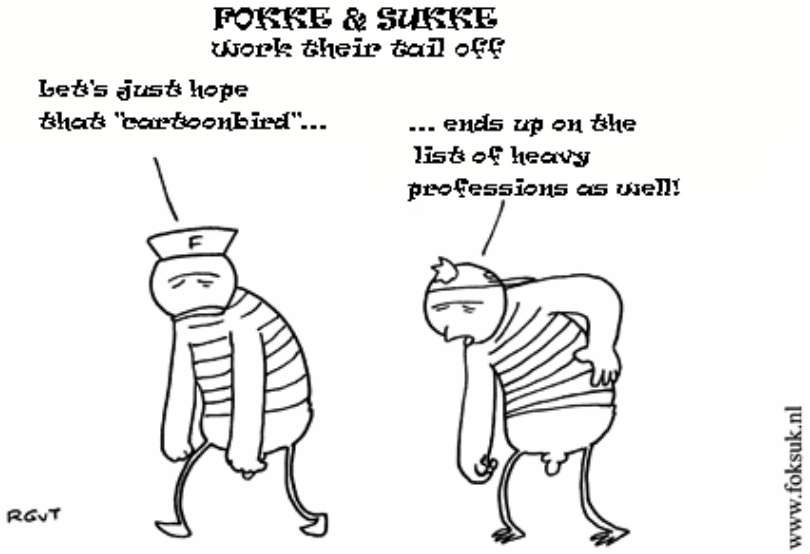
THE EFFECT OF JOB CHARACTERISTICS ON HEALTH

A EUROPEAN UNION DATA ANALYSIS

MASTER'S THESIS HEALTH ECONOMICS, ERASMUS SCHOOL OF ECONOMICS.



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ABSTRACT

OBJECTIVE – The objective of this thesis is to find evidence on the effect of job characteristics on health. This is done on the basis of hypotheses based on the dominant literature in this field of study: the demand-control model of Karasek (1979), the Whitehall studies (Marmot et al., 1991), the effort-reward imbalance model (Siegrist, 1996) and the work of economist, amongst others Case & Deaton (2005).

METHODS – This thesis is based on the fifth wave (year 2010) of the European Working Conditions Survey (EWCS), conducted by the European Foundation for the Improvement of Living and Working Conditions (EFILWC). Statistical analysis was performed, mainly using ordered logistic regression analysis.

FINDINGS – Low job control at work is negatively related to health, and so is high job demand. However, the combination of both does not reinforce the negative effect. High effort has a negative impact on health. There might be a possibility that this negative effect can be partly offset by the positive effect of reward, but it is rejected that, if properly rewarded, high effort does not have a negative impact on health. No evidence is found for the economics hypothesis that high effort is compensated for in terms of reward.

PRELUDE

Dear reader,

Before you lies my Master's Thesis, the research project that finalizes my academic career at Erasmus University Rotterdam. I think this prelude is the perfect place to thank some people for their help and support:

First off all, I would like to express my appreciation to my supervisor Hans van Kippersluis for his critical view on my thesis and his positive attitude regarding it. Thank you!

Secondly, I would like to thank my friend Anne for the notes on this thesis and the suggestions for improvement she provided. And Thomas, I would especially like to thank you for all the mental support during the writing process!

Finally, my thanks go out to my parents Henny and Diederik, who have always supported and motivated me to study and develop myself!

Hopefully you will enjoy reading this thesis.

Kind regards,

Vera Luggenhorst

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CHAPTER 1: INTRODUCTION

1.1 THE PROBLEM UNDER RESEARCH

Throughout Europe, a declining fertility and a rising life expectancy result in an ageing population. The perhaps dated pension systems, rising health care costs and the affordability of the welfare state in general, are of concern and therefore widely discussed. A critical look at the system is needed. Drastic reforms on various fronts are eventually unavoidable.

A possible element of the reforms is an increase of the mandatory retirement age. The cost of the welfare state can then be paid for by a larger part of the population. Arguments against this option are that it may be unfeasible for or unfair to people with a so-called "heavy profession". Unfeasible, because this group may have a faster deteriorating health compared to others, and are therefore not able to lengthen their productive life. Unfair, when these people have a shorter life expectancy, and are therefore expected to have relatively fewer days left to enjoy their retirement benefits.

There is no agreement yet on the definition of a "heavy profession". Economists, however, have reached consensus about the positive relation between social status and health. Workers lower on the occupational ladder usually report relatively poorer health (Case & Deaton, 2005).

1.2 CONTEXT

Being more precise about what causes the health gap for this group of workers, will help to say something substantial about what is in fact a "heavy profession". This gives rise to academic research that pays specific attention to the causes of the health burden related to the working situation. For that reason, this thesis seeks for a better understanding of what specific job characteristics (both physically and psychologically) are harmful to health.

1.3 RELEVANCE

In the literature, widely available evidence confirms that physical demands at the job affect health status. There is also some research available about the psychosocial job characteristics that influence health. However, the possibilities of self-selection of individuals with certain health states into certain professions is not always properly taken into account. Moreover, researches have not always succeeded in clustering both the physical and psychosocial aspects.

In this thesis, emphasis will be put on specific job characteristics instead of binary classifications or specific occupations, as each occupation is a unique combination of many job characteristics with all its specific aspects. It are the harmful job characteristics that need to be discerned, to be able to designate the persons that deserve or need early retirement. Furthermore, this information is an input to be able to improve working conditions, to strive towards working situations wherein all workers are able to work until the same retirement age.

1.4 RESEARCH QUESTION

For the remainder of this thesis, on the basis of the introduction above, the following research question is composed:

What is the effect of job characteristics on health?

CHAPTER 2: THEORY

This chapter is about the theory surrounding the subject of this thesis: the relation between job characteristics and health. To start, a brief outline is provided of existing literature about the effect of occupation or job characteristics on health. Distinction will be made between two theoretical frameworks. The first will focus on the relation between job demand and job control, whereas the second will focus on effort and reward. At the end of each theoretical framework, the hypotheses to be tested in this thesis will be stated.

2.1 THEORETICAL FRAMEWORK 1: DEMAND & CONTROL

The first model to be discussed is the demand-control or job-strain model. The leading implication of this model is that increasing job demand simultaneously with decreasing job decision latitude is expected to increase job strain. By job strain the interaction between job demand and job control is meant, which occurs in case of a mismatch between those two factors (Karasek, 1979).

Job demand depends on stressors existing in the work setting, where the focus is on the psychological aspects. Psychological job demand can result from working fast and hard, for example from finishing the work load, getting unforeseen tasks, and having personal conflicts related to work.[1] Psychological job characteristics are considered to be negatively correlated to health (Karasek, 1979).

Job control refers to the potential control of a worker on his work assignments and behaviour. Possible measures for job decision latitude are workers decision autonomy on the work floor and the degree of skill discretion. Importantly, "constraints on decision making, not decision making per se, are the major problem, and this problem affects not only executives but workers in low status jobs with little freedom for decision (Karasek, 1979)." Job control is considered to be positively related to health (Karasek, 1979).

In line with the above theory of Karasek (1979), from the Whitehall studies (Marmot et al., 1991) [2] it can be concluded that, to explain social inequalities in health, one must go further than discrepancy in health services or life style. One of the possible explanations for differences in the prevalence and incidence of diseases, next to for example genetically different risk factors, is the difference in work environment. As an important factor in the working environment, again the psychosocial factor "low job control" is emphasized (Marmot et al., 1991).

The Whitehall studies name the role of job control and job support as possible explanations for the (persistent) mortality differences (Marmot, Kogevinas, & Elston, 1987). After conducting analysis, the Whitehall 2 studies indeed conclude that low control, but – in contrast to the theory in the demand-control model outlined above – not high demand, at work is related to the increased incidence of coronary heart disease (Marmot, Bosma, Hemingway, Brunner, & Stansfeld, 1997).

[1] Physical job characteristics, like carrying heavy loads, may affect job strain via other mechanisms, which may bias the results. A self-evident effect of physical labour could be a deteriorating health. Therefore, it may be necessary to control for physical job characteristics, to be able to find the effect of psychological job characteristics specifically.

[2] The Whitehall studies confirm the presence of the often put forward social gradient in mortality. The concepts of rank and social status are brought into the theory of job demand in these studies, i.e. why and how is health status affected by grade of employment or being part of a certain social class (Marmot et al., 1991).

All in all, the Whitehall studies on the one side, and the demand-control model of Karasek (1979) on the other side, thus disagree about the effect of high job demand on health. This results in two alternative hypotheses to be tested:

HYPOTHESIS 1

a. Low job control at work is negatively related to health (Whitehall).
b. Low job control in combination with high job demand at work is negatively related to health (Karasek).

2.2 THEORETICAL FRAMEWORK 2: EFFORT & REWARD

In this second theoretical framework, the relation between job characteristics and health is looked at from an economist's point of view. In the working paper of Case & Deaton (2005), the decline of health over the life-time is broken down by occupation, gender, sex and income. Remarkable differences are found. Before retirement age, women have better self-reported health status in both the top and bottom quartile of the income distribution. For the top quartile, this dissimilarity remains, whereas for the bottom quartile this is conversed after retirement age. Next, they show that people with manual occupation report worse health.

In the well-known theoretical framework called the Grossman model, where a model is constructed to determine the demand for health, people have three kinds of capital. These are assumed to be substitutable to a certain extent. The first, health capital, is more equally distributed over the population compared to the other two, human capital and financial capital. This is explained by the fact that most people start their lives with a healthy body, while not every individual grows up in similar wealth or is equally stimulated to study hard. The Grossman model predicts that people, who possess less human and financial capital, are more reliant on health capital: their body. Besides, health decreases with age, and it decreases more rapidly when the body is used intensively. Consequently, it decreases more rapidly for those who possess less human and financial capital. The health capital can fortunately also be increased by health investments (Grossman, 1972).

The process of health decision making can be described as an economic problem in which consumers search for an optimum by deriving marginal costs and marginal benefits of health investment. Constraints are given by the initial endowment of the different forms of capital. Benefits can be both consumption or production benefits, where the first refers to feeling better and the latter refers to being able to perform tasks in a better way, which is very important in a working situation. Costs of health investment may be viewed as opportunity costs, the money and time spent on improving health could have been spent in a different manner (Muurinen & Le Grand, 1985).

