Tilburg University

Overweight, underpaid?

Research on the influence of obesity on wages in the Netherlands

Master thesis

Sanne Metsemakers

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Summary

The prevalence of overweight and obesity increased considerable in the Netherlands the last decades. This paper focuses on the influence of obesity on the labor market. Previous research in the U.S. indicates overweight men earn more than normal weighted men which is in contrast to a decrease in earnings for overweight men in Europe. In the U.S. the wage level of obese women is generally significantly lower compared to normal weighted women and no significant results of overweight women in the U.S. prevail. In European research the wage levels both overweight and obese women tend to be negatively significant. European research indicates a higher BMI causes higher unemployment and self-employment probabilities of both men and women. Men seem to be able to avoid the labor market penalty and thus seem to take advantage of more labor market mobility than women, who do experience a wage penalty in European studies.

The main explanation of economic theory and previous research, on the question why obese individuals might receive lower wage levels and experience a lower employment probability than normal weighted individuals, is they are negatively discriminated. Several reasons are provided to explain these expected differences through not only focusing on arguments of the employer but also including the influence of market institutions and time preferences.

This paper examines Dutch data between 2002 and 2009 of the DNB Household Survey of CentERdata. The models considered are: three (limited) OLS-models; a full model controlling for fixed effects; and the Heckman model which controls for sample selection. This study advances the understanding of the sources of the wage differences by not only focusing on the overall wage effect within the same dataset but also separating the wage effect of the public and private sector; considering the preference of being in paid employment; being employed in the public or private sector; and self-employment. The results have to be interpreted with caution because of two reasons. First, all data are self-reported. Secondly, the models do not control for endogeneity which implies reverse causality cannot be excluded. In this study overweight women experience a wage penalty, which is according to theory and previous research. It seems men are able to eliminate this penalty due to larger labor market mobility since they are overrepresented in the public sector. But when considering wage levels in the public sector, obese men earn less than normal weighted individuals which contradicts the rational aim to avoid a penalty. Also the lower self-employment rate of obese and overweight women contradicts rationality because of the experienced wage penalty.

Summary in Dutch

Overgewicht en obesitas komen steeds vaker voor in Nederland. Deze thesis bekijkt de invloed van overgewicht en obesitas op het loonniveau op de arbeidsmarkt. Onderzoek in de V.S. laat zien dat mannen met overgewicht meer verdienen in vergelijking met mannen met een normaal gewicht. Dit staat in contrast met de lagere lonen van mannen met overgewicht in Europa. In de V.S. is het loonniveau van vrouwen met obesitas lager dan het loonniveau van vrouwen met een normaal gewicht. Er is geen significant verschil gevonden voor vrouwen met overgewicht. In Europees onderzoek is het loonniveau van zowel vrouwen met overgewicht als obesitas significant lager in vergelijking tot vrouwen met een normaal gewicht. Europees onderzoek laat zien dat een hoger BMI een hogere kans op werkloosheid tot gevolg heeft. Tevens zijn zowel mannen als vrouwen met een hoger BMI vaker zelfstandig ondernemer. Binnen Europese studies lijkt het erop dat mannen met overgewicht en obesitas in staat om het loonverlies te ontwijken.

De economische theorie en voorgaand onderzoek verklaart de lagere lonen en het minder vaak hebben van een baan van mensen met overgewicht en obesitas met behulp van het concept van negatieve discriminatie. In deze scriptie worden verschillende verklaringen gegeven voor loonniveau verschillen. Hierbij ligt de focus op zowel de argumenten van de werkgever als op de invloed van marktinstituties en tijdsvoorkeur.

In deze thesis is Nederlandse data van CentERdata tussen de jaren 2002 en 2009 onderzocht. Aan bod komen de volgende modellen: drie (beperkte) lineaire regressies; een volledig model welke controleert voor constante effecten; en het Heckman model welke controleert voor steekproef selectie. Dit onderzoek heeft als doel het vaststellen en verklaren van loonverschillen tussen mensen met overgewicht en/of obesitas en mensen met een normaal gewicht. Het inzicht ten aanzien van deze loonverschillen wordt vergroot door binnen dezelfde dataset niet alleen de totale looneffecten te onderzoeken, maar ook looneffect binnen de publieke en private sector; het aantal mensen met een baan; het aantal mensen met een baan binnen de publieke en private sector; en de kans op zelfstandig ondernemerschap. De resultaten dienen met enige voorzichtigheid te worden geïnterpreteerd, omdat alle data door de respondent zelf is gerapporteerd. Ook controleren de modellen niet voor endogeniteit waardoor omgekeerde causaliteit kan niet worden uitgesloten. Deze studie concludeert dat vrouwen met overgewicht een loonverlies ervaren. Dit is in lijn met de theorie en voorgaand onderzoek. Aangezien mannen met obesitas oververtegenwoordigd zijn in de publieke sector lijkt het er in eerste instantie op dat zij in staat zijn dit loonverlies te ontwijken door meer arbeidsmobiliteit. Het loonniveau

van mannen met obesitas in de publieke sector is echter lager vergeleken met het loonniveau van mannen met een normaal gewicht. Dit spreekt het rationele doel om een loonverlies te vermijden tegen. Omdat vrouwen met overgewicht een loonverlies ervaren spreekt ook het lagere percentage vrouwen met overgewicht en obesitas welke zelfstandig onderneemt in vergelijking tot vrouwen met een normaal gewicht de economische rationaliteit tegen.

Preface

This thesis represents the end of my student life and the closure of my Master of Science in Economics at Tilburg University. After my first study economics teacher at Fontys Hogescholen and one year of being part-time in front of groups of adolescents I decided to focus on economics instead of teaching. In order to gain more knowledge about economics I decided to start the Bachelor 'economie en bedrijfseconomie' with thereafter the matching Master Economics at Tilburg University. It took some time getting used to colleges and listen for hours, but I managed to get through. Next to more knowledge about economics in general, I learned to be critical and to analyze subjects from different perspectives.
Writing this thesis I gained a lot of knowledge about the process of writing and contents of a thesis. It was a long process, with sometimes healthy reluctance, but I always enjoyed my subject because of the social perspective.

Without support the writing process of my thesis would be much harder and therefore I would like to take the opportunity to thank some people. First of all, I would like to thank my supervisor at Tilburg University, Prof. dr. ir. J.C. van Ours, for his valuable comments and patience. Also I would like to thank my fellow students for the great times in colleges and during assignments, and in special Sophie. Thereafter I would like to thank my parents, who always supported me during my studies. Now the time has come to stand on my own feet. But most of all I want to thank my boyfriend because he was my most important mental supporter and because he endured my complaints during stressful exam periods.

I hope my thesis will be read with the same enjoyment as I wrote it with.

Sanne Metsemakers
Tilburg, December 2010

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Chapter one Introduction

The prevalence of excessive fatness is increasing in Western societies. The World Health Organization uses the body mass index (BMI) to determine prevalence and classifies an individual as *underweight* when BMI is less than 18.5; as *normal* or *healthy weighted* when BMI is between 18,5 and 25; as *overweighed* when BMI is between 25 and 30; and *obese* when BMI is 30 or higher. Overweight and obesity are caused by a combination of too much calorie intake and not enough physical exercise (WHO, 2010). Mostly prevention of obesity is augmented by the negative health consequences of excess fatness. In many Western countries basic health care is considered as a right of their citizens and through collectively supported health care systems health costs are only partially borne by individuals. Besides the right of basic health care, most Western countries consider a minimum living standard as a right which goes together with a minimum income provided by the society when the individual is not able to provide a sufficient income. A safety net is also a cost borne by society which can be indirectly related to the health consequences of obesity. For example, an individual receives social benefits when becoming unable to work caused by bad health conditions.

At first glance it might seem that overweight and obesity only generates health related costs for society as mentioned above. In this thesis I examine whether the prevalence of overweight or obesity also affect economic outcomes in the Netherlands by examining the effect on wage levels. Existing studies examine the U.S., Europe as a whole, a group of European countries or one European country, but, to my best knowledge, no research on this topic has been conducted in the Netherlands. Research about the effect of obesity on wage levels has started in the U.S. where the prevalence of obesity and overweight is highest. Because in Europe prevalence is also increasing, the interest on the interaction between excess fatness and labor market outcomes is increasing but more focused toward employment probability. If a wage or employment difference of overweight individuals compared to normal weighted individuals, is found it is very complex to determine if the relation is causal and not a correlation and what exactly caused the difference.

The prevalence of obesity is relatively low in the Netherlands but nevertheless a concern based on the large increase in prevalence (Hollander AEM de, et al. 2006). In 2009 47% of the Dutch population over 20 can be categorized as being ‘overweight’ and therefore experience an increased probability to become obese (RIVM Nationaal Compas Volksgezondheid, 2010). This indicates an increasing influence of obesity in society and makes a labor economist wonder to what extend an increase of obesity influences wage levels. Therefore the main question of my thesis is the following:

Does the prevalence of overweight or obesity influence individual wage levels in the Netherlands?

This study advances the understanding of the sources of the wage differences by not only focusing on the overall wage effect within the same dataset but also separating the wage effect of the public and private sector, considering the preference of being in paid employment, being employed in the public or private sector and self-employed. Examining all these effect within the same dataset gives a more complete picture about the wage penalties and labor market behavior of overweight and obese individuals. The outcome provides insight in the problem of overweight and obesity in the Netherlands and emphasizes whether there is a need to prevent a further increase of overweighed people in the Netherland based on the labor market consequences argument. In this paper there is made use of data of the DNB Household Survey.

The outline of this thesis is as follows. Chapter two starts with a theoretical framework on how the labor market functions and how wage levels are affected by labor market mechanism. The third chapter starts with introducing the concept of obesity and thereafter explains how excessive fatness might influence wage levels and finally considers previous research in the U.S. and Europe. In chapter four the hypotheses tested are presented in order to find an answer to the research question, exposed in chapter one, and thereafter the descriptive statistics and an explanation of the used model and methods will be considered. The results are presented in chapter four section five. Finally, chapter five summarizes the main conclusions and provides an answer to the research question. This chapter closes with pointing out the imperfections of the analyses, possible policy measures and suggestions for further research.

Chapter Two Theoretical framework: The labor market and wage differentials

This chapter explains how wage levels are affected by labor market mechanisms. First, a general impression of the labor market and pricing mechanisms is provided. Secondly, the factors which explain wage differentials are examined within an economic and theoretical framework.

2.1 Introduction: the labor market.

On the labor market employers and persons in search of employment get in contact with each other. Through various ways employers indicate they are in need of employees and persons in search of employment indicate they are available on the labor market, through for example; the employment office; a temporary employment agency; a newspaper; and the internet. Employers demand labor and therefore they are denoted as the demand side. On the other side of the market there are jobseekers offering their potential, the supply side of the labor market.
The most important factor that influences the labor market is the economic situation. The economic situation depends on the demand for consumption, investments, the governmental demand and foreign demand. The demand for labor is a derived demand and increases when the demand for products and services increase; the demand for products and services increase when the purchasing power of potential buyers increase; and firms can only satisfy this demand when there is sufficient supply of qualitative labor. The previous interactions within an economy show that the factor labor is crucial for the existence of the different markets in an economy and ensures money flows continuously.

The labor market can be viewed as just a place where supply and demand meet each other and the pricing and allocation process takes place. On the labor market the product labor is traded. The supply and demand of labor differs among various occupations, skills and demographic groups and within these segments pricing is determined separately. After employers and employees get in contact, information about price and quality is exchanged though, for instance, applications and interviews. Finally an agreement about the terms of employment is reached on several aspects such as the conditions of work, job security, wage levels and employer-provided health insurance. The main point of compensation is the wage level. The wage level is determined by the price employers are willing to pay and employees are willing to accept for the offered labor. The price depends on the supply of labor but, as mentioned before, also on the available capital on the demand side which interacts with the overall economic situation. In general when supply is high, assuming a sufficient qualitative supply, prices drop.

The government monitors the national economy and interferes when necessary within the labor market mechanism. In order to influence the labor market governments regulate interactions through labor market policies by, for example, the ability to declare a CAO[1] generally binding. The direct goal of these policies is to create sufficient employment and the indirect goal is the stimulation of national economy. The level of interference differs between countries depending on historical tradition. This interference often occurs together with employer and employee organizations[2] whose influence will be highlighted later on.

2.2 Human capital and wage differentials.

The level of human capital explains wage differentials. Workers differ and human capital represents the unique set of abilities and acquired skills. The level of human capital is composed by the level of education, previous experience and innate ability. In turn these are influenced by the discount rate or time preference and rate of return of schooling of a person. The level of education and previous experience can be used as a signaling device for innate ability by employers because it shows previous capabilities and development opportunities.

The wage level of an employee is predominantly determined by the level of human capital (Borjas, 2008). Human capital is mainly acquired during educational programs and informal and formal on the job training. A profit maximizing firm always chooses the applicant whom they think contributes the most to the overall profit. Generally more human capital will raise profits and therefore employees with more human capital are expected to experience higher wage levels compared to employees with less human capital. This implicates that earnings are expected to be higher and unemployment rates lower for higher educated persons.

The question is why certain individuals drop out of high school and others achieve a professional degree. In order to answer this question we start with a model, which explains wage differentials called, the human capital earnings function and developed by Jacob Mincer:

Log $w = a$ * years of schooling + b * *years of experience* + b * (*years of experience*)^2 + *other variables*

[1] 'Collectieve Arbeids Overeenkomst' or collective labor agreement: set of agreements between employers and trade unions additional on the individual agreement.

[2] Employer and employee organizations are also called the *social partners*.

The percentage reward expressed in wage level resulting from an additional *year of education*, or in other words the rate of return to schooling is represented by *a*. This interpretation of *a* is accurate when there is no unobserved innate ability. The coefficients *years of experience* and *years of experience squared* represent on the job training resulting from an additional year of labor market experience. As mentioned by Heckman et al. (2003) this simplified model implies that the coefficient *years of schooling* is equal to the internal rate of return to schooling and ignores tuition costs, the effect of income taxes and uncertainty.

The idea that more education increases the productivity and thus the wage level of a worker is based on the schooling model. But another explanation why higher educated individuals experience higher wage levels is because they signal a certain level of innate ability. Through educational attainment the worker signals to be qualified for smart work which can be considered as a signal that the employee can be positioned into a certain labor market segment with the corresponding wage level. The employer thus assesses the educational qualifications when worker's ability is difficult to determine. A second signal of a certain level of innate ability is previous experience. During previous work experience an employee not only had the opportunity to obtain more knowledge but also had the opportunity to develop important personal characteristics. Jacob Mincer's human capital earnings function emphasizes the importance of the possibility of signaling potential ability through including years of schooling and past experience in his model.

But why do quit some individuals high school and attain others a professional agree? According to economics theory, education is valued by individuals because of the possible increase of future earnings. But attending college also generates costs and therefore is an investment. Next to expenses during college, also opportunity costs have to be considered since attending college full-time entails not choosing for being in the labor force.

The marginal rate of return of schooling determines the number of years of education. This marginal rate of return of schooling is the increase of earnings per unit spend on education. Since each additional year of schooling generates a smaller wage increase the marginal rate of return to schooling is a decreasing function of the number of years of education.

Thus, in order to make the decision between attending an additional year of education and entering the labor force, the discount rate of the investment, in this case the marginal rate of return of schooling plays a crucial role. From an economic point of view an individual should attend school until the discount rate is equal to the marginal rate of return since this maximizes the present value of lifetime earnings.

