Health and working hours: a Dutch analysis

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Date final version: 8 April 2020

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I. Introduction

There has already been a lot of discussion around the topic of the number of working hours an employee is required to, or would like to, make, and especially in relation to the influence that working time may have on an individual's mental health, including their stress levels, and physical health. In 1993, the European Council thus proposed a Working Time Directive in which several restrictions were set to the number of working hours an employer could impose on its employee. One of the reasons for proposing this directive, was that, based on research which focused on Germany in particular, the general consensus was that too much working time was bad for an employee's health. The focus in that specific research was mostly on shift work, which could entail night shifts or other shifts outside 'normal office hours' (Harrington, 1994). Since then, the Council has updated the 1993 Directive in 2003, making sure that there is enough rest time for employees to recover from their work. Another aspect to this topic is the balance between work and life, and there has recently been an increased public interest in the importance of balancing these two well. In the Netherlands, trade union CNV has argued that the average weekly working time should not be 36 or 40 hours, but rather 30 hours (NOS, 2019). CNV has claimed that this should decrease the number of people who go on sick leave or suffer from a burn-out (NOS, 2019). However, as most relevant literature to this topic comes from outside of the Netherlands, it may be of interest to see whether these claims of (un)healthiness due to working hours also hold for the Dutch. As the Dutch population have a history of working more part-time, especially compared to other European countries (CBS, 2014), decreasing full-time hours to 30 hours may perhaps not be very useful. Before actually looking into implementing any policies, it may therefore be relevant to see whether the claim of decreased health actually holds for the Netherlands. The main question that I have posed for this thesis is therefore:

"Are longer working hours associated with worse health in the Netherlands?"

This question will be answered by first looking at an analysis that makes use of data on the Dutch working population, divided over different sectors, to see whether there may be a connection between working hours and the sickness rate that companies in those sectors report. The second analysis will be done on more detailed data on the Dutch working population. In this analysis, the relationship between having worked long hours for multiple years, and physical and mental health will be examined. Robustness checks for physical health are done by looking at hospitalisation and BMI, while for mental health, more information is drawn from looking at the separate aspects that go into the mental health index. This thesis contributes to the existing literature by taking a new approach to the influence of having worked long hours, by making use of the panel data to control for the health at the beginning of working long hours. Through the analyses, I find that for this Dutch sample, there seems to be a very small negative relationship between having worked long hours for multiple years

and physical health, and a very small positive relationship between having worked long hours for multiple years and mental health, both with no economic significance. The findings with regards to physical health are in line with most findings of other existing literature, while the findings with regards to mental health are not.

The remainder of this thesis will be structured as follows. In section II, the relevant literature and a short background to the evolution of working time in the Netherlands will be sketched out. In section III, I will discuss the first analysis, which includes the dataset and relevant variables, the empirical strategy that is employed and the eventual results and discussion thereof. In section IV, the second analysis will be discussed, which similarly includes a description of the dataset, relevant variables, the strategy and the results that follow, including a discussion. In section V, this thesis will be concluded, and the main question will be answered.

II. Literature and background

Before starting the analyses of this thesis, it is first important to look a little into the literature and background of the topic. In this section, I look into the already existing literature, which will help form hypotheses in the next chapters containing the analyses. I also look a little into the background of working hours in the Netherlands, as this may differ from other countries' history of working hours, and it will also help sketch some context for the analyses that will follow.

II.I. Literature

Not much has yet been written on the relationship between working hours and health for Dutch employees. However, there does exist a sizeable international literature that deals with this topic, as it has been a topic of discussion for many years already. A few years ago, there were experiments in Sweden, where instead of eight hours per day, employees were able to work for six hours per day. Effects differed between workplaces, but quite a few employees reported being more productive, feeling happier, and requesting less sick leave (NOS, 2016; Alderman, 2016; Congregalli, 2018), which would conversely imply that working more hours has a detrimental effect on the employees' health. Sparks et al. (1997) have performed a meta-analytic review of existing literature at that time, and found a small but significant positive trend of increasing health problems with increasing hours of work. In a more recent systematic review of literature, Bannai and Tamakoshi (2014) show that working long hours has a negative association with the probability of getting coronary heart disease, being in a depressive state, having anxiety and a person's sleep condition. They also identified a case in which switching from normal hours to longer hours could affect an individual's lifestyle negatively, which included smoking, drinking, less physical activity and weight gain.

Countries may differ in its (regulatory) circumstances, which may affect the number of hours that workers are working. It is therefore interesting to look at the situation in several different countries, for which Artazcoz et al. (2013) provide a good first overview of the situation in Europe. The authors find that in countries with a male breadwinner model, such as the UK, long working hours are associated with poorer health only for male workers. Countries that have a dual breadwinner model, which are the Nordic and Eastern European countries as the authors have found, differ slightly among themselves. In Nordic countries, such as Denmark, Finland, but also the Netherlands, long working hours are associated with poor health outcomes for both sexes, while in Eastern European countries, such as Estonia and Lithuania, the association was stronger for women. This difference can be explained as in Eastern European areas, governmental support for families and children is much less than it is in the Nordic countries.

For other European countries and areas, such as Catalonia (Artazcoz, Cortès, Escribà-Agüir, Cascant, & Villegas, 2009), France, Portugal, (Sánchez, 2017) and Germany (Cygan-Rehm & Wunder, 2018), research has also found that working longer hours has clear associations with worse

health, either mental or physical. For example, Artazcoz et al. (2009) find that for women in Catalonia, working long hours (more than 50 hours per week) is associated with shortage of sleep and smoking. For men, working long hours is also associated with shortage of sleep and smoking, but also inter alia poor mental health, and no leisure-time physical activity. For Germany, Cygan-Rehm and Wunder (2018) have looked at a change in statutory workweek regulations, and find that increasing working hours has a substantial adverse consequence on subjective and objective health measures, such as doctor visits, sick leave, and nights spent in hospital.

Outside of Europe, Shields (1999) has found that in Canada, changing from standard to long hours (more than 40 hours) can increase the risk of negative health behaviours, specifically being more likely to increase cigarette consumption for both sexes, being more likely to gain weight for men and being more likely to increase alcohol consumption and experience depression for women. In China, Wu et al. (2019) have looked at working long hours for the population of Beijing, and using data from a questionnaire, find that working more than 8 hours per day is negatively associated with the self-rated health of individuals. As for mental health, Frijters, Johnston & Meng (2009) make use of the temporary migration in China that occurs from rural to urban areas, and find that for rural Chinese migrants, working more than 60 hours per week increases mental distress. Ahn (2018) similarly finds that in South Korea, working more than 60 hours per week is associated with significantly higher levels of depressive symptoms; these are however mostly driven by women, as men who worked more than 60 hours per week did not show a significant increase in depressive symptoms. However, for men, working less than 30 hours per week made them more likely to report higher levels of depressive symptoms.

