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The Health Effects of Working Overtime

Evidence from Austrian Micro Data

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Abstract

This paper investigates the effects of working overtime on health. Overtime has previously been examined in this context mainly as a one-dimensional variable. This paper takes into account the multi-dimensional character of this factor. In addition to solely relating overtime to a health measure, this paper focuses discretely on the remuneration, the regularity, and the temporal extent of overtime, each of which comprising one of the different dimensions of overtime examined. The empirical analysis makes use of data deriving from the EU-SILC for Austria for the year 2007. The dataset offers two variables in order to study health outcomes, namely general health status and chronic disease. Chronic disease and overtime suffer, however, from reverse causality. Hence, all the empirical results of this study are exclusively based on general health status as a measure of health. The first finding is that an immediate relationship between health status and overtime is not verifiable. Nevertheless, the analysis of the different dimensions of overtime reveals significantly adverse effects on health. Unpaid overtime affects the workers' health negatively, while paid overtime does not seem to do so. No significance was found for regularly recurring overtime, whereas erratically occurring overtime is associated with adverse health outcomes. The evidence for a relation between the temporal extent of overtime and health is weak; only the combination of working unpaid overtime at a high extent (i.e. more than 25 hours per month) shows a distinctly detrimental effect on workers' general health status.

Keywords: overtime; health; chronic disease; remuneration; Austria

Contents

1. Introduction

Ever since the onset of the Industrial Revolution workers have been struggling with long working hours. The conditions gradually ameliorated towards the end of the 19th century with the formation of trade unions. The collective power gained by the workers allowed them to make a stand against their employers and demand better working conditions. The slogan "8-8-8" (Eight hours labor, Eight hours rest, Eight hours recreation) was put forward by the labor movement, stressing their claim for shorter working hours. By the year 1918 many European countries started to establish the eight-hour workday by law and the 48-hour workweek became common practice (Weblexikon der Wiener Sozialdemokratie, 2012). Throughout the 20th century, the statutory workload decreased steadily. In 1993 the European Union passed the so-called "Working Time Directive" (93/104/EC). It established minimum rules on working time in all member states in order to protect workers' health and safety. In its current version (2003/88/EC) from 2003 the directive entitles workers among other things to "*a limit to weekly working time, which must not exceed 48 hours on average, including any overtime*" (European Commission, 2012).

Workers' health is determined by many factors such as safety measures and hygiene at the workplace. Factors relating to time - rest breaks during working hours, total working hours, annual leave, etc. - are also acknowledged to influence health status. For this reason, the above mentioned EU directive imposes limits on those factors. The enforced regulations on total working hours can, therefore, be viewed as one reason why the general state of health in the population improved from the onset of the Industrial Revolution up to the present. Even so, heavy workloads are far from being a phenomenon of the past. Working overtime is part of the daily routine for a large fraction of employees irrespective of gender, age, type of industry or occupation, hierarchical position within a company, etc.

The issue of overtime work and its relation to workers' health has mainly received attention from occupational physicians. Studies from this field consistently conclude that there is evidence that overtime work has adverse effects on workers' health (see e.g. Sparks, et al., 1997; Spurgeon, et al., 1997; van der Hulst, 2003). The reduced availability of time or ability to use time effectively for sleep, recovery from work, family, and other non-work-activities is supposedly the causing factor for negative health consequences (Caruso, et al., 2006). The health consequences being studied range from general ones, such as subjective health status,

to physiological ones, e.g. cardiovascular disease, and health-related behaviors, notably smoking and alcohol consumption (van der Hulst, 2003).

The fact that research upon the issue at hand by health economists is scarce is not satisfactory. Another more serious aspect that seems to have been neglected by previous research of any discipline is the consideration of the multi-dimensional character of overtime work. Previous research typically relates a specific health measure to overtime, in which overtime takes on the form of a dummy variable. As this paper will demonstrate, this one-dimensional representation of overtime is too crude. In fact, the focus of this paper lies upon three additional dimensions. The aspects of remuneration (paid vs. unpaid), regularity (regularly recurring vs. erratically occurring), and temporal extent (low vs. high extent) of overtime will be empirically addressed both individually and in an interrelated way.

Emphasis is also placed on the theoretical investigation of the health effects of the remuneration aspect of overtime. This issue can be approached by using a standard microeconomic model where utility-maximizing individuals face a trade-off between allocating time to work or leisure. Since this framework only allows to derive predictions regarding individuals' utility, additional considerations of the health investment model of Grossman (1972) are taken into account in order to look at individuals' utility and health simultaneously. On this basis, predictions of the sign of the effect of overtime on health can be derived. Taken together, this theoretical framework suggests that adverse health effects for unpaid overtime seem to be plausible, while the matter appears to be less clear for paid overtime. Hence, one objective of this paper is to empirically examine these hypotheses for unpaid and paid overtime.

The empirical investigation draws on Austrian data from the EU-SILC for the year 2007. Two different measures for health - general health status and chronic disease - are intended to be studied separately for a sample of 2,968 employed individuals between the age of 16 and 64. A problem in using these general health measures is that there is good reason to suspect that they suffer from reverse causality; that is to say that overtime can influence the general health condition but in the same time the general health condition may in its own right affect the incidence of overtime. For chronic disease this endogeneity problem proves to be true. Hence, all the empirical results of this study are exclusively based on general health status as a measure of health. Somewhat contrary to previous research, the first finding is that an

immediate relationship between health status and overtime is not verifiable. Nevertheless, the analysis of the afore-mentioned different dimensions of overtime reveals significantly adverse effects on health. For the remuneration aspect, the results support the derived hypotheses. Unpaid overtime is indeed found to be detrimental to workers' health status, while paid overtime does not seem to have a similar effect. No significance was found for regularly recurring overtime, whereas erratically occurring overtime is associated with adverse health. The evidence for a relation between the temporal extent of overtime and health is weak. Only the combination of working unpaid overtime at a high extent (i.e. more than 25 hours per month) shows a distinctly unfavorable effect on workers' general health status. It should be noted though, that the cross-sectional setting of this analysis does not allow for a causal interpretation of all these effects of working overtime on health.

The subsequent sections of this paper are structured in the following way. Section 2 gives an overview on previous research on the topic. In Section 3, microeconomic theory is used to model the remuneration aspect of overtime and to make predictions on how it might be related to health. Descriptive statistics on the data and the empirical model specification are provided in Section 4. Section 5 is devoted to the estimation results and their robustness and discusses the limitations of this study. Finally, Section 6 concludes.

2. Previous research

Occupational medicine[1] is the research field most concerned with impacts of different work-related characteristics on health. In the past decades occupational-medical studies focusing exclusively on the issue of overtime and the associated health effects have been rather sparse. The focus has predominantly been on the health consequences of shift work or long working hours (Sparks, et al., 1997). Nevertheless, those studies which addressed the overtime topic almost unambiguously report at least some evidence of adverse health consequences from working overtime. Three meta-analytic reviews (Sparks, et al., 1997; Spurgeon, et al., 1997; van der Hulst, 2003) have revealed a broad consensus among occupational physicians in that workers' health - both directly and indirectly - becomes impaired as a result of regularly performed overtime work. In the following, firstly, the concept of overtime is defined and elaborated on. Secondly, the mechanism behind the health impairment is touched upon as well

[1] Also referred to as "industrial medicine"

as the health consequences studied so far. The last point in this section summarizes four weaknesses inherent in most previous studies.

2.1. Overtime

Overtime can be defined as hours spent working that exceed the contractual hours. Hence both full-time and part-time employees can work overtime. The expressions “long working hours” and “long workhours” are often used interchangeably for overtime work in the literature. As Beckers, et al. (2007) point out this is not correct, since long working hours refer to workhours that exceed the standard full-time workweek. Thus, for full-time workers these expressions can be used synonymously; part-time workers can only perform overtime work, though. This distinction is noteworthy, because the analyzed sample in this study contains both full-time and part-time workers.

The scientific literature mainly portrays and studies overtime as a one-dimensional issue. Most studies neither distinguish between paid and unpaid overtime nor between voluntary and involuntary overtime or regular and erratic overtime. It is the multi-dimensional character, though, that gives this topic an intriguing perspective with respect to its possibly different effects on workers’ health. The motivations for the various forms of overtime are diverse.

The employer-side argument for involuntary overtime is basically one of cost efficiency. Obligating employees to perform overtime saves costs for recruiting additional personnel, their training, fringe benefits, etc. (Johnson & Liscomb, 2006; Dembe, 2009). Even so, this argument is called into question by the findings of Shepard & Clifton (2000). Using panel data, they conclude that a 10% increase in overtime hours is associated with a 3% decrease in the productivity across most of 18 studied manufacturing industries of the US economy. Furthermore, the issue of mandatory overtime gives rise to ethical concerns. As long as the hours worked in excess of the contractual hours are being paid and the extent is within the legal boundaries, overtime is ethically tolerable. If, however, involuntary overtime is not remunerated for, ethical concerns cannot be easily pushed aside. Coercion to do extra working for no pay remotely reminds of slavery-like practices. Caruso, et al. (2006) note that mandatory overtime is an important source of frustration for workers.

On the contrary, utility maximization can be viewed as the employee-side argument for voluntary overtime. In situations where individuals strive to earn additional money, the

opportunity to work overtime comes in useful (Dembe, 2009). Similarly, Caruso, et al. (2006) argue that workers, who want to increase their pensions by increasing their pre-retirement income, are inclined to do overtime voluntarily. Besides the motivation of receiving monetary benefits, one motivation could also be to avoid negative consequences, such as sanctions imposed by supervisors or job insecurity (Tucker & Rutherford, 2005). In the latter case the decision of working overtime is more of a semi-voluntary nature. This being said, the combination of voluntarily chosen unpaid overtime seems to be surprising at first sight. Those workers might have a hidden agenda though. For West Germany Pannenberg (2005) reports that over a period of 10 years unpaid overtime workers experience at least a 10% higher increase in income than their fellow workers. The analysis of Anger (2008) sheds more light upon this finding and shows that unpaid overtime functions as a signaling device, with which workers signal their value to their employers. In addition, Anger (2008) finds that those unpaid hours are not necessarily spent in a productive way; rather they are merely used to be seen at the workplace (so-called presenteeism).