The discount rate depends on the time preference of an individual which is the valuation of giving up current consumption in return for future rewards. A high rate of time preference results in a lower probability the individual will attend further education because future income opportunities are valued low compared to current income opportunities, and vice versa when time preference is low. The time preference of an individual and the related discount date are influenced by uncertainty since the eventual reward of giving up current income and attending college with the corresponding costs is uncertain. Thus, beside the argument of increased human capital, the higher wage level of higher educated persons can be considered as a wage differential to compensate for the investment in education and the corresponding uncertainty.

Next to the marginal rate of return to schooling and time preference of education an individual's choice also depend on innate ability. Despite an equal marginal rate of return and time preference the increase in earnings can outweigh the forgone earnings because effort is lower for high innate ability workers compared to low innate ability workers. The effect of innate ability on educational decisions reflects innate abilities and the accompanying development capabilities and is therefore important in determining wage levels.

2.3 Labor unions and employment protection.

Next to individual characteristics wage levels are also influenced by labor market institutions. Boeri and van Ours (2008) define a labor market institution as follows: 'A labor market *institution* is a system of laws, norms, or conventions resulting from a *collective* choice and providing constraints or incentives that alter *individual* choices over labor and pay.' This section considers the influence of trade unions and employment legislation on wage levels.

A labor market institution of great influence in the process of wage setting is the labor union. On voluntary basis employees can join a labor union with goals and values similar to their own. A union can exert power on behalf of their members and bargain with the employer about all aspects of an employment contract such as working conditions and wage levels. An agreement between employer and employee organizations, a CAO, can be declared generally binding for the whole sector by the Dutch government. From an economic point of view the power of a trade union to set the wage above the market wage is not desirable because this has negative consequences for the employment level, an increase in unemployment. As consequence of this increase the portion spent on unemployment

benefits increases which influences public budget.
Next to the wage setting of labor unions, wage levels are also affected by the level of employment protection. The level of employment protection is determined by the government and employer and employee organizations. An employer adapts hiring decisions when considering national employment protection legislation. Legislation concerning employment protection increases costs of lay-offs and discourages employers to hire employees during economic expansions. Therefore countries with a high level of employment protection experience fewer fluctuations in employment levels on the labor market. Employment protection might also affect the amount of effort of employees because a low level of employment protection is expected to stimulate effort because lay-offs are easier if the employer is not satisfied with job performances, and vice versa. When layoffs are difficult through costly hiring and firing procedures the determination of the additional productivity a person will contribute to the firm becomes more important *before* hiring. So the hiring process and fluctuation in employment level are greatly influenced by the way employment protection is organized.

2.4 Labor market discrimination.

Much of the variation in wage levels remains unexplained. A possible explanation of this unexplained variation is that employers have preconceptions about employees which results in prejudice about employees. According to the Van Dale (2005) dictionary prejudice is an opinion about somebody not based on knowledge or reasoning but on tending, tradition or a resigned following opinion. Discrimination is the action of unequal treatment of somebody under not relevant characteristics. The main characteristic of discrimination is that, since it concerns similar individuals, it is caused by prejudice against a certain group in society. Discrimination reflects when individuals with similar characteristics are offered different wage levels based on differences in for example age, gender, ethnicity and physical appearance. This section explains the possible influence of discrimination on labor market outcomes. The types of discriminations distinguished are taste discrimination, customer discrimination and statistical discrimination.

As considered in the second section of this chapter differences in earnings are partly explained by labor market segments which in turn are highly influenced by educational attainment and previous experience. But characteristics like gender and race seem to influence wage level too. Nobel Prize winner Gary Becker (1971) developed the concept of *taste discrimination*. He argues the level of discrimination

depends on the social and physical distance between the discriminated group and other groups and on their socioeconomic status. According to Becker (1971) an increase of the size of the discriminated group can have two results: an increase of discrimination because the majority begins to fear their growing power; or the increase generates more knowledge which declines prejudice and therefore discrimination.

The most fundamental implication of Becker's theorem is that negative discrimination is unprofitable because discrimination against a group involves costs. According to Becker's model the workforce would not be segregated when there was no discrimination, because for example black and whites would be perfect substitutes. Without discrimination an employer would hire a worker at the wage level equal to the value of the marginal product. But when discriminating negatively, the marginal product is equal to the wage level plus the costs of the prejudice experienced. Becker (1971) thus states that prejudice results in disutility caused by the difference between the true wage rate and the experienced wage rate of the employer which is raised by the level of discrimination costs. For example, an employer who discriminates black employees experiences an additional cost when hiring the black employee on top of the agreed compensation for the supplied labor. With other words, discrimination by an employer results in a wage gap between equally skilled workers and firms who do discriminate the least will choose to hire the discriminated group first.

Taste discrimination does not only create additional costs for the employer it also results in hiring the wrong number of employees and the wrong 'color' of employees. When the costs of discrimination enter the function the firm moves away from the profit-maximizing level number of employees. The additional costs caused by discrimination results in a lower wage level for negatively discriminated groups. The discriminated group has to accept lower wage levels than the non-discriminated group to compensate for the wage penalty and this result in a lower number of individuals of the discriminated group on the labor market compared to the optimal situation. Therefore the discriminated group is expected to be unemployed more often compared to non-discriminated individuals.

Next to employers also customers are able to discriminate and influence hiring decisions. When customers discriminate, the purchasing decision is not based on the actual price but additional costs are experienced comparable to the concept of taste discrimination. But discrimination of customers does not have to be of large influence when the employee is allocated to a position where *customer discrimination* does not matter much. When avoiding costumer contact is less easy wage levels can be influenced more heavily.

The third type of discrimination is called *statistical discrimination*. *Statistical discrimination* occurs when

there is certain information about a group. For example, when previous experiences of an employer with female employees, with certain characteristics and statistical information collected by an employer, indicate a higher absenteeism probability of females compared to males. Absent employees do reduce firm productivity and therefore a profit-maximizing employer prefers the same skilled male applicant instead of the female applicant. But the higher probability of being absent of females does not imply anything about the true probability a particular person will be absent.
Beside probability also the predictability can influence decision making. When for example averages are the same, the employer prefers the person who is part of the group where predictability is better. In other words; uncertainty influences labor market decisions and induces the employer to rely on the average performance and predictability of a whole group instead of information about the actual individual. By using average performance to predict the productivity of a group, employers create wage gaps and gaps in labor market opportunities between groups. But employers will always use all information available in the wage-setting process and therefore statistical discrimination will continue to exist on the labor market.

A final explanation for wage differentials between certain groups related to labor market discrimination is occupational crowding. Sometimes it looks like an employer discriminates, but in reality the employee sorts himself in certain occupations. This so called occupational crowding is not necessarily caused by discrimination but a result of different interests or the sorting in 'appropriate' jobs of for example males and females. Thus occupational crowding can also be an explanation for differences in wage levels between certain groups apart from discrimination.

2.5 Conclusion.

This chapter discussed the factors that influence the price of labor on the labor market. Beside a general description of the labor market the effects of human capital; labor market institutions; and discrimination where discussed. The level of education and previous experience are important determinants in setting wage levels and used as signaling device for innate ability by employers. Educational attainment, expressed in level and years of experience, is dependent on the individual discount rate, time preference and the rate of return of schooling. Furthermore the wage setting process is influenced by labor market institutions like employer and employee organizations and country specific legislation. However much of the variations between wage levels remains unexplained and

might be a result of discrimination.

A difficult to measure influence on wage levels is the level of discrimination which is a consequence of prejudice. There seems to be a thin line between prejudice and signaling because both are largely subjective and depending on personal views and past (statistical) experiences of a group instead of statistics about the actual individual. The interference of labor unions on the labor market creates a bargained wage level above profit-maximizing wage. This interacts with the costs of discrimination because a minimum wage level above a market clearing wage means employers experience discrimination costs on top of the minimum wage level. As a result the first persons who are expected to drop out of the labor market through a wage level above the market clearing wage are expected to be discriminated employees. Thus the larger influence of labor market institutions in social welfare economies affects the employment level of discriminated groups especially.

A high level of employment protection might increase the importance of signaling since, because of additional firing and hiring costs on top of the experienced costs of discrimination, lay-offs are less easy. A consequence might be that discriminated employees do not get the opportunity to show abilities. This reasoning implicates discrimination may have a larger impact on the labor market decision when employment protection is higher.

This chapter considers a profit-maximizing firm. The government is also a large employer but is not profit-maximizing. Non-profit institutions might take other considerations into account when making labor market decisions for instance based on social values. Therefore non-profit organizations may be less inclined to discriminate.

Chapter Three Obesity, labor market outcomes and previous research

The previous chapter explains which factors influence the wage level of an individual. As indicated physical appearance might be an important determinant of wage levels since employees have prejudices which they use as a signaling device. As a consequence individuals suffering of excessive fatness might experience discrimination based on their appearance in combination with general beliefs and previous experience about this group.

This chapter examines the possible influence of excessive fatness of individuals on the labor market starting with introducing the concept of obesity, followed by connecting between the theory from chapter two and excessive fatness. Finally, previous research in the U.S. and Europe is examined.

3.1 Introduction of obesity.

The World Health Organization (WHO, 2010) defines overweight and obesity as excessive fat accumulation which increases health risks and is caused by a combination of too much calorie intake and too little physical exercise. Overweight and obesity are related to several health risks and chronic diseases such as diabetes, cardiovascular diseases and cancer. Beside the physical risks also mental problems like depression, feelings of loneliness, sadness and tension are more common for people with overweight (RIVM Nationaal Kompas Volksgezondheid, 2010).

A common used instrument for measuring obesity is the Body Mass Index. The Body Mass Index, further denoted as BMI, is calculated by the weight in kilogram divided by the square of the height in meters of an individual or kg/m^2. BMI is classified in four categories. An individual is classified as *underweight* when BMI is less than 18.5; as *normal* or *healthy weighted* when BMI is between 18,5 and 25; as *overweight* when BMI is between 25 and 30; and *obese* when BMI is 30 or higher (WHO, 2010).

Table 1 shows an overview of European countries and their BMI distribution. In the Netherlands 39,4% of the adult men experience overweight in comparison to 27.3% of the adult women, but 9,9% of the female population suffers from obesity in comparison to 7,9% of the male population (Eurostat, 2010). In the U.S. the lowest prevalence of obesity is 18,6% in the state of Colorado and nine out of fifty-one states had an prevalence of obesity above 30% in 2009 (Centers for Decease Control and Prevention, 2010). The data of Eurostat show overweight and obesity are very common in the Netherlands although

Table 1. Percentage of adults with overweight and obesity (source: Eurostat, last update 22-09-2010).[3]

	BMI	*Denmark*	*Germany*	*Finland*	*Sweden*	*United Kingdom*	*Netherlands*
Male							
Underweight	BMI <18,5	1,0	0,4	1,5	1,0	4,1	*2,1*
Normal weight	18,5≤ BMI <25	49,4	32,9	41.1	48,2	29,6	*50,6*
Overweight	25≤ BMI < 30	39,8	48,0	42,8	40,2	43,9	*39,4*
Obese	BMI ≥30	9,8	18,8	14,7	10,5	22,3	*7,9*
		100,0	100,0	100,0	100,0	100,0	*100,0*
Female							
Underweight	BMI <18,5	4,7	1,5	2,4	3,4	5,9	*3,6*
Normal weight	18,5≤ BMI <25	61,4	45,6	51,8	59,7	37,5	*59,2*
Overweight	25≤ BMI < 30	24,8	31,3	31,3	27,3	33,6	*27,3*
Obese	BMI ≥30	9,1	21,7	14,5	9,6	23,0	*9,9*
		100,0	100,0	100,0	100,0	100,0	*100,0*

does not prevail more often than in other European countries. The prevalence of obesity in the United States is of another magnitude. Considering the high prevalence in the U.S. it is not surprising research about the relationship between obesity and wage-outcomes started in the U.S.

Apart from the determination of healthy and unhealthy weight BMI is a commonly used instrument for measuring fatness of individuals but also an instrument debated for several reasons. The main advantage of using BMI is that the only information needed is weight and height which is easy to collect, but the argument against the use of BMI is that body composition is not taken into account. When using BMI no distinction is made between several components which influence whether a person can be labeled as overweighed or obese and faces the corresponding health related problems. There are different types of physiques which can be explained by gender and age but also by bone structure and the degree of muscularity which in turn is partly influenced by race. This indicates when using BMI for individual judgment of excess fatness, BMI might be a crude measurement method (Gallagher et al, 1996). Previous research tried to solve the possible measurement error of BMI by adopting other instruments in order to determine unhealthy weight. For example Yusuf et al. (2005) used waist-to-hip ratio and waist and hip circumferences and Johansson et al. (2007) used fat mass expressed in kilograms of an individual and waist circumference. But the WHO (2010) recognizes the use of BMI as a measurement instrument valid for population research.

[3] The countries reported are included in the examined previous research. Data of another European country can be extracted from Eurostat.

3.2 Obesity and the labor market.

This section discusses how excessive fatness might be related to the labor market and affects wage levels. First the relation between physical appearance and discrimination is examined; secondly the influence of labor market institutions on labor market decisions concerning signaling and discrimination is addressed; thirdly a possible relation between time preference of food intake and overall time preference of obese persons is suggested; and finally the problem of causality and endogeneity is discussed.

3.2.1 Discrimination and excessive fatness.

As mentioned in chapter two physical appearances can influence the process of wage setting and employment probabilities. Employers consider it difficult to measure characteristics such as commitment, engagement and social skills. In society individuals with excessive fatness seem to suffer from prejudice and are associated with personal characteristics like: not clever, laziness and lack of self control. Even though there is no clear evidence, the employer might conceive obesity to be a signal of laziness and lack of self control and therefore might assume that work ability and productivity is influenced by bodyweight and can result in lower wage levels. This so called *taste discrimination* of obese individuals results in irrational costs for society because it results in both the wrong number and the wrong 'type' of employees caused by the additional costs experienced by employers and is therefore undesirable.

Beside taste discrimination by employers, customers are also able to discriminate individuals with excessive body fat. A lower productivity can not only be explained by physical capabilities or laziness, but can also be a result of discrimination of customers towards obese employees. Then prejudice of consumers, or *customer discrimination*, towards obese employees explains a lower productivity compared to healthy weighted employees instead of being a result of physical or mental components. If obese people are discriminated in general, being obese can be a handicap in face-to-face contact with costumers and influence productivity directly. The consequences of customer discrimination are probably less expensive for society compared to taste discrimination since the employee can be

allocated to a position with less customer contact. Obese individuals might also anticipate on this allocation effect through already sorting themselves in certain jobs or occupations. The level of labor mobility influences the degree of self-selection and the ability to avoid the labor market penalty for obese employees. When labor mobility is high the employee should be able to eliminate the difference between true wage costs and the wage costs experienced by the employer, which includes additional costs caused by discrimination. Occupational crowding is based on interest of a certain group who sorts themselves into 'appropriate jobs' for example for men and women. This phenomenon might explain wage differentials between obese and non-obese individuals but has to be considered separately from discrimination because it is based on individual choice. When experiencing a wage penalty through occupational crowding a process of self-selection into jobs, in order to avoid the wage penalty, would be natural to be put in motion.

