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Cognitive Load and Occupational Injuries*

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Abstract

We investigate the impact of cognitive load on occupational injuries using survey data. Cognitive load is defined in the literature as a tax on bandwidth which reduces the amount of cognitive resources available for engaging in logical reasoning. We proxy cognitive load with the number of non-professional tasks that individuals perform every day, conditional on the time they spend on them. The underlying assumption is that when individuals perform a large number of those tasks, this requires mental organization which keeps part of their working memory busy. We show that cognitive load increases the risk of occupational injury for both males and females. The effect is stronger for individuals in high-risk occupations and, among those, for low-educated workers.

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I. Introduction

A growing literature in psychology, economics and cognitive sciences has developed on the impact of cognitive load on individuals' abilities and preferences.

The concept of cognitive load builds on the two-system model of the brain (Kahneman, 2002, 2011). In this framework, people have a fast system (system 1) that governs automatic and effortless thoughts and a slow system (system 2) which is deliberate and costly (Schilbach et al., 2016). When required to make a decision, system 1 quickly reaches a decision but is prone to biases and errors. System 2 is more accurate but overriding an intuitive decision made by system 1 comes at a cost. Individuals have a mental reserve, called bandwidth (Mullainathan and Shafir, 2013), for the effortful thought required to use system 2. Cognitive load acts as a tax on bandwidth which reduces the amount of cognitive resources available for engaging in logical reasoning.

The literature has investigated the impact of cognitive load on a number of individual outcomes. The vast majority of the research manipulates cognitive load in the lab. A widespread method to impair cognitive resources is to have subjects hold a 7-or-more digit number or letter sequence in their memory while making choices (Miller, 1956). The impact on bandwidth can be readily measured using, for example, Raven's matrices which capture fluid intelligence, i.e. the capacity to think logically and solve problems in novel situations independent of acquired knowledge (Mani et al. 2013). Alternatively, the effect on bandwidth can also be measured via arithmetic mistakes or the reduced ability to spot flawed logical arguments in syllogisms (De Neys, 2006). Under cognitive load, individuals perform significantly worse on all these cognitive tasks, thus suggesting that the effort made to memorize the number/letter sequence reduces the amount of "working memory" (De Jong, 2010) and hence, the cognitive resources available for deliberation.

The tax on bandwidth imposed by cognitive load has been shown to have consequences both in terms of preferences and quality of judgement – see Schilbach et al. (2016) for a review of the literature.

Individuals under cognitive load change their preferences. They are typically more risk averse (Benjamin et al., 2013; Deck and Jahedi, 2015; Gerhardt et al., 2016), more impatient over money and have a greater likelihood to anchor (Deck and Jahedi, 2015). They also make more random decisions (Franco-Watkins et al., 2006) and poorer dietary choices (Zimmerman and Shimoga, 2014). Mentally burdened individuals indeed favor immediate gratification at the expense of long-term costs. Shiv and Fedorikhin (1999) show that undergraduate students under high cognitive load are more likely to choose chocolate cake over a fruit salad than students under lower cognitive load. Similarly, female undergraduates self-reporting themselves as restrained eaters are found to consume more ice cream than unrestrained eaters when cognitively loaded (Boon et al. 2002). More recently, Byrd-Bredbenner et al. (2016) confirm that individuals under cognitive load are more likely to eat few fruit and vegetables and to eat in response to external cues or emotions. Another strand of literature suggests that cognitive burden may also affect generosity in a dictator game although, the direction of this effect is ambiguous: Benjamin et al. (2013) find individuals to be more selfish under cognitive load while Schulz et al. (2014) find the opposite effect and Hauge et al. (2016) do not find any significant effect.

Beyond preferences, the quality of judgement also turns out to be affected by cognitive load. Hon et al. (2013) show that working memory load reduces the sense of agency, i.e. the extent to which individuals perceive whether they may be responsible or not for a given outcome. More importantly, experiments run by Kleider and Parrott (2009) show that when subject to high cognitive load, police officers are more likely to shoot unarmed targets. In their review of the literature, Kleider-Offutt et al. (2016) suggest that it is due to the fact that these officers lack the cognitive resources necessary to engage controlled processing so that they rely on automatic processing. Similarly, Correll et al. (2007) show that cognitive load increases the racial bias against black people in police shooting decisions. They conclude that cognitive resources are needed to override the use of automatic stereotypes. Kleider et al. (2012) also find that mock-jurors rely more on stereotypes when mentally burdened. This suggests that unbiased decisions require processing resources that are less available under cognitive load.

If cognitive load deteriorates the ability to solve problems, retain information and engage in logical reasoning, it is likely to impact individual performance. In this paper, we investigate its impact on a dimension that has not been studied yet, i.e. individual productivity. We focus on one particular aspect of productivity, i.e. occupational injuries. These incur enormous costs both to employees and employers. Estimates from the Bureau of Labor Statistics suggest that US employers pay almost $1 billion per week for direct workers' compensation costs alone and up to $170 billion when taking into account both direct and indirect costs (CDC, 2007). A most common cause of occupational injury is distraction (European Commission, 2009). Now, one of the components of bandwidth is executive control which determines our ability to focus and shift attention to work with information in our memory. So, one can hypothesize that reduced bandwidth due to cognitive load is likely to generate distraction thereby increasing the risk of work accident. This is what we want to investigate in this paper.