Generally, the literature thus shows that for most countries working long hours has an adverse relationship with the workers' mental and physical health, although there are differing interpretations of 'long hours'. For the Netherlands, working more than 45 hours can be considered long, as the standard of 40 is quite prevalent. However, in this thesis, robustness checks will also be done for long hours consisting of more than 50 and more than 60 hours.

The literature also has given some insights into what the reasoning may be for employees to work longer hours. Two theoretical constructs that offer guidance, are norms and bargaining power (Drago, Wooden, & Black, 2009). Specifically, the relevant norms that could be at play in this case are the ideal worker norm and consumerism. The ideal worker is a theoretical worker that loves his or her job so much, that they are willing to do a lot for it, and thus will work for very long hours (Picchi, 2016). The ideal worker norm, then, affects mostly highly educated professionals, who are expected to work long hours for a long period of time (Drago, Wooden, & Black, 2009). Consumerism may cause individuals to want and expect high levels of consumer spending, so that they may have no choice but to work long hours to fund this spending (Artazcoz, et al., 2013; Drago, Wooden, & Black, 2009). Bargaining power may be relevant in the case where employers hold a greater leverage over employees, for

example in the cases of non-unionised workplaces, workers who receive low pay, have temporary contracts, or are in situations of economic vulnerability, since in those cases, the employer can essentially force the employee to work longer hours (Artazcoz, et al., 2013).

Another reason why workers may work longer hours is because they like doing so. For example, Ten Brummelhuis et al. (2017) show that working long hours in itself does not necessarily influence a person's health, but rather a compulsive work mentality, with little work enjoyment, may be harmful for a person's health. Enjoying their work can thus be a reason for an individual to work long hours. Individuals may also work long hours due to intrinsic motivation. Gicheva (2019) for example, shows that, at higher levels of experience, working longer hours is predictive of altruism in public school teachers, meaning that they are intrinsically motivated to work long hours and derive utility from it. If workers work long hours because they like doing it, there may be a selection effect, however, where people self-select into jobs that may make them work long hours, just because they like doing so.

From the literature, it also follows that there is a possibility of the 'healthy worker' effect. This is a type of selection bias, which occurs due to the fact that people who have become less healthy may drop out of the employed population, so that when comparing the employed population to the general population, it may be biased towards healthy people (Shah, 2009). Unfortunately, it is very hard to control for this effect, which is why it is not possible to interpret the results that are found in this thesis as fully causal. Rather, this thesis is meant to give new insights into the relationship between working hours and health.

II.II. Background

It is not entirely clear how working hours have developed during Ancient History, but estimations say that people worked around 15 hours per week, and not more than 5 to 6 hours per day (Jansen, 2019). This is probably not extraordinary, as people were more dependent on aspects of nature, such as light and dark (Elias, 1985). It is known that during the Middle Ages, work was carried out more in small-scale and artisanal environments (Schor, 1991), and there was very little separation between an individual's private and professional life. This separation became clearer during the 16th and 17th century, and most definitely during the Industrial Revolution (Beckers, 1983). During the Industrial Revolution, working hours became more transparent. People worked days of 12 to 16 hours and working 70 to 90 hours a week was not an unusual occurrence (Giele, 1979). Since 1900, there have been 8-hour working days, and from the Second World War on, Dutch workers were trying to get a 40-hours workweek and a five-day workweek. While in some industries, workers already did not have to work on a Saturday, it was on 23 December 1960 that Saturdays were officially declared a free day by the government, and slowly implemented over all industries (Jansen, 2019). In 1982, the Agreement of Wassenaar (*het Akkoord van Wassenaar*) was made between employers and employees, both represented in the Labour Foundation (*Stichting van de Arbeid*). This agreement entailed that in exchange for decreasing wages, working hours would be decreased as well (Dinkgreve, Zwolsman, & Jansen,

1997). Since then, the Dutch trend of working part-time has flourished (Jansen, 2019). Since then, working hours have stayed mostly constant, although people have argued that standard working hours should decrease even further (NOS, 2019). An argument that is presented in favour of this decrease, is that working many hours is detrimental to an employee's health, which will be further examined in the next sections.

III. Analysis I – CBS data

In the first analysis, I will look at the relationship between average health and average working hours for Dutch employees. Average health is measured by looking at the average sickness rates within a sector, and working hours are also divided by sector. This analysis will give a rough indication of the relationship between health and working hours for the Dutch population and is a first exploration into the answer to the question whether working hours affect health of Dutch workers.

III.I. Data

The dataset that is used in the first analysis is constructed from three datasets retrieved from the database of Statistics Netherlands (Centraal Bureau voor de Statistiek, CBS). The first two datasets contain the same type of information, that is, they contain information per sector for the years 1996-2008 and 2008-2012 on the average working hours of the working population, their occupational level and the number of people who are self-employed, or in a permanent or flexible employment relationship. Both datasets are based on the Labour Force Survey (Enquête Beroepsbevolking, EBB), which is a so-called rotating panel survey with five survey-moments in total, per respondent (CBS, Enquête beroepsbevolking (EBB)). The survey occurs per telephone; since 2012 the first survey of the year can also be filled in through the internet. The selected sample is a stratified two-stage sample, in which in the first stage, municipalities are selected from which the addresses should be drawn. Larger municipalities are always represented in the sample, smaller are divided over 66 strata. In the second stage a systematic sample of addresses is drawn for each municipality. Sample sizes with regards to households may still differ slightly per year but are attempted to keep constant. Per household, a maximum of eight people will then be interviewed. For 2017, the sample size for the first survey of the year consisted of 145.000 households that were contacted through a letter for a survey that took place on the internet. Of the non-respondents to this initial survey, 27.000 households were contacted through telephone interviewing and 26.000 through face-to-face interviewing. The results from the surveys are also weighted, which occurs in two steps. The first step consists of assigning starting weights, so that any unequal drawing probabilities that result from the sample selection may be corrected for. The second step reduces the distortion that can be caused by non-response.

For the dataset that is constructed for the first analysis, data on the average working hours of the complete working population (including both full-time and part-time employees) and the sectors is used, for all the years that Statistics Netherlands could provide. Since the dataset that covers the years 1996-2008 and the dataset that covers the years 2008-2012 have a slightly different grouping of sectors, I have grouped the sectors in a way so that the datasets' sectors coincide, and they can be construed into one single dataset. This has yielded 15 sectors, namely: (1) Agriculture, forestry and fishing; (2) Mineral extraction; (3) Industry; (4) Utilities and waste management; (5) Construction; (6) Commerce; (7) Transport, storage and communication; (8) Hospitality; (9) Financial services; (10) Real

estate and other business services; (11) Public administration and government services; (12) Education; (13) Health and welfare; (14) Culture, sports and recreation; and (15) Other services.