Finally, obese individuals may have to deal with *statistical discrimination*. According to the House of Commons Health Committee (2004) in England the lost earnings attributable to sickness caused by obesity was between 1.300 and 1.450 million pounds in 2002. Thompson et al. (1998) shows empirical evidence that in the United States the prevalence of obesity costs business 15 million dollars each year. So a valid argument for an employer for negatively discriminating obese persons seems to be the higher probability of health problems. An increased probability of health problems results in a higher probability the employee will be absent and a higher rate of absenteeism of employees generates costs for the employer. In the United States an employer often contributes to health care costs of its employees so when there is an increased probability of health problems this is expected to influence the process of wage setting. When the overweight person has to quit because of health conditions the firm also experiences loss of firm specific human capital and has to invest again in search costs in order to hire a new employee.

The question is whether this type of statistical information provides information about a particular employee. For example when statistics show obese employees are absent more often this does not have to be true for the obese individual. As substantiated in the previous chapter statistics provide only information about the average employee and does not provide information about a particular employee. Besides, one can argue more absenteeism does not necessary imply higher costs for the employer since this does not have to influence total productivity. So in the case of *statistical discrimination* an employer bases his decision on the available statistics but in reality has imperfect information about the true health and productivity of an individual obese employee.

Finally it needs to be mentioned that the data of Eurostat (2010) shows the segment of the population

which can be classified as overweight or obese is growing. As reasoned by Becker (1971) an increase of the discriminated group can have two effects. The first effect is that an increase of the group can increase discrimination because the majority begins to fear their growing power. This seems to be irrational in case of an increase of prevalence of obesity since this group is not connected with each other nor is able to exert power over non-obese individuals. The second effect implies that an increase of prevalence can generate more knowledge and will decline discrimination, which seems to be a rational consequence.

3.2.2 Obesity and labor market institutions.

The level of bargain power of labor unions, legislation about minimum wage levels and the level of employment protection can also influence the effect of obesity on labor market outcomes. At first sight it seems logical that wage differences between obese and normal weighted individuals will be limited in an economy in which labor unions are well represented because of the collective agreements about compensations, including minimum wage levels, and the result of equal treatment of members. But minimum wage levels above market wage generate unemployment and the first individuals who will drop out of the labor market will be the discriminated ones since their costs are the agreed minimum labor union wage plus the costs generated by the level of discrimination level. When the minimum labor union wage is equal for all union members, or all employees when generally binding, negative discriminated groups will not be able to agree a wage level below the wage level of normal weighted individuals in order to compensate for the wage penalty. The previous implicates wage levels of discriminated groups to be lower than for non-discriminated groups. As a consequence it is expected that obese individuals are more often unemployed than normal weighted persons when minimum wage levels are above market wage.

As mentioned in chapter two section four, also the level of employment protection might influence obese individuals if discriminated. When lay-offs are less easy, the more careful employers have to make hiring decisions. Because a lot of personal characteristics are difficult to determine before hiring an employee, employers may rely heavier on signaling devices which are related to prejudice and the various forms of discrimination. Summarized; theory states a wage level above the market clearing wage level is expected to generate more unemployment when employees are discriminated because this generates additional costs for the employer.

3.2.3 Obesity and time preference.

When there is a negative relation between individuals with excessive fatness and labor market outcomes it might be possible that this relation is caused by specific characteristics of the group. An explanation for a negative relation between obesity and labor market outcomes can be that persons with overweight or obesity suffer from a higher level of time preference in terms of food intake and value the long-term health effects of overweight less than normal weighted employees. But do obese individuals value overall future consumption lower in daily life situations compared to normal weighted individuals? If this is true these persons are expected to invest less than average in training and education because this pays off only on the long run. As a consequence both educational attainment and the effect of training-on-the-job is expected to be lower, which in turn would explain lower wage levels of obese employees compared to healthy weighted employees.

3.2.4 Causality.

The aim of this thesis is to determine whether obesity influences wage levels and presents unbiased results. But the relation between BMI and wage levels can be present because of three effects: the effect of obesity on wage levels; the effect of wage levels on obesity; or a third exogenous factor which affects both wage levels and obesity e.g. individual time preference. The results can be influenced by reversed causality because lower wage might cause obesity. For example when persons receive a low income they might be more likely to purchase fatter food because on average this food is cheaper than vegetables (Drewnowski, 2004). Long-term unemployment can influence self-confidence and mental health negatively. Mental health in turn can influence body weight, particularly among women (Bove and Olsen, 2005). Also unemployed individuals have more opportunities to consume food during daytime and, depending on the occupation, might exercise less and therefore burn less calories which in turn causes more fat storage compared to employed persons. Beside reverse causality the relation between obesity and wage levels can be biased through unobserved variables such as time preference. Finally, a biased outcome can be a result of systematic measurement errors of unobserved factors which influences wage levels. This would be the case if for example individuals of lower socio-economic groups

report a lower weight than their actual weight and higher socio-economic groups report their true weight (Morris, 2007).

3.2.5 Endogeneity.

Several studies tried to solve the problem of endogeneity with different methods. BMI is endogenous when correlated with the error term. Mainly three methods are used in the literature in order to exclude the endogeneity bias: lagged measures, fixed effects and instrumental variables (IV).
If lagged measures of BMI are used then the lagged BMI variable has to be independent of the residual. And since the residual is likely to represent some omitted variables which are both related to BMI and the labor market outcome the residual is unlikely to be independent of the BMI.
When fixed effects are used to exclude causality the regressors has to be exogenous. Also all unobserved characteristics of the individuals not included in the model are assumed to be constant over time. This means BMI has to be uncorrelated with the error term which is unlikely for the same reasons explained for lagged measures. Also there exists a trade-off between precision and consistency. When the fixed effects method is used for a short period of time the probability unobserved individual differences appear is lower. But a short observation period results in less precision of the estimates which can result in no differences at all when limiting the unobserved individual effects. On the other hand a longer time period will result in better estimates but unobserved individual characteristics are probably not constant over time and this causes inconsistency. Besides even when the assumptions are satisfied reversed causality cannot be excluded.
The third method uses instrumental variables to disentangle causality between BMI and labor market outcomes. For this method a variable is needed which is correlated with and endogenous to obesity but uncorrelated with the dependent variable. The used instrumental variables in previous research are debatable. For example Cawley (2000) uses the weight of the child as an instrumental variable for the weight of the mother. This instrumental variable relies on genetics which influences BMI exogenously but can also influence labor market outcomes and the wage level of the mother which would eliminate the weight of the child as a valid instrumental variable. This same problem occurs when the weight of siblings is used to instrument individual weight (Cawley, 2004). Other examples of instrumental variables used are whether the parents ever used obesity-related medicines and the mortality status (Greve, 2008). Both instruments might be invalid because unobserved variables affecting both BMI and labor

market outcomes cannot be excluded. Morris (2006) used average BMI of people in the same health authority area which is discussable because health authorities are able to select individuals.
A less used method is propensity score matching. This method can control for unobserved variables by classifying individuals with the same observable characteristics in separate groups assuming unobserved characteristics are also equal (Sousa 2005). A large sample is required to obtain significant outcomes. In order to increase the sample size pooling seems to be an option but this will restrict the value of the results.

3.3 Previous research.

The increasing interest in the influence of obesity on labor market outcomes is caused by the increase of prevalence of obesity and started in the U.S. At first, research was predominantly focused on the interaction between wage levels and obesity but recent research also examines the effect of obesity on employment probability (predominantly in European countries). This section examines previous research in the U.S, Europe as whole and individual European countries[4].

3.3.1 Previous research in the U.S.

In most previous research in the U.S the National Longitudinal Survey of Youth (NLSY) was used. This dataset is designed to collect information about labor market activities of young men and women. Nevertheless the results differ through the use of different survey years, age groups, methods and definitions of obesity.
Register and Williams (1990) used cross-sectional data of employed persons between 18 and 25 years old from 1982. To determine obesity this research defined obesity as being in excess of 20 percent above the standard weight for height according to Metropolitan Life Insurance Company. The results indicate obesity lowers wage levels of women with 12% in contrast to no significant effect for men.
Loh (1993) remarks Register and Williams (1980) both included part-time and full-time employed persons in his sample which might bias the results. Therefore Loh (1993) only includes full-time employees. Also ages differ since Loh (1993) used persons between 18 and 22 years old between the

[4] Appendix I provides an overview of the results of previous research in the U.S, Europe as whole and individual European countries

years 1982 and 1985. For the definition of obesity the relative effects of height and weight are used which is defined as the actual height or bodyweight divided by the average height or weight in the population. Loh (1993) concludes that 10% more weight than average decreases the hourly wage with 13,6% for men. Also obesity slows down the subsequent wage growth by approximately 5,5% for men. In his paper he considers a possible omitted variables bias. To test whether both the variables age and experience effect wage, taking into account the variables age and experience are highly correlated with each other, the experience variable is replaced by age and age squared. From the results can be diverted height and weight remain significant which proves skill levels of older workers are not of great influence. But because within the sample there are only very small age differences this result should be expected. Other omitted variables mentioned are differences in school attainment, because obese children could be negatively discriminated in class, and the increased probability of obese persons to develop mental problems which both are not proven to be of a significant impact.

Pagan and Davila (1997) used NLSY data of 24-to-31- year olds in 1989 to examine the relation between obesity and earnings and the influence of occupations. Their results indicate both women and men experience a penalty for being obese. But when interaction term between BMI and occupations is included men experience a positive significant wage result in the when occupied in the branches 'Transportation/Material Moving x BMI' and 'Handlers/Helpers/Laborers x BMI' in which obese men are also over-represented. Obese males earn less than non-obese individuals in the occupations 'Managerial and Professional' in which they are underrepresented. The overrepresentation of obese men in occupations with a significant positive wage result and the underrepresentation of obese men in occupation with a significant negative wage result suggest self-selection in occupations and a certain level of labor mobility of men. Obese women are not able to offset the overall wage penalty by selection themselves in occupations which suggest a limited level of labor mobility.

Averett and Korenman (1996) examined the effect of being obese aged 16 to 24 years in 1981 on wage differentials at age 23 to 31 in 1988. The results suggest that obese women experience lower wage levels. The effect of being obese in 1981 on hourly wages in 1988 results in a decrease of hourly wage and the same holds for overweight women. For men being obese at age 16 to 24 years in 1981 effected wage differentials at age 23 to 31 in 1988 which resulted in a decrease of hourly wage. Considering the effects of BMI on hourly wages by race of BMI in 1988 both overweight and obese white women experience a wage penalty and white women classified as obese in 1981 also experience a considerable wage penalty. White men both obese in 1981 and 1988 experience a wage penalty. To test for reverse causality they used lagged data by comparing the outcomes of ages between 23 and 31 and obesity at

ages 16 to 24. Women who become obese later in life are better off than women who where obese in both age groups. This suggests contemporaneous labor market outcomes are not likely causing weight gain and therefore relaxes the possibility of reverse causality.

The research of Cawley (2000, 2004) was the first including instrumental variables to control for endogeneity and is therefore an example for future research. The results of Cawley (2000) suggest especially white women suffer from a decrease in employment probability. After dropping all women out of the labor force no evidence was found that BMI affects the probability of employment.

The innovation of Cawley (2004) are the various methods used to control for reverse causality and controls for a large number of (genetic) personal and employment characteristics. He examines four methods in order to derive a robust result and exclude endogeneity: ordinary least square (OLS) with current and lagged weight; fixed effect taking differences with another individual with highly correlated genes; and instrumental variables where the weight of a child is used to control for the weight of the mother. OLS results suggest white women who experience overweight earn 4,5% less and obese white women earn even 11,9% less wage than persons with a healthy weight. This result is strikingly similar to the result of Averett and Korenman (1996). The OLS results of overweight men present a positive wage effect of 3,9%. The results of the fixed effect model presents a weakened impact compared to the OLS results but presents still a positive wage effect for overweight men and a negative effect for obese females. None of the IV results with BMI and the classifications in the regression is significant.

Baum and Ford (2004) used a sample which included larger age differences and therefore a higher probability of a higher weight and persons with more work experience in the sample than in previous research. Various models are examined like individual difference models, sibling difference models and individual difference sibling difference models. They conclude both obese men and women experience a wage penalty but women suffer a larger penalty than men. According to the wage level and individual difference models obese workers experience a flatter wage profile. Explanations suggested are: a higher discount rate of obese employees; discrimination of employers in combination with less training opportunities; and wage penalties are age dependent.

The aim of Cawley and Danziger (2005) is to examine factors which influence the process from current to former welfare recipient. The sample consists of single mothers in het U.S. and the data are collected through personal interviews. The results of obese persons, defined as individuals with a BMI from 30 to 40, where not significant compared to overweight and healthy weighted individuals. Therefore this paper examined morbid obese persons, defined as individuals with a BMI of 40 or higher. In the reduced model the enormous decrease in earnings of 70,8% for women with morbid obesity is striking. Adding

controls for individual fixed effects or health problems reduces the results considerable but does not result in significant outcomes. An explanation of the divergent results is that the used dataset Women's Employment Study (WES), which exists of data of current en former welfare recipients, differs from the commonly used NLSY dataset. Firstly, WES reflects both the correlation of weight with hours worked and the correlation of weight with wage rates, while the NLSY results are only in wage level. Secondly, the NLSY is a national representative sample, while WES represents less educated women with less market experience than the national average. Thirdly, Cawley (2004) included a richer set of family backgrounds. Fourth, the NLSY dataset is thirty times larger than the WES dataset.
Han et al. (2009) extends previous studies by allowing the effect to vary by gender, age and type of interpersonal relationships required in each occupation. They find only a significant wage penalty for women and none for men of any race. The wage penalty is larger for occupations where interpersonal contact is important and when the employee becomes older. Also the probability of employment decreases for any race except for black men and women.

Considering the results of previous research described in appendix I the results in the U.S. show that decreases of wage for obese women are larger and more often significantly negative compared to men. Controlling for fixed effects obese white females earn significantly less than healthy white females. The results of obese white men are all insignificant, but overweight white males earn significantly more than then healthy weight ones. Controlling for endogeneity with instrumental variables only the research of Ford and Baum (2004) show a negative significant relation between BMI and wages of females.

3.3.2 Previous research in Europe.

Research in Europe on the relationship between obesity and labor market outcomes is relatively recent. The papers highlight not only the effect of obesity on wages but also the effect of obesity on employment probability. The research in Europe about the effect of obesity on labor market outcomes is separated in research in Europe as a whole and research in an individual European country.

