%	7.7%	6.4%	7.7%	0.33
Lower secondary	28.8%	29.6%	29.2%	28.4%	29.0%	25.1%	26.8%	30.7%	25.2%	0.46
Higher secondary	52.6%	51.6%	50.5%	53.4%	51.5%	56.8%	52.6%	49.4%	53.9%	0.51
University/University college	13.0%	13.5%	12.1%	10.7%	14.4%	12.1%	12.9%	13.4%	13.2%	0.86
Family composition										
Single, without children	18.8%	17.2%	21.0%	21.1%	18.5%	17.6%	18.8%	15.2%	14.4%	0.06**
Single with children	5.6%	5.7%	7.0%	5.6%	6.4%	6.8%	4.8%	4.8%	7.3%	0.62
Partner, without children	25.1%	26.8%	25.5%	25.6%	28.9%	27.1%	31.1%	29.3%	26.2%	0.38
Partner, with children	50.5%	50.3%	46.5%	47.7%	46.2%	48.5%	45.3%	50.7%	52.1%	0.31
<b><u>JOB CHARACTERISTICS</u></b>										
Shift or night work	86.8%	87.5%	89.7%	88.3%	84.8%	89.2%	88.9%	88.7%	85.5%	0.36
Mainly shift work	74.1%	79.1%	80.6%	79.4%	76.6%	82.5%	82.5%	83.2%	77.6%	0.02
Fixed shift	15.6%	17.1%	17.2%	17.6%	16.1%	15.7%	13.4%	17.1%	15.3%	0.95
Mainly night work	27.3%	24.7%	24.8%	23.6%	22.0%	20.3%	20.2%	21.3%	24.1%	0.26
Frequency of night work										
Never night work	28.6%	30.5%	32.2%	33.1%	34.8%	30.5%	31.0%	34.0%	33.0%	0.81
1 - 5 nights/month	41.5%	43.7%	38.3%	31.5%	37.9%	44.4%	45.5%	42.2%	37.5%	0.01***
>5 nights/month	29.9%	25.8%	29.4%	35.4%	27.3%	25.1%	23.5%	23.8%	29.5%	0.02**
Mainly weekend work	9.8%	13.0%	14.0%	13.2%	14.6%	10.8%	12.3%	10.4%	10.4%	0.30
Gross hourly wage	20.20	20.04	19.00	19.08	19.60	19.63	19.87	19.98	19.27	0.25
wage <=15	18.3%	12.8%	19.6%	16.9%	19.2%	17.9%	14.7%	16.7%	15.3%	0.69
Sector										
Chemical	25.4%	27.9%	26.9%	26.0%	27.6%	26.6%	26.5%	27.7%	22.6%	0.65
Security	10.2%	8.0%	8.1%	8.7%	8.0%	6.1%	8.2%	7.3%	7.5%	0.58
Metal	7.7%	7.8%	9.7%	9.5%	8.2%	8.9%	7.8%	8.9%	7.8%	0.92
Other	56.6%	56.3%	55.2%	55.8%	56.1%	58.4%	57.4%	56.0%	62.1%	0.47
<b><u>HEALTH CHARACTERISTICS</u></b>										
Sleeping pattern										
Poor	68.9%	61.4%	70.0%	67.8%	63.0%	67.5%	67.9%	69.2%	67.9%	0.26
Neutral	17.0%	24.3%	15.0%	21.4%	19.9%	18.6%	14.2%	16.9%	19.0%	0.02**
Good	14.1%	14.2%	15.0%	10.9%	17.2%	13.9%	17.9%	13.9%	13.1%	0.36
Physical condition										
Poor	41.3%	36.5%	44.9%	41.4%	37.6%	37.1%	37.9%	45.7%	37.2%	0.11
Neutral	22.0%	28.7%	21.5%	22.7%	20.2%	21.3%	22.7%	20.7%	27.7%	0.10
Good	36.7%	34.8%	33.6%	35.9%	42.2%	41.6%	39.5%	33.6%	35.1%	0.20

Note: \*\*\*, \*\*, \* indicate significance at the 1%, 5% and 10% level, respectively. The number of observation differs per variable because the half of the respondents did not complete the entire survey.

**Table B.3: Number of observations by treatment-wage**

	€ 12	€ 13	€ 14	€ 15	€ 16	€ 17	€ 18	€ 19	€ 20
Morning shift	98	120	108	105	104	85	108	107	117
Evening shift	118	117	93	105	83	82	86	92	97
Night shift	111	98	98	106	94	88	95	118	110
Rotating shifts – predictable schedule	89	116	93	85	98	98	105	119	114
Rotating shifts - unpredictable schedule	103	98	124	106	95	106	104	112	111

Note: Chi-squared test, p-value=0.52.