The third dataset contains information on the sickness rate of employees per sector, for the years 1996-2018. The information from this dataset is based on the quarterly survey that Statistics Netherlands carries out with Dutch businesses (CBS, Ziekteverzuim, kwartaalenquête (vanaf 1996)). The stratified sample size is around 20.000 businesses, which are either private or public, and businesses that have 100 or more employees are observed integrally. The survey is held digitally and in writing, both with questionnaires. The results are weighted by business, with the number of employees of that particular business. Then, the number of observed companies that are in a particular sample cell (which are similar companies) are increased to the total number of that sample cell. The sickness rate in this survey is calculated by dividing the total number of sick days an employee has by the total number of their contractual workdays.

For the dataset that is constructed in the first analysis, all data on sickness rates and sectors is used, for the years up till 2012. As the other datasets only contain information for the years up till 2012, the years after 2012 have been dropped from this set. I have grouped the sectors in a similar way as the other two datasets, so that the datasets could be combined in a single complete dataset, which resulted in the same 15 sectors. For the mineral extraction sector, there is actually no data on working hours provided by CBS. Both datasets are combined into a single dataset, while averaging out the sickness rate per sector.

Table 1 provides an overview of the descriptive statistics of the used variables in the CBS dataset, which includes an average of the sickness rates and working hours over all the sectors, and also sickness rates and working hours per sector. As is visible from the table, the data does not provide an average number of working hours for the mineral extraction sector, which is why unfortunately, the data on this sector cannot be used in the analyses.

Table 1. CBS data's descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Sickness rate	228	4,389	1,230	2	7,8
Sector 1: Agriculture, forestry & fishing	17	2,953	0,633	2	3,9
Sector 2: Mineral extraction	17	3,476	0,452	2,9	4,5
Sector 3: Industry	17	5,612	0,620	4,9	6,6
Sector 4: Utilities and waste management	13	5,454	0,773	4,5	6,8
Sector 5: Construction	17	4,465	0,395	4	5,2
Sector 6: Commerce	17	3,559	0,514	2,8	4,6
Sector 7: Transport, storage & communication	17	4,518	0,491	3,7	5,2
Sector 8: Hospitality	14	2,793	0,531	2,1	3,8
Sector 9: Financial services	17	3,735	0,772	2,7	5
Sector 10: Real estate & other business services	13	4,105	0,695	3,2	5
Sector 11: Public administration & government services	17	6,047	0,880	5,1	7,7
Sector 12: Education	9	5,122	0,233	4,9	5,6
Sector 13: Health and welfare	17	6,165	1,036	5,0	7,8
Sector 14: Culture, sports & recreation	13	3,862	0,362	3,5	4,6
Sector 15: Other services	13	4,000	0,502	3,3	4,8
Average number of working hours	226	35,719	3,339	28,5	45,2
Sector 1: Agriculture, forestry & fishing	17	43,566	0,858	42,1	45,2
Sector 2: Mineral extraction	0				
Sector 3: Industry	17	36,620	0,386	36,3	37,5
Sector 4: Utilities and waste management	17	37,445	0,321	36,8	38,2
Sector 5: Construction	17	39,202	0,262	38,8	39,7
Sector 6: Commerce	17	35,054	1,078	33,8	37,2
Sector 7: Transport, storage & communication	17	36,780	0,517	36,1	37,9
Sector 8: Hospitality	17	36,620	0,386	36,3	37,5
Sector 9: Financial services	17	34,970	0,629	34,0	36,1
Sector 10: Real estate & other business services	17	35,800	0,760	34,7	37,1
Sector 11: Public administration & government services	17	34,930	0,410	34,5	36,2
Sector 12: Education	17	32,183	0,902	31,3	33,9
Sector 13: Health and welfare	17	29,173	0,780	28,5	30,9
Sector 14: Culture, sports & recreation	17	34,023	0,609	33,3	35,1
Sector 15: Other services	5	32,860	0,194	32,6	33,1

III.II. Empirical Strategy

The empirical strategy that I will employ for the first analysis, is as follows. First, I will look at scatterplots for each sector, where each scatterplot will be created by plotting the datapoints that combine the average working hours with the sickness rate, per sector. In these scatterplots, a fitted line will also be included, to examine the possible relationship between the two variables and whether this relationship is positive or negative. To be able to carry out a fixed effects regression, the data will be turned into panel data, after which a fixed effects regression will be carried out, by regressing average

sickness rates on average working hours, and clustering the errors on the level of the sector. Even though there are other variables that may influence the sick leave rate, which makes it hard to draw hard conclusions from this regression, it will be an interesting exploration into the possible connection between an employee's working hours and their health, and a first step towards answering the main question this thesis has posed.

III.III. Results and discussion

The scatterplots that are included in the appendix provide an overview of the average working hours compared to the average sickness rates in each of the 15 sectors that are included in the CBS data. Each dot corresponds to an average sickness rate in a certain year, for that specific sector. As is visible in these scatterplots, for most of the sectors, higher average working hours are associated with higher average sickness rates. Only for the utilities and waste management sector and the education sector does this association not hold.

In table 2, the results of a fixed effects regression of average sickness rates on average working hours can be found, clustered on the level of the sector. From the table, it follows that a one hour increase in average working hours is associated with an increase of 0,4 percentage point in average sickness rate. This positive association between working hours and sickness rate is highly significant, which thus implies that it is not unlikely that a negative connection exists between the number of hours a person works and their health. This possible negative connection will be further explored in the next section, which will delve deeper into different aspects of a person's health.

Table 2. Fixed effects regression of sickness rates on average working hours

		Dependent variable: Sickness rate
Independent variable:		
Average number of working hours		0,404 (0,085)***
Number of observations		203
Number of sectors		14
R-squared	within	0,1968
	between	0,1480
	overall	0,1187

Standard errors are clustered on the level of the sector.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

IV. Analysis II – LISS data

IV.I. Data

In this part of the paper I make use of data of the LISS (Longitudinal Internet Studies for the Social sciences) panel administered by CentERdata (Tilburg University, The Netherlands). The LISS panel is a representative sample of Dutch individuals who participate in monthly Internet surveys. The panel is based on a true probability sample of households drawn from the population register. The sample is selected by CentERdata together with Statistics Netherlands. In total, about 5000 households consisting of about 7000 respondents participate in the LISS panel,[1] but over time this may slowly lessen. Every two years, CentERdata will therefore, together with Statistics Netherlands, recruit new households so as to complete the number of households again and keep the sample representative of the Dutch population. To this purpose, Statistics Netherlands will provide CentERdata with a list of addresses, whose corresponding names are found in the Key Register of Persons (Basisregistratie Personen, BRP), and a letter will be sent to these persons. Afterwards, they will be contacted by telephone, to see whether they want to join the panel. When participating in the survey, a respondent will receive compensation for every completed questionnaire. Households that could not otherwise participate are provided with a computer and Internet connection. A longitudinal survey is fielded in the panel every year, covering a large variety of domains including work, education, income, housing, time use, political views, values and personality. For this thesis, I have made use of the panel data regarding an individual's work, education, and health, which are part of the panel's Core Study.