Given that we are interested in occupational injuries on the job, ethical as well as legal concerns prevent us from manipulating cognitive load in an experimental setting. We thus rely on survey data. Of course, manipulation of working memory in the lab has the key advantage of generating within-subject variation while being strictly exogenous. We replicate this set-up as closely as we can with our data. We consider that individuals are mentally burdened when they have to keep in mind non-professional preoccupations while working. This is, in some sense, equivalent to what Mani et al. (2013) do in their experiment when they induce rich and poor subjects to think about everyday financial demands. For the rich, these demands have no consequence, while for the poor, they trigger distracting concerns that reduce their bandwidth as measured by the Raven's matrices. The idea that preoccupation induces a reduction in bandwidth is central to our measure of cognitive load. Using time-use information provided by the German Socio-Economic Panel (SOEP), we indeed capture cognitive load with the number of non-professional tasks (e.g. housework, child care etc.) performed by individuals each day, independent of the time spent on them. The underlying assumption is that when individuals perform a large number of those tasks, this requires mental organization and hence generates preoccupation which keeps part of the individual's working memory busy. In turn, this may create distraction thereby increasing the risk of work injury. Our empirical strategy relies on estimating OLS and fixed-effect linear probability models in which the individual probability of occupational injury is modelled as a function of cognitive load and a number of individual characteristics. To the extent that we include individual fixed-effects in our preferred specification, our identification strategy relies on within-individual variation. Our results suggest that cognitive load increases the risk of occupational injury for both males and females. The effect is stronger for individuals in high-risk occupations and, among those, for low-educated workers.

Our paper relates to the small literature on the impact of cognitive load on individuals' ability to perform a secondary task. This has been particularly investigated in transport studies where researchers study in the lab the impact of cognitive load on the quality of driving as evaluated using a driving simulator. Participants typically have to travel in a 3-vehicle column as the middle car. They must keep a constant distance with the preceding car which is driving at a moderate speed. The quality of the driving is measured by the standard deviation in the traffic lane position and standard speed deviations. The primary memory task consists in the so-called "n-back" task, i.e. recalling a series of numbers that the speaker told earlier. In this context, the impact of high cognitive load is ambiguous. Kruszewski et al. (2017) find that the quality of driving deteriorates under high cognitive load, while Li et al. (2018) find the opposite: lane-keeping increases, and the timing of events suggests that cognitive load improves gaze concentration and physical arousal which positively affect the quality of driving. We complement this literature by considering another secondary task, i.e. one's professional activity and measure the performance on this task by the occurrence of occupational injuries in real life situation. Our results suggest that beyond road traffic accidents, cognitive load also represents a risk factor for occupational safety.

Our research also relates to the literature on occupational injuries. Several determinants have been uncovered in the vast literature on work accidents, among which the most prominent are the economic sector, the type of work contract, firm size and the characteristics of the job such as long hours of work, monotony, lack of autonomy at work and job dissatisfaction – see Pouliakas and Theodossiou (2013) and Picchio and Van Ours (2017). Our paper adds to this literature by emphasizing the role of cognitive load in jeopardizing health and safety at work.

The rest of the paper is structured as follows. Section II describes the data and presents summary statistics. Section III lays out our empirical strategy. Section IV presents the empirical results and Section V concludes.

II. The Data

To investigate the impact of cognitive load on occupational injuries, we need data containing information on work accidents on the one hand, and that allow us to build a proxy of cognitive load on the other hand. The German Socio-Economic Panel (*SOEP)* provides such data. It is a longitudinal survey that follows households and all their members aged 16 and above since 1984, first in the Federal Republic of Germany, and since 1990 in the whole of Germany – see Wagner et al. (2007).

Over the period 1987-1999 (except in 1990 and 1993), individuals who reported they worked during the previous year were asked whether they had to be treated either by a doctor or in hospital the year before the survey because of a work accident. When the individual answered "yes" to this question at the survey year $t+1$, we coded her as having a work accident during year *t*. We then define a dummy variable equal to 1 at year *t* when the individual reported having a work accident during that year. All other variables are based on the survey that took place at year t.

A key challenge for us is, of course, to measure cognitive load in our survey data. We proxy cognitive load by the number of non-professional tasks performed by individuals every day. Our data contains time-use information for weekdays for all years starting in 1987. Since 1991, the various non-professional activities an individual can engage in are consistently listed as: errands (shopping, trips to government agencies, etc.), housework (washing, cooking, cleaning), child care, education or further training (also school, university), repairs on and around the house, car repairs, garden work and hobbies and other free-time activities. We consider that hobbies and free-time activities are unlikely to tax bandwidth. In contrast, having to handle several chores and education or training programs every day does. So, we capture cognitive load with the number of different tasks to which an individual reports dedicating a positive number of hours on a typical weekday – excluding hobbies but including education and training. Given that we want to capture the brain burden generated by the variety of tasks one has to think of contemporaneously, we proxy cognitive load by the number of those tasks, conditional on the time that the individual spends on them. By doing so, we will be able to estimate the impact of the number of different tasks one has to handle every day on the risk of occupational injuries, independent of the total amount of time dedicated to those tasks. Our preferred measure of cognitive load includes education and training since we believe that it contributes to the reduction in working memory to the extent that individuals have to think about it. But, given that it is different in nature from chores, we also run a robustness check excluding it.

SOEP also contains information on a large variety of individual characteristics, namely gender, age, the number of years of education, marital status, whether individuals are in employment or not, occupation and industry, the daily number of hours worked and of hours dedicated to non-professional activities, tenure, the number of children under 16 and the number of adults in the household. We control for these variables in our regressions.

Overall, we have consistent information on occupational injuries and cognitive load for years 1991 to 1998 (excluding 1992).[1] Given that we are interested in work accidents we only keep

[1] This is due to the fact that the question on work accident last year was asked for the last time in 1999 and was not asked in 1993.

individuals in employment, aged 18 to 64, who have answered the question on occupational injuries the year after. We drop individuals in the armed forces.[2] Our final sample contains 45,564 observations belonging to 12,020 individuals.