## Appendix C: Additional results

**Table C.1: The distribution of the shift premium, by treatment (alternative definition of the inattention rate)**

	p25	p50	p75
Morning shift	-0.71 (0.37)	0.50 (0.23)	1.72 (0.44)
Evening shift	1.52 (0.30)	3.54 (0.25)	5.55 (0.39)
Night shift	3.16 (0.53)	5.59 (0.56)	8.01 (1.10)
Rotating shifts – predictable schedule	1.98 (0.36)	3.36 (0.29)	4.73 (0.51)
Rotating shifts - unpredictable schedule	2.50 (0.52)	5.76 (0.63)	9.01 (1.12)

Note: Following Mas and Pallais (2017), the inattention rate is defined as the share of respondents selecting the job with shift work when this job pays €3 less than daytime work. Bootstrapped standard errors using 500 replications are in parentheses.

**Table C.2: The distribution of the shift premium without correcting for inattention, by treatment**

	p25	p50	p75
Morning shift	-2.64 (0.37)	0.63 (0.21)	3.89 (0.34)
Evening shift	0.67 (0.23)	3.55 (0.27)	6.42 (0.47)
Night shift	0.97 (0.40)	6.50 (0.83)	12.03 (1.64)
Rotating shifts - predictable schedule	-0.35 (0.34)	3.41 (0.30)	7.17 (0.63)
Rotating shifts - unpredictable schedule	0.76 (0.38)	6.10 (0.74)	11.45 (1.46)

Note: Robust standard errors are in parentheses.

**TableC.3: Heterogeneity of the shift premium, unconditional and conditional estimates**

	Unconditional	Conditional on worker characteristics	Conditional on job and health characteristics	Conditional on worker, job and health characteristics
<b><u>WORKER CHARACTERISTICS</u></b>				
<b>Men vs. women</b>	0.66 (0.35)	0.68 (0.34)	0.89 (0.52)	0.77 (0.55)
<b>Age (base level &lt;35 years old)</b>				
35-44	0.99 (0.37)	1.06 (0.35)	1.17 (0.52)	1.08 (0.55)
45 - 54	1.11 (0.35)	1.33 (0.33)	1.34 (0.53)	1.40 (0.59)
>=55 y	1.27 (0.36)	1.52 (0.34)	1.03 (0.47)	0.90 (0.50)
<b>Education (base level = at most primary)</b>				
Lower secondary	1.10 (0.50)	1.07 (0.48)	1.31 (0.73)	1.06 (0.92)
Higher secondary	1.49 (0.47)	1.52 (0.44)	1.42 (0.61)	1.04 (0.83)
University college/university	2.70 (0.60)	2.46 (0.57)	2.54 (1.28)	2.30 (1.04)
<b>Family composition (base level = living alone without children)</b>				
Living alone, with children	0.49 (0.64)	0.15 (0.68)	1.43 (14.54)	1.78 (14.29)
Living together, without children	0.38 (0.38)	0.20 (0.36)	0.29 (0.48)	0.09 (0.52)
Living together, with children	0.26 (0.34)	(-0.03) (0.36)	0.46 (0.53)	0.38 (0.56)
<b><u>JOB CHARACTERISTICS</u></b>				
<b>Daytime worker vs. night worker</b>	1.69 (0.35)		1.32 (0.47)	1.45 (0.51)
<b>Rotating vs. fixed shifts</b>	-0.19 (0.46)		-0.58 (0.52)	-1.07 (0.59)
<b><u>HEALTH CHARACTERISTICS</u></b>				
<b>Physical condition (base level = poor)</b>				
Average	-0.31 (0.20)			-0.40 (0.53)
Good	-0.58 (0.37)			-0.29 (0.43)
<b>Sleep quality condition (base level = poor)</b>				
Average	-0.65 (0.48)			-0.91 (0.55)
Good	-1.61 (0.43)			-1.74 (0.47)
<b>Number of observations</b>	Depends on the variable	4,564	2,319	2,110

Note: The table shows the difference between the shift premium across groups (e.g. men vs. women or individuals with at most primary education vs. individuals with university(college) education) for different specifications. Column 1 shows the unconditional estimates, which are also reported in Figures 2, 3 and 4 in the main text. Columns 2, 3 and 4 include differences in the shift premium conditional on worker, job and health characteristics, respectively. The three regressions also include dummies indicating the treatment. Consider as an example the difference in the shift premium demanded by women vs. men. Without control variables, the shift premium demanded by women is €0.66 higher than for men (column 1). The difference amounts to €0.68 when controlling for other worker characteristics such as age and level of education (column 2); to €0.89 when controlling for worker characteristics and for characteristics of the current job (column 3); and to €0.77 when controlling for worker, job and health characteristics. Bootstrapped standard errors (500 replications) are reported in parentheses. The number of observations decreases as more control variables are added to the model because half of the respondents did not complete the entire survey.