For the analyses, I have made use of the years 2008-2013 and 2015-2018, skipping 2014 as this year was missing in the Health study within the LISS panel. The panel contains several variables that have been used in this analysis, some of which have been transformed for this thesis. The main independent variable that is used, the number of working hours, has been constructed by adding the answer to the question 'How many hours per week do you work on average?' to the answer to the question 'How many hours per week do you usually work in this second work setting? If you have multiple sideline jobs, please indicate the total amount of hours.'. This addition has only been made for the people who perform paid work, who perform unpaid work while retaining their benefit or allowance, who perform voluntary work, and who perform paid work but are looking for more or other work; all others have been dropped from the sample.

The dependent variables that are used in this thesis are an individual's self-assessed general health index, their BMI, whether or not they have been in the hospital in the last 12 months, an individual's mental health index (MHI-5), and the separate factors that go into the mental health index. A respondent's self-assessed general health is based on the answer to the question 'How would you describe your health, generally speaking?', with 1 being 'poor' and 5 being 'excellent'. The BMI

[1] https://www.website.lisspanel.nl/onderzoeken

variable has been created by using the formula for BMI[2] on the self-reported weight and height of respondents. Observations from individuals who didn't fill in their weight or height, or with a height lower than 145 cm, have been dropped.[3] Subsequently, the binary variable that indicates whether an individual has a healthy BMI has been created, for which a BMI that is between the boundaries of 18.5 and 25 is a healthy BMI, and anything that is outside of these bounds is not (Voedingscentrum, n.d.). The variable that indicates whether the individual has been in the hospital in the last 12 months, is based on the answer to the question 'Did you spend any time in hospital or a clinic over the past 12 months?', with the possibility of answering either 'yes' or 'no'. For an individual's mental health, a good indicator is the MHI-5 mental health index. This index can be calculated by scoring the answers to five statements, adding them up while subtracting 5, and then multiplying by 4. The statements from which the MHI-5 index can be calculated, are in the LISS survey data, and are also used as dependent variables separately: 'This past month, (a) I felt very anxious; (b) I felt so down that nothing could cheer me up; (c) I felt calm and peaceful; (d) I felt depressed and gloomy; (e) I felt happy'. The answers range from 'never' to 'continuously' and are coded so that the index can be calculated. The answers to the questions are coded as follows: never (1), seldom (2), sometimes (3), often (4), mostly (5) and continuously (6). For statements a, b, and d, so for being anxious, being down, and being depressed, the score of a statement equals the coding. For statements c and e, which are being peaceful and being happy, the score is the opposite of the coding (so if an individual feels calm and peaceful continuously, it is given a score of 6, while if they never feel calm and peaceful, it is given a score of 1).[4] Subsequently, the binary variable that indicates whether an individual's mental health index can be considered as healthy, is constructed by defining every index number that is greater than 60 as healthy.[5]

In addition to the independent and dependent variables, some controls are also added. These are an individual's gender, their age, the amount of schooling they have had, and whether the individual suffers from a longstanding disease, affliction, or handicap. While an individual's gender and age speak for themselves, the variable that indicates the level of schooling of an individual is created by dividing the respondents into seven categories of schooling, which are (1) none; (2) elementary; (3) middle school;[6] (4) secondary;[7] (5) post-secondary;[8] (6) tertiary;[9] and (7) post-tertiary.[10]

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[2] The formula for BMI is BMI = (weight in kg)/(height in m)^2.

[3] This choice follows from the fact that this thesis focuses on adults who have a job and thus have a number of working hours. When adults do not grow taller than 145cm, they most likely have achondroplasia, and for them, the standard BMI cannot be applied very well.

[4] The MHI-5 indicator can then be calculated as follows: MHI-5=4*(a+b+c+d+e−5).

[5] This choice has been made as CBS and RIVM made the same choice on choosing the breaking point of healthiness for the MHI-5. This choice was based on the only Dutch research which has been done on Dutch respondents, which concluded that for the Netherlands, a breaking point of 60 was the best choice. (TNO Research)

[6] Intermediate professional education, for example, VMBO or MAVO.

[7] Secondary education, for example, HAVO, VWO, or MBO.

[8] Continued intermediate professional education, for example, post-MBO.

[9] Higher professional education or university education, for example, HBO or WO.

[10] Post-academic education, including PhD.

The variable that indicates whether the individual suffers from a longstanding disease, affliction, or handicap is based on the positive or negative answer to the question 'Do you suffer from any kind of long-standing disease, affliction or handicap, or do you suffer from the consequences of an accident?'. This variable is added as it may affect both a person's health (especially in the case of self-assessed health and mental health) and may also influence the number of hours an individual works.

Table 3 provides an overview of the descriptive statistics of the used variables in the LISS dataset, including the variables that were created in the interest of this thesis' analysis.

Table 3. LISS data's descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Variables of interest					
Total number of working hours	35356	30,016	15,670	0	120
General health (self-assessed)	56617	3,117	0,773	1	5
Hospitalisation in the last 12 months	56399	0,104	0,305	0	1
BMI	56617	25,532	4,591	7,086	83,984
Healthy BMI	56617	0,489	0,500	0	1
Mental health index (MHI-5)	56617	74,435	16,479	0	100
Anxious	56617	4,845	1,030	1	6
Down	56617	5,301	0,980	1	6
Peaceful	56617	4,232	1,095	1	6
Depressed	56617	4,952	1,039	1	6
Happy	56617	4,279	1,070	1	6
Healthy MHI-5	62512	0,812	0,391	0	1
Controls					
Gender	55042	1,537	0,499	1	2
Age	60937	48,971	17,480	15	101
Long-standing disease	56616	0,310	0,462	0	1
Schooling	35356	4,591	1,354	1	7

IV.II. Empirical Strategy

In the second analysis, first a fixed effects regression is carried out on the LISS panel data, for investigative purposes. This regression is carried out with the different health variables as dependent variables, and the continuous variable 'total number of working hours' as independent variable. However, it is very likely that there exists a reverse causality effect, as an individual is very likely to

work less (more) in future years due to a worse (better) health in the year of observation. The focus will therefore be on the following analyses, which are regular Ordinary Least Squares (OLS) regression analyses. In these regressions, the length of the panel is used to create a variable so that it is possible to look at the difference between an individual's 'starting health' and 'ending health', after having worked respectively 10, 7, or 5 years for more than at least 45 hours per week. This setup allows me to see whether working long hours for multiple years is related to an individual's health, be it physical or mental. For the main health variables, which are self-assessed general health and having a healthy mental health index (MHI-5), robustness checks will also be done with working for at least 50 or 60 hours per week. The OLS regressions will be carried out by making use of a dummy variable for having worked long hours for respectively 10, 7, or 5 years, as well as controlling for the individual's beginning health, their gender, age, schooling, and whether they suffer from a longstanding disease. Particularly controlling for the individual's beginning health helps control for influences that affect the individual's current health, that have stayed constant over the years. Lastly, robust standard errors are used to correct for heteroskedasticity.