Appendix Table A.1 provides descriptive statistics. The average proportion of employees with at least one occupational injury during the year is 5.8%, it is higher for males than for females (7.3% and 3.6%, respectively). Part of this difference is due to the fact that females are underrepresented in high-risk occupations, in particular skilled and unskilled blue-collar ones as shown on Figure 1. But, within these occupations, females also face a lower risk of occupational injury, suggesting that they hold different types of jobs – see Figure 2. Females also work fewer hours than males do while spending more time on non-professional activities – see Appendix Table A.1. As expected, the number of non-professional tasks performed by females is on average larger than for males (2.73 and 2.12, respectively). As evidenced on Figure 3, a very small proportion of females do not perform any task (1.3% as compared to 9.8% of males). 16.7% of females perform 4 tasks as compared to only 11.2% of males. Interestingly, the proportion of individuals performing the maximum number of tasks (i.e. 5) is very small for both genders: 2.3% of females and 1.7% of males.[3] Given that individuals performing all 5 tasks are very few and that females not involved in any task are likely to be highly selected, our preferred measure of cognitive load is based on a dummy variable capturing a large number of tasks performed.[4] To the extent that performing 4 or 5 tasks seems to be particularly harmful to occupational injuries – see Figure 4 –, we define this dummy variable as equal to 1 if the individual performs more than 3 tasks and 0 otherwise. In our sample 12.9% of males and 19% of females perform a large number of tasks.

III. The Econometric Model

To investigate the impact of cognitive load – as measured by performing a large number of non-professional tasks – on the risk of occupational injuries, we estimate the following model:

$$OI_{it} = \beta_0 + \beta_1 Many\_Tasks_{it} + X_{it}\beta_2 + \gamma_t + \varepsilon_{it} \qquad [1]$$

[2] They represent 0.47% of our sample. Their inclusion does not affect our results.

[3] This overall pattern of tasks across gender is very similar if we exclude education and training from the list of non-professional tasks. In this case, 24.6% of males perform 3 tasks as compared to 41% for females with the corresponding figures being respectively 8.5% and 12.8% for males and females performing the maximum number of tasks, i.e. 4.

[4] We also perform some robustness checks using the total number of non-professional tasks carried out.

where OI_{it} is a dummy variable equal to 1 if individual *i* had to be treated for an occupational injury at year *t* and 0 otherwise. $Many\_Tasks_{it}$ is a dummy indicator equal to 1 if individual *i* performed a large number of non-professional tasks on weekdays at year *t* and 0 otherwise. X_{it} is a vector of individual characteristics – including the total number of hours worked and of hours dedicated to non-professional activities – and γ_t are time fixed effects. Standard errors are clustered at the individual level. Given the potential negative effect of cognitive load on individual attention highlighted in the literature, we expect β_1 to be positive.

A problem in estimating equation [1] arises from the fact that omitted individual characteristics may be correlated both with the probability of occupational injury and with our measure of cognitive load. For example, very dynamic individuals may be more prone to handling many tasks while being also more at risk of occupational accident if they are not cautious enough. If this is the case, our estimate of $\beta_1$will be upward biased. To deal with this issue, we estimate an augmented version of equation [1], including individual fixed-effects. We thus decompose the error term into a time invariant unobserved heterogeneity (α_i) that is allowed to be correlated with $Many\_Tasks_{it}$ and X_{it} and an idiosyncratic time varying error term (τ_{it}). β_1>0 then suggests that an increase in the probability of performing a large number of tasks generates an increase in the risk of occupational injury.

IV. Results

We first estimate the impact of cognitive load on the risk of occupational injury by OLS. On our full sample – see Table 1, col (1) –, we confirm that females experience a lower risk of occupational injury than men. The risk of work accident also decreases with age – although at a decreasing rate – and with the number of years of tenure – although at a very small pace. It does not seem to vary with the number of years of education, nor with marital status or the composition of the household. It is significantly higher for all blue-collar and unskilled white-collar occupations than for managers, with the larger difference being for craft and related trade workers. Unsurprisingly, the risk of occupational injuries increases with the number of hours worked per day. Similarly, performing a large number of non-professional tasks is positively and significantly associated with the risk of occupational injuries. Interestingly, conditional on the number of non-professional tasks, the time spent doing them does not seem to affect the risk of work accident. This suggests that, rather than the number of hours dedicated to non-professional activities, it is their variety that matters. Having to think about many different tasks contemporaneously indeed reduces the amount of brain resources that employees can use to develop health-preserving strategies on the job, thus increasing the risk of occupational injuries. When splitting our sample across gender, the results turn out to be very similar for males with a slightly larger gap in the risk of work accidents between managerial occupations on the one hand, and blue and unskilled white-collar occupations on the other hand – see Table 1, col (2) –. Here again, the number of hours worked increases the risk of occupational injury, as does performing a large number of non-professional tasks. For females too, the number of hours worked has a positive effect on the risk of occupational injury – see Table 1, col (3) –. Performing a large number of non-professional tasks also increases the risk of work accident among females. However, contrary to men, the type of occupation does not seem to be related to the probability to have a work accident. This first set of results suggests that the impact of cognitive load on the risk of occupational injury is not particularly driven by either males or females.[5] Working under cognitive load increases the risk of occupational injury by 31.5% and 44.4% for males and females respectively, at sample average.

One concern when estimating equation [1] by OLS is that omitted individual characteristics could bias our results. To overcome this problem, we re-estimate our model including individual fixed effects – see Table 1, cols (4) to (6). Interestingly, the number of hours worked is no longer significant, suggesting that individuals working long hours have unobserved time-invariant characteristics – or steadily work in specific jobs – that make them more at risk of occupational injuries. In contrast, the impact of cognitive load remains positive and significant both in the whole sample (at the 1% level) and for males (at the 10% level) and females (at the 5% level) separately.[6] To the extent that occupational injury is a binary variable, we check that our results are robust to estimating a fixed-effects logit model. When doing so, the point estimates (resp. standard errors) on the cognitive load variable are: 0.280 (0.091) in the full sample, 0.211 (0.110) for males and 0.404 (0.167) for females, thus confirming that an increase in cognitive load significantly raises the risk of occupational injury.