Workers with better health are expected to be less likely to have a physically demanding job because their opportunity costs are higher. They have more health to lose when the depreciation rate of their health increases (Case & Deaton, 2005). Besides, poorer and less-educated people have a more constrained choice in optimizing the output of their health capital, as they rely heavily on their health capital and have fewer possibilities to invest in their health (Muurinen & Le Grand, 1985). Furthermore, once someone has a physically demanding occupation, and health care does not succeed in full health repair, the higher depreciation rate will result in an actual decline in health. Therefore, the health of the bodies of manual workers with low education or wealth will deteriorate faster with age (Case & Deaton, 2005). To sum up, the group of the poorer and less-educated workers is expected to end up in lower skilled occupations more often, and experiences a steeper decline in health as they get older (Muurinen & Le Grand, 1985).

Siegrist's effort-reward imbalance model states that high effort, for example in physically demanding jobs, does not affect health in a bad way if it results in a suitable reward. Compared to the demand-control model described in the first theoretical framework, the focus in this model is shifted from control towards reward (Siegrist, 1996). "Effort at work is spent as part of a socially organized exchange process to which society at large contributes in terms of rewards (Siegrist, 1996)." The imbalance from high cost or effort in combination with low gain or reward violates expectations of reciprocity in social interaction. Therefore it is possible that it leads to distressing experiences and results in undesirable health outcomes like depression. To illustrate,

having a high-demanding unsteady job on a high-level with few prospect for promotion relates to a stressful working context (Siegrist, 1996).

Effort is composed of intrinsic and extrinsic effort. The former corresponds to the motivation of the worker in a demanding situation; the latter corresponds to the demand on the job itself. Reward has three pillars: money, esteem or approval, and status control (Siegrist, 1996).

The compensating wage differential theory, developed by Adam Smith, predicts that a higher wage is needed in order to make an undesirable job acceptable to an individual. In a perfect market there would be no reason to differ from either a low-pay/low-effort or high-pay/high-effort combinations in work. In practice, however, there are many market imperfections that may prevent workers from ending up in a balanced effort-reward situation. In lower socio-economic groups, the effort-reward imbalance may be obstinate due to social constraints. The costs of becoming unemployed as a result of lowering effort are higher compared to the costs of keeping up the same effort, even if it is not balanced with reward (Siegrist, 1996).

Based on the theory above, this thesis aims to research whether high efforts indeed result in higher rewards via the market, or that workers do not always receive the appropriate compensation for their effort.

HYPOTHESIS 2

a. High effort has a negative impact on health.
b. If properly rewarded (money, esteem or approval, and status control), high effort does not have a negative impact on health (Siegrist).
c. If high effort has a negative impact on health, it is compensated for in another reward (Economists).

CHAPTER 3: METHODS

In short, this chapter outlines the chosen methodology to answer the research questions and test the hypotheses. For this purpose, the following is described in this chapter. First, a description of the dataset used to execute the research is given. Then, the sampling strategy is explained. Also, the variables used are illustrated and some descriptive statistics are provided. Finally, it is outlined how data analysis is used to test the hypotheses based on the before-mentioned dominant literature in the field of research of job characteristics and health.

3.1 DATA SELECTION

The dataset used for this thesis is the European Working Conditions Survey (EWCS), conducted by the European Foundation for the Improvement of Living and Working Conditions (EFILWC), and is funded from the general budget of the European Commission. The EWCS contains extensive, detailed information on physical environment, workplace design, working hours, work organisation, well-being, and social/colleague relationships in the workplace, founded on a wide range of questions.

Cottini & Lucifora (2010) point out why the dataset is very suitable to study the effects of working conditions on health. An important reason for this is that "the availability of a standard questionnaire across countries and waves reduces considerably the risk of measurement error in morbidity indicators and job attributes due to different wording of questions and variables coding (Cottini & Lucifora, 2010)."

Today, five waves of the years 1991, 1995, 2000 & 2001, 2005 and 2010 of the EWCS are available. However, the questionnaire is developed and adjusted, therefore the set-up of the dataset has changed slightly over time. Most importantly, the availability of variables varies per wave. A number of variables used to test hypotheses in this thesis were only available in the most recent wave. Fortunately, measurement over time was not required to find an answer to the research questions. Therefore, in this thesis only the most developed and recent dataset of the year 2010 is used.

3.2 SAMPLE STRATEGY

This study aims to provide cross-country evidence on the relationship between job characteristics and health. The choice to only use the EWCS data of 2010 will prevent biases as the questionnaire has changed over time. Furthermore, the countries taken into account in this thesis are the members of the EU in the survey year 2010. This is to preclude biases due to differences in legislation. At least to some extent, legislation in European Union countries will be similar due to European Union legislation.

Since the foundation of the European Union in 1952, with the entry of the first 12 EU member states, more countries have entered. The member states of the EU in 2010, with the year of entry between brackets, are: Austria (1995), Belgium (1952), Bulgaria (2007), Cyprus (2004), Czech Republic (2004), Denmark (1973), Estonia (2004), Finland (1995), France (1952), Germany (1952), Greece (1981), Hungary (2004), Ireland (1973), Italy (1952), Latvia (2004), Lithuania (2004), Luxembourg (1952), Malta (2004), Netherlands (1952), Poland (2004), Portugal (1986), Romania (2007), Slovakia (2004), Slovenia (2004), Spain (1986), Sweden (1995) and United Kingdom (1973) (European Union, n.d.).

3.3 VARIABLES

The choice of variables is based on the literature discussed in chapter 2. The variables, in their initial form, are listed below with the variable name in parenthesis.

DEPENDENT VARIABLES

Several dependent variables are conceivable to test the hypotheses, an overview is provided in table one, including some descriptive statistics. The main is self-rated health (srh), which reflects how the respondent values his/her own health in general, where index values 1-5 respectively correspond to a very bad, bad, fair, good and very good self-rated health. It can be considered as an overall measure of health and it covers all health aspects that are relevant to the respondent. Self-rated health is a common measure of health in academic research (Smith, 1999 ; Deaton & Paxson, 1998).

Alternatively, it will be considered whether the respondent has, over the last twelve months, suffered from the health problems depression (depr), overall fatigue (fatigue) or cardiovascular disease (cardio). When compared to self-rated health, these measures of health are more specific as they are directed at one aspect of health. Moreover, these measures are more objective compared to the self-assessed health measure.

The last alternative dependent variable is absenteeism for reasons of health problems (absent), which is an indirect, but objective, measure of health. It reflects, over the past 12 months, how many days the respondent has been absent from work for reasons of health problems. It is related to health, however it should be taken into account that one worker may stay home because of having a cold, while the other would still be present with laryngitis. It can nevertheless be seen as an important measure in economics, as one of the important spin-offs of good health is presence and productivity at work.

Statistics	Srh	Depr	Cardio	Fatigue	Absent
Mean	3.961	.113	-.065	.414	6.242
Median	4		0	0	0
SD	0.772	.317	.247	.492	19.811
N	35303	35234	35223	35252	34041
Min	1	0	0	0	0
Max	5	1	1	1	365

TABLE 1 – DESCRIPTIVE STATISTICS THE DEPENDENT VARIABLES

INDEPENDENT VARIABLES

JOB CONTROL

In line with the job strain model of Karasek (1979), the job control variables are split up into two categories: skill discretion and decision authority. High skill discretion means that a worker is stimulated to use his or her intellectual capabilities at work. Decision authority means that the worker has the freedom to decide on targets and how to achieve those targets.

The degree of skill discretion is determined by four variables. First, whether or not the main job of the respondent involves complex tasks (complex). Second, whether or not the main job of the respondent involves learning new things (learnnew). Third, whether or not the main job of the respondent is non-repetitive, i.e. does not involve short repetitive tasks of less than 10 minutes (nonrep). These three measures are dummy variables. Fourth, to what extent the respondent is

able to apply own ideas in work (applyideas), where value 1 indicates that the respondents is never, and value 5 indicates that the respondents is always able to apply own ideas in work.

Decision authority is reflected by three aspects. The first is whether the respondent is free to choose or change how to work (choose), which is interpreted as a summation of dummies indicating whether the respondent is able to choose or change the method, order and speed of tasks. The second is whether own decisions are allowed for the respondent (decision). It is composed by a summation of whether the respondent can decide on what is the division of tasks, who will be the head of the team and what is the timetable of work. The third is whether the respondent has a say over his/her work situation (havesay), when it comes to being consulted before targets are set, being involved in improving the work organisation, having a say in the choice of working partners and being able to influence decisions that are important for your work situation.

JOB DEMAND

Job demand, both physical and psychosocial, is reflected by the following variables. To start, a physical measure of working hard is included: whether the respondents job involves carrying or moving heavy loads (carry). Besides, it is considered whether the work of the respondent involves working at very high speed (highspeed), which is a both physically and psychologically demanding job characteristic.

Whether the respondent works in his or her free time in order to meet work demands (overtime) and has enough time to get his/her job done (enoughtime) reflect whether the respondent works under time pressure. In addition, a possible line of reasoning is that more work is more demanding, both physically and psychologically.

Finally, two psychologically demanding job characteristics are taken into account, namely whether the job involves tasks that are in conflict with the respondents' personal values (conflictingvalues) and whether the respondent experiences stress in work (stress).

EFFORT

The effort a worker invests in his job can be split up into two parts: intrinsic and extrinsic effort. The first refers to a workers need for control in a demanding work setting, the latter refers to demands and obligations on the job (Siegrist, 1996). The emphasis in this thesis will be on extrinsic effort, as measures for intrinsic effort, such as negative feelings related to coping with a demanding work setting, are difficult to measure and unfortunately not available in the EWCS dataset.

To determine whether the worker faces high effort conditions at work, it is considered whether the worker has to do piece work by checking whether earnings consist of piece rate or productivity payments (piecepay). Furthermore, it is taken into account whether the respondent has a monotonous job (monotonous), works in shifts (shifts) and has to work in his/her free time in order to meet work demands (overtime). Besides, the number of people under supervision of the respondent are considered (supervision), according to Siegrist (1996) this is closely associated with pressure at work.

Furthermore, the degree of stress at the workplace (stress), the amount of interruptions multiplied by whether these are perceived as disturbing (interruption), the inconsistency of working hours demanded in hours per week (inconsistenthw), and whether the worker faces difficult problems in his work (complex) are considered when determining effort at work.

REWARD

The possible societal rewards for a workers effort are money, esteem and status control (Siegrist, 1996). The first is measured by the monthly net earnings of the respondent (income) and whether payments are received on a regularly basis. The second is reflected by whether or not the manager of the respondent respects the respondent as a person (respect) and whether the respondent feels helped and supported by colleagues (colhelp) and the manager (manhelp). Status control, finally, is reflected by the type of contract of the respondent (contract) and whether the job offers good prospects for career advancement (prospects).

OVERVIEW VARIABLES

Below in table 2, 3 and 4 an overview of the dependent and independent variables is provided, including the abbreviations used in the equations in section 3.5. Additional descriptive statistics of the independent variables are provided in appendix A.