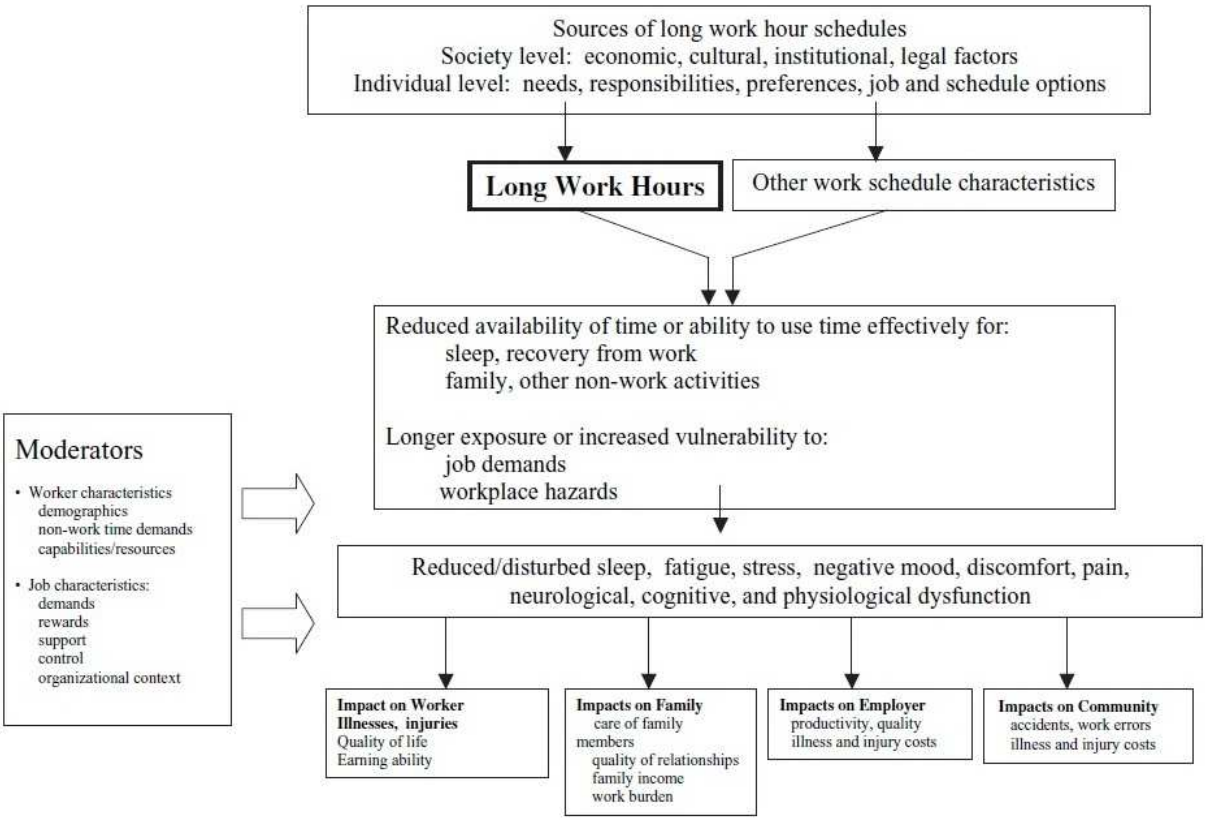
Individuals, who perform overtime on a voluntary basis, pose a problem to any empirical estimation that cannot control for them. It seems intuitive that those individuals are less prone to any health consequences as compared to their involuntarily working counterparts. In fact, Dembe, et al. (2005) point out that mandatory overtime appears to be especially unfavorable for health. Investigating the effect of overtime on health, the presence of voluntary overtime workers in the sample might bias the expected negative estimate downwards to become insignificant or even positive, if one cannot control for those workers. Only one study seems to have taken account of a few dimensions of overtime. Van der Hulst & Geurts (2001) find negative health effects for workers receiving only a low reward for overtime – independent of high or low pressure to perform overtime. By contrast, the combination of a high pressure to do overtime and a high reward does not seem to increase the chances of ill-health as compared to workers with low pressure and high rewards. These results indicate that it does not matter for workers' health whether overtime is voluntary (low pressure) or involuntary (high pressure), but that it matters whether it is paid (high reward) or unpaid (low reward).

2.2. Health Consequences

Caruso, et al. (2006) provide a conceptual framework for the study of what they term "undesirable impacts of long work" (see Figure 1). The centerpiece of this framework describes the mechanism through which overtime impairs workers' health. This mechanism is

identified to run through two channels. The argument for the first channel is that the prolonged exposure of overtime workers to the potentially hazardous workplace leads to more workplace injuries, simply because they spend more time at the workplace than non-overtime workers (Caruso, et al., 2006). However, this channel is called into question by the findings of Dembe, et al. (2005)[2]. They conclude that it is not the prolonged exposure to workplace hazards per se that leads to more occupational injuries and illnesses, but rather that jobs with overtime schedules are associated with a 61% higher injury hazard rate than jobs without overtime, even when controlling for the type of industry and occupation.

Figure 1: Framework for the study of undesirable impacts of long work (Caruso, et al., 2006)



The second channel concerns the reduced availability of time or ability to use time effectively for sleep, recovery from work, family, and other non-work activities (Caruso, et al., 2006). The research community seems to be of unambiguous consensus regarding this channel in that the reduced time for recovery impairs different aspects of workers' health. Figure 1 only highlights a handful of those aspects, e.g. reduced/disturbed sleep, fatigue, stress, etc. Van der Hulst (2003) groups these health outcomes into direct and indirect ones.

[2] Even though published in 2005, Caruso, et al. (2006) did not take account of the paper by Dembe, et al. (2005).

The direct health outcomes are closely attributable to the increased effort for work and the reduction in available time for recovery (van der Hulst, 2003). This is believed to disturb certain physiological processes (blood pressure, hormone excretion, or activity of the nervous system), which eventually leads to ill-health (van der Hulst, 2003). In general, a lot of different psychological and physiological health outcomes have been studied so far[3]. Most obvious there is strong evidence that overtime workers exhibit reduced sleep hours (Artazcoz, et al., 2009; van der Hulst, 2003), increased stress levels (Sparks, et al., 1997) and a higher incidence of self-reported hypertension (Artazcoz, et al., 2009). Increased risk for cardiovascular diseases is consistently found to be associated with overtime (van der Hulst, 2003; Virtanen, et al., 2010). The immune system also appears to suffer from the overtime burden as well as self-reported physical health (van der Hulst, 2003). Fatigue is another well-investigated health outcome, with some studies reporting a significant relationship (van der Hulst, 2003) and others failing to find this (Beckers, et al., 2007). Poor mental health status (Artazcoz, et al., 2009) among men, depressive and anxiety symptoms in women (Virtanen, et al., 2011) and vulnerability to major depressive episodes (Virtanen, et al., 2012) are all factors associated with overtime. Finally, self-perceived general health status is among the most studied indicators but the evidence for a negative relationship with overtime is either weak (van der Hulst, 2003) or not verifiable (Artazcoz, et al., 2009).

By contrast, the indirect health outcomes encompass the health-related behavior of overtime workers. Working overtime is believed to induce them to change that, with the behavior itself being eventually responsible for workers' physiological ill-health. Spurgeon, et al. (1997) point out that heavy drinking, smoking, and drug abuse is more prevalent in overtime workers. Sparks, et al. (1997) mention inadequate diet and a lack of exercise. On the contrary, van der Hulst (2003) reports that the evidence for a change in health-related behavior is either weak (for alcohol consumption and body-mass-index) or nonexistent (for smoking, psychotropic drugs, eating habits, and physical exercise). Despite this, more recent studies do find significant relationships. Artazcoz, et al. (2009) show that overtime is associated with smoking both for men and women, and no physical activity during leisure time for men. Drawing on panel data Taris, et al. (2011) find that overtime work is related to lower levels of physical activity and intake of fruit and vegetables, but not to smoking and alcohol consumption.

[3] Sparks, et al. (1997) find a stronger link from overtime to psychological than physiological health measures.

Figure 1 reveals that there is a plentitude of factors that moderate the relationship of health and overtime. First of all, gender seems to play a decisive role. While some studies argue that men, as the breadwinners of the households, are more prone to negative health effects of overtime (Artazcoz, et al., 2009), other studies argue that it is the double-role of women, who both work overtime and keep the household, that makes them more prone (Sparks, et al., 1997; Spurgeon, et al., 1997). Workers' age, the type of job, and whether one has at least to a certain degree control over one's own work schedule seem to have a moderating effect (Sparks, et al., 1997). Johnson & Lipscomb (2006) mention the content of work and the social class of workers to be of importance. Finally, social support both within and outside the workplace appears to be a significant moderator in the relationship between overtime and health (Tucker & Rutherford, 2005).

Given all these points, four weaknesses of previous research can be identified. First, most studies fail to take account of the multi-dimensional character of overtime. They distinguish neither between paid and unpaid overtime nor between regularly and erratically performed overtime. Second, many analyses are based on cross-sectional data and hence, do not allow for a causal interpretation of the health effect of overtime. Third, small sample sizes and/or non-representative samples of the population are often being used. In fact, 22 out of 27 studies analyzed by van der Hulst (2003) and all 21 studies analyzed by Sparks, et al. (1997) focused exclusively on a selective sample of a specific occupation or industry. Finally, many studies do not control for covariates (van der Hulst, 2003).