So far, we have used a binary indicator of cognitive load capturing high rather than low cognitive burden. However, it is interesting to test the robustness of our results using a more

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[5] Results of OLS estimates of a model where the dummy variable « Woman » is interacted with each of the explanatory variables included in Table 1 does not reject the hypothesis that the point estimates of "Many non-professional tasks" are equal for men and women at the 5%-level (p-value: 0.257).

[6] Results of FE estimates of a model where the dummy variable « Woman » is interacted with each of the explanatory variables included in Table 1 does not reject the hypothesis that the point estimates of "Many non-professional tasks" are equal for men and women at the 5%-level (p-value: 0.984).

continuous measure, i.e. the total number of non-professional tasks performed by an individual each day. When doing so, the OLS estimates suggest that handling few tasks (0 or 1 as compared to a reference level of 3) reduces the risk of occupational injuries at least in the whole sample and for males – see Appendix Table A.2. For females, the effect is not clearly signed and, in any case, insignificant at conventional levels. In contrast, performing four or five non-professional tasks every day (as compared to 3 tasks) has a positive and significant impact on the risk of occupational injuries both in the whole sample and for males and females separately. The fixed-effects estimates yield similar results although the effects are statistically significant only for five different tasks for males and four for females.

One could worry that our measure of cognitive load based on multi-tasking aggregates heterogeneous non-professional tasks. In particular, considering participation in education and training as generating the same kind of cognitive load as domestic chores may be disputable. One the one hand, when individuals have to dedicate brain resources to continuous education and training this is likely to reduce the amount of working memory that they can dedicate to make decisions and, in particular, to engage in health-preserving strategies on the job. On the other hand, whether this tax on bandwidth is of the same nature or amount as the one generated by chores remains unclear. To make sure that our results are not driven by a specific effect of education and training, we re-estimate our model using the total number of tasks performed excluding education and training as a measure of cognitive load – see Appendix Table A.3. The results are very similar to those in Appendix Table A.2. The OLS estimates suggest that performing a limited number of tasks as compared to the reference level (i.e. 3) reduces the risk of occupational injuries in the whole sample and for males. Here again, performing the maximum number of tasks (i.e. 4) increases the risk of work accidents both in the whole sample and for males and females separately. Fixed-effect estimates yield similar results: increasing the number of tasks performed from 3 to 4 increases the risk of occupational injuries (at the 1% level of significance for the full sample and at the 10% level for males and females separately). This confirms that our results are not driven by education and training and that having to handle a variety of tasks in parallel to a working activity is harmful to occupational health. The cognitive load that this generates reduces the ability to make appropriate decisions and pay attention that would allow employees to protect themselves against injuries.

Presumably, cognitive load does not affect occupational injuries in the same way according to the type of occupations. As evidenced in Figure 2 and Table 1, some occupations are more exposed to work accidents. This is the case of elementary occupations, plant and machine operators, craft and trade workers, skilled agricultural workers and service and sales workers. We define these as high-risk occupations. In contrast, managers, professionals, technicians and clerks represent low-risk occupations. To compare the impact of cognitive load on work accidents according to the level of occupational risk, we split our sample between high and low-risk occupations and re-estimate our baseline fixed-effect linear model. The results are presented in Table 2. In low-risk occupations – see Panel A – cognitive load has no significant effect on the risk of occupational injury. In contrast, in high-risk occupations – see Panel B.1 – an increase in cognitive load increases the risk of occupational injuries both in the whole sample and for males and females separately. This suggests that the negative effect of cognitive load on health at work is concentrated on jobs in which the occupational risk is initially high. In those jobs, the lack of attention and/or of ability to efficiently develop health-preserving strategies that is induced by cognitive load constitutes an additional cause of accidents.

Whether or not cognitive load generates the same type of threat for all individuals in high-risk occupations is an important question, in particular when coming to the targeting of prevention campaigns. An important dimension of potential heterogeneity is, of course, education. To investigate this issue, we split our sample across individuals with high (i.e. above-average[7]) versus low education. As evidenced in Table 2 – Panel B.2, individuals with a high level of education are not significantly affected by cognitive load. The positive effect of cognitive load on occupational injuries in high-risk occupations is entirely driven by employees with a low level of education. Whatever the sample we consider (either the whole sample or males and females separately), cognitive load significantly increases the risk of work accidents in this group.

Overall, our results suggest that handling a large number of non-professional activities generates a threat for health at work for individuals in high-risk occupations and with a low level of education. For this subgroup of population, the necessity to keep in mind considerations related to a large number of non-professional activities while working generates a tax on bandwidth which prevents individuals from ensuring the safety of their working environment. This suggests that when an individual is employed in a high-risk job, distraction is a problem but that a high-enough educational level may help coping with the cognitive burden imposed by multi-tasking.

[7] In our sample, it corresponds to individuals with 12 years of education or more.

V. Conclusion

In this paper, we complement the standard analyses of cognitive load in the lab, by investigating its impact on occupational injuries using survey data. We consider that individuals are mentally burdened when they have to keep in mind non-professional preoccupations while working. So, we proxy cognitive load with the number of non-professional tasks that individuals perform every day, conditional on the time they spend on them. The underlying assumption is that when individuals perform a large number of those tasks, this requires mental organization which keeps part of their working memory busy.

We show that cognitive load increases the risk of occupational injury for both males and females. The effect is stronger for individuals in high-risk occupations and, among those, for low-educated workers. These findings suggest that, in high-risk jobs, distraction increases the risk of occupational injury, but that a high-enough educational level may help individuals cope with the cognitive burden imposed by multi-tasking.