Main		**Alternatives**	
Variable name	*Abbreviation*	*Variable name*	*Abbreviation*
Self-rated health	srh	Overall fatigue	fatigue
		Depression or anxiety	depr
		Cardiovascular diseases	cardio
		Absenteeism for health reasons	absent

TABLE 2 - OVERVIEW DEPENDENT VARIABLES.

Job control				**Job demand**	
Skill discretion		*Decision authority*			
Variable name	*Abbreviation*	*Variable name*	*Abbreviation*	*Variable name*	*Abbreviation*
Complex	complex	Choose	choose	Carry	carry
Learn new	learnnew	Decision	decision	High speed	highspeed
Non-repetitive	nonrep	Have a say	havesay	Overtime	overtime
Apply ideas	applyideas			Enough time	enoughtime
				Conflicting values	conflictingvalues
				Stress	stress

TABLE 3 - OVERVIEW INDEPENDENT VARIABLES HYPOTHESES 1A & 1B.

Effort		**Reward**		
Variable name	*Abbreviation*		*Variable name*	*Abbreviation*
Piece pay	piecepay	*Money*	Net monthly income	income
Monotonous	monotonous	*Esteem*	Manager respect	respect
Shifts	shifts		Colleague respect	colhelp
Overtime	overtime		Manager help	manhelp
Supervisor	supervision	*Status control*	Prospects	prospects
Stress	stress		Contract type	contract
Interruption	interruption			
Inconsistent hours per week	inconsistenthw			
Complex tasks	complex			

TABLE 4 - OVERVIEW INDEPENDENT VARIABLES HYPOTHESES 2A, 2B & 2C.

CONTROL VARIABLES

Control variables are added to the regressions to get the effect of the selected job characteristics on health as pure as possible. The categories of control variables to distinguish are presented below. For a schematic overview of all control variables, see appendix B.

DEMOGRAPHICS & INDIVIDUAL CHARACTERISTICS

The first set of control variables consists of demographics and individual characteristics of the respondents. These are included in the analysis to filter out as much as possible variance in health related to individual characteristics, to be able to be as precise as possible to find the effect of job characteristics on health.

These variables include gender, age and whether or not both the respondent and his/her parents were born in the country they live in. Net monthly earnings from the respondent's main paid job in euro's is only taken into account when testing the first two hypothesis on control and demand, as income is a variables of interest in the second set of hypotheses. For a first impression on this basic data, see table 5 below.

Statistics	Age	Male	Income
Mean	42.218	.494	3.32e+07
Median	42	0	1750
SD	12.063	.500	4.59e+07
N	35193	35372	35370
Min	15	0	2.53808
Max	91	1	1.00e+08
Range	76	1	1.00e+08

TABLE 5 - DESCRIPTIVES AGE, GENDER & INCOME

Furthermore, the maximum educational level attained by the respondent is taken into account. The individual has either maximally achieved primary, secondary or tertiary education.

Finally, the European sub-regions are included. The following regions are distinguished:

NORTH – Denmark, Sweden and Finland.
WEST – Ireland, United Kingdom, Netherlands, Belgium, Luxembourg and France.
CENTRAL – Germany, Poland, Czech Republic, Austria, Slovakia, Hungary and Slovenia.
SOUTH – Greece, Italy, Malta and Cyprus.
SOUTHWEST – Spain and Portugal.
EAST – Estonia, Latvia and Lithuania.
SOUTHEAST – Romania and Bulgaria.

Table 6 provides an overview of these regions in combinations with the health status that respondents have reported. The number of respondents is given with the percentage between brackets. Note that in the Northern part of the EU relatively most people report very good health and that in the South-eastern part relatively most people report very bad health. By controlling for the EUR sub-regions, these regional disparities are controlled for.

	Self-rated health						
	Very bad	Bad	Fair	Good	Very good	Total	
North	6 (0.19)	77 (2.48)	528 (17.04)	1454 (46.92)	1034 (33.37)	3099	*0.131*
Central	27 (0.30)	271 (3.00)	2351 (26.05)	4525 (50.14)	1851 (20.51)	9025	*0.381*
South	7 (0.15)	54 (1.19)	771 (17.05)	2398 (53.02)	1293 (28.59)	4523	*0.191*
Southwest	8 (0.40)	56 (2.79)	522 (26.01)	1114 (55.51)	307 (15.30)	2007	*0.085*
East	9 (0.30)	122 (4.07)	1393 (46.45)	1287 (42.91)	188 (6.27)	2999	*0.127*
Southeast	12 (0.59)	88 (4.34)	498 (24.57)	1050 (51.80)	379 (18.70)	2027	*0.086*
Total	69	668	6063	11828	5052	23680	
	0.000	*0.028*	*0.256*	*0.499*	*0.213*		

TABLE 6 - DISTRIBUTION OF RESPONDENTS OVER THE EU SUB-REGIONS.

OTHER WORK CHARACTERISTICS

Controlling for other work characteristics is necessary in the analysis to filter out as much as possible variance in health related to characteristics related to working life. Again, this is done to be able to be as precise as possible about the effect of job characteristics on health.

First of all, dummies corresponding with the work situation of the respondent are taken into account, is the respondent working, unemployed, unable to work due to long-term illness or disability, on childcare or other leave, retired or a full-time homemaker.

Next, the employment status of the respondent is considered. This reflects whether the respondent is self-employed with or without employees, or employed.

Importantly, the occupation of the respondent and the sector in which the respondent is working are controlled for. Also, the possibility is considered that it may be interesting to take into account whether the respondent works in the private, public, joint private-public, not-for-profit or another sector.

Finally, the number of hours the respondent usually works per week in his/her main job is considered. In some jobs it is very common to work more hours, while in other this is not. Obviously, a job that requires working many hours is demanding, however, an effect on health may be caused by hours worked instead of work characteristics, in which we are interested.

3.5 METHODOLOGY

This thesis aims at revealing the effect of different job characteristics on health. In this section the methodology to accomplish this is explained. The hypotheses stated in the previous chapter will be tested with quantitative research. Econometric methods are suitable for testing the economic relationship between job characteristics and health as it enables the researcher to find out about sign, magnitude and significance of each job characteristic or group of job characteristics on health.

APPLICABLE TO ALL HYPOTHESES

Prior to explaining the methodology per hypothesis, the methodology applicable to all or most hypothesis is explained below.

With the help of statistical software program STATA, both OLS and (ordered) logit models are used to test the hypotheses. In case of the latter, average marginal effects that predict the outcome "very good" are calculated. Often, the outcomes of the OLS and logit models are similar. In that case, only the results of the marginal effects of the logit model are presented. The logit model is preferred as it allows for non-linearity, which is preferable as it is likely that the distance between "good" and "very good" differs from the distance between "fair" and "good".

Furthermore, white standard errors are used to overcome the problem of heteroskedasticity.

For each hypothesis in the subsequent sections several equations will be presented. This clarifies the variables taken into account in each test. For simplicity, these equations are only presented in linear form.

The same control variables summed up in the previous paragraph are added to each regression. In the equations this is reflected as $\gamma*X$. This is an important step to filter out the pure impact of each job characteristic, as this effect should not be contaminated by the effect that is entwined with the jobs for which a certain job characteristic often appears to be present. Sign, significance and magnitude before and after adding the control variables to the model are compared and interpreted. Only the results that are interesting to the reader will be presented.

To be able to consider the effect of interaction terms and the effect of a category of job characteristics on health as a whole, one variable per aspect (demand, control, effort, reward) is needed. In practice, however, several variables are available per aspect. To be able to create one variable per aspect, ordered categorical variables are transformed into dummy variables. Subsequently, by summation of these dummy variables, a scale is constructed. Such a scale can be interpreted without difficulty and, moreover, can be used to create an interaction term.

Initially, the equations are tested by taking self-rated health as measure of health. Conclusions can be drawn with more certainty, however, if similar results turn up for different dependent variables. Therefore, to assure the robustness of the results of this thesis, the alternative dependent variables are taken as a measure of health in some instances as well. The results of these additional regressions are outlined in the last section of this chapter.

HYPOTHESIS 1A – LOW JOB CONTROL AT WORK IS NEGATIVELY RELATED TO HEALTH (WHITEHALL).

JOB CONTROL, SEPARATE VARIABLES

The first equation contains the seven variables representing job control as the independent variables and health as the dependent variable.

$$Health = \beta_0 + \beta_1 * complex + \beta_2 * learnnew + \beta_3 * nonrep + \beta_4 * applyideas + \beta_5 * choose + \beta_6 * decision + \beta_7 * havesay + \gamma * X + \varepsilon$$

It will be discussed whether their effect on health is indeed positive and significant.

SCALE FOR LOW JOB CONTROL

With the significant variables with positive sign, a scale for low job control (ljc) is constructed. Ljc intends to measure a lack of job control, which has a negative effect on health, whereas several measures in their original form are indicators of the presence of job control, which has a positive effect on health. Therefore, compared to the first regression, the scale of job control is reversed in this second regression.

Most variables are dummies so this reversal could easily be established. Some variables, however are scales, these will be turned into dummy variables, which equal one if the value of the ordered categorical variable is below the median. For example, the median value of applyideas is four. The dummy in the sum representing applyideas in low job control equals one if the respondent never, rarely or sometimes applies own ideas in work.

Ljc is then constructed by adding all dummy variables.

The second regression then consists of taking this scale as the independent variable instead of the separate job characteristics in the first regression. All five dependent variables are considered in this case.

$$Health = \beta_0 + \beta_1 * ljc + \gamma * X + \varepsilon$$

HYPOTHESIS 1B - LOW JOB CONTROL IN COMBINATION WITH HIGH JOB DEMAND AT WORK IS NEGATIVELY RELATED TO HEALTH (KARASEK).

JOB DEMAND, SEPARATE VARIABLES

Again, the first equation contains the factors corresponding to job demands as the independent and health as the dependent variable is run.

$$Health = \beta_0 + \beta_1 * highspeed + \beta_2 * carry + \beta_3 * overtime + \beta_4 * shortontime + \beta_5 * conflictingvalues + \beta_6 * stress + \gamma * X + \varepsilon$$

SCALE FOR HIGH JOB DEMAND

On the basis of this, a scale for high job demands (hjd) is created by summing up the variables above. A higher value for hjd corresponds to a higher job demand. Some variables needed to be transformed from categorical into dummies. Then, high job demand is considered to be present if the value of the ordered categorical variable is above the median.