The following research considers the effect of obesity on labor market outcomes in Europe as a whole in which overweight is defined as BMI between 25 and 30 and obesity is defined as BMI above or equal to 30 and all use the European Community Household Panel (ECHP). The ECHP is coordinated by Eurostat and is a cross sectional longitudinal survey covering all countries in the European Union between 1994 and 2001. Data about height and weight are self reported and only available between 1998 and 2000 of

seven countries namely: Finland, Denmark, Ireland, Belgium, Austria, Italy, Portugal, Greece and Spain. D'Hombres and Brunello (2005) included persons between the 18 and 64 years and persons employed 15 or more hours a week. In order to correct for outliers, only persons with a BMI between 15 and 35 are included. The used methods are OLS, fixed effects and instrumental variables. OLS results in a positive significant effect for males and a negative significant effect of absolute BMI on wages for females. The results of the fixed effect model are mixed and not significant. After controlling for endogeneity through the BMI of a biological family member the result for males is no longer significant. The IV results show a negative relation between BMI and wages for females. For males the negative relations become again positive in the extended models. Subsequently D'Hombres and Brunello (2005) distinguish countries in the 'olive belt' (Greece, Portugal, Spain and Italy) and the 'beer belt' (Central and Northern European countries) and find a negative relationship between BMI and wage in the 'Olive belt' countries in contrast to a positive relation in the 'Beer belt' countries. It is suggested the different outcomes can be caused by differences in BMI, weather related and individual (unobserved) productivity since productivity may increase with body fat in countries with lower temperatures.
Sousa (2005) measures whether individuals with a higher BMI than 25 are less often active on the labor market using OLS and a probit model. Propensity score matching is used to correct for the estimation of the treatment effects controlling for non-random assignment of control and treatment groups. Assumed is that if all observable characteristics are the same in the treated and untreated group also the unobservable characteristics will be. The results indicate a decrease of labor market participation of women with a BMI above 25 but increases for men in this classification. Subsequently the results do not change when separating Northern and Southern countries.
In the research of Garcia and Quintana-Domeque (2006) individuals between the age 25 and 54 years old working 15 hours or more a week are defined and included as employed. The used measures of body size are BMI, weight in kilograms and a medical indicator of being obese, the results are presented for all nine countries separately. Considering the relation between obesity and employment in Europe as a whole Garcia and Quintana-Domeque (2006) conclude no overall relation is found. Obese men and women do not seem to be more likely to be self-employed relative to being an employee compared to normal weighted individuals. Another indication of discrimination would be a higher probability of being unemployed relative to being in paid employment, but these results are heterogeneous across countries. Overall significance between obesity and wage is difficult to determine for Europe as a whole. The significant results of separate European countries exposed in appendix I.
The research of Atella et al. (2008) examines the Quartile Regression approach to point out differences

in effect of obesity and overweight at different points of the wage distribution. The overall results suggest wages of women are negatively affected in all segments of the distribution while men experience only negative effects when both obese and in the 15th wage percentile. Next to the overall result presented in appendix I country by country results are also available.
The parametric and semi-parametric results of Hildebrand et al. (2010) suggest an inverted U-shape between BMI and wages for overweight males. BMI of women seem to peak at healthy weight. This is consistent with the parametric studies such as Cawley (2004) and the negative wage penalties as in Ford and Baum (2004) and Han et al. (2009). The results of women are also consistent with the pooled OLS estimates of Atella et al. (2008).

As described in appendix I, the results of previous research in Europe as a whole, where the ECHP dataset is used in all researches, indicate females with higher BMI earn less. But the results of males are rather mixed. Male results are less often significant and the sign of the effect differs in different researches. Two papers adopt the instrumental variable method but report different outcomes. D'Hombres and Brunello (2005) report a significant negative relation between BMI and wages for females and a positive relation for men but Atella et al. (2008) report a negative effect for both men and women. Possibly the age groups used or the use of different instruments to control for endogeneity causes this dissimilarity. Considering the effect of BMI on employment status, Garcia and Quintana-Domeque (2006) point out the results can be affected by reverse causality between a higher BMI and increases in the probability of self-employment and unemployment or some kind of selection or sorting.

The following research is performed on data from an individual European country.
Sargent and Blanchflower (1994) used data from the National Child Development Study from England to determine the relationship between obesity and hourly wages. Obesity is defined as all persons above the 90th percentile and grossly obese at the 99th percentile of the BMI distribution. The sample includes 23 year olds born between March 3rd and 9th 1953 and the only method used is OLS. Obese persons received significantly less schooling than non obese persons, but there is no relationship found between obesity at any age and earnings at the age of 23 years for males in contrast to females, controlling for social class and ability test scores of the child. This reduces the argument of discrimination and discount rate for males.
Sarlio-Lahteenkorva and Lahelma (1999) used the nationwide Finnish Survey of Living Condition collected in 1994. They controlled for age, the level of education, the region and long-term illness. The sample consists of women between the age 25 and 65 and excludes women with children aged below

four years old. The results indicate overweight of women is correlated with current employment and obesity of women to long-term employment in contrast to no significant outcome for men. Next to the feature the height and weight are self-reported, only multivariate analyses using log regression are considered. Also no IV-regressions are performed to control for reverse causality which probably causes underestimation of the effect of obesity on employment.

Morris (2006) examines the effect of obesity on employment with employment defined as being in paid employment or self-employed. Data of the Health Survey of England are used from rounds 1997 and 1998. The strength of this dataset is that data about height and weight are collected by a nurse instead of self reported. Using both a univariate probit model and propensity score matching (nearest neighbor matching) obesity has a significant negative effect on employment for males. Controlling for reverse causality the instrumental variable used is the prevalence of obesity in the area in which the respondent lives. Using the IV model obesity has a significant negative effect on employment for both females and males. Since ñ is positive, unexplained factors that affect obesity are positively correlated with unexplained factors that affect employment. Morris (2006) used the Wald test to test this possible correlation and since ñ=0 is not rejected for men it is suggested obesity does not affect the univariate probit models for males, assuming the instrument is valid. But ñ=0 is rejected for females which suggests the univariate probit models are biased and the negative effect from obesity on employment is probably underestimated.

Rooth (2007) used manipulated pictures to examine whether employers react different when the same applicant with the same background was shown as a normal weighted person or with considerable overweight. He concludes the obese person receives 10% to 20% less callbacks compared to the normal weighted person, everything else equal since the pictures where manipulated.

Greve (2008) uses data from the Danish Work Environment Cohort Study (DWECS) of 2000. The interviewed persons are aged between 18 and 60 years. The effect of BMI on employment is significant and U-shaped for men and significantly negative for women. Greve (2008) suggests the different outcomes are a consequence of the use of BMI which does not distinguish fat and fat free body mass. She also explores the effect of BMI on wages for the private and public sector separately. Model one only includes, next to the controls variables, BMI and generates no significant outcomes. But when including BMI and BMI squared significant results emerge in the private sector for men with a maximum BMI of 28,5 and a minimum BMI of 28 for women. The maximum BMI of 28,5 of men can be driven by high-weight levels of men employed in the private sector in Denmark. The minimum BMI of 28 of women is explained by non-selection into the labor market of obese women.

Mahler (2008) used German Socio-Economic Panel (GSOEP) data from Germany between 2002 and 2004 and concludes obese German female workers earn 5 to 7 percent less because of productivity concerns. This effect on obese male worker disappears when controlling for physical and mental status. Female workers might select themselves in certain jobs and therefore the discrimination argument is not examined by the author.

Lindeboom et al. (2009) used National Child Development Study (NSDS) data from England. The results show both obese men and women experience lower employment probabilities compared to non-obese individuals. This effect remains after controlling for a large scale of factors including ability and parental control and input variables. Obesity has a negative effect on wages of women in contrast to no effect on men.

Lundborg et. al. (2010) examined a large sample of Swedish men between the ages 28-38 in 2003. A variation of models is tested from only controlling for age to controlling for age, height, parental characteristics, cognitive skills, non-cognitive skills, physical fitness and muscular strength. The overall significance, except when controlling for muscular strength, of both overweight and obese men on earnings is striking and ranges from 18,3 % decrease in annual earnings for obese individuals, only controlling for height and age, to 2,7% decrease controlling for all mentioned variables. The results for overweight persons range from a 7,4 % decrease in annual earnings only controlling for age to a decrease of 1,0% controlling for al variables mentioned. In order to determine if much of the wage variation is determined by family factors, controlling for sibling fixed effects results in half the decline of annual earning in percentage which suggests family factors are of large influence on annual earnings. Again all results are significant, except when controlling for muscular strength and all controls. This suggests the results of the full sample are robust to the inclusion of family fixed effects. So the overall results of this paper suggest the relation between obesity and earnings is correlated with physical fitness and skills.

Considering the results of previous research, described in appendix I, of separate European countries all significant outcomes show a negative result. The magnitude of this negative outcome is larger for females than males. Only the results of Greve (2008) show a positive relation between BMI and employment for males when controlling for fixed effects or if only employment in the private sector is measured. Considering the outcomes; after controlling for endogeneity only Morris (2006) gained significant results using instrumental variables, which suggests a negative effect between obesity and employment in which the large effect on females is remarkable.

3.4 Conclusion.

This chapter introduces obesity and considers the possible effects of obesity on labor market outcomes starting with a brief introduction; followed by theory; and ending with considering previous research. Measurement methods and results need to be considered with some criticism. BMI might not be a proper instrument to measure the effect of physical appearance in case of excessive fatness because BMI does not take body proposition into account. Nevertheless, in case of population research the WHO (2000) recognizes BMI as a valid measurement.
Considering previous research the results in the U.S. suggest overweight and obesity of women is correlated with lower wages compared to healthy weighted women. The relation between obese men and wage do not result in significant outcomes but men classified as overweight seem to earn more compared to healthy weighted men. Results in Europe as a whole suggest BMI of women to be negatively correlated with wages and a higher BMI might increase the probability of self-employment and unemployment. The results of BMI on wages of men are mixed just as the outcomes of both men and women when controlled for endogeneity with instrumental variables. The results of separate European countries are more consistent and most significant results are negative. The influence of BMI of women on wages and employment is of a larger magnitude compared to men in most significant results.

The overall results of previous research suggest obese women experience lower wages than healthy weighted women, in contrast to a wage increase of overweight men. This result can be explained by arguing obese women are negatively discriminated and overweight men experience positive discrimination. But the result can also be caused by occupational crowding or larger labor mobility of men which makes men more able to eliminate penalties by selecting themselves the *right* job. This means that if labor mobility is larger for men compared to women then it is easier for men to select themselves in jobs where overweight is not an issue or even a positive characteristic. Jobs where overweight might be of less influence is when the employee has no contact with the costumer in order to avoid customer discrimination or possibly overweight of men is associated with authority.
Furthermore the influence of both reverse causality and endogeneity has to be considered because this biases the results. A causal effect is difficult to determine. Previous research used several methods and instruments to control for this endogeneity bias but still arguments the used instruments are not perfect and probably a bias remains present.

A relation between BMI and wage can be explained through the concept of discrimination since lower wages can be a consequence of taste, customer or statistical discrimination which generates a discrimination penalty. Occupational crowding and labor mobility can both influence the penalty level. But differences in time preference between obese and non-obese individuals can also explain differences in wage level through educational attainment and the use of on-the-job training possibilities. Furthermore it is suggested the wage penalty due discrimination might influence the employment rate and self-employment level of obese individuals when bargain power of labor unions and the level of employment protection is considerable. The results of Rooth (2007) support the likelihood employers discriminate obese persons apart from productivity concerns. This has consequences for the level of bargaining power which in turn influences for example hiring chances, wage-setting and promotion opportunities (Puhl and Brownell, 2001). When in the process of hiring employees physical discrimination prevails, it should be reasonable to expect unemployed individuals are more often obese but also individuals who are self-employed. There seems to be only weak evidence obese individuals are more self-employed than non-obese individuals, but obese seem to have a higher probability to be unemployed (Garcia, 2007). However, overall European research suggests higher BMI causes a higher unemployment probability and higher self-employment probabilities of both men and women. Becker (1971) argues an increase of the discriminated group implies more information is available about for instance productivity and therefore discrimination declines. Therefore a higher prevalence of excessive fatness is expected to result in a lower level of discrimination of persons suffering from excessive fatness and a smaller effect of BMI on wages and employment probability in the U.S. compared to Europe. This theory is partly confirmed by the fact overweight men seem to earn more than normal weighted men in the U.S. compared to a decrease in earnings for overweight men in Europe. In the U.S. wages of obese women are generally significantly lower compared to normal weighted women and no significant results of overweight women in the U.S. prevail. In European research both overweight and obese women tend to be negatively significant. So overweight women do not earn significantly less than normal weighted women in het U.S. compared to a negative significant result in Europe where prevalence is lower than in the U.S. This also seems to confirm the theory of Becker (1971) that the effect of excessive fatness is lower in the areas where prevalence is higher caused more knowledge about the group. Thus since the prevalence of obesity is relatively low in the Netherlands, we can expect the social degree of acceptance is low and therefore find significant labor market penalties. According to theory it would be reasonable to assume that the level of prevalence

influences the level of stigmatization which in turn can influence the impact of personal problems on labor market attitudes of overweight and obese individuals in the Netherlands.

Chapter Four Empirical Analyses

This chapter starts with stating the hypotheses. In the second section the used dataset will be examined by describing the survey. The third section considers the descriptive statistics and an explanation of the model. Methods used in the analysis will be considered in the fourth section. Finally the results are presented in section five followed by the conclusion.

4.1 The hypotheses.

Through the growing prevalence of obesity in the Netherlands the influence of obesity on labor market outcomes is of increasing interest. Previous research frequently considered the influence of overweight and obesity on wage levels of men and women. Considering theory it is expected wage levels of obese individuals are lower when they experience discrimination because employers experience an additional cost, which can be translated as a wage penalty for the employee. But, as explained in theory, labor institutions like labor unions and employment protection legislation might also influence labor market outcomes. The focus of European research on the influence of obesity on employment status reflects the stronger influence of labor market institutions on the labor market in European countries. Also, the employment probability can influence the bargaining process, hiring chances, the process of wage setting and promotion opportunities.

As displayed in table 2, this paper tests six hypotheses in order to improve understanding of the influence of overweight and obesity on the labor market. The first hypotheses tests whether wage levels of obese individuals differ compared to normal weighted individuals as frequently tested in U.S. research; the second hypotheses considers whether there are differences in the probability being currently in paid employment, as frequently tested in European research. It could be individuals experience discrimination but are able to eliminate the penalty through labor market mobility. In order to detect this effect differences in the probability of currently being in paid employment in the public sector compared to being employed in the private sector are considered; the influence on employment in the public and private sector on wage levels; and the probability of being self-employment when obese compared to being normal weighted.

Table 2. Hypotheses[5].

Hypothesis I	**H_0**: There is no difference between the wage levels of obese individuals compared to normal weighted individuals. **H_1**: There is a difference between the wage levels of obese individuals compared to normal weighted individuals.
Hypothesis II	**H_0**: The probability obese individuals are currently in paid employment is equal compared to the probability normal weighted individuals are currently in paid employment. **H_1**: The probability obese individuals are in paid employment is not equal compared to the probability normal weighted individuals are in paid employment.
Hypothesis III	**H_0**: The probability obese individuals are in paid employment in the public sector is equal compared to the probability normal weighted individuals are in paid employment in the public sector. **H_1**: The probability obese individuals are in paid employment in the public sector is not equal compared to the probability normal weighted individuals are in paid employment in the public sector.
Hypothesis IV	**H_0**: There is no difference between the wage levels of obese individuals in the public sector compared to normal weighted individuals in the public sector. **H_1**: There is a difference between the wage levels of obese individuals in the public sector compared to normal weighted individuals in the public sector.
Hypothesis V	**H_0**: There is no difference between the wage levels of obese individuals in the private sector compared to normal weighted individuals in the private sector. **H_1**: There is a difference between the wage levels of obese individuals in the private sector compared to normal weighted individuals in the private sector.
Hypothesis VI	**H_0**: The probability obese individuals are self-employed is equal compared to the probability normal weighted individuals are self-employed. **H_1**: The probability obese individuals are self-employed is not equal compared to the probability normal weighted individuals are self-employed.