Our research is, to our knowledge, the first to study the effects of cognitive load using survey data. Although non-experimental measures of cognitive load have drawbacks since they are not as neat as experimental ones, they also have some advantages in that they allow to study the impact of cognitive burden on outcomes that are difficult to reproduce in the lab, e.g. occupational injuries. More research is certainly needed in this area but this primarily requires collecting relevant information in surveys. Assessing the type of questions that would allow researchers to accurately measure cognitive load is still an open issue.

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Tables and Figures

Figure 1 – Occupational structure by gender

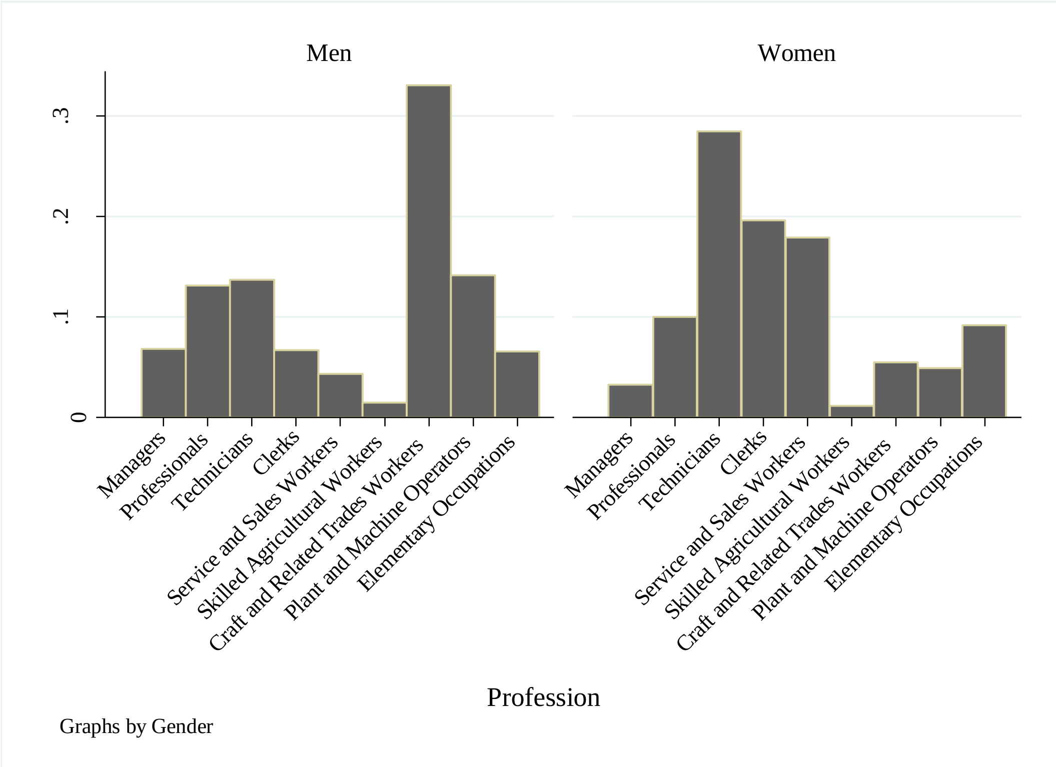

Figure 2 – Occupational injuries by gender and occupation

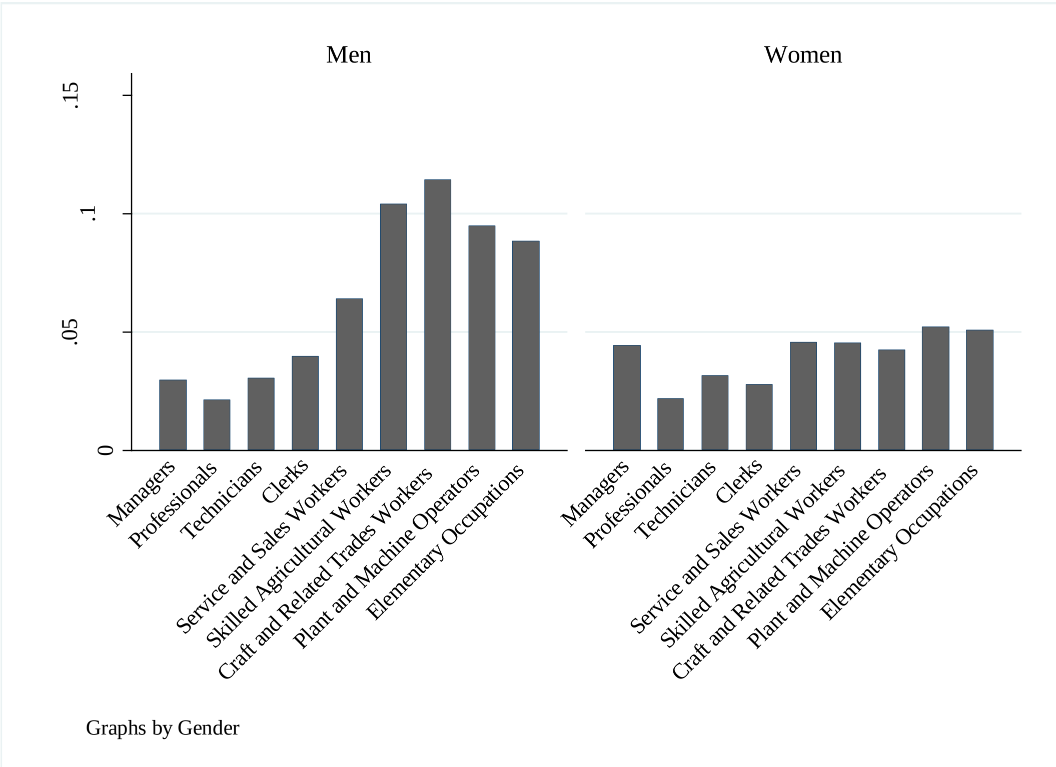

Figure 3 – Distribution across the number of non-professional tasks, by gender

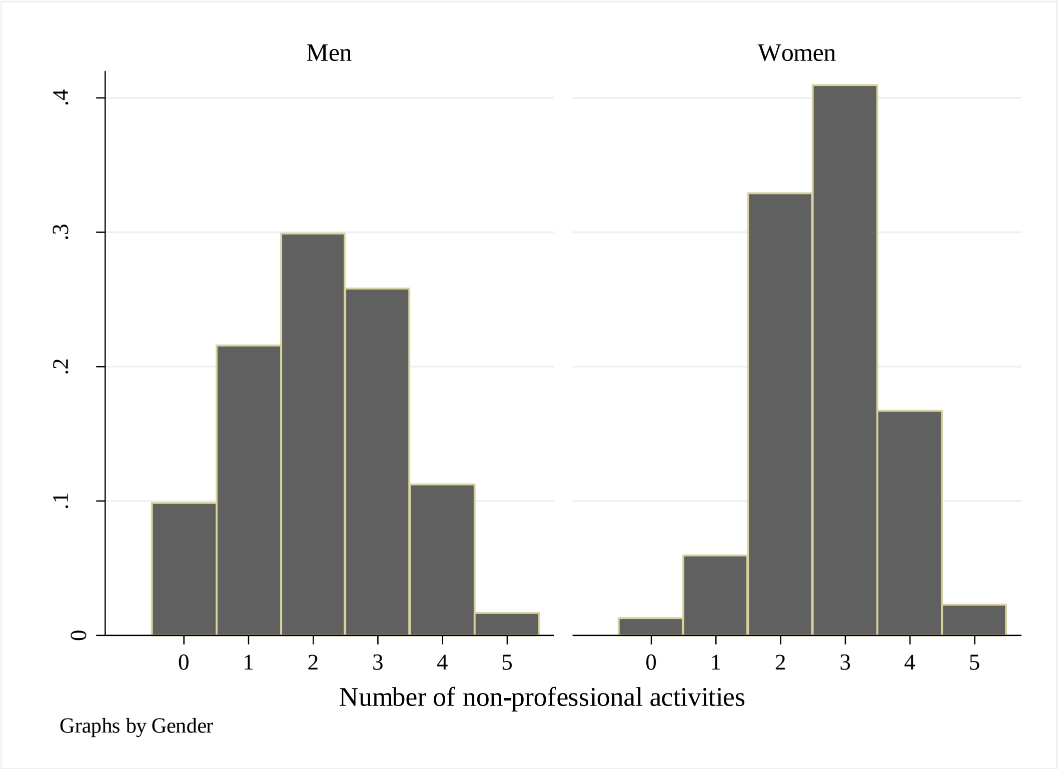

Figure 4 – Occupational injuries by number of tasks and gender

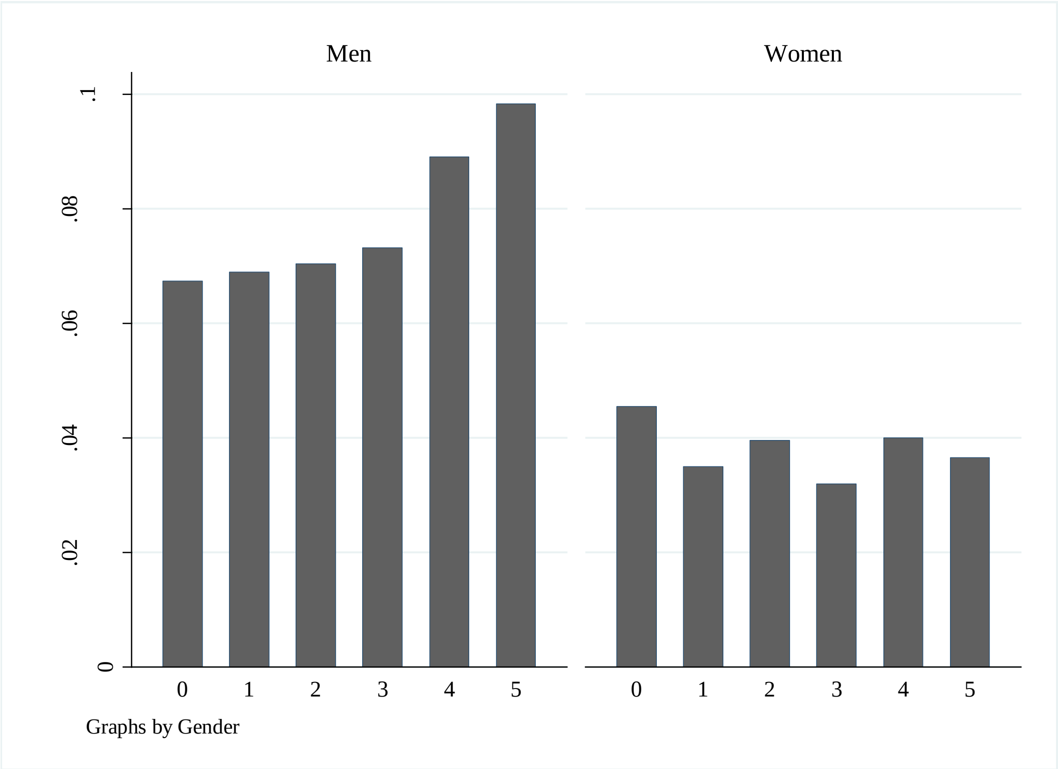

Table 1 Occupational injuries and cognitive load (large number of non-professional tasks)