The second regression then consist of this scale as the independent variable and health as the dependent variable, in the form of both self-rated health as well as the four alternative dependent variables.

$$Health = \beta_0 + \beta_1 * hjd + \gamma * X + \varepsilon$$

HIGH JOB DEMAND & LOW JOB CONTROL

Now a regression will be run to consider the simultaneous effect of hjd and ljc on health.

$$Health = \beta_0 + \beta_1 * ljc + \beta_2 * hjd + \gamma * X + \varepsilon$$

HIGH JOB DEMAND, LOW JOB CONTROL & INTERACTION TERM

Subsequently, an interaction term is created from high job demand and low job control (hjdljc). This term, together with ljc and hjd to see if there is a significant effect of the interaction or the effect of the separate factors, are reflected in the equation below to be tested empirically.

$$Health = \beta_0 + \beta_1 * hjdljc + \beta_2 * ljc + \beta_3 * hjd + \gamma * X + \varepsilon$$

An alternative suggested by Schnall, Landsbergis, & Baker (1994), is creating a quotient term of job demands divided by job control, and running a regression with this quotient as an independent variable on a single dependent health variable. Importantly, the effects of demand and control should be added separately as well to be able to conclude whether significant effects are related to the interaction or the separate variables.

$$Health = quotient + jd + jc + \gamma * X + \varepsilon$$

$$S.t.quotient = \frac{demand}{control}$$

When interpreting this quotient, the main interest will be in the sign, not the magnitude as the outcome of the quotient will not lie between 0 and 1, but between 0 and 1.2, which is less easy to interpret.

HYPOTHESIS 2A – HIGH EFFORT HAS A NEGATIVE IMPACT ON HEALTH.

EFFORT, SEPARATE VARIABLES

The first equation formulated to test this hypothesis contains of nine independent variables representing effort and the dependent variable self-rated health.

$$Health = \beta_0 + \beta_1 * piecepay + \beta_2 * monotonous + \beta_3 * shifts + \beta_4 * overtime + \beta_5 * supervision + \beta_6 * stress + \beta_7 * interruption + \beta_8 * inconsistenthw + \beta_9 * complex + \gamma * X + \varepsilon$$

SCALE FOR EFFORT

When it is clear which variables have a significant impact on health, these are used to construct a scale for effort. As a higher value for effort refers to high effort at work, dummy variables that need to be constructed out of categorical variables equal one if the value for that variable is above the median.

To test the effect of the scale for effort on health, all five dependent variables are used.

$$Health = \beta_0 + \beta_1 * effort + \gamma * X + \varepsilon$$

HYPOTHESIS 2B – IF PROPERLY REWARDED (MONEY, ESTEEM OR APPROVAL, AND STATUS CONTROL), HIGH EFFORT DOES NOT HAVE A NEGATIVE IMPACT ON HEALTH (SIEGRIST).

REWARD, SEPARATE VARIABLES

To start, interest is in the effect on health of the separate variables representing reward, as reflected in the following equation.

$$Health = \beta_0 + \beta_1 * income + \beta_2 * paidregular + \beta_3 * respect + \beta_4 * colhelp + \beta_5 * manhelp + \beta_6 * prospects + \beta_7 * contract + \gamma * X + \varepsilon$$

SCALE FOR REWARD

On the basis of the above regression, a scale for reward is constructed. To keep an even impact of all three pillars of reward suggested by Siegrist (1996), one indicator is selected for each pillar. For reward 'money', a dummy variables which indicates whether income is above the median income (€1750) of the sample. For reward 'esteem', respect is used as an indicator as the largest magnitude on health of the esteem variables is found for respect. Prospects is the indicator of the reward 'status control', as this variable has a clear significant positive effect on health.

Then, a regression is run with reward as the independent an health as the dependent variable, with the latter again in the five possible different forms.

$$Health = \beta_0 + \beta_1 * reward + \gamma * X + \varepsilon$$

EFFORT AND REWARD

Now, both the scales for effort and reward are uses in a regression to test their simultaneous effect on health. All five dependent variables have been considered in this case.

$$Health = \beta_0 + \beta_1 * effort + \beta_2 * reward + \gamma * X + \varepsilon$$

EFFORT CONDITIONAL ON LEVEL OF REWARD

The next step is to test what the effect of effort on health is, with reward set at different levels. In line with the hypothesis, it is expected that effort will have a smaller impact on health if rewards are higher.

$$Health = \beta_0 + \beta_1 * effort + \gamma * X + \varepsilon$$
$$s.t.\ reward = 0 \mid 1 \mid 2 \mid 3$$

HYPOTHESIS 2C – IF HIGH EFFORT HAS A NEGATIVE IMPACT ON HEALTH, IT IS COMPENSATED FOR IN ANOTHER REWARD (ECONOMISTS).

EFFECT OF EFFORT ON REWARD

Building on the previous findings, the first part of this hypothesis is taken as given. And if indeed high effort has a negative impact on health, this may be compensated for in another reward. Therefore, the question raises whether there is an effect of effort on reward. This is what is researched in this first regression.

$$Rewards = \beta_0 + \beta_1 * effort + \gamma * X + \varepsilon$$

To test this, an OLS model is used instead of a logit model, as the distinction between the levels 0, 1, 2 and 3 is less clear compared to for example self-rated health, where the levels correspond to a certain quality of life. Reward comes closer to a continuous variable, even though values between for example 1 and 2 are not possible, as the value of 1 can mean that either one of the aspects of reward is present in the working life of the respondent. We do not know which one. Therefore, the decision is made to make use of the most simple model, OLS, that finds average linear effects.

EFFECT OF EFFORT ON MONEY, ESTEEM AND STATUS CONTROL.

Subsequently, interest is in whether the effect of effort is different for the separate aspects of reward, as is reflected in the equations below. Money reflected by income, esteem reflected by respect and status control reflected by prospects.

$$Money = \beta_0 + \beta_1 * effort + \gamma * X + \varepsilon$$
$$Esteem = \beta_0 + \beta_1 * effort + \gamma * X + \varepsilon$$
$$Status\ control = \beta_0 + \beta_1 * effort + \gamma * X + \varepsilon$$

CHAPTER 4: RESULTS

Below, the results are presented. Each step taken to answer each hypothesis is discussed. Per hypothesis, after listing the results, a conclusion will be drawn: it is either confirmed, partly confirmed or rejected. After discussing all hypotheses, a robustness test is conducted to find out more about the validity and strength of the results.

4.1 HYPOTHESIS 1A – LOW JOB CONTROL AT WORK IS NEGATIVELY RELATED TO HEALTH (WHITEHALL).

JOB CONTROL, SEPARATE VARIABLES

The effects of the separate aspects of job control are presented in table 7 below. Next, these results will be interpreted.

Job control variables		dy/dx
Skill discretion:	Complex	-.017***[3]
	Learn new	.007
	Non-repetitive	.017***
	Apply ideas	.012***
Decision authority:	Choose	-.001
	Decision	.007***
	Have a say	.015***

TABLE 7 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

COMPLEX – Whereas having complex tasks is expected to have a positive effect on health, these results show that this has a highly significant negative result. A possible explanation for this is that having complex tasks asks a lot of the worker; dealing with complex tasks at work could be a serious stress factor, which has a negative effect on health. Hypothesis not confirmed.

LEARN NEW – After adding control variables, this variable turned from significant into insignificant. The interpretation of this could be that it primary reflected variation that is indirectly related to learn new, which is now reflected by one of the control variables. For example, it could be that learning new things in work is dependent on occupation. In some jobs this may be necessary or ordinary course of business. Once occupations are then added, this variable no longer has a significant impact. Hypothesis not confirmed.

NON-REPETITIVE – On average, doing non-repetitive work compared to doing repetitive work increases the probability of having self-assessed health "very good" by 1.7 percentage points, ceteris paribus. Hypothesis confirmed.

APPLY IDEAS – On average, if the respondent increases one point on the scale reflecting how often it occurs he or she can apply own ideas at work with one point, that increases the probability of having self-assessed health "very good" by 1.2 percentage points, ceteris paribus. Hypothesis confirmed.

[3] To indicate significant levels throughout this thesis, the following notation is used: *** indicates that the variable is significant at the 1% significance level, ** indicates that the variable is significant at the 5% significance level and * indicates that the variable is significant at the 10% significance level.

CHOOSE – This variable appears to have a negative impact on self-rated health but is found to be highly insignificant. The hypothesized positive effect of being able to choose your own order, method and speed of work on self-rated health is not confirmed.

DECISION – On average, being able to make one additional type of decision at work, increases the probability of having self-assessed health "very good" by 0.7 percentage points, ceteris paribus. Hypothesis confirmed.

HAVE A SAY – On average, having a say in what happens in the workplace on one more aspects increase the probability of having self-assessed health "very good" by 1.5 percentage points, ceteris paribus. Hypothesis confirmed.

SCALE FOR LOW JOB CONTROL

Four out of seven variables representing job control have a positive impact on health at the 1% significance level, namely: non-repetitive, apply ideas, decision and have a say. These are included in the scale for low job control (ljc).

	dy/dx
Low job control (ljc)	-.012***

TABLE 8 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

The interpretation of the result presented in table 8 is as follows. On average, one additional factor of low job control present in the respondents work situation decreases the probability of having self-assessed health "very good" by 1.2 percentage points, ceteris paribus. Hypothesis confirmed.

CONCLUSION

Low job control affects health negatively.

To be precise, the absence of (part of) the following factors of job control is found to be harmful to health: doing repetitive work, at most sometimes being able to apply ideas at work, not being able to make own decision at work and not having much to say at work. So indeed, like Marmot et al (1991) suggest, it is likely that job control has an important impact on the differences in the prevalence and incidence of diseases.

Hypothesis confirmed.

4.2 HYPOTHESIS 1B – LOW JOB CONTROL IN COMBINATION WITH HIGH JOB DEMAND AT WORK IS NEGATIVELY RELATED TO HEALTH (KARASEK).

JOB DEMAND, SEPARATE VARIABLES

The effects of the separate aspects of job control are listed in table 9, subsequently, these results will be interpreted.

Job demand variables	dy/dx (without control variables)	dy/dx (with control variables)
High speed	.004***	-.002**
Carry heavy loads	-.024***	-.019***
Overtime	.006***	-.004**
Short on time	-.017***	-.026***
Conflicting values	.000	-.004**
Stress	-.032***	-.037***

TABLE 9 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL).

HIGH SPEED – This variable has a positive sign before, and a negative sign after adding control variables. Working at very high speed certainly requires a lot from the worker as a good concentration might be very important and proceedings will have to be done quickly in order to keep up with the high working speed. A possible explanation for the initial positive sign is that working at high speed may keep the worker fit and active. However, as soon as control variables are added one by one, it turns out that fitness and activity could be reflected by region instead of by this variable of interest. Fitness and activity is also highly influenced to the way people spend their free time, which could vary per region. On average, an increase of one on the scale of working on high speed decreases the probability of having self-assessed health "very good" by 0.2 percentage points, ceteris paribus. Hypothesis confirmed.

