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SFI – THE DANISH NATIONAL CENTRE FOR SOCIAL RESEARCH

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Does higher education reduce body weight?
Evidence using a reform of the student grant scheme

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Abstract:

The prevalence of obesity and overweight has increased in almost all Western countries in the past twenty to thirty years, with social disparities in many of these countries. This paper contributes to the literature on the relation between education and body weight by studying the effect of higher education on body weight according to subgroups of parental income background. To uncover the causal relationship between higher education and body weight, we use a reform of the Danish student grant scheme, which involved a grant increase of approximately 60% in 1988. When using this reform as instrumental variable, we find no effect among men of higher education on the probability of being either overweight or healthy-weighted. However, we find suggestive evidence that the effect differs by income background. Amongst men who grew up in low-income households, enrolling in higher education increases the probability of being in a healthy weight category (and reduces the probability of being overweight). Amongst men who grew up in middle- or high-income households, enrolling in higher education has no effect on the probability of being either healthy-weighted or overweight.

Keywords: Health production, Education, Returns to education, Overweight, Selection bias, Student grant scheme, Income background

1. Introduction

At time writing, there is a rapidly evolving economic literature studying nonpecuniary returns to schooling: health, crime and marital outcomes (Oreopoulos and Salvanes, 2011). Given the importance of the obesity epidemic, which is prevailing in almost all developed countries, the returns to schooling in terms of reduced weight might be a notable part of the "total" returns to schooling. In many Western countries there has been a dramatic increase in overweight and obesity rates and the governments have been concerned not only about the pace of the increase in overweight and obesity but also about inequalities in their distribution across socio-economic groups (Sassi et al., 2009). Despite this concern, a recent OECD report shows that governmental policies have failed to protect vulnerable groups from a further increase in obesity (OECD, 2012).

This paper examines how higher education, i.e. 2 to 5 years added to 12 years of education, affects body weight. Education policies might be an important instrument in the fight against increasing obesity rates. However, although a large number of studies show a negative association between education and body weight, determining whether this relationship is causal or driven by unobserved factors correlated with education remains a key issue.

We use a reform of the Danish student grant scheme in 1988, which involved a grant increase of approximately 60%, to study the effect on body weight of taking a higher education. As we are particularly interested in policies aimed at vulnerable groups, we examine this relationship separately for people growing up in low-income (parental income below 60% of the median average gross income) and non-low-income households.

Whilst several papers have examined the relation between education and body weight, little consensus is apparent about the sign, size and significance of the effect of education on body weight (Nayga, 2000; Arendt, 2005; Kenkel et al. 2006; MacInnis, 2008; Brunello et al., 2009; Grabner 2009; Reinholt and Jürges, 2009; Clark and Royer, 2010; Webbink et al. 2010; Jürges et al. 2011; Kempner et al. 2011; Lundborg, 2012). Although the different results might be due to the studies' coming from different countries, the differences in the results might also be due to different levels of education being evaluated. For example some studies examine the effect of one more year of compulsory education (e.g. Arendt, 2005), others examine the effect of completing high school (e.g. Kenkel et al., 2006), and others examine educational categories (e.g Lundborg, 2012).

We add to the literature in at least two ways: First, we use an instrument, a reform for the student grant scheme, which has not been used before in the literature, and estimates the impact of education on health. Whilst previous studies have been estimating effects for those at the lower end of the education distribution we estimate the effect on the margin 12 or more years of schooling, and hence obtain effects that will reflect a different local average treatment effect (LATE) than the one typically obtained in studies using schooling reforms as instruments. Second, by taking parental income background into account when examining the relation between education and body weight we focus our research on a policy-relevant group. The empirical differences in the effect of higher education on body weight depending on economic background give us an indication of the mechanism that drives the results: if the effect of higher education depends on the income background of an individual, then the effect of higher education indicates that the change in social network (which most people from low-income families experience when they enrol in an institution of higher education) could be an important explanation for why education affects body weight.