As mostly follows from the existing literature and is also the general feeling that working long hours evokes, working more hours is expected to be detrimental to a person's health, either physical or mental. The hypothesis that I will look into is therefore that an individual that has worked long hours for a longer period of time, has a worse health than an individual who has not. This hypothesis can subsequently be adapted to the different dependent variables.

IV.III. Results and discussion

This section will first describe and discuss the results that follow from the analyses done on the physical health variables, which are self-assessed general health, having been hospitalised, and having a healthy BMI. Self-assessed general health is taken as a physical health measure, as there is a proven strong relationship between self-rated health and mortality and morbidity (Idler & Benyamini, 1997; Latham & Peek, 2013). Then, the results from the analyses on mental health will be described and discussed, which are done with the mental health index MHI-5, having a healthy MHI-5, and the separate variables of the MHI-5 index, which are being anxious, down, peaceful, depressed, and happy.

Physical health

Table A.1, which can be found in the appendix, shows the fixed effects regression estimates for the physical health measures. These seem to point into the direction that there is no clear relationship between physical health and working hours, but for this type of analysis, there is a high possibility of reverse causality as an individual may choose to work more (less) hours, precisely because they are feeling (less) healthy. The relationship may then not only be one way (working hours affecting health) but also the other way around (health affecting working hours). To account for this, a regular OLS

regression is carried out, that makes use of the time differences in the panel to see whether working long hours for 10, 7, or 5 years has an influence on an individual's self-assessed general health. For the first regression specification, all respondents that have responded to all ten years of the panel are included, while a dummy is created for whether individuals have worked long hours for all ten years. Similarly, for the second regression specification, all respondents that have at least seven years of observations are included, and a dummy is created for whether individuals have worked long hours for at least seven years. The last regression specification includes all respondents that have at least five years of observations, and a dummy for whether individuals have worked long hours for at least five years. For all specifications, controls are added to control for the health at the beginning of the period of working long hours, an individual's gender, age, schooling, and whether they suffer from a long-standing disease or not.

The resulting estimations of these specifications can be found in table 4. Only the last column shows a significant result, which is negative. It implies that having worked long hours for at least 5 years is related to deeming your general health about 0,05 points lower on the general health index scale. As the general health index runs from 1 to 5, and the standard deviation within the general health index is about 0,77, having worked long hours for at least 5 years does not have a very economically significant relationship with self-assessed general health. For the longer periods of 7 and 10 years, no significant effect is found, which may be partly due to a smaller sample. The economic significance of these longer periods, however, is even smaller than that of the period of 5 years, which would imply that there could be a very small negative relationship between working long hours and self-assessed general health, but it is not economically significant.

Tables A.2 and A.3, which can be found in the appendix, contain robustness checks with regards to the number of long hours, by doing the same analysis as in table 4, but taking respectively 50 and 60 hours, instead of 45 hours, as the cut-off point. Table A.2 strengthens the results from table 4, as the results from having worked long hours for 5 and 7 years are more significant, and still negative. For the 10-year period, the effect has become positive, but insignificant, which may be due to the small sample size. The results in table A.3 for the 5- and 7-year periods are not significant anymore, and highly significant and positive for 10 years. However, few individuals have worked more than 60 hours for multiple years, which could affect the significance levels of all three columns. These robustness checks, especially table A.2, strengthen the conclusion that there may be a slight negative relationship between working long hours and self-assessed general health, which is not economically significant.

Table 4. OLS regression of a self-assessed general health index on working long hours

	Dependent variable: General health		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	-0,005 (0,076)	-0,029 (0,027)	-0,047 (0,018)***
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,2697	0,3048	0,3399

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

As robustness checks on physical health, OLS regression analyses are also carried out on whether the individual has been into the hospital in the last 12 months, and an individual's BMI. Table 5 shows the OLS regression estimates for the relationship between working long hours and having been hospitalised in the last 12 months before the survey. There is no significant relationship between working long hours and having been hospitalised in the last 12 months, for any of the durations of working long hours. As this may be due to the smaller sample size, the economic significance is also considered. The OLS regression estimate is positive, indicating that there could be a positive relationship between having worked long hours for a long period of time, and having been hospitalised. However, the probability increases with 0,4% to 7,8%, while the standard deviation for having been hospitalised in the last 12 months is about 30%. The results from this regression are therefore also not very economically significant, which indicates that there is probably not a very large relationship between having worked long hours for several years and having been hospitalised.

Table 5. OLS regression of having been hospitalised on working long hours

	Dependent variable: Hospitalisation in last 12 months		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,078 (0,073)	0,004 (0,014)	0,006 (0,009)
Controls	YES	YES	YES
Number of observations	1504	7025	11970
R-squared	0,0169	0,0104	0,0131

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

The second robustness check is by regressing having a healthy BMI on working long hours. In table 6, the results from this OLS regression are shown. The last column is very statistically significant and shows a negative relationship between having worked long hours and having a healthy BMI. The 7 years and 10 years columns both show a positive relationship, albeit not statistically significant. This change from negative to positive could be due to the smaller sample for those longer periods, as there are less individuals who have worked long hours for those longer periods. The table shows that having worked long hours for 5 years has a negative influence on the probability of having a healthy BMI of 4%. As it is a quite small decrease, it cannot be considered a very economically significant result.

Table 6. OLS regression of having a healthy BMI on working long hours

	Dependent variable: Healthy BMI		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,086 (0,062)	0,003 (0,017)	-0,039 (0,011)***
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,4164	0,4556	0,5158

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

The results from these three analyses indicate that there is a small negative effect of having worked long hours for multiple years on an individual's physical health, which would be in line with most of the literature, specifically Sánchez (2017) and Cygan-Rehm and Wunder (2018). However, the results that are found are not very economically significant.