4.2 DNB Household Survey (DHS).

From 1993 to 2009 CentERdata collected economic data yearly. The aim of their data collection is to improve understanding between economic and psychological aspects to determine saving behavior of households. DNB Household survey uses an internet panel which reflects the Dutch speaking population. If participants do not own an internet connection a Net.Box is provided to connect with internet through television. CentERdata donated a television in case the participant didn't own one.

[5] In all hypotheses 'obese' can be substituted by 'overweight' and all hypotheses are with respect to the Dutch population.

Every week participants complete a questionnaire without the use of an interviewer. This is assumed to be an advantage for the panel member because they can fill in the questionnaire any time. Also the routing can be adjusted or questions can be phrased in a different way due to previous answers through the use of internet.

4.3 Descriptive statistics.

The data for this research are composed out of three questionnaires from 2002 to 2009. The used questionnaires are: general information from the household; household and work; and health and income. The used data might be biased for several reasons but these biases are limited as much as possible. Only persons who reported employed 15 hours or more are included to reduce bias concerns, especially for women. In order to control for both labor market responsibilities and generate a correct interpretation of BMI because of physical developments until the age of twenty-one (RIVM, 2010), the included ages of the observed individuals are chosen to be between twenty-one and sixty-four. Furthermore, the large age range increases the probability of inclusion of individuals with higher BMI and the influence of experience on the results. The data do not provide information about whether a woman is pregnant. The bias depends on how many pregnant women filled in their current weight, but it cannot be excluded this biases the results.
In the previous section it is mentioned the Dutch speaking population is interviewed. As mentioned by Burkhauser and Cawley (2008) the ethnical background can influence prejudice indicators of employers. Since origins are not mentioned the lack of this control variable may bias the results.
Considered the questionnaires are in Dutch it is assumed the respondents have to have an adequate command of the Dutch language. This assumption excludes the option the respondent does misinterpret questions. Besides, this assumption increases the sample selection bias because the Dutch population who does not understand the Dutch language adequately is excluded, although this is probably a small bias.
The use of an internet panel might influence the reliability of the collected data. But when information about e.g. income is asked the participant also had to report the source in order to improve reliability. The data about height and weight are probably biased because it is known questions about height tend to be over reported and answers about weight tend to be under reported (Fortenberry, 1992). Bendixen et al. (2004) shows an underestimation of BMI of 1,9 percent points for men and 5,3 percent points for

women.

Figure 1 shows the average BMI trend of men and women from 2002 to 2009. The trends of both men and women in the sample show an increase of BMI values which is in line with population expectations. In 2002 the average BMI of men and women was close to equal in contrast to a clear difference in BMI values in 2009. Because of the distinction of body composition and other behavioral distinctions results of men and women are displayed separately.

Figure 1. Average BMI trend 2002-2009 DNB Household survey.

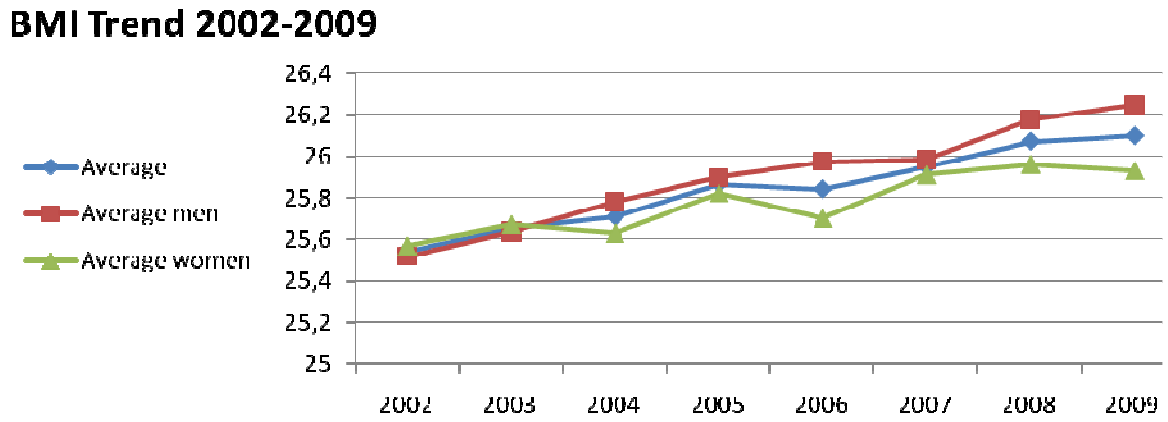

Table 4 and table 5 in appendix II show the summery statistics of employed men and women respectively. The total number of observations is 5639 for males and 5381 for females. The average BMI is a little higher for men than women but in turn the standard error is higher for women which is explained by the higher percentage of women categorized as obese or underweight. The distribution of the classifications reveals the same pattern as the nationwide statistics described in chapter three. For men being overweight is more common compared to women, but women tend to be more often obese. The wage per hour is determined by two variables reported in DHS namely the standard number of hours worked in a week and the yearly gross income in euros. The wage per hour is calculated by dividing the yearly income by the usually number of hours worked each week times 52 reported by the individual. The average wage level per classification of men confirms the expectation overweight and obese individuals earn less than normal weighted individuals. This is in contrast to the averages of women in which obese women earn more than overweight and normal weighted women. The explored variables concerning men are as expected based on theory. Men with obesity are more often self-

employed[6] and overweight or obese men are less often currently in paid employment and work more often in the public sector[7]. The summery statistics of women are less in line with the expectations based on theory. Overweight and obese women have a lower probability of currently having a paid job[8], and are less often self-employed and less employed in the public sector.

However these correlations do not imply a causal relationship. In order to control for the possible correlation, different multivariate regressions are conducted to control for variables which can be correlated to the dependent variable and BMI. Considering the control variables of men, all experience and social variables are positive related with the classification.

The educational control shows educational attainment and BMI classifications are negatively related. Educational attainment is assumed to be constant over time. Because educational attainment occasional changed over time, the most common educational attainment or, when equal, the highest level of educational attainment is retrained. All observations reporting a height lower than one meter or a resulting BMI lower than 10 are dropped from the dataset because of realistic reportage of height and weight.

The health controls for men confirm the self-reported health status decreases when overweight or obese and an increase of experiencing a chronic health condition. These health controls are also included to control for personal psychological problems since the reportage of health status and the suffering from a chronic health condition probably also has a mental component. The probability of being a smoker decreases when being overweight or obese in this dataset. Considering the control variables of women within the experience controls, only the probability of having children seem to be positive related with the BMI classifications. The average age of women is higher in the overweight classification compared to normal weighted individuals but this trend does not continue in the obese classification, the same applies to the distribution of having a spouse. The educational control and health controls show the same distribution as described for men.

[6] Self-employed (=1) if the most important occupation of the respondent is: works in own business; or free profession, freelance, self-employed. The respondent is employed (=0) if the primary occupation of the respondent is being employed on contractual or/and permanent basis (questions 'BEZIGHEI' and 'LOOND2' of DHS household survey).

[7] Working in the public sector (=1) if the respondent indicates to be employed by the government and is working in the private sector (=0) if indicating (question LOOND3 of DHS household survey), other institutions excluded.

[8] Currently in paid employment (=1) if the respondent indicates one or both questions of importance: the primary occupation is having a paid job; or the respondent indicates to have a paid job, even if it is only for one or a few hours per week or for a short period (although <15 hour a week are excluded). If the respondent did not satisfy one of these requirements the dummy variables is equal to zero.

In summary, based on the descriptive statistics overweight and obese men are expected to earn less compared to normal weighted individuals in contrast to a mixed probability in women classifications. Overweight and obese men are more often self-employment and employed in the public sector than normal weighted men and the wage distribution shows lower wage levels for overweight and obese men. This contradicts each other because higher percentages of self-employment and employment in the public sector suggests overweight and obese men might be able to eliminate the experience wage penalty, but this does not seem to be true considering the wage distribution. The wage distribution of women is not clear, since it seems obese women earn more than normal weighted women. Obese and overweight women are less often self-employed or employed in the public sector compared to normal weighted women.

4.4 Model and methods.

As described in the section descriptive statistics, to determine the results of the six hypotheses six dependent variables: the wage level; currently in paid employment; in paid employment in the public (private) sector; the wage level in the public sector; the wage level in the private sector; self-employment. The results who determine the effect of excess fatness and the dependent variable are considered in two dimensions. The first dimension is the model used and the second dimension the used independent variable for measuring the effect between BMI and wage levels which is determined for three different equations.

Starting with the first dimension; model one, two and three are ordinary least square regressions (OLS). The first model controls only for experience represented by the variables age and age squared. The second model adds a control for education. The educational attainment with diploma is split in low, middle and high educational attainment of an individual. The third model controls for experience, educational attainment and health and will be referred as being the full model. The health control represents three dummy variables, which are one if true, controlling for: self-reported health status is one if reported good or excellent and zero if reported fair, no good or poor; suffering of a chronic health condition; and being a smoker. The used control variables are explanatory variables frequently used in previous research.

Model four presents the result of the full model and controls for fixed effects. This results in the exclusion of the educational control since this control is constant over time. Controlling for fixed effects

means a comparison of the log hourly wage observations of each survey year the same participant is present in the dataset.

Model five presents the results of the two-step Heckman selection model. A sample selection problem occurs when the observed sample is not randomly selected but systematically chosen from the population. This model increases the number of observations by assuming that the missing values of the dependent variables imply that the dependent variable is unobserved. The Heckman selection model assumes an underlying regressive relationship which explains the conditions when the dependent variable is observed in the sample. The used model in this research assumes the dependent variables are a function of experience, educational and health controls. The likelihood the dependent variable is observed is assumed to be a function of: the age of the respondent; whether the respondent has any children living in the household; if the respondent can be qualified as primary income provider; and whether the respondent has a spouse living in the household.

The second dimension presents the used independent variable for measuring the effect between BMI and wage levels which is determined for three different equations. The first equation presents the absolute BMI. The result of this equation represents the percentage change in wage level when BMI increases with one. The second equation includes a dummy variable presenting one if the person is overweight or obese and zero if normal weighted, so underweight persons are excluded in this equation. The third equation includes dummy variables in which the effect of being classified as underweight, overweight and obese is measured compared to normal weighted. The results of the second and third equation are dummy variables which mean being in a particular weight classification effects wage level by the result presented in percentage.

In order to control for biases the Wald and Hausmann test are conducted. For almost all models the modified Wald-test is conducted results in a value lower than 0,05. Therefore all equations control for this heteroskedasticity by adding ‘robust’ to the regression. Furthermore the Hausmann test indicates random effects are not appropriate in most of the regressions. Therefore model four controls for fixed effects. Finally, model five controls for sample selection by adopting the Heckman sample selection model.

Previous research adopted several other methods. In order to uses lagged BMI properly the lagged BMI has to be independent of the residual. Since omitted variables are likely to be related to both BMI and the dependent variable, the residual is unlikely to be independent of the BMI. The same problem occurs when using fixed effects because the model assumes all unobserved variables are constant over time. Also the fixed effects suffer from a trade-off problem between consistency and precision. When the

regression is performed within a short period of time there is a lower probability of individual differences in the regression, but generates less precision, and vice versa when using a long period of time. But since fixed effects are commonly used in previous research this method is included to be able to compare the results. Both lagged measures and fixed effects do not control for reverse causality.
The instrumental variable method can control for reverse causality when using the correct instrument. A correct instrument has to be correlated with the endogenous explanatory variables, and may not be correlated with the error term of the equation. So, the instrument can only affect the dependent variable through its effect on the independent variable, in this case the effect on BMI. Previous research uses BMI of the child (Cawley, 2000), BMI of a sibling or lagged BMI (Cawley, 2004), BMI of a family member (D' Hombre and Brunello, 2005), biological BMI (Atella et al., 2008) and the prevalence in the area the respondent lives (Morris, 2005). It is evident the instrumental variable is perfect when genetic characteristics are equal to the genetics of the respondent. Previous research discusses previously used instrumental variables to a large extend since they are never perfect. A twin study would approach the perfect instrument the most. In the data available of DNB Household survey it is not evident which household members is a biological family, which excludes the possibility of using a genetic respondent as instrumental variable in order to exclude reverse causality. Because other methods, like the biological BMI and the prevalence in the area the respondent lives, are both not available and not satisfying in resolving the correlation problem the instrumental variable approach is not covered in this research.

4.5 Results.

This section starts with exploring the influence of BMI on hourly wage. Second the probability of currently being in paid employment is considered since this is an important research objective in European studies. Differences in wage levels might be eliminated by labor market mobility and thereafter we are curious whether the effects are different for the public sector, private sector and the self-employment probability. Current employment in the public sector compared to the private sector is considered, wage differences for both the public and private sector are explored and the probability of being self-employed. Tables 6 to 11 in appendix II[9] contain the results discussed.

[9] The classification underweight is displayed in each table because this variable is included in the third regression, but is ignored in discussing the results since this is beyond the scope of the research question.

Table 6 shows the overall results of the effect of BMI or BMI classifications, on wage levels of men and women. Considering the wage per hour of men it seems wage is negatively influenced by absolute BMI since the full model is significant on the 0.10 level and wage levels are reduces by 1,2 percent point when BMI increases with one. When controlling for fixed effect significance disappears, but after applying Heckman selection in model 5 significance returns since wage levels are significantly influenced by absolute BMI and reduces with 0,6 percent point at the 0.05 level. The third equation, in which the effect on classifications is displayed, shows a significant reduction of the wage level of 6,2 percent point at the 0,10 level in the obese classification when applying the Heckman selection model (model 5). When considering the wage effect of women, the results are more convincing. The wage level of overweight women is significantly negative and is approximately 10 percent point lower compared to normal weighted women. The significant negative impact on overweight individuals only disappears when controlling for fixed effects. Considering obese women, only the Heckman selection model results in a negative significant result of 10,5 percent point. The negative wage effect suggests discrimination of overweight and obese females in terms of wage compared to normal weighted female employees. If this discrimination effect is also present for males, they are able to select themselves in the right jobs and dismiss the penalty in most cases since significance does appear less often compared with the results of women. This would imply male employees have larger labor market mobility than females.

European research focuses more on employment of obese and overweight individuals. Table 7 shows men experience a positive relation between absolute BMI and the probability of currently being in paid employment, in contrast to no significant results for women. No effects are found for both overweight and obese women, and absolute BMI of women. Controlling for fixed effects, a positive effect seems to reveal for obese men since this relation is significant on the 0.05 level. But since the OLS models and Heckman selection model do not show significant results for any classification in equation 2 and 3, it cannot be concluded obese men are less often in paid employment than normal weighted men. The results of men suggest absolute BMI has a strong positive significant effect on the probability of being in current employment for at least 15 hours per week. When absolute BMI of men increases with one unit, then the probability of being in paid employment increases with 3,8% to 7,8%. The significant effect disappears when controlling for sample selection for men in model five. Men experience a positive relation between BMI and being in paid employment in contrast to both positive and negative insignificant) results of women.

Wage developments of individuals in the private and public sector might be different over time. Therefore the effect of BMI on wage levels might differ too when separating the private and public

sector. When considering the probability of currently being in paid employment in the public sector compared to the probability of currently being in paid employment in the private sector, as displayed in table 8, it seems obese men tend to be weakly overrepresented in the public sector, although this effect disappears when controlling for sample selection. The results of overweight and obese women do not show a significant effect. Nevertheless it is striking the relation between BMI and the probability of employed in the public sector compared to the private sector is negative for women's classifications, in contrast to men which were positive. This can indicate overweight and obese men prefer to work in the public sector and overweight and obese women prefer to work in the private sector, but since the results are not significant, this is only a suggestion.