3. Theoretical considerations

Economists are concerned with the utility-maximizing allocation of scarce resources. One such resource is time. Labor economics is the sub-discipline that tells us about individuals' decision of allocating their precious time between leisure and work, i.e. the labor supply decision. Assuming[4] that individuals maximize their utility with their contractual work hours, it can be investigated how involuntary overtime shifts them away from the optimal equilibrium. In that case, working overtime means to sacrifice leisure time so that disutility is

[4] Many economists point out that the desired working time often does not correspond to the actual working time and individuals face so-called "work hours constraints" (Sousa-Poza & Henneberger, 2002). Work hours constraints are found to adversely affect workers' health (Bell, et al., 2011). But even so, looking at 21 developed countries Sousa-Poza & Henneberger (2002) conclude that the majority of workers does not face hours constraints.

created. This leads to a sub-optimal solution, if overtime is not sufficiently remunerated for. This framework only allows to derive predictions regarding individuals' utility, but not health. Therefore, additional considerations of the health investment model of Grossman (1972) are taken into account in order to look at individuals' utility and health simultaneously. Based on these theoretical considerations, hypotheses about the health effects of paid and unpaid overtime can be derived.

3.1. Labor Supply Decision and Overtime

Utility-maximizing individuals in working age are provided with a timely budget of 168 hours per week. They face a trade-off between two goods for which this budget is used to allocate among. This trade-off is displayed in Figure 2. On the one hand individuals can devote their time to consuming leisure. On the other hand they can dedicate a certain amount of time to work, for which income is generated which can be used for consumption. In a realistic setting individuals not working still receive a certain income (e.g. a minimum income) allowing them to consume a certain amount of goods. The decision to enter the labor market depends on whether the market wage rate *w* exceeds an individual's reservation wage (Borjas, 2005). Once the decision to work is made, individuals choose the working time that maximizes their utility. The optimum is reached when a worker is indifferent between working one more hour at a wage rate of *w* and one more hour of leisure (Borjas, 2005). This is achieved in point A in Figure 2, where an individual working the contractual hours of work ("standard hours") derives a maximizing utility of U.

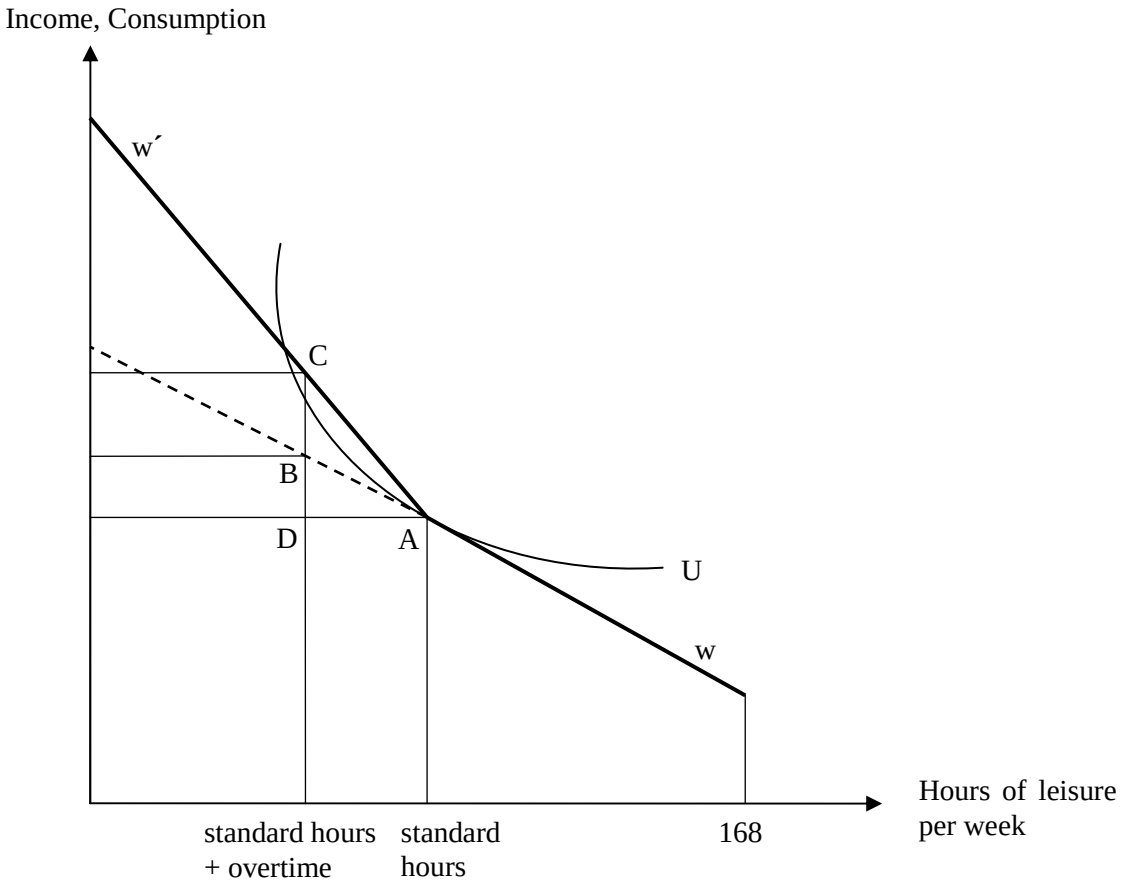
In the basic setting of Figure 2 it can be investigated how the need to do overtime affects individuals' utility. One key assumption is that individuals maximize their utility with the freely chosen contractual work hours in point A. The second assumption[5] is that the employer obligates the employees to perform overtime. Furthermore, a distinction can be made in that overtime can be remunerated or not. Figure 2 takes account of three different types of remuneration for a specific but equal amount of overtime.

In the first case employees' overtime is remunerated at the standard wage rate *w*. The equilibrium would be point B, which is characterized by fewer hours of leisure but an increase

[5] Voluntary overtime, as discussed in Section 2.1., violates both assumptions. Hence, all following arguments based on these assumptions apply only to involuntary overtime.

in income. At this point employees value one more hour of leisure higher than the additional wage of one more working hour. Therefore, B represents a sub-optimal solution.

Figure 2: Labor supply decision of an overtime working individual



In the second case workers receive their standard wage rate plus an overtime premium[6] for each hour worked in excess of the standard hours. Thus, each hour of overtime is remunerated at a constant wage rate *w'* that exceeds the standard wage rate *w*. This leads to a kink in the wage rate line. The resulting equilibrium is in point C, again with fewer hours of leisure but this time a higher increase in income than in the first case. In the way it is depicted in Figure 2, point C would indeed be superior to point A, because point C lies above the indifference curve U. However, this finding depends on both the shape of the indifference curve and the extent of overtime. For a more curved indifference curve, i.e. being closer to an L-shape as in the case of complementary goods, point A would be preferred to C. In a similar way, more hours of overtime would shift point C further up along the wage rate line. As soon as point C

[6] This is a reasonable assumption since many industrialized countries obligate the employers to pay an increased remuneration for overtime. In Austria, the country used in the empirical analysis later on, all overtime hours of full-time workers must be awarded with either a premium of 50% or compensatory time-off (Bundeskanzleramt Österreich - Arbeitszeitgesetz (Working Hours Act) §10 (1), 2012)

is shifted past the point where the indifference curve U and the wage rate line intersect, point A becomes advantageous to C.
In the third case workers are not remunerated for overtime, i.e. the case of unpaid overtime. The emerging sub-optimal equilibrium is now in point D. The difference to the former two cases where individuals received remuneration for overtime is that in addition to fewer hours of leisure, workers are left with the same income. Consequently, independent of the shape of the indifference curve, workers experience a drop in their utility.

What is common to all three of the above cases is the decrease in leisure time. For paid overtime with a premium the results on individuals' utility is ambiguous, whereas paid overtime without a premium leads to less utility as does unpaid overtime. Thus, the analysis above has shown that the reduced time for leisure basically results in disutility, if overtime is not sufficiently remunerated for. At this point it is tempting to simply equate utility with health and derive hypotheses based on the considerations up till now. However, in the analysis above utility is only composed of leisure and income/consumption. The factor health also contributes to individuals' overall utility or well-being. Most important, health itself is affected by the altered time and monetary circumstances of overtime working individuals, because time and money are key factors in the production of individuals' health. Therefore, below it will be discussed how individuals' health is affected by both the shorter leisure time and the two basic remuneration types for overtime, i.e. paid and unpaid overtime.

3.2. Overtime and Investments in Health

In his seminal paper Grossman (1972) introduces the notion of the investment character of health. In his model individuals are not only consumers of health but also producers of it. Grossman describes that individuals demand the commodity health and satisfy this need through the consumption of health care services. This yields directly a higher utility to individuals for the simple reason that they derive more utility from being healthy than sick (Sintonen & Linnosmaa, 2000). The novelty of Grossman's approach is that he takes into account individuals' possibility to actively invest in their health, e.g. by physical exercise, a healthy diet, prophylactic medication, etc. However, these investments come at a cost, because both monetary resources and time must be devoted to the production of health. Individuals indirectly derive utility from these investments in that the benefits of a better health allow them to have more time available for both work and leisure (Jones, et al., 2006).

In a more formal way the direct and indirect effect of health on individuals' utility can be expressed as follows.

- Utility function: $U = U(\underset{+}{H},\ \underset{+}{X},\ \underset{+}{K},\ \underset{+}{L}, \dots)$

with H = health, X = consumption bundle of non-health related goods, K = consumption bundle of unhealthy goods, such as tobacco, alcohol, etc., L = leisure used for non-health related activities

- Health production function: $H = H(\underset{+}{L},\ \underset{-}{K},\ \underset{+}{M}, \dots)$

with L = leisure used for recovery and physical exercise, K = consumption bundle of unhealthy goods, M = consumption of health care services and medication

Within this framework it is possible to investigate how the two basic cases of paid and unpaid overtime impact on workers' health. By means of the presented health production function hypotheses on the expected results can be derived for each case. The first factor in the health production function is leisure time (L), which is believed to be positively associated with health. Consumption of unhealthy goods (K) is the second factor contributing to health. Obviously, an increase in the consumption of these goods will worsen health. The third factor – consumption of health care services and medication (M) – is positively linked to health.