CARRY HEAVY LOADS – On average, an increase of one on the scale of whether the job involves moving or carrying heavy loads decreases the probability of having self-assessed health "very good" by 1.9 percentage points, ceteris paribus. Hypothesis confirmed.

OVERTIME – This variable has a positive sign before, and a negative sign after adding control variables. If people state that they regularly work in their free time in order to meet work demands, this is not necessarily forced by the employer, it could also indicate high motivation or involvement of the worker. This could have a positive effect on health. When control variables are added one by one, it turns out that motivation and involvement could be represented by the European sub-regions. History could be of influence on this effect. A country with a communistic background, may induce far less entrepreneurial attitude, compared to a country with a long history of capitalism. On average, an increase of one on the scale of working overtime decreases the probability of having self-assessed health "very good" by 0.4 percentage points, ceteris paribus. Hypothesis confirmed.

SHORT ON TIME – On average, an increase of one on the scale of being short on time decreases the probability of having self-assessed health "very good" by 2.6 percentage points, ceteris paribus. Hypothesis confirmed.

CONFLICTING VALUES – This variable has a negative but insignificant impact on self-rated health in the model without control variables. When control variables are added one by one, the variables turns out significant when the European sub-regions are added. This may imply that

the effect of having a job that is in conflicting with personal values differs substantially between countries or regions. Perhaps in some countries people have more difficulties to cope with these inner conflicts than in others. This could be due to religion or the lack of economic welfare. On average, an increase of one on the scale of tasks that are in conflict with the worker's personal values decreases the probability of having self-assessed health "very good" by 0.4 percentage points, ceteris paribus. Hypothesis confirmed.

STRESS – On average, an increase of one on the scale of experiencing stress at work decreases the probability of having self-assessed health "very good" by 3.7 percentage points, ceteris paribus. Hypothesis confirmed.

SCALE FOR HIGH JOB DEMAND

	dy/dx
High job demand (hjd)	-.041***

TABLE 10 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

The interpretation of the result in table 10 is that on average, one additional factor of high job demand present in the respondents work situation decreases the probability of having self-assessed health "very good" by 4.1 percentage points, ceteris paribus. Hypothesis confirmed.

HIGH JOB DEMAND & LOW JOB CONTROL

	dy/dx
High job demand (hjd)	-.041***
Low job control (ljc)	-.004*

TABLE 11 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

Considering hjd and ljc simultaneously, as presented in table 11, leads to the same sign, magnitude and significance for hjd compared to the outcome in table 10. The significance and magnitude of low job control respectively are lower and smaller, and the sign has remained negative, compared to table 8. Taken together, both hjd and ljc remain to have a negative impact on health. Hypothesis confirmed.

HIGH JOB DEMAND, LOW JOB CONTROL & INTERACTION TERM

	dy/dx
High job demand (hjd)	-.040***
Low job control (ljc)	-.003
Hjdljc	-.000

TABLE 12 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

The interaction term between high job demand and low job control, which is added to the previous regression presented in table 11, is insignificant at the 10% significance level, see table 12. Therefore it cannot be concluded that especially the combination of high job demand and low job control has a negative impact on health. Hypothesis rejected.

QUOTIENT

	dy/dx
Quotient (demand/control)	-.005
High job demand	-.044***
Low job control	-.003

TABLE 13 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

An increase in the quotient, which would imply either an increase in job demands or a decrease in job control, while keeping the other factor constant, appears to have a negative effect on the probability of self-reporting health as “very good”. Relatively more demand compared to control would thus have a negative effect on health. Nevertheless, all taken together, only high job demand has a significant effect on health in the model of which the results are presented in table 13. This implies that it is not the interaction between the two factors but the separate effect of high job demand that is of importance to health. Hypothesis rejected.

CONCLUSION

Indeed, next to low job control, high job demand has a significant negative effect on health, for all variables taken into account it can be confirmed that they have a significant negative impact on health. The aspects with the highest significance level and also the highest magnitude are whether the respondent: has a job that involves carrying or moving heavy loads, has enough time to get the job done and experiences stress at work.

It is not confirmed in this study that the factors low job control and high job demand reinforce each other. The only confirming result is that low job control and high job demand taken together in one model also have a negative impact on health. However, no evidence is found for an interaction effect between high job demand and low job control; neither for the multiplication nor for the quotient. This means it is not specifically about the combination of these two.

Hypothesis rejected.

4.3 HYPOTHESIS 2A – HIGH EFFORT HAS A NEGATIVE IMPACT ON HEALTH.

EFFORT, SEPARATE VARIABLES

Table 14 shows the effect of the various effort variables on self-rated health. Below the table, these results are interpreted.

Effort variables	dy/dx (without control variables)	dy/dx (with control variables)
Piece pay	-.022***	-.011*
Monotonous	-.048***	-.030***
Shifts	-.026***	-.016***
Overtime	.004*	-.008***
Supervision	.000	.000
Stress	-.042***	-.047***
Interruption[4]	-.004***	-.038***
Inconsistent hours per week	-.013***	-.015***
Complex	.026***	.013***

TABLE 14 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL).

PIECE PAY – On average, doing piecework work compared to not doing piecework, decreases the probability of having self-assessed health "very good" by 1.1 percentage points, ceteris paribus. Hypothesis confirmed.

MONOTONOUS – On average, having a monotonous job compared to having a non-monotonous job, decreases the probability of having self-assessed health "very good" by 3.0 percentage points, ceteris paribus. Hypothesis confirmed.

SHIFTS – On average, working in shifts compared to not working in shifts, decreases the probability of having self-assessed health "very good" by 1.6 percentage points, ceteris paribus. Hypothesis confirmed.

OVERTIME – After adding control variables the sign of this variable changes from positive into negative. The positive aspects of working in leisure time, for example related to motivation, are now reflected by the control variables and a more pure effect of overtime is reflected after adding control variables. On average, working in free time in order to meet work demands decreases the probability of having self-assessed health "very good" by 0.8 percentage points, ceteris paribus. Hypothesis confirmed.

SUPERVISION – On average, in the situation where the respondent gets 100 workers extra under his/her supervision, this increases the probability of having self-assessed health "very good" by 0.4 percentage points, ceteris paribus. Supervision has a mean of 2.363 and a standard deviation of 52.504. This rather small magnitude together with the fact that this variable is insignificant, implies that the number of people under supervision of the respondent is not of major importance when illustrating the variance in health. Hypothesis rejected.

STRESS – On average, additional stress of one point upon the scale decreases the probability of having self-assessed health "very good" by 4.7 percentage points, ceteris paribus. Hypothesis confirmed.

[4] Taking a continuous variable measuring the amount of interruptions did not change the results.

INTERRUPTION – On average, one extra disturbing interruption decreases the probability of having self-assessed health "very good" by 3.8 percentage points, ceteris paribus. Hypothesis confirmed.

INCONSISTENT HOURS PER WEEK – On average, working inconsistent hours a week compared to working consistent hours a week, decreases the probability of having self-assessed health "very good" by 1.7 percentage points, ceteris paribus. Hypothesis confirmed.

COMPLEX – On average, doing complex work compared to not doing complex work, increases the probability of having self-assessed health "very good" by 1.3 percentage points, ceteris paribus. The effect is the opposite from what was expected. A possible explanation is that doing complex tasks could be seen as a challenge rather than an effort, which has a positive effect on health. Hypothesis rejected.

SCALE FOR EFFORT

Of the variables tested on whether or not they affect health, the variables piece pay, monotonous, shifts, overtime, stress, interruption and inconsistent hours per week have a negative sign and a significant negative impact with a minimum significance level of 5% in the ordered logit model. Those are included in the scale for effort (effort). Whether the respondent has complex work, is assumed not to be an effort, but a stimulating challenge. Therefore, it is excluded from the scale of effort for that reason.

	dy/dx
Effort	-.038***

TABLE 15 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

The effect of effort on health shown in table 15 can be interpreted as follows. On average, if the score on the scale for effort increases by one out of five points, or in other words, if one more aspect of effort is present in the working life of the respondent, this decreases the probability of having self-assessed health "very good" by 3.8 percentage points, ceteris paribus. Hypothesis confirmed.

CONCLUSION

It is found that effort at work is negatively related to health.

The aspects of effort that are negatively related to health are: whether the respondent is paid piece-based, has monotonous work, works in shifts, works in his/her free time in order to meet work demand, experiences stress in the workplace, experiences disturbing interruptions and works inconsistent hours per week.

Hypothesis confirmed.

4.4 HYPOTHESIS 2B – IF PROPERLY REWARDED (MONEY, ESTEEM OR APPROVAL, AND STATUS CONTROL), HIGH EFFORT DOES NOT HAVE A NEGATIVE IMPACT ON HEALTH (SIEGRIST).

REWARD, SEPARATE VARIABLES

Table 16 shows the effects of reward on self-rated health, which are interpreted below.

Reward variables	dy/dx
High income[5]	.029***
Respect	.107***
Manager helps	.021***
Colleagues help	.014***
Prospects	.036***

TABLE 16 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

MONEY – On average, if the respondent has a high income, this increases the probability of having self-assessed health "very good" by 2.9 percentage points, ceteris paribus. Hypothesis confirmed.

ESTEEM – On average, if the manager respects the respondent as a person and if the manager, or the colleagues, help and support him, this respectively increases the probability of having self-assessed health "very good" by 10.7, 2.1 and 1.4 percentage points, ceteris paribus. Hypothesis confirmed.

STATUS CONTROL – Initially, two variables representing status control are taken into account: whether the job offers good prospects for career advancement and the type of employment contract of the respondent. The latter variable has a counterintuitive effect: a fixed contract had the most negative effect on health, while this type of contract should strengthen the control over status of the respondent. This may imply that the type of contract reflects another impact than the one sought-after in this regression. Therefore, the final model in this step only contains prospects for career advancement as a representative of status control. On average, if the respondents gets better career prospects, this increases the probability of having self-assessed health "very good" by 3.6 percentage points, ceteris paribus. Hypothesis confirmed.

SCALE FOR REWARD

	dy/dx
Reward	.059***

TABLE 17 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

Table 17 shows that on average, one additional factor of reward present in the respondents work situation increases the probability of having self-assessed health "very good" by 5.9 percentage points, ceteris paribus. Hypothesis confirmed.

[5] Using lnincome instead of the variable high income does not differ outcomes.

EFFORT AND REWARD

	dy/dx
Effort	-.036***
Reward	.054***

TABLE 18 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

When considering effort and reward together (table 18), the signs remain the same, compared to the previous regressions (table 15 and 17). Also, the magnitude remains notably similar.