The positive results of obese men can be caused by labor mobility which makes them able to eliminate an optional wage penalty in the private sector by preferring the public sector. Therefore the effect of BMI on wage levels in both the public and private sector is also measured.

Table 9 considers the effect of BMI on wage levels of men if employed in the public sector. It is striking this relation is negative and strongly significant in case of absolute BMI as independent variable and classified as obese. When absolute BMI of men increase with one, the hourly wage of men employed in the public sector deceases even with 2,3 to 4,4 percent point. Table 9 shows a strong negative effect between obese men and the probability of being in paid employment in the public sector. Table 9 indicates this relation is probably biased by sample selection since the results of table 9 are strongly significant except when controlling for fixed effects. Obese men earn 28,6 percent point less than normal weighted men in the full model and 21,2 percent point less when controlling for sample selection. The Hausmann test shows controlling for random effects instead of fixed effects is also appropriate for the full male model. When controlling for random effects this results in a significant wage decrease when employed in the public sector of 28,6 percent point on the 0.05 level for obese men. The only significant result is of obese women in the Heckman sample selection model, although weak and only significant at the 0.10 level.

Table 10 considers the effect of BMI on wage levels of men if employed in the private sector which results in no significant outcomes in the overweight or obese categories. The overall results are positive which indicates a positive relation between BMI of men and wage levels in the private sector. For women the sign of the results differ and only overweight females seem to earn significantly less when controlling for sample selection, which is not strong enough to extract any conclusions.

When individuals are negatively discriminated and mobile on the labor market it would be rational that they select themselves into occupations where a penalty does not exist. Considering table 6, the wage

results suggest men might be able to select themselves into the jobs to avoid a penalty to a larger extent than women. The option of becoming self-employed (table 11) could be attractive in order to avoid a penalty. In table 11 the same models are run with as dependent variable self-employment in contrast to being an employee. None of the results are significant except the Heckman sample selection results of women. These results show a lower probability of being self-employed when overweight or obese compared to normal weighted of approximately 3 percent point at the 0.01 level for overweight and obese women. This result is rather puzzling because it is expected obese and overweight women tend to avoid the wage penalty shown in table 6 and will be overrepresented in the self-employment category. This might imply women are not able to eliminate the wage penalty due to limited labor mobility in order to select themselves in the option of self-employment.

Table 3 provides an overview of the discussed results.

Table 3. Hypotheses and results[10].

Hypothesis I	**H_0:** There is no difference between the wage levels of obese individuals compared to normal weighted individuals. **H_1:** There is a difference between the wage levels of obese individuals compared to normal weighted individuals. **Men:** H_0 not rejected in when considering classifications, but a possible negative effect when considering absolute BMI. **Women:** H_0 rejected in case of overweight (negative).
Hypothesis II	**H_0:** The probability obese individuals are currently in paid employment is equal compared to the probability normal weighted individuals are currently in paid employment. **H_1:** The probability obese individuals are in paid employment is not equal compared to the probability normal weighted individuals are in paid employment. **Men:** H_0 rejected in case of absolute BMI (positive). **Women:** H_0 not rejected.
Hypothesis III	**H_0:** The probability obese individuals are in paid employment in the public sector is equal compared to the probability normal weighted individuals are in paid employment in the public sector. **H_1:** The probability obese individuals are in paid employment in the public sector is not equal compared to the probability normal weighted individuals are in paid employment in the public sector. **Men:** H_0 not rejected. **Women:** H_0 not rejected.
Hypothesis IV	**H_0:** There is no difference between the wage levels of obese individuals in the public sector compared to normal weighted individuals in the public sector.

[10] In all hypotheses 'obese' can be substituted by 'overweight' and all hypotheses are with respect to the Dutch population.

	H_1: There is a difference between the wage levels of obese individuals in the public sector compared to normal weighted individuals in the public sector. **Men:** H_0 rejected in case of absolute BMI and classified as obese (negative). **Women:** H_0 not rejected.
Hypothesis V	**H_0**: There is no difference between the wage levels of obese individuals in the private sector compared to normal weighted individuals in the private sector. **H_1**: There is a difference between the wage levels of obese individuals in the private sector compared to normal weighted individuals in the private sector. **Men:** H_0 not rejected. **Women:** H_0 not rejected.
Hypothesis VI	**H_0**: The probability obese individuals are self-employed is equal compared to the probability normal weighted individuals are self-employed. **H_1**: The probability obese individuals are self-employed is not equal compared to the probability normal weighted individuals are self-employed. **Men:** H_0 rejected in case of absolute BMI and classified as obese. **Women:** H_0 rejected in case of both overweight and obesity (Heckman selection model).

4.6 Conclusion.

The most important conclusion from this chapter is that overweight and obese women suffer a wage penalty, which is in line with previous research, in contrast to no significant results for overweight and obese men. By separating the effect of obesity on wage levels in effects in the private and the public sector the effect it is expected the results of the private sector are more often significant through larger wage fluctuations than in the public sector, but the reverse seems to be true. Obese men seem to be overrepresented in the public sector, since the results are positive although not significant. This can indicate they are able to use their labor market mobility in order to avoid the wage penalty. But the results of the log wage per hour of men employed in the public sector indicate wage levels of obese men and the relations with absolute BMI are significantly lower compared to normal weighted men, which is striking. The results indicate a strong positive significant effect between absolute BMI and the probability of being in paid employment for men, but this effect is not reflected when considering the classifications.

Women experience a wage penalty in the overall results of table 6 but the evident significance disappears when separating the result in public and private sector. When considering the effect of absolute BMI, overweight and obese women on the wage level in the public and private sector, the results are not convincing. This indicates women do not experience a wage penalty when the wage level of the public and private sector are examined separately. Only weak significance persists in case of obese women in the public sector and overweight women in the private sector when controlling for

sample selection. Within the framework of labor market mobility it is remarkable obese and overweight women are less often self-employed than normal weighted women.

Chapter Five Conclusion

Chapter five summarizes the main conclusion of the previous chapters and provides an answer to the research question exposed in chapter one. Furthermore this chapter points out the imperfections of this thesis, present policy suggestions based on the results and suggestions for further research.

5.1 Main conclusion.

This thesis focuses on wage differences between obese and overweight individuals compared to normal weighted individuals on the Dutch labor market. To the best of my knowledge, this thesis is the first research in this form on the influence of obesity on wage levels in the Netherlands. This study also contributes to finding an explanation of a possible wage penalty for individuals with higher BMI by additionally exploring the effect of BMI on wage levels in the public and private sector; current employment probability and whether the effect differs when only measuring current employment probability if the individual is employed in the public sector compared to the private sector. Previous research did not control for sample selection for which is controlled for in this research with the Heckman selection model.

In chapter one the following research question is formulated:

Does the prevalence of overweight or obesity influence individual wage levels in the Netherlands?

The first step in answering the research question is exploring which factors influence prices of labor on the labor market. And therefore the possible influence of human capital, labor market institutions and discrimination are discussed. In the wage setting process, the employer uses frequently the educational attainment and previous experience as signaling device for the determination of innate ability. Labor institutions might decrease employment of discriminated groups through introducing minimum or bargained wage level and employment protection legislation but non-profit organizations might be less inclined to discriminate.

Previous research in the U.S. indicates overweight men earn more than normal weighted men which is in contrast to a decrease in earnings for overweight men in Europe. In the U.S. wages of obese women are generally significantly lower compared to normal weighted women and no significant results of overweight women in the U.S. prevail. In European research both overweight and obese women tend to

be negatively significant. European research indicates a higher BMI causes higher unemployment probability and higher self-employment probabilities of both men and women. Since men seem to be able to avoid the labor market penalties it can be stated men take advantage of more labor market mobility than women, who do experience a wage penalty in European studies.
According to the expectations from theory and previous research the results of this paper indicate overweight and obese women suffer from a wage penalty. It seems men are able to eliminate this penalty due to larger labor market mobility since they are overrepresented in the public sector. But when considering wage levels in the public sector, obese men earn less than normal weighted individuals which contradicts the rational aim to avoid a penalty. Also the lower self-employment rate of obese and overweight women contradicts rationality because of the experienced wage penalty. A possible explanation can be that overweight and obese women tend to experience customer discrimination which cannot be avoided by becoming self-employed. Both contradictions need further research.

The Dutch results show similarity with previous literature: overweight and obese women experience lower wage levels compared to normal weighted individuals; and the results indicate a strong positive significant relation between absolute BMI and the probability of being in paid employment for men. The lower wage of women can have several reasons. The main reason suggested by previous research is overweight and obese women experience negative discrimination. But also mental health of this group caused by stigmatization can result in lower self-esteem which in turn affects decision making during life time and can result in lower wage levels. The strong preference of obese men for employment in the public sector might be caused by occupational crowding since the wage level is significantly lower for obese men employed in the public sector.

Most research only considered the effect of the classification on employment probability and not BMI. Garcia and Quintana-Domeque (2006) only provide weak evidence of separate European countries but no European evidence on a relation between obesity and employment and self-employment by exploring ECPH data and examined various European countries. Since the research of Sousa (2005), Sarlio-Lahteenkorva and Lahelma (1999), Morris (2006), Rooth (2007) all indicate a negative relation between overweight and obesity and employment probability, it was expected this relation also would exist in the Netherlands. Only Greve (2008) considers both an equation including absolute BMI and an equation including classifications separately for men and women. She only generates significant results when including BMI and BMI squared which complicates the interpretation of results. Greve (2008) also suggests women in the obese classification do not select themselves into employment but she did not

consider the results for the public and private sector separately. This diminishes the suggestion of Greve (2008) obese women are less often in paid employment. But when considering the Dutch results in table 9 the argument of Greve (2008) might be valid since overweight women tend to earn less compared to normal weighted women in the private sector when controlling for sample selection, although only at the 0.10 significance level.

As described in the conclusion of chapter three the fact that all data is self-reported reduces the reliability of the data. Also only limited models are considered: multivariate OLS analyses using a log regression when the dependent variable was not a dummy variable; a model controlling for fixed effects; and the Heckman selection model to control for sample selection. The missing regression is an IV-regression in order to control for reverse causality and probably causes biases of the effect of BMI on wage levels and labour market outcomes. Because a suitable instrument is not present it is the result cannot be interpreted as a strictly causal interpretation of the effect of BMI on wage levels and the other dependent variables. The possibility BMI is correlated with unobserved variables and the possible existence of reverse causality are the most important factors that can cause an endogeneity bias. In response of addressing unobserved variables the IV method would be straightforward, but the selection of a strong instrument turns out to be challenging. After the research of Cawley (2004), many studies used the BMI of genetic related family members, but conclude this control for potential endogeneity does not affect their results substantially. Beside Atella et al. (2008) discusses the quality of the previous use of genetic related family members as instrument in ECPH data and concludes the use of this instrument can also lead to non-random sample selection. Based on the possibility of non-random sample selection my study presents the Heckman model (model 5) and does not address the potential endogeneity of BMI in this study because of the absence of convincing instruments in the data. Therefore the results cannot be interpreted as fully causal.

The results can also be biased through the use of BMI which can cause misclassifications since body composition of especially men might result in opposite effects even though men medically classified as overweight or obese still perceive a different wage level compared to men medical classified as healthy weighted. For example muscular men can be classified as overweight but perceived to be extremely competent by the employer. Also only a short period of time is considered in this research which may have consequences for the fixed effect model. The probability of unobserved individual differences is lower when using a short period of time, but on the other hand this results in less precision of the estimates which can result in no differences when limiting the unobserved individual effects.

This paper questions whether the prevalence of overweight or obesity influence individual wage levels in the Netherlands, which can be confirmed. The wage level of women classified as overweight is lower compared to women classified as normal weighted; the wage level of men employed in the public sector is lower when both classified as obese compared to men classified as normal weighted and when considering absolute BMI.

5.2 Further research.

Further research needs be performed in order to understand the effect of excessive fatness on the labor market. In the Netherlands additional research should control for labor market characteristics instead only for personal characteristics. To explore the effect in different market segments different occupations can be examined; the effect along the wage distribution since low wage levels might be affected differently than high wage levels; the effect of different ages groups; whether interaction with customers and colleagues effect wage levels; and the possibility that employees who experience a wage penalty might also be inclined to develop better job skills to compensate for the obesity effect. In order to determine causality all further research will benefit from an adequate instrumental variable.

5.3 Policy suggestions.

Overweight and obesity are an increasing problem in Western countries. The associated direct and indirect costs point out the need to take action in order to deal with this problem. Obviously the policy implications depend on the underlying causal relationship. If obesity and overweight are causing a wage penalty or/and a lower probability of being in paid employment then for both the individual and society large gains might be feasible. A policy suggestion can have two different principles: a focus on prevalence; or a focus on the reduction of the wage penalty, probably caused by discrimination.

When a policy focuses on prevalence then more efficient obesity treatments can be a solution. Another possibility is to cover the treatment of obesity in the social healthcare package, compared to current coverage of programs to quit smoking, and highlight this in national campaigns. More attention to nutrition counseling and weight loss treatments might be an option in order to improve public health. Policy implications can also use a more negative approach. Obesity can be viewed as a negative market

externality which can be corrected by a tax on these people or on, for example, junk food. But this can result in more stigmatization since the overweight and obese groups are treated different. Another option is providing a subsidy to the non-obese. However, this only solves the problem indirect.

The policy can also focus on eliminating the wage penalty. Previous research in the U.S. shows positive wage discrimination of overweight males in contrast to a wage penalty of overweight males in Europe. This confirms the theory of Becker (1971) that an increase of the size of the discriminated group generates more knowledge which declines prejudice and therefore discrimination. The higher level of prevalence of overweight and obesity in the U.S. thus might increase acceptance and eliminates the penalty. This implicates an increase of prevalence of overweight and obesity will eventually decrease discrimination and will eliminate wage penalties based on excessive fatness in the Netherlands. Obviously, it is not clear the wage penalty is a result of discrimination or is caused by other variables and therefore the government has to stimulate research on the origin of a wage penalty before implementing a policy.

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Appendix I

Research on the relation between obesity and overweight & wage levels and employment status of males and females.
Only significant results are presented.[11]

Research in the United States				Results			Other
Author and title	**Title**	**Data used**	**Definition of obesity (1) or (0)**[12]	**OLS Outcome: log wage equation**	**Fixed effects**	**Instrumental Variable**	
C.A. Register and D.R. Williams (1990)	Wage effects of obesity among young workers	NLS[13] 1982 18-25 years	Excess of 20 percent above standard weight for height[14] (0)	Females: obese -12,4% ***			
E.S. Loh (1993)	The economic effects of physical appearance	NLS 1982- 1985 18-22 years	Relative weight: actual weight divided by the average weight in the population[2 (0)] Obese: relative weight at least	*Relative weight* Males: 10% more weight than average decreases the hourly wage rate with 13,6%**			Impact of obesity on wage- changes -5,5%* for males

[11] *Significant at the 0.10 level, **Significant at the 0.05 level,***Significant at the 0.01 level

[12] When the outcome is not measures in classifications but in actual BMI (0) then the results has to be interpreted as follow: an increase of one unit BMI means a wage difference in percentage as presented in the results. When classifications or dummies (1) are used then the results presented has to be interpreted as follow: being in the reported classification means the result is the wage difference in percentage compared to healthy weighted individuals.