Independent of the exact remuneration of overtime, leisure time is decreased by working overtime. Thus, the health production function proposes that this decrease in leisure time is expected to negatively affect health. The previous research discussed in Section 2 suggests that working overtime is accompanied by a change in health-related behavior. In the presence of overtime, the consumption of unhealthy goods such as tobacco or alcohol is likely to increase as well as the adoption of an unhealthy diet. Finally, if overtime is paid for, the higher wage enables an increased consumption of health care services and medication, leading to a better state of health. However, in the case of unpaid overtime additional consumption of health care services and medication is limited.

As a result, in the case of paid overtime the health outcome is ambiguous – with less leisure, and a potentially unhealthier lifestyle, but increased opportunity for the consumption of health care services and medication. It is unclear by how much the increased opportunity for consumption of health-enhancing services offsets the two former negative effects. Thus, the

hypothesis for the effects of paid overtime on health remains undecided. In the case of unpaid overtime the result is much clearer. The reduction in leisure time, a potentially unhealthier lifestyle combined with no further monetary resources for the consumption of health-enhancing services is expected to lead to a worse state of health. Consequently, adverse health effects of unpaid overtime are hypothesized. If, however, unfavorable health effects were also to be found for paid overtime, then the negative effects of unpaid are expected to be stronger.

4. Data and Methodology

The data for the empirical analysis are retrieved from Statistics Austria, the statistical agency of Austria. Among other datasets Statistics Austria provides a 50% sub-sample of the Austrian data from the EU-SILC (i.e. European Union Statistics on Income and Living Conditions) for the year 2007 free of charge (Statistik Austria, 2012). The EU-SILC is an annually conducted survey coordinated by Eurostat yielding nationally-representative data (Eurostat, 2012). To my knowledge the relationship between health and overtime has not been investigated so far by means of this dataset.

4.1. Descriptive Statistics

The EU-SILC is a rich dataset comprising data gathered at the household level separately for each household member aged 16 or older (Statistik Austria, 2012). A total of 6,596 observations is included in the dataset for the year 2007. Besides a number of demographic variables, the dataset also contains job-related and health-related variables. In order to investigate the health effects of working overtime, it is necessary to exclude all observations outside the legal working age, i.e. individuals aged 65 years or older, in a first step. In a second step all non-working observations and all employers of the working age population are excluded. 3,070 observations meet these two criteria of being aged between 16 and 64 and actually working as an employee[7]. In a final step, a further 102 observations for which certain values for different variables are missing have to be excluded. As a result, 2,968 observations (1,612 men and 1,356 women) can enter the empirical analysis.

[7] The EU-SILC does not distinguish between employees and so-called independent contractors (in German: “Freie Dienstnehmer”) and denotes both of them as “employees”.

Health variables

Two health-related variables in the dataset are identified to be apposite for the estimation. The first health measure is self-perceived general state of health[8]. The five possible answer categories are very good, good, fair, poor, and very poor. Table 1 reveals that almost half of all employees (47.4%) perceive their health as very good, and another two fifths (39.3%) as good. Only 11.3% consider their health status as fair and a minority of 1.8% and 0.2% deem their state of health to be poor and very poor, respectively. One apprehension when relying on a self-reported measure is that e.g. personality characteristics influence the results. However, Sparks, et al. (1997) point out that studies drawing on both self-reported and non-self-reported health measures have found a link between overtime and health and thus see no objection to using a self-reported health measure. The second health measure is chronic disease[9], with the possible outcomes being "yes" or "no". As Table 1 indicates 14.8% affirm the former and 85.2% the latter.

Creation of the overtime variables

Among the job-related variables in the EU-SILC dataset one concerns whether both full-time and part-time employees regularly work overtime. 906 observations or 30.5% of all employees indicate to fall into this category. For these observations, two further questions aim at eliciting how many paid and unpaid hours per month are being performed. Besides answering these two questions with a precise amount of hours, it is possible to state that the monthly overtime hours fluctuate in way that makes it impossible to specify a monthly average. Based on these three indications a number of variables can be created to take into account the multi-dimensional character of overtime in the actual estimation.

The first dimension concerns the remuneration of overtime. It is possible to distinguish between three groups (see Table 1). 518 out of all 906 overtime workers are fully remunerated[10] ("only paid overtime"), 170 merely receive remuneration for a certain number of their total hours of overtime ("paid+unpaid overtime"), and 218 do not receive any remuneration whatsoever ("only unpaid overtime"). The second dimension looks at the regularity of overtime work. A distinction is made between employees who regularly work overtime for an evenly number of hours per month and those whose hours fluctuate and

[8] The exact phrasing in the questionnaire was: "How is your general state of health?"
[9] The exact phrasing in the questionnaire was: "Do you suffer from a chronic disease/illness?"
[10] Note that full-time workers in Austria had to be awarded with a wage premium of 50% in addition to the normal wage rate in 2007, whereas part-time workers were not eligible to that premium (see footnote 6).

Table 1: Frequency distribution of the overtime variables for the two dependent variables general health status and chronic disease (in %)

	General health status					Chronic disease		Total
	very poor	poor	fair	good	very good	no	yes	
Full sample	0.2	1.8	11.3	39.3	47.4	85.2	14.8	100 (n=2968)
Overtime working conditions								
No overtime	0.3	2.0	10.4	39.8	47.5	86.1	13.9	100 (n=2062)
Overtime	0.1	1.2	13.2	38.2	47.2	83.2	16.8	100 (n=906)
Remuneration								
Only paid overtime	0.2	1.4	12.0	35.7	50.8	83.0	17.0	100 (n=518)
Paid+unpaid overtime	0.0	1.2	14.1	41.2	43.5	85.3	14.7	100 (n=170)
Only unpaid overtime	0.0	0.9	15.6	41.7	41.7	82.1	17.9	100 (n=218)
Regularity								
Regular overtime	0.1	1.2	13.4	36.0	49.2	82.9	17.1	100 (n=803)
Erratic overtime	0.0	1.0	11.7	55.3	32.0	85.4	14.6	100 (n=103)
Extent of regular overtime (hours per month)								
Low (1-10)	0.3	1.2	14.8	35.0	48.6	83.1	16.9	100 (n=331)
Medium (11-24)	0.0	1.6	12.2	30.3	55.9	82.7	17.3	100 (n=254)
High (25+)	0.0	0.9	12.8	44.0	42.2	83.0	17.0	100 (n=218)

therefore cannot state a number of monthly hours of overtime. Table 1 shows that 803 observations fall into the former category (termed "regular overtime") and 103 into the latter ("erratic overtime"). For this group of 803 regular overtime workers, who state a monthly average of hours of overtime, a further distinction is made for the temporal extent of overtime. This final dimension encompasses three groups of low-extent (1-10 extra hours per month), medium-extent (11-24 hours), and high-extent overtime workers (more than 25 hours)[11]. Table 1 presents the frequency distribution of each created overtime variable based on the answer categories of the two health measures.

Control variables

The EU-SILC dataset offers a set of demographic variables and besides overtime other job-related variables. These variables are intended to be included in every regression. The set of demographic variables is comprised of workers' age, a dummy variable for sex, a dummy indicating whether the birthplace was outside of Austria, three education dummies for different degrees (vocational school, high school, and university; compared to compulsory school), two dummies for the relationship status (married/cohabiting and divorced/widowed; compared to singles), and a dummy representing whether the individual is the main earner (i.e. breadwinner) of the household. The set of job-related control variables contains a dummy for part-time workers (defined as less than 31 contractual hours per week), a dummy for a temporary position, a dummy that indicates whether a worker has changed occupation in the last 12 months, a dummy for workers who are able to give directions to co-workers (i.e. being some sort of superior), and two dummies for the company size (10 to 49 employees and more than 50 employees; compared to a size of 1 to 9 employees). Table 2 shows the frequency distribution of the control variables based on the answer categories of the two health measures.

As a final point, the EU-SILC dataset for Austria allows to address three of the four identified weaknesses of previous studies highlighted in Section 2. The underlying questionnaire of the EU-SILC explicitly asks for the incidence of paid and unpaid overtime. In addition, it is possible to distinguish between regularly and erratically carried out overtime work. Information about the temporal extent of overtime per month is also available for regular overtime workers. In short, it is possible to take into account the multi-dimensional nature of

[11] The minimum reported monthly hours of overtime are 1 hour, the maximum 149 hours, and the average 20.8 hours with a standard deviation of 18.7 hours.