During their university years young people are greatly influenced by friends and classmates' lifestyles and opinions, and acceptance amongst friends can be crucial for both adolescents' physical and mental health. Several papers find that friends or classmates have a significant positive impact on health-related behaviours amongst young people e.g. smoking, eating, exercising, binge drinking or illicit-drug use (see, e.g. Norton et al., 1998; Lundborg, 2006; Clark and Loheac, 2007; Harris and González, 2008; Yakusheva et al., 2011, Halliday and Kwak, 2012). Likewise, there appears to be a causal influence of peers on adolescent body weight (Mora and Gil, 2012).

As a significant share of people complete an education at Danish universities, Denmark makes a good case for studying the effect on body weight measures of completing a higher education depending on the family income through child- and adulthood.[1] Furthermore, a relatively high level of social mobility exists in Denmark (Blanden et al., 2005). Thus any observed effect of the reform is less likely to be influenced by a few observations.

Body weight composition differs significantly for men and women. In the initial data set we have very few men being underweight, while a significant number of women are in this weight category.

[1] According to the OECD (OECD, 2012) an average of 39% in the OECD countries and 50% in Denmark, amongst younger cohorts, are expected to complete a tertiary, largely theory-based, education over their lifetimes.

Thus estimating the results for women require another estimation model (a multivariate model) than the one we use in this paper. For brevity we focus on men in this paper.

Our results suggest that higher education has no effect on body weight amongst men that were affected by the instrument. This result is in line with the previous literature (Arendt, 2005; Kenkel et al., 2006; Reinholt and Jürges, 2009; Lundborg, 2012). However, we find suggestive evidence that this effect differs according to income background. For men who grew up in low-income households, enrolling in higher education significantly increased the probability of being in a healthy weight category. For men who grew up in middle- or high-income households, completing a higher education have no such effect.

The paper is structured as follows. Section 2 presents the hypothesis and the results of the previous literature on the relation between education and body weight. Section 3 describes the background of the Danish student grant scheme. Section 4 describes the data, and Section 5 gives the results and discusses the results. Section 6 concludes.

2. Hypotheses and previous evidence on body weight and education

Previous literature has explained the relation between education and health by a more efficient health production function (Grossman, 1972) and increased allocative efficiency in health production (Rosenzweig and Schultz, 1982 and Kenkel, 1991) for people with a higher level of education.

Several other explanations for the mechanism through which education affects health exist. Kenkel (1991) and Nayaga (2000) study the importance of specific health knowledge related to education. Kenkel (1991) includes direct measures of health knowledge when estimating the effect of education on the consumption of cigarettes, alcohol and time spent on exercise. He concludes that even when he includes information on health knowledge, most of the effect on exercise of more education remains. In contrast, Nayaga (2000) finds that when he includes a measure of knowledge on the relation of diet to disease when estimating the relation between education and obesity, the parameter estimate on education becomes insignificant.

Cutler and Lleras-Muney (2010) argue that more years of education improve general skills, critical thinking and decision-making abilities. Basic information on healthy living is something that most individuals understand and have access to, and most food products are labeled. However, there are many ways of healthy living, and almost every day the news media report new information on 'healthy' products.[2] Analysing this overload of information and making the right food choices requires certain skills in critical thinking and decision-making.

Influence from peers at school has also been shown to affect health behaviours such as eating and physical exercise (Yakusheva et al., 2011). Increasing the number of years in school amongst people coming from low-income families might give these young people a different social network than the one related to the environment in which they grew up. As educated people in general eat more healthily, exercise more and are less likely to be obese, people coming from disadvantaged families might be motivated to adjust to the healthy lifestyle social norm of their educated peers. Although the effect from an educated social network does not explain why education decreases the likelihood of being obese, it might instead explain why the effect differs according to parental income background.