Mental health

In table A.4, which can be found in the appendix, the fixed effects regression estimates are shown for the mental health measures. From this table, it seems to follow that the number of working hours has no clear relationship with an individual's mental health. Similar to the physical health analysis, however, in this case there is also a very high possibility of reverse causality being present. For mental health, it also holds that an individual may choose to work more (less) hours, because they are feeling (less) healthy, making it likely that the relationship between the two variables runs in both directions. To account for this reverse causality, an OLS regression that is set up in the same way as for the physical health measures, is carried out. This means that the time difference in the panel is used to see whether working long hours for 10, 7, or 5 years has an influence on an individual's mental health, as

measured by the MHI-5 mental health index. In all regressions, dummies are used for having worked long hours for respectively 10, 7, or 5 years, and controls are added to control for the health at the beginning of the period of working long hours, an individual's gender, age and schooling, and whether they suffer from a long-standing disease or not. In table 7, the regression estimates can be found for the OLS regression of having a healthy mental health index on working long hours. Only the last column shows a significant result, which is positive. This means that having worked long hours for 5 years, actually has a positive influence on the likelihood of having a healthy mental health index. However, the economic significance for this result is not very high, as it is a 2% positive influence of working long hours for 5 years on the probability of being mentally healthy.

In tables A.5 and A.6, which can be found in the appendix, robustness checks with regards to the number of long hours are reported. These robustness checks are through the same analysis as in table 7, but take respectively 50 and 60 hours, instead of 45 hours, as the cut-off point. Both tables are in line with the result from table 7, which is that having worked long hours for a longer period of time is actually positively related to the likelihood of having a healthy mental index, since both tables show positive relationships for all periods. Table A.5, however, shows only a significant result for the 10-year period, while table A.6 shows significant results for all periods. Though small sample sizes could affect all significance levels, these robustness checks still strengthen the conclusion that there may be a positive relationship between working long hours and the likelihood of having a healthy mental health index, but it is not economically significant.

Table 7. OLS regression of having a healthy mental health index on working long hours

	Dependent variable: Healthy MHI-5		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,009 (0,058)	0,014 (0,015)	0,020 (0,009)**
Controls	YES	YES	YES
Number of observations	1576	7590	13067
R-squared	0,1191	0,1028	0,1255

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

As some information gets lost in the transformation from the mental health index to the variable that indicates whether or not an individual is mentally healthy,[11] the mental health index itself is also regressed on having worked long hours. As follows from table 8, there is no significant relationship between the mental health index itself and having worked long hours. In combination with table 7, this would imply that there is a small influence on the probability of being mentally healthy, which means having a mental health index higher than 60, but this is not a constant relationship over all the index values between 0 and 100, as it is not visible in the regression on the actual mental health index itself.

Table 8. OLS regression of an individual's mental health index on working long hours

	Dependent variable: MHI-5		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	-0,287 (2,570)	0,156 (0,602)	0,550 (0,391)
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,2218	0,2473	0,2802

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

To see which of the variables mostly drives the relationship between the mental health index and working long hours, OLS regressions have also been carried out on the variables that indicate whether an individual has felt (a) anxious; (b) down; (c) peaceful; (d) depressed; and (e) happy. The results from these regressions can be found in tables A.7 to A.10, which can be found in the appendix, and in table 9. The regressions for having felt anxious, down, peaceful, and depressed show no significant relationship between working long hours and the dependent variable, while the regression on being happy shows a significant positive result in the last column. This would imply that the relationship between being mentally healthy and working long hours, is mostly driven by the fact that individuals who have worked long hours are more likely to indicate they are happy. The economic significance of this result is, however, not too large, as it indicates that having worked long hours for at least 5 years is related to being 0,06 points happier. As this scale runs from 1 to 6, and the standard deviation is about 1,07, having worked long hours for at least 5 years does not have a very economically significant relationship with being happy.

[11] An individual is defined as being mentally healthy in case their mental health index is greater than 60.

Table 9. OLS regression of being happy on working long hours

	Dependent variable: MHI-5 - Happy		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	-0,103 (0,164)	0,015 (0,044)	0,059 (0,027)**
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,1975	0,1925	0,2191

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

The results from these analyses indicate that there is actually a small positive effect of having worked long hours for multiple years on an individual's mental health, which is contrary to what most of the existing literature has found. However, the economic significance of these results is also very small.

V. Conclusion

In this thesis, I have examined the possible relationships between working long hours and several health measures of a Dutch sample, which are self-assessed general health, hospitalisation, BMI, and a mental health index (MHI-5). The general hypothesis that is studied, is that the number of working hours has an adverse relationship with an individual's health. This hypothesis is tested using data from CBS and the LISS panel. For the LISS panel, more specifically, I have looked at the hypothesis that an individual who has worked long hours for a longer period of time, has a worse health than an individual who has not.

The CBS data is constructed from three datasets that are retrieved from the CBS database, which contain information per sector on the average working hours of the working population, the employment relationships, and the sickness rate of employees within these sectors, for the years 1996-2012. For each sector, scatterplots are created that combine the average working hours with the sickness rate, which show that for most sectors, higher average working hours are associated with higher average sickness rates. A fixed effects regression is also carried out, which may contain a lot of omitted variables, but combining both analyses yields an interesting result. Based on the CBS data, a highly significant positive relationship exists between the average number of working hours and the sickness rate.

To further explore the relationship and look at it at a more detailed level, I have made use of the LISS panel, which consists of survey data from a representative sample of Dutch individuals and contains information on several subjects. In this thesis, data on work, education and health of respondents is used, covering the years 2008-2018, excluding 2014. For both physical and mental health, OLS regressions are carried out, which correct for the possibility of reverse causality. For physical health, the estimates show that there is a small negative effect of having worked long hours for multiple years on an individual's health, but it is not a very economically significant result. For mental health, there is actually a small positive effect of having worked long hours for multiple years on an individual's health, but similar to the physical health results, this is also not very economically significant.

Looking at all results from the analyses, the findings point into the direction that for physical health, there is a small negative relationship with the number of working hours, while for mental health, it is the opposite and the relationship is positive. However, there are several drawbacks to this conclusion. Firstly, even though there is a strong relationship between physical health and self-reported health, it would be more interesting to make use of more objective indicators of health in further research. Secondly, there has been literature that shows that for mental health, it is not the number of hours that really affects one's mental state, but rather whether the person is really passionate about their job and enjoys it (Ten Brummelhuis, Rothbard, & Uhrich, 2017; Gicheva, 2019). Even though it is hard to evaluate whether the respondent is passionate about their job, it would be interesting to

include this in further research. Also, the data that is used is based on survey data, which could possibly be biased, as it contains the responses of individuals who are paid to fill out the surveys. The responses could also be slightly distorted due to differences in interpretation of the questions. Lastly, the analyses that are carried out are very hard to interpret causally, as there may still be a lot of omitted variables in the regression specifications. Even though having panel data enabled me to make use of a different approach, which was making use of the length of the panel by creating dummies, ideally, an IV approach would have been used. I would therefore recommend this for future further research on this topic.