Table 2: Frequency distribution of the control variables for the two dependent variables general health status and chronic disease (in %)

	General health status					Chronic disease		
	Very poor	Poor	Fair	Good	Very good	No	Yes	Total
Full sample	0.2	1.8	11.3	39.3	47.4	85.2	14.8	100 (n=2968)
Demographic characteristics								
Female	0.3	1.8	10.9	40.1	46.9	85.1	14.9	100 (n=1356)
Male	0.2	1.7	11.5	38.6	47.9	85.3	14.7	100 (n=1612)
Born in Austria	0.2	1.5	10.6	39.0	48.6	85.4	14.6	100 (n=2569)
Born abroad	0.5	3.3	15.3	41.1	39.8	84.2	15.8	100 (n=399)
Level of education								
Compulsory school	0.2	3.3	18.5	37.0	41.0	82.7	17.3	100 (n=422)
Vocational school	0.2	1.7	12.2	42.0	43.9	84.7	15.3	100 (n=1649)
High school	0.2	0.6	7.1	37.1	55.0	87.1	12.9	100 (n=518)
University	0.3	1.8	4.7	33.5	59.6	87.9	12.1	100 (n=379)
Relationship status								
Single	0.0	0.8	6.5	31.0	61.7	89.7	10.3	100 (n=757)
Married/cohabiting	0.3	1.9	12.1	41.5	44.2	84.7	15.3	100 (n=1967)
Divorced/widowed	0.8	3.7	19.3	47.1	29.1	75.0	25.0	100 (n=244)
Breadwinner of HH	0.2	2.1	13.1	40.6	44.1	83.7	16.3	100 (n=1696)
Not breadwinner	0.3	1.3	8.8	37.7	51.9	87.2	12.8	100 (n=1272)
General employment conditions								
Full-time	0.3	1.9	10.7	38.5	48.6	85.5	14.5	100 (n=2330)
Part-time (<31h/week)	0.2	1.3	13.2	42.2	43.3	84.0	16.0	100 (n=638)
Permanent employment	0.2	1.8	11.7	40.8	45.6	84.7	15.3	100 (n=2678)
Temporary employment	0.3	1.7	7.6	25.5	64.8	90.3	9.7	100 (n=290)
Job change	0.0	1.2	14.8	37.9	46.1	81.5	18.5	100 (n=243)
No job change	0.3	1.8	10.9	39.4	47.6	85.5	14.5	100 (n=2725)
Ordinary employee	0.2	1.9	11.1	39.2	47.6	85.8	14.2	100 (n=1886)
Superior	0.3	1.5	11.5	39.6	47.2	84.2	15.8	100 (n=1082)
Company size (Nr. of employees)								
Small (1-9)	0.2	1.9	11.2	40.7	46.0	84.8	15.2	100 (n=643)
Medium (10-49)	0.3	1.6	12.3	38.3	47.5	86.4	13.6	100 (n=1049)
Large (50+)	0.2	1.8	10.4	39.4	48.1	84.5	15.5	100 (n=1276)

overtime. Another issue concerned small sample sizes and non-representative samples. As pointed out before, the EU-SILC is a nationally representative dataset with a large number of observations. Finally, the great number of demographic and job-related variables allows for a well-controlled estimation. Unfortunately, one issue cannot be addressed. It was only possible to retrieve data for the year 2007. Thus, no panel could be constructed, thereby making it impossible to infer a causal interpretation of any health effects.

4.2. Estimation Model

In its most basic form a model for the estimation of the effect of working overtime on health can be written down as:

$$H_i = \beta_0 + \beta_1 OT_i + \beta_2 X_i + \varepsilon_i \tag{1}$$

where H denotes a measure of health, OT a measure of overtime, X a set of job-related and demographic control variables, and ε the error term for individual i.

As previously mentioned two different measures of health are intended to be used for the estimation. The first dependent variable, general health status, is an ordinal one, because it includes five categories with a natural ordering. One option for a regression with an ordinal dependent variable is to use an ordered logit model. The ordered logit model looks as follows (Verbeek, 2008).

$$y_i^* = x_i'\beta + \varepsilon_i \qquad \text{with } y_i = 1, 2, \dots, M \tag{2}$$

$$y_i = k \quad \text{if } \delta_{k-1} < y_i^* \leq \delta_k \tag{3}$$

In the general specification the ordered logit model is based on an underlying latent variable, y_i^*, and the observed one, y_i (Verbeek, 2008). In the case of the health status variable M takes on a value of 5 and k ranges from 1 (very poor) to 5 (very good). The error term ε_i is assumed to have a logistic distribution.

By contrast, the second dependent variable, chronic disease, is dichotomous and thus one option is to use a logit model for the estimation. For reasons stated below the general specification of the logit model is omitted here.

The different dimensions of overtime

As mentioned earlier, the overtime variable (OT in the estimation model) is supposed to take account of the multi-dimensional nature of overtime and hence, a number of variables were created. These variables separately enter the estimation model according to the investigated dimension. The coefficient β_1 will give the effect of working overtime on either general health status or chronic disease. The pure health effect of working overtime is, however, only the first and most basic dimension that can be studied. Given the previous research discussed in Section 2, the expected result is an adverse effect of overtime on health.

The second dimension covers the remuneration aspect of overtime work. In this case OT enters the estimation model in form of three dummy variables, i.e. doing only paid overtime, a mix of paid and unpaid overtime, and only unpaid overtime. The expected results were theoretically derived in Section 3. It was concluded that a negative effect of unpaid overtime seems to be plausible, whereas for paid overtime the predictions were ambiguous. The case of partially remunerated overtime might fall somewhere in between these two extremes. Furthermore, negative health effects are expected to be more pronounced for unpaid overtime, if a negative result is also found for paid overtime.

The third dimension addresses the regularity of overtime work. Two dummy variables denote regularly recurring overtime and erratically occurring overtime. Predictions for the expected results are in a sense difficult to derive. As stated above, previous research suggests a negative impact of overtime in general. The interesting aspect is then which group of overtime workers exhibits stronger health effects. The key difference between the two dummy variables is that workers of the first one roughly know how much overtime they will have to do each month, whereas workers in the second group are faced with fluctuating overtime. Thus, the difference is an issue of certainty about when and how many extra hours are needed to be spent at the workplace. Greco & Roger (2003) found that uncertainty constitutes a stressor and is detrimental to health. Therefore, it can be hypothesized that the negative impact of erratically occurring overtime is stronger than for regularly recurring overtime.

The fourth and final dimension concerns the temporal extent of overtime. Three dummies indicate low extent (1 to 10 hours of overtime per month), medium extent (11 to 24 hours), and high extent (25 and more hours). Since every additional hour of overtime correspondingly decreases leisure time, it can be expected that the greater the extent of overtime, the stronger

the negative health effect is. One has to keep in mind, though, that only the group of regular overtime workers (803 observations) can enter this estimation, because the group of erratic overtime workers does not state an actual amount of hours.

Finally, the issue of endogeneity needs to be discussed. Bell, et al. (2011) point out that the occupational-medical literature on overtime and health barely touches upon that problem. Indeed it seems plausible that workers' health plays a major role in the decision to do overtime, if this decision can be made by the worker (i.e. voluntary overtime). Thus, healthy workers might opt to do overtime more frequently than their less healthy co-workers; or given that everybody does overtime, healthy workers choose to do more hours, because they need less time for recovery. In the case when the employer is to decide upon whether her employees work overtime (i.e. involuntary overtime), reverse causality will become a problem under one condition. The employer somehow perceives the different health statuses of her employees and takes this into account when assigning overtime to them.

5. Results

As explained in the previous section, there is good reason to suspect that health and overtime predict one another. Thus, before the actual estimation the issue of endogeneity is tested for. This is done by using the overtime variable as a dependent variable and the health variable (either general health status or chronic disease) as an explanatory variable. The results confirm the suspicion for chronic disease[12] to suffer from reverse causality, but not for general health status. For this reason, only the regression results for general health status as the dependent variable are discussed below.

The actual estimations have been carried out with the statistical software Limdep 9.0. Table 3 presents the estimation results for general health status. Throughout all regressions robust standard errors were used to take account of heteroskedasticity. Column (1) of Table 3 displays the results of the first and most investigated dimension of overtime, i.e. whether overtime workers' perception of health status is different from non-overtime workers'. At conventional levels the result indicates no significant differences. This finding is not surprising given the conclusions of van der Hulst (2003), who pointed out the difficulty of

[12] At the 5% significance level chronic disease is found to be endogenous both when it is used as a single explanatory variable and when additionally all control variables of the ordinary estimation model are included.

Table 3: Results for general health status (for marginal effects see Table 4)

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
Overtime	-0.102					
	(0.085)					
Only paid overtime		0.040				
		(0.106)				
Paid+unpaid overtime		-0.160				
		(0.153)				
Only unpaid overtime		-0.374				
		(0.144)***				
Regular overtime			-0.052			
			(0.090)			
Erratic overtime			-0.437			
			(0.168)***			
Low-extent				-0.053		
				(0.126)		
Medium-extent				0.177		
				(0.146)		
High-extent				-0.198		
				(0.142)		
Regular & paid					0.048	
					(0.109)	
Regular & paid+unpaid					-0.121	
					(0.181)	
Regular & unpaid					-0.255	
					(0.162)	
Erratic & paid					0.019	
					(0.282)	
Erratic & paid+unpaid					-0.536	
					(0.308)*	
Erratic & unpaid					-0.767	
					(0.250)***	
Low extent paid						-0.211
						(0.221)
Low extent paid+unpaid						0.041
						(0.844)
Low extent unpaid						-0.319
						(0.321)
Medium extent paid						0.229
						(0.140)
Medium extent paid+unpaid						0.045
						(0.269)
Medium extent unpaid						0.016
						(0.218)
High extent paid						-0.008
						(0.188)
High extent paid+unpaid						-0.221
						(0.234)
High extent unpaid						-0.687
						(0.319)**
Control variables						
Sex (female)	0.006	0.018	0.007	0.008	0.019	0.011
	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)
Age	-0.058	-0.057	-0.058	-0.057	-0.057	-0.057
	(0.004)***	(0.005)***	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Born abroad	-0.431	-0.435	-0.419	-0.433	-0.422	-0.439
	(0.112)***	(0.112)***	(0.112)***	(0.112)***	(0.113)***	(0.112)***
Vocational school	0.577	0.571	0.580	0.565	0.580	0.561
	(0.123)***	(0.123)***	(0.123)***	(0.123)***	(0.123)***	(0.123)***

Table 3 (continued)

Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)
High school	1.071	1.080	1.068	1.069	1.080	1.072
	(0.145)***	(0.145)***	(0.145)***	(0.145)***	(0.145)***	(0.145)***
University	1.402	1.406	1.394	1.387	1.404	1.390
	(0.162)***	(0.162)***	(0.162)***	(0.162)***	(0.162)***	(0.163)***
Married/cohabiting	0.061	0.060	0.059	0.054	0.051	0.054
	(0.108)	(0.108)	(0.108)	(0.108)	(0.108)	(0.108)
Divorced/widowed	-0.319	-0.326	-0.319	-0.324	-0.338	-0.327
	(0.165)*	(0.166)**	(0.166)*	(0.165)**	(0.167)**	(0.166)**
Main earner	-0.143	-0.141	-0.144	-0.152	-0.141	-0.151
	(0.094)	(0.094)	(0.094)	(0.093)	(0.094)	(0.093)
Part-time	-0.147	-0.143	-0.145	-0.140	-0.140	-0.139
	(0.106)	(0.106)	(0.106)	(0.106)	(0.106)	(0.106)
Temporary position	0.439	0.445	0.444	0.427	0.448	0.431
	(0.158)***	(0.158)***	(0.158)***	(0.157)***	(0.158)***	(0.158)***
Job change	-0.443	-0.428	-0.443	-0.440	-0.431	-0.432
	(0.144)***	(0.145)***	(0.144)***	(0.144)***	(0.145)***	(0.146)***
Superior	-0.019	-0.017	-0.020	-0.024	-0.018	-0.026
	(0.081)	(0.081)	(0.081)	(0.081)	(0.082)	(0.081)
Company size (10-49)	-0.048	-0.043	-0.044	-0.061	-0.038	-0.060
	(0.101)	(0.101)	(0.101)	(0.101)	(0.102)	(0.102)
Company size (50+)	0.022	0.018	0.025	0.005	0.021	0.002
	(0.098)	(0.099)	(0.098)	(0.099)	(0.099)	(0.099)
Constant	8.082	8.075	8.080	8.077	8.071	8.083
	(0.214)***	(0.215)***	(0.214)***	(0.214)***	(0.215)***	(0.215)***
Threshold parameters						
parameter 1	2.161	2.161	2.161	2.161	2.161	2.161
	(0.155)***	(0.155)***	(0.155)***	(0.155)***	(0.155)***	(0.155)***
parameter 2	4.264	4.264	4.262	4.263	4.264	4.264
	(0.078)***	(0.078)***	(0.079)***	(0.078)***	(0.079)***	(0.078)***
parameter 3	6.485	6.489	6.486	6.485	6.491	6.490
	(0.070)***	(0.070)***	(0.070)***	(0.070)***	(0.070)***	(0.070)***
Number of observations	2968	2968	2968	2968	2968	2968
McFadden Pseudo R^2	0.073	0.074	0.073	0.073	0.075	0.075
Prob (Chi-sqd)	0.000	0.000	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

hitting upon significance when using such a general health indicator, and Artazcoz, et al. (2009), who found a significant relationship for six different health measures but not for self-perceived health status.

Turning to the control variables in column (1), it is apparent that age has the expected significant negative impact on general health. Being born outside of Austria, being divorced or widowed as compared to being single, and having changed job in the last 12 months are all factors associated with worse health. On the contrary, compared to only having completed compulsory education, graduates of all three higher education levels report significantly better health, with university graduates exhibiting the best health. Having a temporary job position as opposed to a permanent position is associated with better health. This latter result is rather

unexpected and not in line with previous research, which consistently reports better health for permanent employed workers (see e.g. Aronsson, et al., 2002; Virtanen, et al., 2005). Insignificant relationships in regression (1) are obtained for gender, being married or cohabiting as compared to being single, being the main earner of the household, working part-time, being a superior at the workplace, and the company size. These results for the control variables hold true for all six specifications of the estimation model (see Table 3).

The above interpretation of the regression results is, however, not that clear-cut. The use of an ordered logit model for the estimation makes the correct inference of the sign and value of any regression coefficient more complicated than in an OLS model. As is explained in Greene (1993), the interpretation of the sign is only unambiguous for the lowest and highest category of general health status, i.e. very poor and very good health, respectively. How a change in an explanatory variable affects the three other health categories in between the two extremes depends on the actual probability distribution of the dependent variable. For a correct inference of both sign and value of a regression coefficient it is necessary to consider marginal effects. Marginal effects show how a change in the explanatory variable by one unit (e.g. for a dummy variable: being born abroad as opposed to being born in Austria; for a continuous variable: an age increase by one year) affects the probability of reporting a specific health category. Table 4 displays the marginal affects for regression (1) of Table 3. Note that all marginal effects were calculated at mean values.

Table 4: Marginal effects for regression (1) of Table 3 (in percentage points)

	Category				
Variable	Very poor	Poor	Fair	Good	Very good
Overtime	0.0	0.1	0.9	1.5	-2.5
Sex (female)	-0.0	-0.0	-0.1	-0.1	0.2
Age***	0.0	0.1	0.5	0.9	-1.4
Born abroad***	0.1	0.7	4.0	5.8	-10.5
Vocational school***	-0.1	-0.8	-4.9	-8.4	14.2
High school***	-0.1	-1.0	-6.9	-17.8	25.9
University***	-0.2	-1.2	-8.0	-23.2	32.5
Married/cohabiting	-0.0	-0.1	-0.5	-0.9	1.5
Divorced/widowed*	0.1	0.5	2.9	4.4	-7.8
Main earner	0.0	0.2	1.2	2.2	-3.6
Part-time	0.0	0.2	1.3	2.2	-3.7
Temporary position***	-0.1	-0.4	-3.2	-7.2	10.9
Job change***	0.1	0.7	4.2	5.8	-10.8
Superior	0.0	0.0	0.2	0.3	-0.5
Company size (10-49)	0.0	0.1	0.4	0.7	-1.2
Company size (50+)	-0.0	-0.0	-0.2	-0.3	0.6

Note: Negative marginal effects in red;
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ in the regression (see Table 3)

In general, Table 4 reveals that a positive estimate in the regression output (Table 3) decreases the probability of being in one of the four lowest health categories and increases the probability of being in the highest category, i.e. very good health status. Conversely, a negative coefficient in Table 3 indicates an increase in the probability of reporting to be in the four lowest categories and a corresponding decrease in the probability for the highest category. Thus, e.g. an individual who was born abroad (negative estimate) has a 10.5 percentage points lower probability of reporting very good health than an individual born in Austria. At the same time it has a 5.8 percentage points higher probability of reporting good health, a 4.0 percentage points higher probability of reporting fair health, etc. (see Table 4). The biggest marginal effects on general health status among the control variables (in descending order) are found for university graduates, high school graduates, and vocational school graduates as compared to compulsory school graduates, having a temporary position, having changed job within the last 12 months, being born abroad, and being divorced or widowed as compared to being single.

The regression presented in column (2) of Table 3 focuses on the monetary aspect of overtime. For the two groups of workers, who receive either full remuneration for all hours of overtime or only remuneration for certain hours, no significant effects are found. Thus, their perception of their general health status resembles that of non-overtime workers. For paid overtime workers this result is in accordance with the derived hypothesis in Section 3. It seems that the negative health effects that come along with the reduced leisure time and a potentially unhealthier lifestyle are counterbalanced by the increasing opportunity to consume health-enhancing services. For unpaid overtime the hypothesis is a negative effect on health. Indeed, this negative relationship for unpaid overtime is found. Looking at the marginal effects, unpaid overtime workers' probability of reporting the highest health category is 9.1 percentage points lower than that of non-overtime workers (see Table 5).

The estimation in column (3) of Table 3 looks at the regularity aspect of overtime. Regularly carried out overtime is not found to be significant. In contrast, erratically performed overtime does have a significantly negative impact on health. In fact, erratic overtime workers' probability of reporting a very good general health status is 10.6 percentage points lower compared to non-overtime workers (see Table 5). This result was hypothesized based on the findings of Greco & Roger (2003), who argued that individuals, who are faced with uncertainty, exhibit a worse state of health. Individuals confronted with erratic overtime find

themselves in a situation of uncertainty. The factor of uncertainty might however be only one possible explanation. Furthermore, Greco & Roger (2003) did not derive their conclusion in the context of "uncertainty as to when to do overtime and how many hours to spend on it".

Table 5: Marginal effects for the regressions (2) to (6) of Table 3 for the overtime variable (in percentage points)

	Category				
Variable	Very poor	Poor	Fair	Good	Very good
(2) Only paid overtime	-0.0	-0.1	-0.3	-0.6	1.0
(2) Paid+unpaid overtime	0.0	0.2	1.4	2.3	-4.0
(2) Only unpaid overtime***	0.1	0.6	3.5	5.0	-9.1
(3) Regular overtime	0.0	0.1	0.4	0.8	-1.3
(3) Erratic overtime***	0.1	0.7	4.2	5.6	-10.6
(4) Low-extent	0.0	0.1	0.4	0.8	-1.3
(4) Medium-extent	-0.0	-0.2	-1.4	-2.8	4.4
(4) High-extent	0.0	0.3	1.8	2.8	-4.9
(5) Regular & paid	-0.0	-0.1	-0.4	-0.7	1.2
(5) Regular & paid+unpaid	0.0	0.2	1.0	1.8	-3.0
(5) Regular & unpaid	0.1	0.4	2.3	3.6	-6.3
(5) Erratic & paid	-0.0	-0.0	-0.2	-0.3	0.5
(5) Erratic & paid+unpaid*	0.1	0.9	5.4	6.5	-12.8
(5) Erratic & unpaid***	0.2	1.4	8.3	8.0	-17.9
(6) Low extent paid	0.0	0.3	1.9	3.0	-5.2
(6) Low extent paid+unpaid	-0.0	-0.1	-0.3	-0.6	1.0
(6) Low extent unpaid	0.1	0.5	3.0	4.3	-7.8
(6) Medium extent paid	-0.0	-0.3	-1.8	-3.7	5.7
(6) Medium extent paid+unpaid	-0.0	-0.1	-0.4	-0.7	1.1
(6) Medium extent unpaid	-0.0	-0.0	-0.1	-0.3	0.4
(6) High extent paid	0.0	0.0	0.1	0.1	-0.2
(6) High extent paid+unpaid	0.0	0.3	2.0	3.1	-5.5
(6) High extent unpaid***	0.2	1.2	7.2	7.6	-16.2

Note: Negative marginal effects in red;
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ in the regression (see Table 3);
The corresponding marginal effects for the control variables for each regression are not shown in this paper, because they are virtually identical to the ones in Table 4.