	(1)	(2)	(3)	(4)	(5)	(6)
Method	OLS	OLS	OLS	FE	FE	FE
Sample	All	Males	Females	All	Males	Females
Dependent variable	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury
Many non-professional tasks	0.021***	0.023***	0.014***	0.013***	0.013*	0.012**
	(0.004)	(0.006)	(0.004)	(0.005)	(0.007)	(0.005)
Females	-0.014***	-	-		-	-
	(0.003)					
Age	-0.004***	-0.006***	-0.001	-0.014	-0.028	0.009
	(0.001)	(0.001)	(0.001)	(0.012)	(0.018)	(0.016)
Age^2	0.004***	0.007***	0.002	0.002	0.003	-0.001
	(0.001)	(0.002)	(0.001)	(0.003)	(0.004)	(0.004)
Years of education	-0.000	-0.000	-0.001			
	(0.001)	(0.001)	(0.001)			
Couple	0.003	0.008	-0.000	-0.001	-0.005	0.005
	(0.003)	(0.006)	(0.004)	(0.007)	(0.011)	(0.008)
# Children in household	-0.002	-0.003	-0.001	0.000	0.001	-0.000
	(0.001)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
# Adults in household	-0.001	0.000	-0.002	-0.008**	-0.008*	-0.005
	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.005)
Tenure	-0.000***	-0.000	-0.001**	-0.001	-0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Hours worked	0.004***	0.005***	0.004***	0.001	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Hours on non-prof tasks	0.001	0.001	0.000	0.000	0.001	-0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Occupations (ref. Managers)						
Professionals	-0.008	-0.007	-0.017	0.003	0.011	-0.022
	(0.005)	(0.006)	(0.011)	(0.009)	(0.010)	(0.019)
Technicians	0.005	0.002	-0.007	-0.001	0.009	-0.029*
	(0.005)	(0.006)	(0.010)	(0.009)	(0.010)	(0.017)
Clerks	0.010*	0.016**	-0.010	0.013	0.032**	-0.019
	(0.005)	(0.007)	(0.010)	(0.010)	(0.013)	(0.017)
Service + shop workers	0.026***	0.029***	0.007	0.011	-0.008	-0.002
	(0.006)	(0.010)	(0.010)	(0.011)	(0.018)	(0.018)
Skilled agricultural workers	0.033**	0.051**	-0.004	0.017	0.030	-0.019
	(0.016)	(0.023)	(0.019)	(0.027)	(0.032)	(0.050)
Craft and trade workers	0.069***	0.078***	0.004	0.035***	0.046***	-0.001
	(0.006)	(0.007)	(0.012)	(0.011)	(0.013)	(0.024)
Plant + machine operators	0.055***	0.065***	0.013	0.029**	0.046***	-0.019
	(0.007)	(0.008)	(0.013)	(0.012)	(0.014)	(0.024)
Elementary occupations	0.047***	0.060***	0.016	0.028**	0.047***	-0.014
	(0.007)	(0.009)	(0.011)	(0.012)	(0.016)	(0.020)
1-digit industry dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Observations	45,564	26,262	19,302	45,564	26,262	19,302
(within) R-squared	0.025	0.027	0.006	0.002	0.003	0.002

Note. Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2 Occupational injuries and cognitive load, by level of risk and education – Fixed-effects

Sample	All		Males		Females	
Dependent variable	Occupational Injury		Occupational Injury		Occupational Injury	
	Panel A - Low-risk occupations					
Many non-professional tasks	0.004		-0.000		0.005	
	(0.005)		(0.008)		(0.006)	
Individual controls	yes		yes		yes	
1-digit industry dummies	yes		yes		yes	
Year dummies	yes		yes		yes	
Observations	22,438		10,593		11,845	
Within R-squared	0.002		0.005		0.002	
	Panel B.1 - High-risk occupations					
Many non-professional tasks	0.023**		0.020*		0.026**	
	(0.009)		(0.012)		(0.013)	
Individual controls	yes		yes		yes	
1-digit industry dummies	yes		yes		yes	
Year dummies	yes		yes		yes	
Observations	23,126		15,669		7,457	
Within R-squared	0.003		0.005		0.009	
	Panel B.2 - High-risk occupations, by level of education					
	Low educ.	High educ.	Low educ.	High educ.	Low educ.	High educ.
Many non-professional tasks	0.026***	0.010	0.023*	0.010	0.030**	0.008
	(0.010)	(0.019)	(0.013)	(0.025)	(0.014)	(0.030)
Individual controls	yes	yes	yes	yes	yes	yes
1-digit industry dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Observations	19,521	3,605	13,248	2,421	6,273	1,184
Within R-squared	0.004	0.009	0.006	0.011	0.012	0.027

Note. Individual controls include gender (in the whole sample), age and age squared, years of education, marital status, the number of children and of adults in the household, 9 occupational dummies (minus one), tenure, the number of hours worked and the number of hours spent on non-professional activities. Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table A.1 – Descriptive statistics

Variables	**Whole sample (n=45,564)**		**Men (n=26,262)**		**Women (n=19,302)**	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Occupational Injuries	0.058	0.233	0.073	0.260	0.036	0.187
Number of non-professional tasks (0 to 5)	2.38	1.14	2.12	1.20	2.73	0.93
Large number of non-professional tasks (≥4)	0.155	0.362	0.129	0.335	0.190	0.392
Hours worked per day	8.87	2.28	9.57	1.81	7.91	2.50
Total number of hours spent on non-professional tasks per day	4.00	3.20	2.99	2.24	5.39	3.75
Gender	0.424	0.494	-	-	-	-
Age	38.6	11.1	39.1	11.2	37.9	10.9
Couple	0.774	0.418	0.789	0.408	0.754	0.430
Years of education	11.6	2.9	11.7	3.0	11.5	2.8
Number of children in household	0.77	0.98	0.84	1.04	0.68	0.89
Number of adults in household	2.35	0.89	2.39	0.91	2.30	0.87
Years of tenure	9.5	9.4	10.5	10.1	8.1	8.3
Occupations						
Managers	0.053	0.224	0.068	0.252	0.033	0.178
Professionals	0.118	0.323	0.131	0.337	0.100	0.300
Technicians	0.200	0.400	0.137	0.344	0.285	0.451
Clerks	0.122	0.327	0.067	0.250	0.196	0.397
Service + shop workers	0.101	0.301	0.043	0.204	0.179	0.383
Skilled agricultural workers	0.013	0.115	0.015	0.122	0.011	0.106
Craft and trade workers	0.214	0.410	0.331	0.470	0.055	0.228
Plant + machine operators	0.102	0.303	0.142	0.349	0.049	0.215
Elementary occupations	0.077	0.267	0.066	0.248	0.092	0.289