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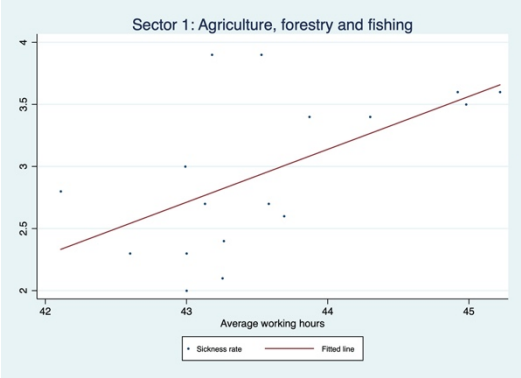
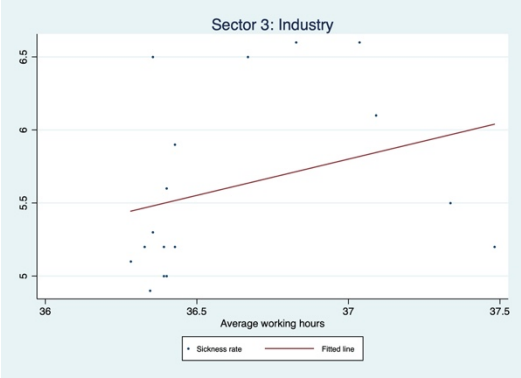
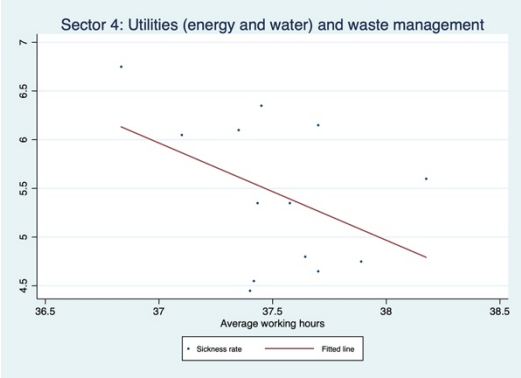
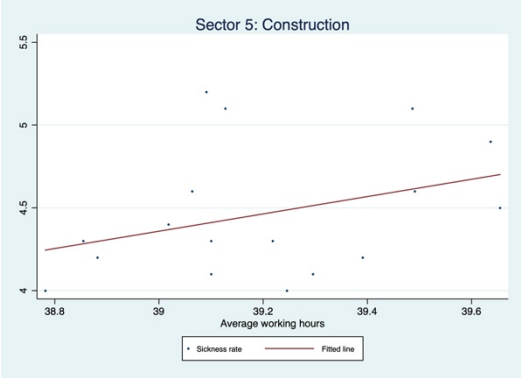
Appendix

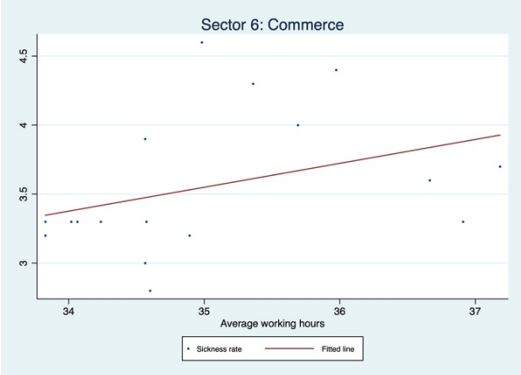
Scatterplots of each sector's average working hours and sickness rates, including fitted line.