On average, an additional factor of effort present in the work situation decreases the probability of having self-assessed health “very good” by 3.6 percentage points, ceteris paribus. Similarly, an additional factor of reward increases this probability by 5.4 percentage points, ceteris paribus. Hypothesis confirmed.

EFFORT CONDITIONAL ON LEVEL OF REWARD

	dy/dx
Effort (with reward=0)	-.021***
Effort (with reward=1)	-.033***
Effort (with reward=2)	-.036***
Effort (with reward=3)	-.190***

TABLE 19 - AVERAGE MARGINAL EFFECTS ON **SELF-RATED HEALTH**, PREDICTING OUTCOME "VERY GOOD" WITH REWARD=0 (ORDERED LOGIT MODEL WITH CONTROL VARIABLES).

The effect of effort on health has a negative sign for all values of reward, as shown in table 19. The magnitude seems to be particularly large if reward of the respondent is present on all three aspects. In other words, a high reward makes effort more harmful to health. Hypothesis rejected.

Note, however, that this result does not necessarily reflect a causal relationship. It could also be the case that effort resulting in worse health, leads to higher reward as a compensation. This possibility will be researched in the final hypothesis, see the next section.

CONCLUSION

First of all, reward is indeed positively related to health. Having an income above the median, being respected by the manager, having a manager or colleagues to help and support you, and having good prospects for career advancement are significant positive factors in explaining the variance in health. In particular, with an exceptionally high magnitude of respect.

Getting to the joint effect of effort and reward on health, mixed results are found. When considering effort and reward simultaneously, the contrary effects of effort and reward confirm that effort and reward may offset each other in terms of health effects. Contrasting, a high reward is found to result in a more harmful effect of effort on health, while it was expected that a reward of substantial form would result in no health effect of effort.

The hypothesis is partly confirmed, as it may be possible that the negative effect of effort on health is (partly) compensated for by the positive effect of reward on health. However, the result above cannot confirm that, if properly rewarded, high effort does not have a negative impact on health.

4.5 HYPOTHESIS 2C – IF HIGH EFFORT HAS A NEGATIVE IMPACT ON HEALTH, IT IS COMPENSATED FOR IN ANOTHER REWARD (ECONOMISTS).

The results of hypotheses 2a and 2b show that effort has a negative impact on health. This is taken as the starting point for testing this hypothesis, so the second part of the hypothesis is of interest. If this would be true, high effort would have a positive effect on reward.

EFFECT OF EFFORT ON REWARD

	Coefficient
Effort	-.037***

TABLE 20 - EFFECT OF EFFORT ON **REWARD** (OLS MODEL WITH CONTROL VARIABLES).

The scale for effort, as it is constructed in this thesis, has a negative impact on reward. This is illustrated in table 20. If effort is present in one more aspect, this decreases the scale of reward by 0.037 points, ceteris paribus.

As no positive effect of effort on reward is found, the hypothesis is rejected.

EFFECT OF EFFORT ON MONEY, ESTEEM AND STATUS CONTROL.

	Coefficient (without control variables)	Coefficient (with control variables)
Effort	.010***	-.002

TABLE 21 – AVERAGE MARGINAL EFFECT OF EFFORT ON **HIGH INCOME** (LOGIT MODEL).

Looking at the separate factors representing effort, it turns out that for high income, a positive effect on reward is found in the model without control variables, see table 21. This shows that an increase in effort results in a larger probability of having high income. However, that this factor becomes insignificant after adding control variables, explains that the variance in income is explained by other factors than by effort. For example, higher age or education could lead to higher income instead of effort.

The positive effect of effort on the probability of having high income therefore does not hold, in the end. The conclusion is that all five separate aspects of effort taken into account in this thesis have a negative effect on reward. Hypothesis rejected.

CONCLUSION

In this research, no evidence is found for the hypothesis that high effort leads to higher reward. This means that effort, which is found to be harmful to health, may not be compensated for in terms of reward, nor in terms of one of the aspects of reward: money, esteem or status control.

Within the possibilities of this research, this hypothesis is rejected.

4.6 ROBUSTNESS CHECKS

In this sub-section the results of a selection of tests that are performed again are presented, now with the use of the alternative dependent variables: depression, cardiovascular disease, fatigue and absenteeism. The central question is: can similar conclusions be drawn when the alternative dependent variables are used? This is done to test the robustness of the results presented above. If the central question can be confirmed this strengthens the results.

The new results are first presented in tables. For the first three dependent variables a logit model with average marginal effects of the independent variable(s) in question is used. For absenteeism an OLS model is chosen, as this is a continuous variable. Attention is paid to similarities and differences with the results with self-rated health as the dependent variable, these results are presented again in italics for clarity and to make the comparison easily.

SCALE FOR LOW JOB CONTROL

Dependent variables	dy/dx	Coefficient
Depression	.013***	
Cardiovascular disease	.004**	
Fatigue	.030***	
Absenteeism		.650***
Self-rated health	*-.012****	

TABLE 22 – EFFECT OF **LOW JOB CONTROL** ON ALTERNATIVE DEPENDENT VARIABLES.

As shown in table 22, low job control both has a positive effect on the probability of having depression, cardiovascular disease or fatigue and on the number of days the respondent is absent for health reasons. This implies that it has a negative effect on health, in line with the result for self-rated health. Robustness confirmed.

SCALE FOR HIGH JOB DEMAND

Dependent variables	dy/dx	Coefficient
Depression	.037***	
Cardiovascular disease	.011***	
Fatigue	.068***	
Absenteeism		1.023***
Self-rated health	*-.041****	

TABLE 23 – EFFECT OF **HIGH JOB DEMAND** ON ALTERNATIVE DEPENDENT VARIABLES.

Table 21 shows that igh job demand has a positive effect on the probability of having depression, cardiovascular disease or fatigue and on the number of days the respondent is absent for health reasons, which is in line with the negative effect on self-rated health. Robustness confirmed.

HIGH JOB DEMAND & LOW JOB CONTROL

Dependent variables	Independent variables	dy/dx	Coefficient
Depression	Hjd	.037***	
	Ljc	.005**	
Cardiovascular disease	hjd	.011***	
	ljc	.002	
Fatigue	hjd	.067***	
	ljc	.016***	
Absenteeism	hjd		.987***
	ljc		.444***
Self-rated health	*hjd*	*-.041****	
	ljc	*-.004**	

TABLE 24 - **SIMULTANEOUS EFFECT** OF HIGH JOB DEMAND, LOW JOB CONTROL AND THE INTERACTION BETWEEN THESE TO ON ALTERNATIVE DEPENDENT VARIABLES.

On the dependent variables depression, fatigue, absenteeism and self-rated health, hjd and ljc have a simultaneous significant impact, which can be interpreted as a negative impact on health. Cardiovascular disease is the exception in this case. Even though hjd has a similar and significant impact, ljc has an insignificant effect. Overall, however, robustness can be confirmed by the results in table 24.

HIGH JOB DEMAND, LOW JOB CONTROL & INTERACTION TERM

Dependent variables	Independent variables	dy/dx	Coefficient
Depression	hjd	.034***	
	ljc	-.000	
	interaction	.002	
Cardiovascular disease	hjd	.008***	
	ljc	-.003	
	interaction	.002**	
Fatigue	hjd	.060***	
	ljc	.007	
	interaction	.004*	
Absenteeism	hjd		.674***
	ljc		.058
	interaction		.192
Self-rated health	*hjd*	*-.040****	
	ljc	*-.003*	
	interaction	*-.000*	

TABLE 25 - **SIMULTANEOUS EFFECT** OF HIGH JOB DEMAND, LOW JOB CONTROL AND THE INTERACTION BETWEEN THESE TO ON ALTERNATIVE DEPENDENT VARIABLES.

For most regressions only hjd has a significant impact on health, this effect of hjd is the same for all models shown in table 25. The variable representing job control is insignificant in all cases.

For only one model, the interaction effect is significant at the 5% significance level, moreover this result is confirming the hypothesis for the case of cardiovascular disease: the combination of high job demand an low job control result in a 0.2 percentage points higher probability of having cardiovascular disease, ceteris paribus. For the other models the interaction effect is insignificant just like in the initial model with self-rated health.

SCALE FOR EFFORT

Dependent variables	dy/dx	Coefficient
Depression	.039***	
Cardiovascular disease	.010***	
Fatigue	.073***	
Absenteeism		.909***
Self-rated health	*-.038****	

TABLE 26 - EFFECT OF **EFFORT** ON ALTERNATIVE DEPENDENT VARIABLES.

In line with the effect on self-rated health, on all alternative dependent variables, effort has a significant negative impact (see table 26), as an increase on the scale of effort results in a higher probability of having the three listed diseases and an increase in absenteeism. Robustness confirmed.

SCALE FOR REWARD

Dependent variables	dy/dx	Coefficient
Depression	-.046***	
Cardiovascular disease	-.014***	
Fatigue	-.071***	
Absenteeism		1.484***
Self-rated health	*-.059****	

TABLE 27 - EFFECT OF **REWARD** ON ALTERNATIVE DEPENDENT VARIABLES.

Looking at table 27, a higher reward leads to a lower probability that the respondents suffers from depression, cardiovascular disease or fatigue. This confirms the robustness.

Yet a higher reward leads to more days absent of the worker, this is contrasting with intuition as it would be expected that higher reward leads to better health leads to fewer days absent for health reasons. Possibly, a worker may call in sick more often as he or she is satisfied with rewards, whereas someone who would like to improve his or her rewards would do this less quickly to improve his rewards. Good rewards could lead to fewer incentives to show commitment and therefore to more days absent for health reasons. This does not confirm robustness.

EFFORT AND REWARD

Dependent variables	Independent variables	dy/dx	Coefficient
Depression	effort	.037***	
	reward	-.039***	
Cardiovascular disease	effort	.009***	
	reward	.013***	
Fatigue	effort	.070***	
	reward	-.063***	
Absenteeism	effort		.834***
	reward		-1.429***
Self-rated health	*effort*	*-.036****	
	reward	*.054****	

TABLE 28 - **SIMULTANEOUS EFFECT** OF EFFORT AND REWARD ON ALTERNATIVE DEPENDENT VARIABLES.

The results for depression, fatigue and absenteeism are as expected, and in line with the results for self-rated health, see table 28. So far, robustness confirmed.

However, that reward has a positive effect on the probability of having a cardiovascular disease contrasts previous results. The medical cause of this disease may not be positively influenced by reward, contrasting to the other two diseases where a positive mental effect of for example esteem seems plausible. Viewed in a different way, people with high rewards may face high pressure at the workplace which is not reflected thoroughly by effort and outweighs the positive effect of their rewards. For this case of cardiovascular disease, the robustness is not confirmed.