[13] National Longitudinal Surveys

[14] As given by the Metropolitan Life Insurance Company (1983)

			1,2 in value (1)				
J.A. Pagan and A. Davila (1997)	Obesity, occupational attainment, and earnings	NLSY[15] 1989 24-31 years	BMI (1)[16]	Males:-1,0%*** Females: -0,8%***			
S. Averett and S. Korenman (1996)	The economic reality of the beauty myth	NLSY 1988 23-31 years	BMI (1)	*1988 BMI* *Overweight* Females: -5,0%* White females:-5,0%* *Obese* Females: -10,0%* White females:-12,0%* White males:-9,0%*	*1981 BMI* *Obese* Males: -8,0% Females: -15,0%* White females -21,0%* White males: -12,0%*		
Cawley (2000)	Body weight and women's labor market outcomes	NLSY 1982-1985	BMI (0)	Female: -0,6%* White females: -0,7%**		Second stage 2SLS Female: -0,4%* White females: -0,7%**	IV: BMI child *Employment Probit with and without IV* Females: not significant
Cawley (2004)	The impact of obesity on wages	NLSY 1981-2000 20-27 years in 1979	BMI (0), weight in pounds controlled for height in inches (0), indicator variable for clinical classifications (1)	*BMI* White[17] females: -0.8%*** *Classification* *Overweight* White males: +3,9%*** White females: -4,5%*** *Obese* White males: -3,3%** White females: -11,9%***	BMI White Females: -0,7%*** Classification White males: overweight +2,2%** White females: obese -8,7%**	Both result measured in BMI and classification no sig. results. White females: weight in pounds -0,3%**	IV: BMI sibling controlling for age and gender
Baum and Ford (2004)	The wage effects of obesity: a	NLSY 1981-1998 >18 years	BMI – obese in comparison to normal BMI (1)	Model 1 and model 2 Males: -3,4%*** and -3,2%***[18] Females: -6,1%*** and -5,8%***	Individual difference models Males: -0,7%*	Individual sibling difference	

[15] National Longitudinal Survey of Youth
[16] The used clinical classifications are: underweight, overweight and obese, healthy weight excluded.
[17] Considered the composition of the Dutch population the main group of interest is white color persons.
[18] Individual model, with and without supplemental covariates

	longitudinal study				Females: -2,3%**	models Females:-4,8%**	
Cawley and Danziger (2005)	Morbid obesity and the transition from welfare to work	WES[19] 1999-2004 15-54 years Personal interview	BMI (0), Obese: 30≤BMI≤40 Morbid obese: BMI≥40 (1)	*Morbid obese Earnings* White females: (0)-3,5%* (1)-70,8%*	*No significant outcomes* But point estimates fall considerable.	*No significant outcomes* But point estimates fall considerable	*Not currently employed* White females: (0)+4,2%* (1)+17,9%*
Han, Norton and Stearns (2009)	Weight and wages: fat versus lean paychecks	NLSY 1981-2000 >18 years >15 hours employed	BMI (1)	*Overweight* White males: +3,2%** White females: -5,0%*** *Obese* White females: -10,9%*** White males: -3,9%*	Obese White females: -7,5%***		Employment: Overweight White males: -0,6%* Obese White females: -1,5%*

Research in Europe				**Results**			**Other**
D'Hombres and Brunello (2005)	Does obesity hurt your wages more in Dublin than in Madrid?	ECPH[20] 1998-2001 18-65 years	BMI on log wages (0)	*OLS* *Reduced model* Females:-1,5%*** *Extended model* Males:+0,3%** Females:-0,5%** *Extended model incl. regional and industry dummies:* Males: +0,4%** Females:-0,2%**	*Fixed effects* No sig. results	*IV* Reduced model Males: -5,9%*** Females:-2,6%** Extended model Males:+1,8%** Females:-1,7%** Extended model incl. regional and industry dummies: Males: +1,3%* Females:-1,0%*	IV: BMI of a biological family member
Sousa (2005)	Does size matter? A	ECHP 1999-2001	BMI ≧25 (1), *Propensity*	*Parametric estimates of BMI≧25 Labor market*	*Propensity score matching*		Direction of the results is

[19] Women's Employment Study

20 European Community Household Panel, designed and coordinated by Eurostat.

	propensity score approach to the effect of BMI on labor market outcomes		*score matching BMI (0)*	*participation* *OLS M*ales: +2,0%*** Females: -0,9%*** *Probit* Males: +1,0%*** Females: -4,0%***	*ATT*[21] *labor force participation* *Nearest-neighbor* Males: +1,6% Females: -1,8%		robust.
Garcia and Quintana-Domeque (2006)	Obesity, employment and wages in Europe	ECHP 1998-2001 25-54 years	BMI (0), an indicator of being obese (1)	*(Log) Hourly wage* *BMI* Males: Belgium +0,5%** Females: Austria -0,6%*; Denmark -0,8%***; Finland -0,8%**; Portugal -0,6%**; Spain -0,6%* *Obese* Males: Belgium +8,4%** Females: Denmark -9,2%***; Finland -9,9%**; Portugal -7,4%*	*Pr. self-employed/Pr. of employee* *BMI* Males: Greece +3,4%***; Ireland +6,9%***; Portugal +4,5%*; Spain +2,9%** Females: Greece +4,5%***; Ireland +5,4%* *Obese* Males: Greece +62,9%***; Ireland +78,4%**; Spain +38,3%** Females: Greece +58,9%***; Ireland +107,5%*; Italy +58,7%*	*Pr.unemployed/Pr. Employed* *BMI* Males: Belgium +7,7%***; Finland -5,5%*; Ireland -7,9%**; Portugal -8,0%*; Spain -4,3%** Females: Austria +6,8%*; Greece +4,1%*; Italy 5,5%***; Spain +3,4%** *Obese* Males: Belgium +205,1%***; Finland +50,3%* Females: Belgium +115,0%***; Italy +71,1%*; Spain +91,4%***	Employed = working >15 hours per week
Atella, Pace and Vuri (2008)	Are employers discriminating with respect to weight? European evidence using quartile regression	ECHP 1998-2001 15-50 years	BMI (1)	*(log) wages* *Incl. health status and occupational dummy* *Overweight* Females: -3,0%*** *Obese* Males: -2,0%*** Females:-5,0%***	*Quartile regression estimates(15, 25 50, 85)* Females: all results sig. ranging from overweight 15th&25th -1,0%** to obese 50th&75th-5,0%*** Males: Sig. except 25th& 85th obese.	*IV* *Overweight* Females: -18,6%* *Obese* Males: -33,7%** Females: -6,5%*	IV = biological BMI

[21] Average effect of overweight on overweight individuals.

					Only 15th obese is negative -2,0%***, other results overweight and obese +2,0%***
Hildebrand and van Kerm (2010)	Body size and wages in Europe: a semi-parametric analysis	ECHP 1998-2001 15-65 years	BMI (0) and (1)	*BMI (0) on wages Baseline model* *Linear specification* Females: -0,4%*** *Quadratic specification* Males:-5,4%*** -4,0%*** *BMI (1)* *Overweight* Female: -2,2%** -3,8%*** *Obese south* Female:-3,9%*** -5,9%***	*BMI (0) on wages Extended model* *Linear specification North & south* Females: -1,6* -0,4%*** *Quadratic specification* Males:-5,4%*** -3,5%*** *BMI (1)* *Overweight* North Males: -1,7%** South Female: -2,7%*** *Obese south* Female: -5,0%***
Research in European countries					
Sargent and Blanchflower (1994)	Obesity and stature in adolescence and earnings in young adulthood	England NCDS[22] 23 years Born between 3-9 March 1958	BMI, obese is defined as ≧90th percentile (1) and grossly obese ≧ 99th percentile (1)	*Multiple regression analyses ,* ≧90th percentile *and earnings* Females: -5.3%** ≧99th percentile *and earnings* Females: -14,0%**	
Sarlio-Lähteen-	The association of	Finland Survey of Living	BMI (1)	*Multivariable logistic regression 95% CI Highest*	*Long-term unemployment*

[22] National Child Development Study

korva and Lahelma (1999)	body mass index with social and economic disadvantage in women and men	Conditions 1994 ≧15 year		*probability Current* un*employment* *Overweight* *F*emales:+1,4%	*Obese* Females: +2,5%		
Morris (2006)	The impact of obesity on employment	Engeland HSE[23] 1997-1998	BMI (1)	*Obesity on employment* *Univariate probit* Marginal effect Males: -2,1%**	*Propensity score matching* *ATT on employment* *Stratification matching* Males: -1,9%** *Kernel Matching* *Males*: -3,4%** *Radius Matching* (0,1) Males: -6,5%** Females: -6,3%** (0,01)Males: -6,8%** Females:-6,1%** (0,001)Males:-6,3%** Females:-5,2%** (0,0001)Males: -3,8%**	*Obesity on employment* *IV* *Marginal effect* Males: -8,4%* Females: -21,3%**	IV: prevalence of obesity in the area the respondent lives
Rooth (2007)	Evidence of unequal treatment in hiring against obese applicants	Sweden	BMI (1)	*Probability of callback for interview* *obese without controls* Men: -6,0%*** Female: -7,0%*** Both: -7,0%***	*Probability of callback for interview, difference in marginal effect when obese-large effect* *Restaurant workers* *Men: -11,0%**** Female:- 19,0% *Preschool teachers* Female:-17,0%*** *Shop sales assistants* Men: -11,0%** Business sales assistants	*Probability of callback for interview, difference in marginal effect when obese both men and women* Sales assistant -11,0%** Business sales assistant -8,0%** Preschool teachers -12,0%** Accountants -6,0% Restaurant workers -15,0%***	

[23] Health Survey for England

					Male: -12,0%***	*No effect:* computer professionals nurses	
Greve (2008)	Obesity and labor market outcomes in Denmark	Denmark DWECS[24] 1995 and 2000 18-60 years	BMI on (log) wage (0) and BMI on employ-ment (0), (1)	*BMI on employment* Females: 0,4%* *Classification on employment* *Overweight* females: -3,9%** *Obese* females: -8,5%***	*Fixed effects BMI on employment* Males: +1,0%* Females: -6,0%***	*BMI on (log) wage* *Private sector* Males:+4,9%** Females:-6,8%*** *Public sector* no sig. outcomes	
Mahler (2008)	Obesity and wages in the German labor market	Germany GSOEP[25] 2002-2004	BMI (1)	*Obese on monthly wage* *Obese* *No controls* Females: -10,8%*** Personal controls Male: -4,2%** Females: -9,8%*** *Personal& health controls* Females: -8,4%*** *Personal &health &labor market controls* Female: 7,1%***	*Obese$_{t-1}$* *No controls* Males: -4,8%** Females: -9,2%*** *Personal controls* Males:-4,8%** Females: 9,1%*** *Personal& health* Females: -7,8%** *Personal& health &labor market controls* Females: -7,2%***		Obese$_{t-1}$ and therefore causal
Linde-boom, Lundborg and van der Klaauw (2009)	Obesity and labor market outcomes: evidence from the British NCDS	Engeland NCDS Born between 3-9 March 1958	BMI (1)	*Obese on (log) wage* *Age 33 no controls* Male: -7,8%** Female: -11,5%*** Basic controls Female:-6,0%** Parental control added Female:-5,6%* Ability control added Female: -5,6%* Parental inputs added	*Obese on employment* *Age 33* no controls Male: -4,5%** Female: -6,1%*** Basic controls Males:-3,0%** Female:-4,6%** Parental control added Males:-3,0%** Female:-4,7%*	*Marginal effects IV* *Wages* No sig. outcomes *Employment* No sig. outcomes	

[24] Danish Work Environment Cohort Study
[25] German Socio-Economic Panel

				Female: -5,6%*	Ability control added Males:-2,5%* Female: -4,5%** Parental inputs added Males:-2,7%* Female: -4,6%**
				Age 42 no controls Female:-5,4%*	*Age 42* no controls Male: -2,3%* Female: -4,9%*** Basic controls Males:-1,9%* Female:-3,9%*** Parental control added Female:-4,0%** Ability control added Female: -3,8%** Parental inputs added Female: -3,8%**
Lundborg, Nystedt and Rooth (2010)	No country for fat men? Obesity, earnings, skills, and health among 450,000 Swedish men	Sweden Statistics Sweden and Swedish National Service administration 2003 28-38 years men	BMI (1)	Earnings Age control Overweight & obese Males: -7,4%*** -18,3%*** Full model Overweight & obese Males: -1,0%*** -2,7%***	Sibling fixed effects Age control Overweight & obese Males:-4,0%*** -9,0%*** Full model: No sig. outcome

Appendix II

Table 4. Summary statistics if men: mean (standard deviation). Ages 21-64, years 2002-2009, the Netherlands.

Variables		Men (N=5639)			
BMI		25,8815 (3.9369)			
Underweight	(BMI<18,5)	.0048 (.0690)			
Normal weight	(18,5 ≦BMI ≦25)	.4442 (.4969)			
Overweight	(25 ≦BMI ≦30)	.4322 (.4954)			
Obese	(BMI ≧30)	.1188 (.3236)			
		1.0000			
			Normal weighted	**Overweight**	**Obese**
Income per hour	(hours per week >15, N=3576)	25.2254 (63.9197)	26.1775 (87.8057)	24.8336 (35.8706)	23.1830 (16.8467)
Currently in paid employment	(hours per week >15, 1=yes, N=3929)	.8407 (.3660)	.8521 (.3551)	. 8388 (.3678)	.8134 (.3900)
Self-employed	(1=yes, N=5238)	.0773 (.2671)	.0829 (.2757)	.0667 (.2496)	.0970 (.2962)
Employed in the public/private sector	(1=public, 0=private, N=3519)	.2711 (.4446)	.2595 (.4385)	.2716 (.4449)	.3028 (.4600)
Controls					
Experience & social					
Age		45,87 (11,17)	43.5389 (11.4286)	47.5474 (10.6356)	49.0985 (9.8206)
Children	(1=yes)	.04621 (.04986)	45.9481 (.4985)	.4551 (.4981)	49.10 (.5003)
Spouse	(1=yes)	.7902 (.04072)	.7569 (.4290)	.8145 (.388	.8299 (.3760)
Educational					
Edulow		.2681 (.4430)	.2184 (.4132)	.2876 (.4528)	.3791 (.4855)
Edumiddle		.3499 (.4770)	.3589 (.4798)	.3509 (.4773)	.3075 (.4918)
Eduhigh		.3820 (.4859)	.4227 (.4941)	.3615 (.4805)	.3134 (.4942)
		1.0000	1.0000	1.0000	1.0000
Health					
Healthreported	1= reported health status good	.9628 (.1894)	.9768 (.1504)	.9581 (.2003)	.9283 (.2581)
Healthchronic	1=chronicle health condition	.2089 (.4066)	.1729 (.3782)	.2150 (.4109)	.3164 (.4654)
Healthsmoke	1=smoker	.2786 (.4483)	.3054 (.4607)	.2565 (.4368)	.2597 (.4388)

Table 5. Summary statistics if women: mean (standard deviation). Ages 21-64, years 2002-2009, the Netherlands.