The regression results for the fourth dimension of overtime - the temporal extent - are shown in column (4) of Table 3. As explained before, only regular overtime workers, who are found to not differ from non-overtime workers in regression (3), entered the three extent-dummy variables. All three dummies representing low extent (1 to 10 hours of overtime per month), medium extent (11 to 24 hours), and high extent (25 and more hours) of overtime are insignificant. These findings partly confirm the results of Taris, et al. (2011), who suggested that a moderate extent of overtime (less than 5 hours per week) does not pose a major risk to workers' health. Up to five hours per week would roughly comprise the low and medium-

extent dummy of this study. However, Taris, et al. (2011) noted that a higher extent of overtime involves a health risk. The high extent dummy of this study cannot support this previous finding (at a p-value of 0.17).

Having looked at the different dimensions of overtime separately, it seems natural to interrelate the different aspects in a final step. This is done in the estimations shown in column (5) and (6) of Table 3. The regularity and the remuneration aspect are linked up with each other in column (5). The combination of erratically occurring and partially paid overtime is found to have a significantly negative effect as well as the combination of erratically occurring and unpaid overtime. The probability of workers claiming to be in a very good health state is 12.8 percentage points lower for the former group and 17.9 percentage points lower for the latter group as compared to non-overtime workers (see Table 5). The combination of regular unpaid overtime only misses to hit upon a negative significance by a narrow margin (p-value of 0.12). In column (6) the temporal extent and the remuneration aspect are being interrelated. Only the combination of unpaid overtime at a high extent is significantly negative. Those workers' probability of stating to be in a very good state of health is 16.2 percentage points lower than that of non-overtime workers (see Table 5).

Sensitivity Analysis

One objection to the obtained results above is that the sample contains both full-time and part-time workers. One could suspect that the health effects of overtime are different for these two groups and e.g. argue that part-time workers are less prone to health effects, because their total number of working hours is in most cases below the number of contractual hours of full-time workers. In order to address that issue a sensitivity analysis is carried out, which repeats the previous estimations (1) to (4) separately for full-time workers and part-time workers[13]. The corresponding tables of the regression results (Table A1 and Table A3) and the marginal effects (Table A2 and Table A4) can be found in the appendix.

Table A1 and Table A3 reveal that for both full-time and part-time workers the pattern for the different dimensions of overtime is identical to the full sample. That is to say that the estimate for overtime is negative but insignificant. Unpaid overtime is still the only manifestation of the remuneration aspect that is significantly associated with adverse health, as is erratic overtime in the regularity aspect. Lastly neither of the three extent dummies is significant for

[13] The estimations (5) and (6) are omitted in this analysis due to a too small sample size for part-time workers.

both full-time and part-time workers. Thus, the obtained results for the different dimensions of overtime with the full sample seem to be robust.

Notable changes only emerge for the control variables. Being the full-time working main earner of the household is associated with a worse state of health (in three of the four estimations), whereas health differences between full-time working separated or divorced people and full-time working singles become insignificant (see Table A1). Part-time working women report a significantly better health than part-time working men (see Table A3). The probability of those females to state a very good health is 14.5 percentage points higher than for males (see Table A4). Finally, temporarily employed part-time workers' health is no longer significantly different from permanently employed part-time workers' health (see Table A3).

Study limitations

The first and foremost limitation of this study is the cross-sectional setting in which the results are produced. The fact that it is only possible to relate current – though to a certain degree regularly recurring – incidence of overtime to current general health status does not allow for a causal interpretation of the effects of overtime on health. Statistics Austria does provide yearly data of the EU-SILC from 2003 to 2007 but, unfortunately, it is not possible to connect the observations of these years in order to create a panel and address this drawback. In fact, Statistics Austria only provides 50% sub-samples of each year's survey. For that reason it is being cautioned that the representativeness of the samples is subject to a larger variation (Statistik Austria, 2012). Consequently, any results may not be entirely indicative of the Austrian population.

Apart from this threat to the external validity of the results, omitted confounding variables pose a possible threat to the internal validity of this study. Unobserved time-invariant variables, which influence both workers' perception of health and predisposition to do overtime, are a potential candidate for such a problem. For instance, workers with certain personality characteristics (e.g. high work-related ambition) might be more predisposed to do overtime and at the same time perceive their health in different way than workers lacking that characteristics.

Another limitation of this study is the use of very general health measures. For those, the overtime variable is suspect to be endogenous. As explained, the relationship between overtime and chronic disease was indeed suffering from reverse causality. This was not the case for general health status, but it is still a rather crude measure. It would be desirable to look in addition at more specific – both physiological and psychological – health outcomes. As previous research suggests, for those the health effects of working overtime might be even more pronounced than for overall health.

Furthermore, encompassing only five categories the general health status variable is itself rather crude. As Table 1 has shown, most observations fall into the two highest categories. More than 85 percent of all observations perceive their health status as either being "good" or "very good". A scale from e.g. 1 to 10 would allow for more variation in the dependent variable and might yield even clearer results.

The last concern pertains to the way information about overtime was elicited in the EU-SILC questionnaire. The preceding question of the question regarding whether an individual works overtime asks for how many hours *per week* one is usually working disregarding any hours of working overtime. The two questions following the yes-or-no-question about overtime ask for the number of paid and unpaid hours of overtime *per month*, respectively. Even though the survey interviews are carried out by means of trained interviewers, it might lead to confusion whether to state weekly or monthly hours of overtime for the two latter questions. Even if only a small part of individuals stated weekly instead of monthly hours of overtime, would it bias the results involving the temporal extent downwards or make them (as in this study) insignificant. And finally, it simply seems to be easier to report weekly overtime hours and give a more precise account of them.

6. Conclusion

The aim of this paper was to study the health effects of working overtime. Previous research regarded overtime mainly as a one-dimensional concept. This paper demonstrated that this one-dimensional representation of overtime is too crude and that the multi-dimensional character needs to be considered instead. Thus, in addition to simply relating overtime to a health measure, the remuneration (paid vs. unpaid), the regularity (regularly-recurring vs.

erratically occurring), and the temporal extent (low vs. high extent) of overtime were the three dimensions specifically focused upon.

The empirical analysis drew on data from the EU-SILC for Austria for the year 2007. The analysis showed that overtime is endogenous for chronic disease and thus chronic disease was an unsuitable measure to study the health outcomes. Therefore, the empirical findings of this study were solely based on general health status as a measure of health. Somewhat contrary to previous research, the first basic result was that no immediate relationship between health status and overtime was found. However, a more detailed look at the different dimensions did reveal significantly adverse health effects. Unpaid overtime was found to negatively affect workers' health, while both fully and partially paid overtime did not seem to do so. In a similar manner, no significance was found for regularly recurring overtime, whereas erratically occurring overtime was associated with an adverse health effect. The evidence for a relation between the temporal extent of overtime and health was weak. It was only the combination of working unpaid overtime at a high extent (i.e. more than 25 hours per month) that showed a distinctly detrimental effect on workers' general health status. Lastly, the interrelation of the remuneration aspect and the regularity aspect indicated that erratically occurring overtime has a significantly negative effect, if overtime is not paid for or if it is only partially paid for.

The two main limitations of this study emerged from the fact that the estimation drew on cross-sectional data. Relating current incidence of overtime to current general health status did not allow for a causal interpretation of the described health effects. Even though it was possible to control for a wide range of demographic and job-related variables, the existence of omitted confounding variables could not be ruled out. Future research has to address these two limitations. Investigating the health effects of working overtime with panel data would yield such causal effects and at least eradicate the problem of omitted confounding time-invariant variables.

Since the Industrial Revolution, workers have been fighting for better working conditions and have managed to put forward the case for the establishment of proper working standards, one of which concerning the amount of working hours. A fair amount of weekly working hours should allow workers to have sufficient time for recovery and non-work related activities. Nevertheless, working overtime is part of the weekly routine for a large fraction of

employees. In fact, the analyzed data showed that this applies to almost one third of all employees in Austria. One issue that generates a great deal of concern is the remuneration of overtime workers. Even though labor laws in 2007 required that all hours of overtime of full-time workers[14] had to be awarded with at least a 50% wage premium in addition to the standard wage rate, the occurrence of both partially paid and unpaid overtime is a fact. The data revealed that 19% of overtime performing full-time workers received remuneration for only a certain part of the total overtime hours and a further 23% did not receive any payments. Thus, these figures indicated a rather weak compliance with labor laws. An obvious policy recommendation to put forward is stricter law enforcement in order to curb the incidence of unpaid overtime. The results of this paper suggest that employees' health is likely to benefit from such actions.

[14] Until the year 2007 part-time workers were not eligible for the 50% overtime premium. Instead, overtime hours of part-time workers had to be remunerated at the standard wage rate. This changed in 2008. Ever since then all hours of overtime of part-time workers must be at least awarded with a 25% overtime premium (Wirtschaftskammer Österreich, 2012).