CONCLUSION

Overall, the effect of job characteristics on different dependent variables representing health is similar. This shows that results are robust, as they are mostly independent on what measure of health is used. Nevertheless, two dissimilarities are detected.

First of all, when considering the effect of reward on health, reward has a positive effect on absenteeism for health reasons, while a negative effect was expected. The possible explanation given for this is that good rewards could lead to fewer incentives to show commitment and therefore to more days absent for health reasons.

Secondly, some exceptions catch the eye considering the variable cardiovascular disease. To start, in the model presented in table 29, a significant interaction effect between low job control and high job demand is found for this dependent variable, which implies that the combination of the two matters for the probability of having cardiovascular disease. This is the only variable for which hypothesis 1b, for which it can be confirmed that the combination of low job control and high job demand at work is negatively related to health. Interesting is, that in the Whitehall studies, the independent variable is cardiovascular disease as well (Marmot et al., 1991), whereas in the study of Karasek (1979) emphasis is put on symptoms of mental strain. It is an important that it does matter to the outcomes which dependent variables is chosen.

Furthermore, in the model where effort and reward are considered simultaneously, as presented in table 28, higher reward leads to a greater probability of having cardiovascular disease, while for the other independent variables it is found to have a positive effect on health. Possibly, people with high rewards may face high pressure at the workplace which is not reflected thoroughly by effort and outweighs the positive effect of their rewards.

CHAPTER 5: DISCUSSION

In this chapter, first of all, attention will be paid to the key positive and negative points of this thesis. Amongst others, internal and external validity are up for discussion, the limitations will be recognized and it will be discussed whether the relation between job characteristics and health is causal.

5.1 VALIDITY

Data on all EU countries is used for this thesis, which represents a wide variety on for example economic development, prevailing political power and geographical location. As all these factors are taken into account, a high external validity of the results is assured.

The internal validity of the effect of job characteristics on health may be less well-established. An average effect is found for all EU countries together, which makes the results more general and less applicable to separate EU countries. Supporting the importance of the country effects, by adding control variables one by one to the regressions, it turned out that the EU sub-regions often had a major impact on the results.

On the other hand, by taking many countries into account, the number of observations has increased impressively, compared to performing this research for only one country specifically. A large amount of observations obviously leads to more valid results, as shocks are filtered out in this way.

The availability of panel data would increase the validity of the results, as the health effect of most job characteristics will usually come clear in the medium term or long run. For example, if a worker starts carrying heavy loads today, he or she usually does not have a back injury instantly, but will develop back injury by repeating certain movements many times. Note that, if a worker has not changed jobs for a longer period of time, the long term effect is in fact also reflected by the analysis performed in this thesis. This could explain why such significant and confirming results are found.

5.2 INDEPENDENT VARIABLES

Another advantageous characteristic of the EWCS dataset is that it has a wide availability of variables. Still, the measures of job control, job demand, effort and reward could have been more complete. Concessions had to be made when choosing variables on the basis of the literature. Some variables were not available in the data set in the exact same way as in the literature. For those, another variable was interpreted as the variables mentioned in the literature.

For example, “high skill level required” “creativity required” were suggested by the literature to indicate job control. In this research, complex and apply ideas were used to reflect these measures. This is only an interpretation or an example of the initially proposed measures by the literature. For apply ideas this seems to have worked well. For the variable complex, on the other hand, it is found that is gives different results compared to what is hypothesized, and inconsistent results. This could be an indication of a wrong interpretation of this variable into skill discretion. It seems likely that it represents another effect than the effect of high skill level required, what it was supposed to reflect. Therefore, eventually, neither for job control, nor for effort, complex is taken into when constructing the scales ljc and effort.

Similarly, two variables measuring job demand, carry and overtime, respectively approach "requires working hard" and "great deal of work to be done". Unfortunately, carrying or moving heavy load is obviously just an example of the aspects of working (physically) hard, which has the implication that working hard is interpreted in a narrower context. Furthermore, having much work to be done does not necessarily mean working overtime. It could also imply that the worker never finishes the workload instead of working extra hours.

Furthermore, in the literature "size of department" was suggested to use for measuring effort, in this research this is reflected by the amount of people that work under the supervision of the respondent, for whom pay increases, bonuses or promotion depend directly on him/her. Point of criticism here could be, that the size of the department is a wider measure than supervision.

Another critical note concerning the independent variables is that no measures of intrinsic effort were available, unfortunately. Similarly, several variables measuring reward were unfortunately missing in the data set, for example "amount of redundancy in the workforce during observation period" and "forced mobility".

The second step in testing most hypothesis was constructing scales out of the variables found to be of significant impact to the category of job characteristics of interest. These are created by summation of separate characteristics. It can be said that they present a simplification of reality. Furthermore, it cannot be stated with certainty, that all relevant aspects are taken into account and that they are summed up in the correct proportion.

5.3 DEPENDENT VARIABLES

Main emphasis of this thesis was on self-rated health as the dependent variable. Self-rated health is perceived as a predictor of mortality, so it implicitly takes future health problems into account. Therefore it is the most important measure of health in this thesis. Flipside of the coin is that self-rated health is influenced by perception, personality and environment. People with the same health status may value their health differently (Schnall et al., 1994).

The robustness test outlined in section 4.6, has strengthened previous results. Outcomes with taking into account other dependent variables such as cardiovascular disease mostly confirm the outcomes from the regressions with self-rated health as the dependent variable.

5.4 CAUSALITY

Simultaneity biases may occur, as causality may run in both directions. An example of this is that having a lower self-assessed health may increase the probability of the respondent to perceive his own work-setting as stressful. Conversely, perceiving the work environment as stressful may also decrease self-assessed health. Huang, Chen, Du and Huang (2012) have found evidence in their study for the contemporary existence of "normal and reversed causal relationships…between job characteristics and psychological health (Huang et al., 2012)". Hence, it is plausible that the association between job characteristics and health found in this thesis could have an underlying effect in both directions.

Furthermore, causal effects in this thesis may be compromised as some workers may self-select into jobs with(out) certain job characteristics. Like Cottini & Lucifora (2010) point out, a worker with a certain risk profile or health status may self-select into a job with risky or safe characteristics. As discussed in chapter 2, workers with worse health may be likely to have a physically demanding job, due to low opportunity costs (Case & Deaton, 2005). If so, this would lead to an overestimation of the effect of physically demanding job characteristics, as the health

of these workers might have been inferior to begin with. On the other hand, it is not unthinkable that a person that is stress-sensitive, may not do psychologically demanding work. If that is indeed the case, the effect of (psychologically) demanding jobs is underestimated, as it does affect the people that do this work less than it would affect an average person.

Within the possibilities of this data set, the control variables contain as many factors as possible that may both influence job characteristics and health, such as occupational level. This minimized under- and overestimation effects as much as possible, however, an omitted variable bias will probably still occur. Ideally, it would have been interesting to control for the health status of the respondent at birth, and whether he or she grew up in a rural or urban area, as these are examples of factors that may influence both health and job characteristics.

Likewise, a company may adjust safety and health regulation according to their working population (Cottini & Lucifora, 2010). The more vulnerable the working population appears to be, the more the regulation is sharpened and the lower the effect of the harmful job characteristics. To prevent this reverse causality to occur in this thesis, it would have been necessary to control for differences in regulation at country and or company level. However, this was impossible as no data was available on this. To illustrate what it could have contributed, it would have been interesting to use a change in regulation at the firm, country or EU-level as an instrument to find an effect of job characteristics on health with more certainty about causality.

A concluding note of this section is that it cannot be concluded that a causal effect is found, as there is too much uncertainty in the direction of the effects and an omitted variable bias is likely to occur.

5.5 CONTRIBUTION

The contribution of this research is high when it comes to the combination of psychosocial and physical job characteristics on health. Both are taken into account as in reality these two can neither be separated from each other, which makes this research more realistic.

Finally, a number of job characteristics that are found to be of significant importance to health are found. These can be taken into account in the discussion around the “heavy professions”. However, many more job characteristics have to be researched to be able to judge about the burden on health from specific occupations in order to, for example, set an appropriate retirement age.

CHAPTER 6: CONCLUSION

This chapter includes what can be concluded and learned from the outcomes of this thesis.

6.1 THEORETICAL FRAMEWORK 1: DEMAND & CONTROL

The first hypothesis of the first theoretical framework is based on the theory of the Whitehall studies (Marmot et al., 1991). It states that low job control at work is negatively related to health, which can be confirmed. Several aspects of job control turn out to be important to be present in the work setting for good health, namely: doing repetitive work, at most sometimes being able to apply ideas at work, not being able to make own decision at work and not having much to say at work.

Secondly, it was hypothesized that low job control in combination with high job demand at work is negatively related to health, which is based on the theory of Karasek (1979). Indeed, high job demand is found to be negatively related to health. Nevertheless, this hypothesis is rejected, as no evidence for an interaction effect is found.

6.2 THEORETICAL FRAMEWORK 2: EFFORT & REWARD

The opening hypothesis within the second theoretical framework states that high effort has a negative impact on health. This hypothesis is strongly confirmed. Whether the respondent is paid piece-based, has monotonous work, works in shifts, works in his/her free time in order to meet work demand, experiences stress in the workplace, experiences disturbing interruptions and works inconsistent hours per week, influences health negatively.

After this confirmation, two alternative hypotheses are tested. One in line with the view of Siegrist (1996), namely: if properly rewarded (money, esteem or approval, and status control), high effort does not have a negative impact on health, and one in line of economists, namely: if high effort has a negative impact on health, it is compensated for in another reward (Case & Deaton, 2005).

First of all, it is important to see whether reward has a positive impact on health. This assumption is without doubt found to be valid, with only one exception. Absenteeism for health reasons increases with higher reward. The explanation proposed for this, is a lack of incentives to put high effort into work if sufficient reward is already gathered, which includes showing up at work if feeling a little sick.

The research on Siegrist's view shows mixed results. The opposite signs of reward (positive) and effort (negative) in one model speak in favour of the validity of this hypothesis. On the other hand, the effect of effort is not found to be smaller if reward is high, so it cannot be stated that the negative impact of effort is undone by reward. Hence it is confirmed that the positive effect of reward can (partly) compensate for the negative effect of effort, however, it is not confirmed that these opposite effects are always in balance or that high effort does not have a negative impact on health if reward is high.

No evidence is found for the economics hypothesis that high effort is compensated for in terms of reward. Within the boundaries of this research, this hypothesis is rejected.