Variables		Women (N=5381)			
BMI		25.7644 (5.1074)			
Underweight	(BMI<18,5)	.0229 (.1495)			
Normalweight	(18,5 ≦BMI ≦25)	.4901 (.4999)			
Overweight	(25 ≦BMI ≦30)	.3200 (.4665)			
Obese	(BMI ≧30)	.1670 (.3731)			
		1.0000			
			Normal Weighted	**Overweight**	**Obese**
Income per hour	(hours per week >15, N=2238)	17.7627 (11.3165)	18.0886 (8.8669)	17.1429 (9.3689)	18.2316 (20.3149)
Currently in paid employment	(hours per week >15, 1=yes, N=3528)	.6460 (.4783)	.6783 (.4673)	.6321 (.4824)	.5977 (.4908)
Self-employed	(1=yes, N=4577)	.0734 (.2608)	.0897 (.2858)	.0576 (.2331)	.0521 (.2223)
Employed in the public/private sector	(1=public, 0=private, N=2468)	.3327 (.4713)	.3557 (.4789)	.3194 (.4665)	.2765 (.4478)
Controls					
Experience & social					
Age		43,65 (11,65)	42.5552 (11.7095)	45.6022 (11.6147)	43.5406 (11.0375)
Children	(1=yes)	.04800 (.04996)	.4827 (.4998)	.4483 (.4975)	.5273 (.4995)
Spouse	(1=yes)	.7762 (.4168)	.7804	.7909 (.4068)	.7453 (.4360)
Educational					
Edulow		.3128 (.4636)	.2571 (.4371)	.3548 (.4786)	.3949 (.4891)
Edumiddle		.3507 (.4772)	.3556 (.4785)	.3461 (.4759)	.3604 (.4804)
Eduhigh		.3355 (.4722)	.3879 (.4874)	.2967 (.4569)	.2436 (.4295)
		1.0000			
Health					
Healthreported	1= reported health status good	.9563 (.2044)	.9666 (.1796)	.9681 (.1459)	.9132 (.2516)
Healthchronic	1=chronicle health condition	.2579 (.4375)	.2321 (.4222)	.2590 (.4382)	.3304 (.4706)
Healthsmoke	1=smoker	.2579 (.4375)	.2874 (.4527)	.2247 (.4175)	.2069 (.4053)

Table 6. Results DNB Household survey. Ages 21-64, years 2002-2009, the Netherlands. Log income per hour[26].

		Model 1[27]	Model 2[28]	Model 3[29]	Model 4[30]	Model 5[31]
	Men N=3576					N=5639
1	BMI (absolute)	-.01447** (.0065)	-.0117(.0066)*	-.0119 (.0066)*	-.0190 (.0118)	-.0063 (.0030)**
	R^2 (overall)	.0563	.1060	.1082	.0100	
2	BMIover_obese	-.0348 (.0279)	-.0179 (.0279)	-.0195 (.0278)	-.0088 (.0362)	-.0103 (.0216)
	R^2 (overall)	.0534	.1055	.1077	.0152	
3	BMIunder	-.1901 (.1448)	-1483 (.1482)	-.1486 (.1493)	-.1844 (.2007)	-.0526 (.1646)
	BMIover	-.0322(.0287)	-.0165 (.0287)	-.0179 (.0286)	-.0086 (.0362)	.0014 (.0227)
	BMIobese	-.0545 (.0595)	-.0290 (.0580)	-.0324 (.0579)	.0421 (.0973)	-.0620 (.0361)*
	R^2 (overall)	.0563	.1071	.1091	.0161	
	Women N=2238					N=5381
1	BMI (absolute)	-.0088 (.0047)*	-.0055 (.0047)	-.0054 (.0047)	-.0022 (.0114)	-.0056 (.0031)*
	R^2 (overall)	.0544	.1035	.1061		
2	BMIover_obese	-.1149 (.0428)***	-.0940 (.0421)**	-.0950 (.0421)**	-.1086 (.0704)	-.0961 (.0295)***
	R^2 (overall)	.0588	.1058	.1077	.0242	
3	BMIunder	-.1432 (.1244)	-.1480 (.1194)	-.1457 (.1191)	-.2688 (.1725)	-.1489 (.0988)
	BMIover	-.1089 (.0453)**	-.0900 (.0445)**	-.0915 (.0443)**	-.1094 (.0703)	-.0902 (.0329)***
	BMIobese	-.1388 (.0678)**	-.1069 (.0669)	-.1056 (.0670)	-.1262 (.1254)	-.1049 (.0434)**
	R^2 (overall)	.0582	.1065	.1097	.0200	

[26] *<0.10, **<0.05, ***<0.01, robust standard errors between parenthesis
[27] Controls for experience (age and age^2), robust
[28] Controls for experience, and the level of education level (dummy variables edulow eduhigh), robust
[29] Full model. Controls for experience, the level of education level and health (self reported health condition, smoker, chronic problems), robust
[30] Full model. Controls for experience, the level of education and health (self reported health condition, smoker, chronic problems), robust fixed effects
[31] Full model. Heckman selection model, two-step: select (age children primary-income-provider spouse)

Table 7. Results DNB Household survey. Ages 21-64, years 2002-2009, the Netherlands. Currently in paid employment.

		Model 1	Model 2	Model 3	Model 4	Model 5
	Men N=3929					N=5639
1	BMI (absolute)	.0038 (.0021)*	.0041 (.0020)**	.0039 (.0020)**	.0078 (.0029)***	.0019 (.0038)
	R^2 (overall)	.2360	.2427	.2817	.2376	
2	BMIover_obese	.0094 (.0114)	.0117 (.0115)	.0122 (.0114)	.0171 (.0149)	.0126 (.0297)
	R^2 (overall)	.2381	.2447	.2832	.2450	
3	BMIunder	.0296 (.0681)	.0365 (.0673)	.0373 (.0672)	.0736 (.0481)	-.0444 (.1906)
	BMIover	.0070 (.0116)	.0092 (.0117)	.0098 (.0115)	.0163 (.0149)	.0119 (.0312)
	BMIobese	.0319 (.0230)	.0357 (.0231)	.0351 (.0225)	.0676 (.0340)**	.0185 (.0473)
	R^2 (overall)	.2360	.2426	.2816	.2401	
	Women N=3528					N=5381
1	BMI (absolute)	-.0018 (.0023)	-.0003 (.0022)	.0004 (.0022)	.0013 (.0037)	.0009 (.0033)
	R^2 (overall)	.1337	.2188	.2310	.0576	
2	BMIover_obese	-.0173 (.0133)	-.0055 (.0133)	-.0009 (.0133)	-.0036 (.0158)	.0188 (.0326)
	R^2 (overall)	.1360	.2221		.0678	
3	BMIunder	-.0522 (.0281)*	-.0518 (.0285)*	-.0550 (.0291)*	-.0405 (.0268)	-.1039 (.1099)
	BMIover	-.0188 (.0137)	-.0080 (.0136)	-.0040 (.0136)	-.0050 (.0158)	.0287 (.0389)
	BMIobese	-.0131 (.0226)	.0037 (.0221)	.0105 (.0222)	.0252 (.0294)	.0000 (.0486)
	R^2 (overall)	.1338	.2193	.2317	.0594	

Table 8. Results DNB Household survey. Ages 21-64, years 2002-2009, the Netherlands. Currently in paid employment in the public sector compared the private sector.

	Model 1	Model 2	Model 3	Model 4	Model 5
Men N=3519					N=5639
BMI (absolute)	.0031 (.0019)	.0032 (.0019)*	.0033 (.0019)*	.0039 (.0021)*	.0009 (.0019)
R^2 (overall)	.0289	.0755		.0019	
BMIover_obese2	.0104 (.0102)	.0117 (.0101)	.0121 (.0102)	.0144 (.0109)	-.0012 (.0149)
R^2 (overall)	.0304	.0763	.0774	.0043	
BMIunder	.0268 (.0201)	.0315 (.0207)	.0317 (.0208)	.0016 (.0045)	.2911 (.1284)**
BMIover	.0093 (.0102)	.0105 (.0102)	.0110 (.0103)	.0141 (.0109)	-.0087 (.0157)
BMIobese	.0353 (.0217)	.0378 (.0217)*	.0387 (.0221)*	.0441 (.0237)*	.0238 (.0231)
R^2 (overall)	.0296	.0762	.0775	.0011	
Women n=2468					N=5381
BMI (absolute)	-.0001 (.0024)	.0014 (.0022)	.0012 (.0023)	.0013 (.0029)	-.0012 (.0017)
R^2 (overall)	.0167	.1692	.1684	.0002	
BMIover_obese2	-.0220 (.0116)*	-.0126 (.0116)	-.0144 (.0118)	-.0154 (.0119)	-.0095 (.0177)
R^2 (overall)	.0221	.1695	.1684	.0010	
BMIunder	-.0021 (.0392)	.0014 (.0357)	.0014 (.0357)	-.0424 (.0380)	.2008 (.0655)***
BMIover	-.0224 (.0117)*	-.0136 (.0118)	-.0155 (.0119)	-.0150 (.0119)	-.0063 (.0198)
BMIobese	-.0313 (.0164)*	-.0130 (.0166)	-.0146 (.0169)	-.0208 (.0174)	-.0131 (.0241)
R^2 (overall)	.0218	.1706	.1696	.0001	

Table 9. Results DNB Household survey. Ages 21-64, years 2002-2009, the Netherlands.
Log income per hour if currently employed in the public sector.

		Model 1	Model 2	Model 3	Model 4	Model 5
	Men N=695					N=954
1	BMI (absolute)	-.0395 (.0120)***	-.0370 (.01172)***	-.0373 (.0118)***	-.0444 (.0175)**	-.0228 (.0047)***
	R^2 (overall)	.0997	.1753	.2015	.0675	
2	BMIover_obese	-.0967 (.0478)**	-.0580 (.0476)	-.0571 (.0480)	-.0083 (.0617)	-.0601 (.0436)
	R^2 (overall)	.0762	.1651	.1885)	.0347	
3	BMIunder	.1394 (.2006)	.2045 (.2097)	.2394 (.2066)	.1693 (.2115)	.2945 (.2722)
	BMIover	-.0578 (.0466)	-0200 (.0468)	-0209 (.0469)	-.0058 (.0621)	-.0117 (.0457)
	BMIobese	-.3371 (.1167)***	-2919 (.1118)***	-.2859 (.1118)**	-.2734 (.1804)	-.2121 (.0630)***
	R^2 (overall)	.0924	.1763	.1984	.0547	
	Women N=482					N=821
1	BMI (absolute)	-.0051 (.0088)	-.0011 (.0090)	-.0010 (.0090)	-.0047 (.0252)	-.0020 (.0061)
	R^2 (overall)	.0509	.1140	.1256	.0176	
2	BMIover_obese	-.0487 (.0688)	-.0260 (.0702)	-.0245 (.0697)	.0933 (.1091)	-.0990 (.0520)*
	R^2 (overall)	.0607	.1219	.1306	.0036	
3	BMIunder	-.2370 (.2341)	-.2344 (.2207)	-.2334 (.2181)	-.1612 (.2065)	-.3873 (.1529)**
	BMIover	-.0207 (.0672)	.0093 (.0699)	.0107 (.0696)	.1036 (.1106)	-.0687 (.0588)
	BMIobese	-.1502 (.1403)	-.1196 (.1387)	-.1166 (.1385)	-.1281 (.2065)	-.1390 (.0834)*
	R^2 (overall)	.0602	.1226	.1347	.0125	

Table 10. Results DNB Household survey. Ages 21-64, years 2002-2009, the Netherlands. Log income per hour if employed in the private sector.

		Model 1	Model 2	Model 3	Model 4	Model 5
	Men N=1719					N=2565
1	BMI (absolute)	-.0005 (.0055)	.0015 (.0054)	.0012 (.0053)	.0061 (.0083)	.0010 (.0046)
	R^2 (overall)	.0450	.0856	.0925	.0346	
2	BMIover_obese	-.0136 (.0403)	-.0037 (.0399)	-.0059 (.0395)	.0213 (.0543)	.0062 (.0317)
	R^2 (overall)	.0448	.0853	.0924	.0350	
3	BMIunder	-.0735 (.0877)	.0034 (.0944)	.0033 (.1085)	-.2745 (.0437)***	.0953 (.2785)
	BMIover	-.0180 (.0414)	-0104 (.0410)	-.0116 (.0407)	.02012 (.0546)	.0041 (.0332)
	BMIobese	.0208 (.0716)	.0468 (.0690)	.0370 (.0688)	.1483 (.1121)	.0457 (.0517)
	R^2 (overall)	.0440	.0850	.0920	.0343	
	Women N=482					N= 1647
1	BMI (absolute)	-.0070 (.0071)	-.0041 (.0069)	-.0015 (.0069)	-.0076 (.0173)	.0024
	R^2 (overall)	.0393	.0725	.0752	.0064	
2	BMIover_obese	-.0825 (.0669)	-.0598 (.0669)	-.0489 (.0667)	-.0494 (.1048)	-.0508 (.0504)
	R^2 (overall)	.0455	.0759	.0765	.0067	
3	BMIunder	-.0347 (.0752)	-.0148 (.0780)	-.0442 (.0811)	-.2324 (.1059)**	-.0283 (.2080)
	BMIover	-.0986 (.0736)	-.0816 (.0731)	-.0743 (.0718)	-.0520 (.1044)	-.0960 (.0564)*
	BMIobese	-.0422 (.0914)	-.0035 (.0916)	.0230 (.0893)	.0413 (.1917)	.0297 (.0677)
	R^2 (overall)	.0480	.0798	.0817	.0054	

Table 11. Results DNB Household survey. Ages 21-64, years 2002-2009, the Netherlands. Self-employed.

		Model 1	Model 2	Model 3	Model 4	Model 5
	Men N=5238					N=5639
1	BMI (absolute)	-.0002 (.0009)	-.0002 (.0009)	-.0016 (.0009)	-.0001 (.0009)	.0006 (.0010)
	R^2 (overall)	.0015	.0021	.0025	.0010	
2	BMIover_obese	.0028 (.0091)	.0031 (.0091)	.0032 (.0091)	.0049 (.0109)	-.0057 (.0076)
	R^2 (overall)	.013	.0019	.0023	.0009	
3	BMIunder	-.0106 (.0049)**	-.0104 (.0049)**	-.0101 (.0051)*	.0042 (.0045)	-.0705 (.0692)
	BMIover	.0035 (.0092)	.0038.0092)	.0039 (.0092)	.0051 (.0109)	-.0118 (.0080)
	BMIobese	-.0063 (.0121)	-.0058 (.0121)	-.0055 (.0121)	-.0119 (.0147)	.0180 (.0123)
	R^2 (overall)	.0011	.0017	.0020	.0008	
	Women N=4577					N= 5381
1	BMI (absolute)	.0000 (.0014)	.0002 (.0014)	.0004 (.0014)	.0024 (.0024)	-.0027 (.0008)***
	R^2 (overall)	.0003	.0084	.0092	.0000	
2	BMIover_obese	-.0042 (.0094)	-.0030 (.0094)	-.0022 (.0094)	.0111 (.0120)	-.0301 (.0078)***
	R^2 (overall)	.0006	.0093	.0100	.0000	
3	BMIunder	.0342 (.0322)	.0332 (.0321)	.0330 (.0322)	.0467 (.0386)	.0189 (.0274)
	BMIover	-.0048 (.0095)	-.0036 (.0095)	-.0030 (.0095)	.0107 (.0119)	-.0291 (.0088)***
	BMIobese	-.0010 (.0123)	.0015 (.0123)	.0030 (.0124)	.0236 (.0167)	-.0326 (.0110)***
	R^2 (overall)	.0011	.0097	.0106	.0001	