Table A.2 Occupational injuries and cognitive load (Total number of non-professional tasks)

	(1)	(2)	(3)	(4)	(5)	(6)
Method	OLS	OLS	OLS	FE	FE	FE
Sample	All	Males	Females	All	Males	Females
Dependent variable	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury
Number of non-professional tasks – 0 to 5 (Ref = 3)						
0 tasks	-0.012**	-0.017**	0.006	-0.007	-0.008	0.021
	(0.006)	(0.008)	(0.014)	(0.007)	(0.010)	(0.018)
1 task	-0.010**	-0.012**	-0.004	-0.000	0.001	-0.001
	(0.004)	(0.006)	(0.006)	(0.005)	(0.007)	(0.007)
2 tasks	-0.003	-0.006	0.003	0.001	0.002	0.002
	(0.003)	(0.005)	(0.004)	(0.004)	(0.006)	(0.004)
4 tasks	0.019***	0.019***	0.014***	0.012***	0.010	0.013**
	(0.004)	(0.007)	(0.004)	(0.005)	(0.007)	(0.005)
5 tasks	0.034***	0.043***	0.017*	0.034***	0.054***	0.008
	(0.009)	(0.015)	(0.010)	(0.011)	(0.017)	(0.013)
Females	-0.015***	-	-		-	-
	(0.003)					
Age	-0.004***	-0.007***	-0.001	-0.014	-0.028	0.009
	(0.001)	(0.001)	(0.001)	(0.012)	(0.018)	(0.016)
Age^2	0.005***	0.007***	0.002	0.002	0.003	-0.001
	(0.001)	(0.002)	(0.001)	(0.003)	(0.004)	(0.004)
Years of education	-0.000	-0.000	-0.000			
	(0.001)	(0.001)	(0.001)			
Couple	0.003	0.008	-0.001	-0.001	-0.005	0.005
	(0.003)	(0.006)	(0.004)	(0.007)	(0.011)	(0.008)
# Children in household	-0.002	-0.003	-0.001	0.000	0.001	-0.000
	(0.001)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
# Adults in household	-0.000	0.000	-0.002	-0.008**	-0.008*	-0.005
	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.005)
Tenure	-0.000***	-0.000	-0.001**	-0.001	-0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Hours worked	0.004***	0.005***	0.004***	0.001	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Hours on non-prof tasks	-0.000	-0.000	0.000	-0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Occupational dummies	yes	yes	yes	yes	yes	yes
1-digit industry dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Observations	45,564	26,262	19,302	45,564	26,262	19,302
R-squared	0.025	0.028	0.006	0.002	0.004	0.002

Note. All specifications include 9 occupational dummies (minus 1). Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3 Occupational injuries and cognitive load
(Total number of non-professional tasks – Excluding education and training)

	(1)	(2)	(3)	(4)	(5)	(6)
Method	OLS	OLS	OLS	FE	FE	FE
Sample	All	Males	Females	All	Males	Females
Dependent variable	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury	Occupational Injury
Number of non-professional tasks – 0 to 4 (Ref = 3)						
0 tasks	-0.015***	-0.018**	-0.004	-0.008	-0.008	0.012
	(0.006)	(0.008)	(0.012)	(0.007)	(0.010)	(0.015)
1 task	-0.013***	-0.015**	-0.003	-0.001	-0.000	0.000
	(0.004)	(0.006)	(0.006)	(0.005)	(0.007)	(0.008)
2 tasks	-0.005*	-0.008	0.001	0.001	0.001	0.003
	(0.003)	(0.005)	(0.004)	(0.004)	(0.006)	(0.005)
4 tasks	0.021***	0.027***	0.012**	0.015***	0.016*	0.011*
	(0.005)	(0.008)	(0.005)	(0.006)	(0.009)	(0.007)
Females	-0.016***					
	(0.003)					
Age	-0.004***	-0.007***	-0.001	-0.014	-0.028	0.009
	(0.001)	(0.001)	(0.001)	(0.012)	(0.018)	(0.016)
Age^2	0.005***	0.008***	0.002	0.002	0.004	-0.001
	(0.001)	(0.002)	(0.001)	(0.003)	(0.004)	(0.004)
Years of education	-0.000	-0.000	-0.000			
	(0.001)	(0.001)	(0.001)			
Couple	0.002	0.007	-0.001	-0.001	-0.005	0.005
	(0.004)	(0.006)	(0.004)	(0.007)	(0.011)	(0.008)
# Children in household	-0.002	-0.003	-0.001	0.000	0.001	-0.000
	(0.001)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)
# Adults in household	-0.001	-0.000	-0.002	-0.008**	-0.008*	-0.005
	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.005)
Tenure	-0.000***	-0.000	-0.000**	-0.001	-0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Hours worked	0.004***	0.005***	0.004***	0.001	0.002	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Hours on non-prof tasks	-0.000	-0.001	0.000	-0.000	0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Occupational dummies	yes	yes	yes	yes	yes	yes
1-digit industry dummies	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Observations	0.025	0.028	0.006	0.002	0.004	0.002
R-squared	45,564	26,262	19,302	45,564	26,262	19,302

Note. All specifications include 9 occupational dummies (minus 1). Robust standard errors clustered at the individual level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.