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Appendix

Table A1: Results for general health status of full-time workers (for marginal effects see Table A2)

Explanatory variable	(1)	(2)	(3)	(4)
Overtime	-0.119			
	(0.090)			
Only paid overtime		-0.005		
		(0.110)		
Paid+unpaid overtime		-0.194		
		(0.159)		
Only unpaid overtime		-0.348		
		(0.157)**		
Regular overtime			-0.075	
			(0.095)	
Erratic overtime			-0.423	
			(0.182)**	
Low-extent				-0.070
				(0.131)
Medium-extent				0.162
				(0.155)
High-extent				-0.219
				(0.144)
Control variables				
Sex (female)	-0.094	-0.084	-0.093	-0.091
	(0.099)	(0.099)	(0.099)	(0.099)
Age	-0.059	-0.058	-0.059	-0.058
	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Born abroad	-0.357	-0.360	-0.348	-0.362
	(0.128)***	(0.129)***	(0.129)***	(0.128)***
Vocational school	0.637	0.633	0.643	0.619
	(0.151)***	(0.152)***	(0.152)***	(0.151)***
High school	1.238	1.249	1.237	1.230
	(0.173)***	(0.173)***	(0.172)***	(0.172)***
University	1.561	1.568	1.554	1.533
	(0.200)***	(0.200)***	(0.199)***	(0.200)***
Married/cohabiting	0.077	0.073	0.076	0.074
	(0.119)	(0.119)	(0.119)	(0.119)
Divorced/widowed	-0.262	-0.276	-0.262	-0.265
	(0.185)	(0.186)	(0.185)	(0.185)
Main earner	-0.178	-0.173	-0.177	-0.189
	(0.107)*	(0.107)	(0.107)*	(0.106)*
Temporary position	0.540	0.547	0.547	0.522
	(0.158)***	(0.184)***	(0.183)***	(0.182)***
Job change	-0.341	-0.322	-0.340	-0.339
	(0.166)**	(0.168)*	(0.166)**	(0.166)**
Superior	0.015	0.017	0.013	0.010
	(0.092)	(0.092)	(0.092)	(0.092)
Company size (10-49)	-0.068	-0.064	-0.061	-0.086
	(0.121)	(0.122)	(0.122)	(0.122)
Company size (50+)	-0.010	-0.016	-0.006	-0.031
	(0.116)	(0.116)	(0.116)	(0.116)
Constant	7.953	7.943	7.949	7.957
	(0.245)***	(0.245)***	(0.244)***	(0.245)***
Threshold parameters				
parameter 1	2.152	2.152	2.152	2.152
	(0.155)***	(0.173)***	(0.173)***	(0.173)***

Table A1 (continued)

Explanatory variable	(1)	(2)	(3)	(4)
parameter 2	4.145	4.146	4.145	4.144
	(0.078)***	(0.091)***	(0.091)***	(0.091)***
parameter 3	6.369	6.372	6.370	6.369
	(0.080)***	(0.080)***	(0.081)***	(0.081)***
Number of observations	2330	2330	2330	2330
McFadden Pseudo R^2	0.078	0.079	0.079	0.078
Prob (Chi-sqd)	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

Table A2: Marginal effects for the regressions with full-time workers of Table A1 (in percentage points)

	Category				
Variable	Very poor	Poor	Fair	Good	Very good
(1) Overtime	0.0	0.2	0.9	1.8	-3.0
(2) Only paid overtime	0.0	0.0	0.0	0.1	-0.1
(2) Paid+unpaid overtime	0.0	0.3	1.6	2.9	-4.8
(2) Only unpaid overtime**	0.1	0.5	3.0	4.9	-8.6
(3) Regular overtime	0.0	0.1	0.6	1.2	-1.9
(3) Erratic overtime**	0.1	0.7	3.8	5.8	-10.4
(4) Low-extent	0.0	0.1	0.6	1.1	-1.8
(4) Medium-extent	-0.0	-0.2	-1.2	-2.6	4.1
(4) High-extent	0.0	0.3	1.8	3.2	-5.4
Sex (female)	0.0	0.1	0.7	1.5	-2.3
Age***	0.0	0.1	0.5	0.9	-1.5
Born abroad***	0.1	0.6	3.1	5.1	-8.8
Vocational school***	-0.1	-0.9	-5.2	-9.6	15.8
High school***	-0.2	-1.2	-7.3	-20.6	29.3
University***	-0.2	-1.3	-8.0	-25.6	35.1
Married/cohabiting	-0.0	-0.1	-0.6	-1.2	1.9
Divorced/widowed	0.1	0.4	2.2	3.8	-6.5
Main earner*	0.0	0.2	1.4	2.8	-4.4
Temporary position***	-0.1	-0.6	-3.6	-9.1	13.4
Job change**	0.1	0.5	3.0	4.8	-8.4
Superior	-0.0	-0.0	-0.1	-0.2	0.4
Company size (10-49)	0.0	0.1	0.5	1.1	-1.7
Company size (50+)	0.0	0.0	0.1	0.2	-0.3

Note: Negative marginal effects in red;
* p < 0.1, ** p < 0.05, *** p < 0.01 in the regression (see Table A1)
The marginal effects of the control variables correspond to regression (1) of Table A1; The marginal effects of the control variables for the regressions (2) to (4) are virtually identical.

Table A3: Results for general health status of part-time workers (for marginal effects see Table A4)

Explanatory variable	(1)	(2)	(3)	(4)
Overtime	-0.222			
	(0.270)			
Only paid overtime		0.327		
		(0.429)		
Paid+unpaid overtime		-0.347		
		(0.566)		
Only unpaid overtime		-0.728		
		(0.380)*		
Regular overtime			-0.116	
			(0.306)	
Erratic overtime			-0.817	
			(0.387)**	
Low-extent				-0.045
				(0.392)
Medium-extent				0.029
				(0.472)
High-extent				-1.085
				(1.078)
Control variables				
Sex (female)	0.631	0.628	0.641	0.620
	(0.282)**	(0.284)**	(0.283)**	(0.280)**
Age	-0.054	-0.054	-0.054	-0.053
	(0.010)***	(0.010)***	(0.010)***	(0.010)***
Born abroad	-0.580	-0.587	-0.543	-0.572
	(0.241)**	(0.243)**	(0.243)**	(0.244)**
Vocational school	0.556	0.539	0.546	0.573
	(0.229)**	(0.231)**	(0.230)**	(0.229)**
High school	0.676	0.676	0.663	0.708
	(0.294)**	(0.293)**	(0.294)**	(0.293)**
University	1.176	1.183	1.167	1.202
	(0.290)***	(0.294)***	(0.292)***	(0.290)***
Married/cohabiting	-0.063	-0.034	-0.057	-0.095
	(0.280)	(0.280)	(0.280)	(0.279)
Divorced/widowed	-0.699	-0.635	-0.695	-0.721
	(0.390)*	(0.395)	(0.392)*	(0.387)*
Main earner	0.125	0.101	0.119	0.118
	(0.213)	(0.212)	(0.212)	(0.211)
Temporary position	0.184	0.207	0.176	0.178
	(0.343)	(0.345)	(0.343)	(0.344)
Job change	-0.860	-0.868	-0.867	-0.862
	(0.313)***	(0.313)***	(0.315)***	(0.315)***
Superior	-0.209	-0.195	-0.200	-0.219
	(0.187)	(0.187)	(0.187)	(0.186)
Company size (10-49)	0.047	0.044	0.039	0.028
	(0.191)	(0.191)	(0.191)	(0.192)
Company size (50+)	0.186	0.183	0.181	0.163
	(0.201)	(0.202)	(0.201)	(0.200)
Constant	8.029	8.045	8.011	8.027
	(0.524)***	(0.525)***	(0.525)***	(0.518)***
Threshold parameters				
parameter 1	2.224	2.221	2.223	2.222
	(0.364)***	(0.365)***	(0.365)***	(0.364)***
parameter 2	4.815	4.813	4.809	4.813
	(0.151)***	(0.152)***	(0.152)***	(0.151)***

Table A3 (continued)

Explanatory variable	(1)	(2)	(3)	(4)
parameter 3	7.086 (0.140)***	7.098 (0.141)***	7.085 (0.141)***	7.087 (0.141)***
Number of observations	638	638	638	638
McFadden Pseudo R^2	0.066	0.069	0.067	0.066
Prob (Chi-sqd)	0.000	0.000	0.000	0.000

Note: Robust standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

Table A4: Marginal effects for the regressions with part-time workers of Table A3 (in percentage points)

	Category				
Variable	Very poor	Poor	Fair	Good	Very good
(1) Overtime	0.0	0.2	2.3	2.7	-5.3
(2) Only paid overtime	-0.0	-0.3	-2.9	-4.9	8.1
(2) Paid+unpaid overtime	0.1	0.4	3.8	3.9	-8.2
(2) Only unpaid overtime*	0.1	0.9	8.9	6.3	-16.3
(3) Regular overtime	0.0	0.1	1.2	1.5	-2.8
(3) Erratic overtime**	0.1	1.2	10.5	6.0	-17.8
(4) Low-extent	0.0	0.0	0.5	0.6	-1.1
(4) Medium-extent	-0.0	-0.0	-0.3	-0.4	0.7
(4) High-extent	0.2	1.8	15.1	5.3	-22.4
Sex (female)**	-0.1	-0.8	-7.4	-6.2	14.5
Age***	0.0	0.1	0.5	0.7	-1.3
Born abroad**	0.1	0.7	6.7	6.0	-13.4
Vocational school**	-0.1	-0.5	-5.6	-7.3	13.4
High school**	-0.1	-0.5	-5.6	-10.5	16.7
University***	-0.1	-0.8	-8.8	-18.9	28.5
Married/cohabiting	0.0	0.1	0.6	0.9	-1.5
Divorced/widowed*	0.1	0.9	8.4	6.4	-15.8
Main earner	-0.0	-0.1	-1.2	-1.7	3.1
Temporary position	-0.1	-0.2	-1.7	-2.6	4.5
Job change***	0.2	1.2	10.89	6.7	-18.9
Superior	0.0	0.2	2.0	2.7	-5.0
Company size (10-49)	-0.0	-0.0	-0.5	-0.6	1.2
Company size (50+)	-0.0	-0.2	-1.8	-2.6	4.5

Note: Negative marginal effects in red;
* p < 0.1, ** p < 0.05, *** p < 0.01 in the regression (see Table A3)
The marginal effects of the control variables correspond to regression (1) of Table A3; The marginal effects of the control variables for the regressions (2) to (4) are virtually identical.