CHAPTER 7: IMPLICATIONS

In this chapter, the link between job characteristics and occupations is established to advice policy makers in the field of improving working conditions or compensating workers for their inferior health due to working circumstances. What can be seen as a "heavy profession"? Subsequently, a management implication of this study on job characteristics and health is stated, as there is also an important role at the company level in improving working conditions.

7.1 POLICY IMPLICATIONS

Each job characteristics has a unique impact on health and is present in some occupations more than in others. This section is a contribution to the discussion on what is the definition of a "heavy profession".

In table 29, per category (job control, job demand, effort and reward) the three most harmful, and in case of reward the most fruitful, job characteristics are taken as a starting point. Subsequently, per job characteristic, the three occupations that have the highest percentage of respondents to which this job characteristic is applicable, are listed.

Job characteristic	Category	-/+	Occupations
Complex	Jc	-	Professionals Legislators, senior officials and managers Technicians and associate professionals
Repetitive	Jc	-	Craft and related trade workers Elementary occupations Plant and machine operators and assemblers
Have no say	Jc	-	Plant and machine operators and assemblers Elementary occupations Clerks
Short on time	Jd	-	Professionals Plant and machine operators and assemblers Technicians and associate professionals
Carry	Jd	-	Skilled agricultural and fishery workers Craft and related trade workers Elementary occupation
Stress	Jd/Effort	-	Legislators, senior officials and managers Professionals Technicians and associate professionals
Interruption	Effort	-	Legislators senior officials and managers Professionals Technicians and associate professionals
Monotonous	Effort	-	Elementary occupations Plant and machine operators and assemblers Skilled agricultural and fishery workers
Prospects	Reward	+	Armed forces Legislators, senior officials and managers Professionals
Respect	Reward	+	Professionals Technicians and associate professionals Armed forces
High income	Reward	+	Legislators senior officials and managers Professionals Armed forces

TABLE 29 – JOB CHARACTERISTICS WITH A POSITIVE OR NEGATIVE EFFECT ON HEALTH, BELONGING TO ONE OF THE FOUR CATEGORIES. IN WHICH THREE OCCUPATIONS ARE THESE JOB CHARACTERISTICS PRESENT MOST OFTEN?

Professionals; technicians and associate professionals; elementary occupations; plant and machine operators and assemblers. These are the occupations represented most often in the list of occupations that often have the job characteristics that are most negatively related to health. On the other hand, technicians are also the workers, together with the armed forces, that get the highest reward.

Striking is, that the group of service workers and shop and market sales workers is the only group of workers that is not at all represented in table 27, so they neither seem to be a "heavy profession" nor they are extensively rewarded.

Then, in table 30, it is stated per occupations to how many of the three most important job characteristics per category workers are exposed more often compared to the average of all workers.

Occupations	Ljc	Hjd	Effort	Reward
Armed forces	1	1	0	3
Legislators, Senior officials and managers	1	2	1*	3
Professionals	1	2	1*	3
Technicians and associate professionals	1	2	1*	3
Clerks	2	0	2	1
Service workers and shop and market sales workers	2	1	1	0
Skilled agricultural and fishery workers	1	1	1	2
Craft and related trades workers	3	2	1	0
Plant and machine operators and assemblers	2	3	1*	0
Elementary occupations	2	1	1	0

TABLE 30 - HOW MANY JOB CHARACTERISTICS ARE PRESENT MORE OFTEN THAN ON AVERAGE PER OCCUPATION?

* THE VARIABLE STRESS IS TAKEN INTO ACCOUNT UNDER HJD. TO AVOID DOUBLE COUNTING, UNDER EFFORT IT IS NOT TAKEN INTO ACCOUNT. THE STARS PUT EMPHASIS ON THE OCCUPATIONS IN WHICH WORKERS ARE EXPOSED TO STRESS MORE THAN AVERAGE.

What immediately catches the eye are the occupations that count six negative job characteristics while scoring zero on reward: craft and related trades workers, and plant and machine operators and assemblers. The workers of those two groups are expected to be worst of when it comes to health deterioration due to work.

Furthermore, to build on the conclusions previously drawn, something can be said about which workers seem to have the best effort-reward balance. Namely, four groups of workers score above average on all facets of reward: armed forces; legislators, senior officials and managers; professionals; and technicians and associate professionals. The workers in these professions could be best off, when considering health effects of their jobs. They are able to compensate the bad by the positive effects on health in terms of high reward.

7.2 MANAGEMENT IMPLICATIONS

What caught the eye in table 16, was the huge magnitude of being respected by your manager on health. To recap, if a respondent feels respected by his manager, this increases the probability of self-reporting "very good" health by 10.3 percentage points, ceteris paribus.

Reward variables	Coefficient
Respect	- 5.123***
High income	-.684**
Manager helps	-.491***
Colleagues help	-.010
Prospects	-.750***

TABLE 31 - AVERAGE EFFECT OF REWARD ON **SELF-RATED HEALTH**, (OLS MODEL WITH CONTROL VARIABLES).

In table 31 the results are presented of an OLS regression of the five characteristics of reward on absenteeism. Of course, main interest of these results is in the effect of respect.

Indeed, the negative relation between respect and absenteeism can be confirmed. If a worker feels respected by his or her manager, this decreases the days a worker is absent from work for health reasons by 5.123 days on average, ceteris paribus.

Clearly, it is not the government that is responsible to improve this working condition. It are the managers themselves who must do this. By making sure their subordinates feel respected by them, managers can lower absenteeism for health reasons. Hence, managers have a financial reason to show employees respect, as absenteeism of employees is usually not free of costs. It is therefore recommended to the manager to pursue the path of increasing the existence of respect on the workplace.

CHAPTER 8: RECOMMENDATIONS

Additional research on the relation between job characteristic and health is needed to be able to draw sure conclusions on what can be named a "heavy profession". Below, some recommendations for future research to achieve this are discussed.

By the use of panel data, the effect of job characteristics on health over time needs to be measured. In this way, it will become clear how health is affected by job characteristics in the past and its long-term effects.

Furthermore, even though this is difficult to achieve, a causal effect of job characteristics on health is needed to draw conclusions with more certainty. One option would be to make the model more dynamic by including lags, both of previous health states and previous occupations and/or job characteristics. This could provide evidence on the long-run impact of both of these factors on current health status, while simultaneously improving the purity of the effect of current job characteristics on health. The second option for finding a causal effect would be controlling for the health state at the beginning of the working life of the respondent. If the respondent already has a long-term illness at this point in time, for example, this may result in a significant difference in occupational choices compared to a respondent who has not got this. Third, if a respondent changes jobs during working life, attention must be paid to this, as it may indicate switching jobs for health reasons.

If there is more certainty about a causal effect, an important step to serve policy makers is connecting the various job characteristics to specific occupations. Policy making would be facilitated by distinguishing many occupations.

Interest would then be in knowing how the working conditions in these occupations or job characteristics can be improved. And, if improving working conditions is infeasible or unaffordable, it is time to consider the options to offer compensation for the health losses due to work. Compensation could for example be differentiated retirement age for different occupations. Further research is needed to carefully distinguish who is eligible for such a compensation. What is considered "fair" in this context, is a political discussion. The main role of researchers in economics is calculating costs and benefits from different policy options, to objectify the discussion.

In addition, it would be interesting to pay attention to the between and within country differences in the effect and presence of job characteristics. This was beyond the scope of this research, but it is crucial to help decision makers in the field of improving conditions or providing compensation. To illustrate, what are the EU best practices, which countries are lacking behind and how can governments learn from this?

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APPENDICES

A. DESCRIPTIVE STATISTICS, INDEPENDENT VARIABLES

	Mean	Median	SD	N	Min	Max
Job control						
Complex*	.570	1	.495	34871	0	1
Learnnew	.680	1	.467	35015	0	1
Nonrep	.607	1	.488	34649	0	1
Applyideas	3.588	4	1.361	34978	1	5
Choose	2.080	3	1.156	34662	0	3
Decision	1.208	1	1.131	19209	0	3
Havesay	1.990	2	1.486	35372	0	4
Job demand						
Highspeed	3.446	3	2.018	35123	1	7
Carry	2.319	2	1.730	35296	1	7
Overtime*	2.038	2	1.244	34127	1	5
Shortontime	1.994	2	.992	35129	1	5
Conflictingvalues	1.695	1	1.096	34761	1	5
Stress*	2.840	3	1.178	35185	1	5
Effort						
Piecepay	.122	0	.327	28774	0	1
Monotonous	.450	0	.497	34934	0	1
Shifts	.173	0	.378	35135	0	1
Supervision	2.363	0	52.504	34978	0	9000
Interruption	.154	0	.361	34946	0	1
Inconsistenthw	.322	0	.467	35214	0	1
Reward						
Income	3.32e+07	1750	4.59e+07	35370	2.538	1.00e+08
Highincome	.498	0	.500	35372	0	1
Respect	.949	1	.220	27972	0	1
Colhelp	3.967	4	1.066	31041	1	5
Manhelp	3.702	4	1.195	28070	1	5
Prospects	2.730	3	1.200	33461	1	5
Scales						
Ljc	2.152	2	.985	34196	0	5
Hjd	1.995	2	1.459	35372	0	6
Effort	1.746	2	1.296	27925	0	7
Reward	1.747	2	.781	27972	0	3

TABLE 32 – DESCRIPTIVE STATISTICS OF ALL INDEPENDENT VARIABLES AND THE SCALES CONSTRUCTED OUT OF THESE VARIABLES. NOTE THAT * INDICATES THAT A VARIABLE IS ALSO USED IN MEASURING EFFORT.

B. OVERVIEW CONTROL VARIABLES

Variable name	
Male	
Age	
Autochthonous	
Net monthly income	
EU sub-regions	
Education level	Primary, secondary, tertiary
Occupation	Armed forces; legislators; senior officials and managers; professionals; technicians and associate professionals; clerks; service workers and shop and market sales workers; skilled agricultural and fishery workers; craft and related trades workers; plant and machine operators and assemblers; elementary occupations.
Work situation	Working; unemployed; on childcare or other leave; retired; fulltime homemaker; student.
Employment status	Self-employed without employees; Self-employed with employees; employed.
Public/private sector	Private sector; public sector; joint private-public organisation or company; non-for-profit sector or NGO.
Working hours per week	
Sector	Agriculture, hunting and forestry; fishing; mining and quarrying; electricity, gas and water supply; construction; wholesale and retail trade, repair; hotels and restaurants; transport, storage and communication; financial intermediation; real estate activities; Public administration and defence; compulsory social security; education, health and social work; other service activities; activities of households; activities of extraterritorial organisations and bodies.

TABLE 33 – OVERVIEW CONTROL VARIABLES