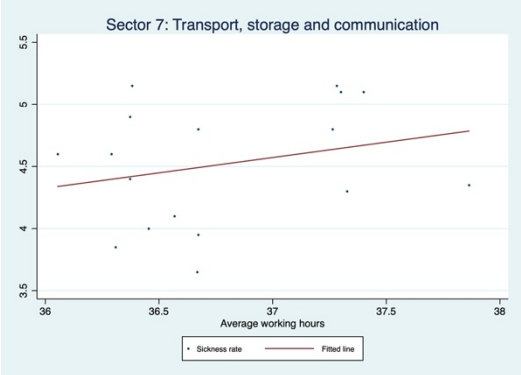


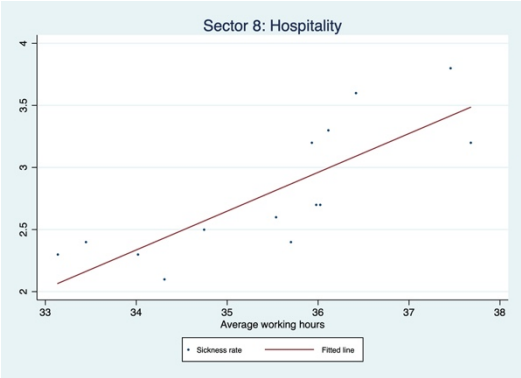








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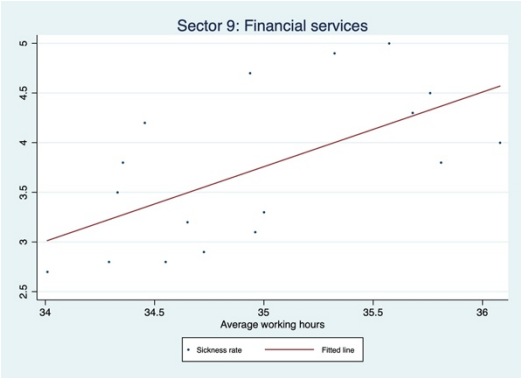
Average working hours
Sickness rate
Fitted line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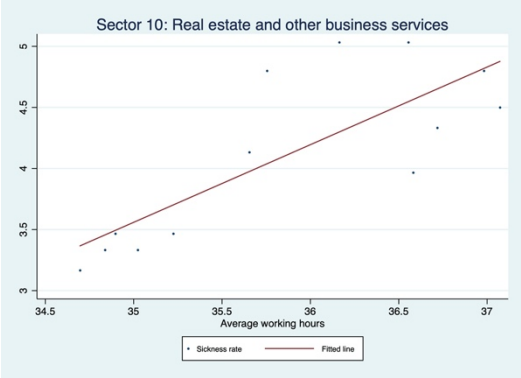
Average working hours
Sickness rate
Fitted line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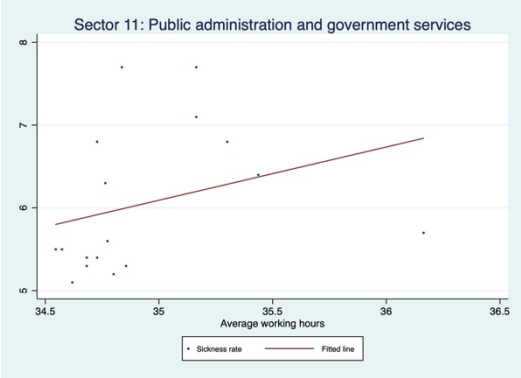
Average working hours
Sickness rate
Fitted line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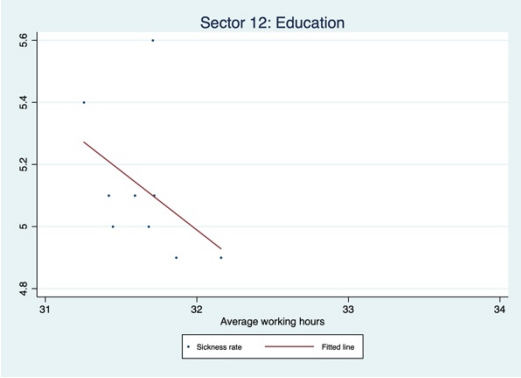
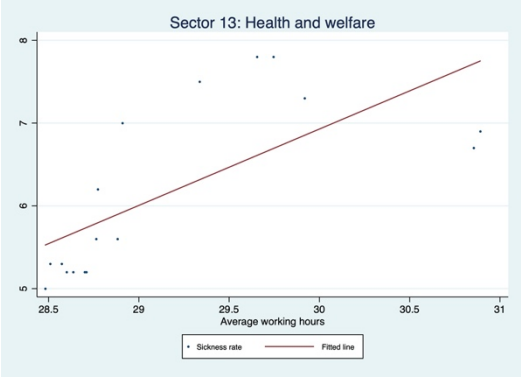
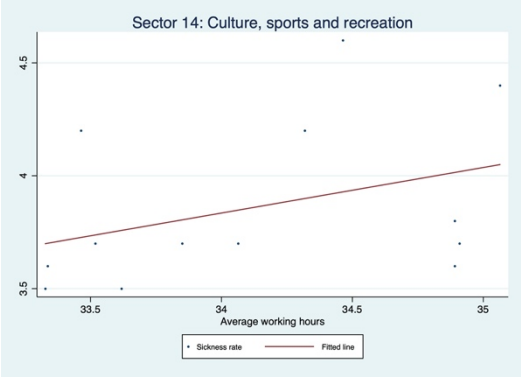
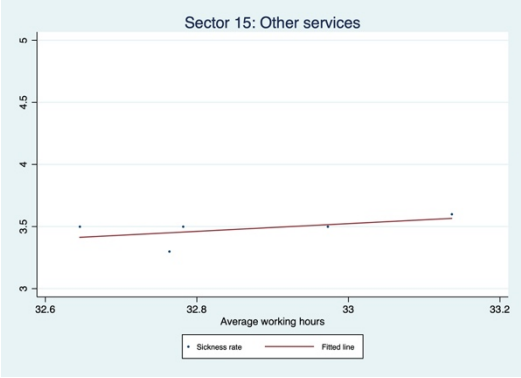
Average working hours
Sickness rate
Fitted line


Sector 12: Education
Average working hours
Sickness rate
Fitted line


Sector 13: Health and welfare
Average working hours
Sickness rate
Fitted line


Sector 14: Culture, sports and recreation
Average working hours
Sickness rate
Fitted line


Sector 15: Other services
Average working hours
Sickness rate
Fitted line

Tables for Physical health

Table A.1. Fixed effects regression of physical health variables on log of working hours

		Dependent variable:		
		General health	*Hospitalisation in last 12 months*	*Healthy BMI*
Independent variable:		(1)	(2)	(3)
Log(Working hours)		0,017 (0,011)	-0,004 (0,007)	0,002 (0,006)
Controls		YES	YES	YES
Number of observations		26694	26600	26694
Number of individuals		7877	7849	7877
R-squared	within	0,0201	0,0081	0,0056
	between	0,1487	0,0165	0,0451
	overall	0,1212	0,0129	0,0371

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.2. OLS regression of a self-assessed general health index on working long hours (50+)

	Dependent variable: General health		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,091 (0,100)	-0,084 (0,038)**	-0,073 (0,022)***
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,2698	0,3051	0,3401

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.3. OLS regression of a self-assessed general health index on working long hours (60+)

	Dependent variable: General health		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,134 (0,041)***	-0,032 (0,069)	-0,060 (0,040)
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,2698	0,3047	0,3397

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Tables for Mental health

Table A.4. Fixed effects regression of mental health variables on log of working hours

		Dependent variable:						
		Healthy MHI-5	*MHI-5*	*MHI-5: Anxious*	*MHI-5: Down*	*MHI-5: Peaceful*	*MHI-5: Depressed*	*MHI-5: Happy*
Independent variable:		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(Working hours)		-0,008 (0,007)	-0,210 (0,255)	-0,016 (0,016)	-0,007 (0,017)	-0,043 (0,019)	0,012 (0,018)	0,001 (0,017)
Controls		YES	YES	YES	YES	YES	YES	YES
Number of observations		26694	26694	26694	26694	26694	26694	26694
Number of individuals		7877	7877	7877	7877	7877	7877	7877
R-squared	within	0,0020	0,0094	0,0222	0,0073	0,0025	0,0086	0,0039
	between	0,0240	0,0430	0,0575	0,0243	0,0304	0,0382	0,0007
	overall	0,0169	0,0324	0,0424	0,0182	0,0199	0,0274	0,0014

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.5. OLS regression of having a healthy mental health index on working long hours (50+)

	Dependent variable: Healthy MHI-5		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,091 (0,018)***	0,013 (0,020)	0,014 (0,012)
Controls	YES	YES	YES
Number of observations	1576	7590	13067
R-squared	0,1195	0,1027	0,1253

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.6. OLS regression of having a healthy mental health index on working long hours (60+)

	Dependent variable: Healthy MHI-5		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,119 (0,039)***	0,082 (0,028)***	0,054 (0,020)***
Controls	YES	YES	YES
Number of observations	1576	7590	13067
R-squared	0,1192	0,1031	0,1256

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.7. OLS regression of being anxious on working long hours

	Dependent variable: MHI-5 - Anxious		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,119 (0,177)	0,061 (0,036)*	0,024 (0,025)
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,1333	0,1791	0,2156

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.8. OLS regression of being down on working long hours

	Dependent variable: MHI-5 - Down		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	-0,091 (0,171)	0,001 (0,038)	0,031 (0,024)
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,0934	0,1191	0,1391

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.9. OLS regression of being peaceful on working long hours

	Dependent variable: MHI-5 - Peaceful		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	0,112 (0,120)	0,009 (0,046)	0,033 (0,029)
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,1335	0,1413	0,1602

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.

Table A.10. OLS regression of being depressed on working long hours

	Dependent variable: MHI-5 - Depressed		
	10 years	*7 years*	*5 years*
Independent variable:	(1)	(2)	(3)
Long hours (dummy)	-0,098 (0,199)	0,018 (0,041)	0,034 (0,027)
Controls	YES	YES	YES
Number of observations	1508	7050	12025
R-squared	0,1351	0,1614	0,1798

Standard errors are clustered on the level of the individual.

*** indicates significance at the 0,01 level.

** indicates significance at the 0,05 level.

* indicates significance at the 0,10 level.