The link between education and body weight might be explained by unobserved factors such as 'value of the future' and individual preferences (Funchs, 1982). Spending more years in school is an investment in the future. The future therefore becomes relatively more valuable amongst people with more education, and the incentive to stay healthy (e.g. to avoid an unhealthy weight increase) is therefore greater amongst people with relatively more education. Individual preferences might contribute to the relation between obesity and education if those who have preferences for education also are those who have preferences for delaying gratification.

The link between education and body weight can also be explained by reverse causality, i.e. body weight might affect educational attainment. Higher body weight could lower academic performance if, for example overweight children are more absent from school because of diseases related to being overweight or if teachers and peers treat overweight children differently (Scholder et al., 2012).

[2] Alternative medical practitioners often supply information on healthy living, e.g. detoxification or the Atkins diet. Understanding the concept and the consequences of these different health instructions is often quite complex.

These explanations indicate that the relation between education and body weight cannot be interpreted as causal without further investigation. A number of studies have examined the causal effect of education on body weight by using reforms in the school system or twin studies. Most of these studies find that the effect on obesity of education disappears when they control for endogeneity, indicating that more years of education do not reduce obesity (Arendt, 2005; Kenkel et al., 2006; Reinholt and Jürges, 2009; Clark and Royer, 2010; Lundborg, 2012).[3] Two studies find a significant effect of education on obesity amongst men. Using changes in compulsory schooling laws in 1949 and 1969 Kemptner et al. (2011) find that one more year of compulsory schooling reduces the probability of being overweight among men with 3-4 percentage point. Webbink et al. (2010), using the Australian twin register, find that one additional year of education reduces the probability of being overweight among men with 3-4 percentage point. Although previous studies achieve different results for the causal effect of education on body weight, most find that controlling for unobserved factors in this relation is important. This paper uses a reform of the 1988 Danish student grant scheme as an instrument for controlling for unobserved factors.

3. The Danish student grant scheme and the 1988 reform

All Danish colleges and universities are publically subsidized, and the tuition is free for Danish students, all EU/EEA[4] students and students participating in exchange programmes.[5] As the Danish student grant scheme is universal, nearly all students receive a student grant for most of their time in education. This student grant scheme is managed by the Danish Educational Support Agency in collaboration with educational institutions. A comprehensive description of the Danish student grant scheme can be found in SU-styrelsen (1999) (i.e. the student grant institution).

Several changes in the Danish student grant scheme took place in the 1980s. The two most important changes were that means-testing stopped and that the size of the grant significantly increased in 1988. Until school year 1986-87 students at age 21 or above received a grant of 30,418 DKK per year (in 2000 prices) equivalent to 3440 UK pounds. In school year 1987-88 the age restriction was reduced, so that students aged 19 or above could receive the same grant. By school year 1988-89 the age restriction was further reduced to 18, and the amount a student could receive

[3] A number of studies have used school reforms to estimate the effect of education on other health outcomes. These studies include Arendt (2005), Lleras-Muney (2005), Grimard et al. (2007), Clark and Royer (2010) and Mazumder (2008). Whilst some find a positive impact of education on health, most papers find no effect.
[4] European Economic Area.
[5] From 2006 all other students have to pay a tuition fee.

per year was increased to 47,839 DKK (in 2000 prices) equivalent to 5410 UK pounds, i.e. an increase of nearly 60%. Every student enrolled in a higher education course was entitled to a number of monthly grants corresponding to the prescribed duration of the chosen study, plus 12 months. If the increase in the student grant should increase the incentive to enroll in a higher education the alternative, the wage one could earn by working, has to be roughly constant over the same period. In 1987 the real wages increased approximately 6%, however, it decreased in 1990 with 5% (Økonomiministeriet, 1997). Thus compared to the percentage increase in the student grant the development in real wage over this period appeared to be stable.

Together with the Danish student grants scheme, students in Denmark are offered supplementary state loans at very favourable interest rates.[6] In 1988-89 both the amount of money students could borrow from the state and the maximum income a student was allowed to earn whilst receiving a student grant were raised. In addition to the reform of the student grant scheme, these changes increased the motivation for completing a higher education in 1988 and thereafter.

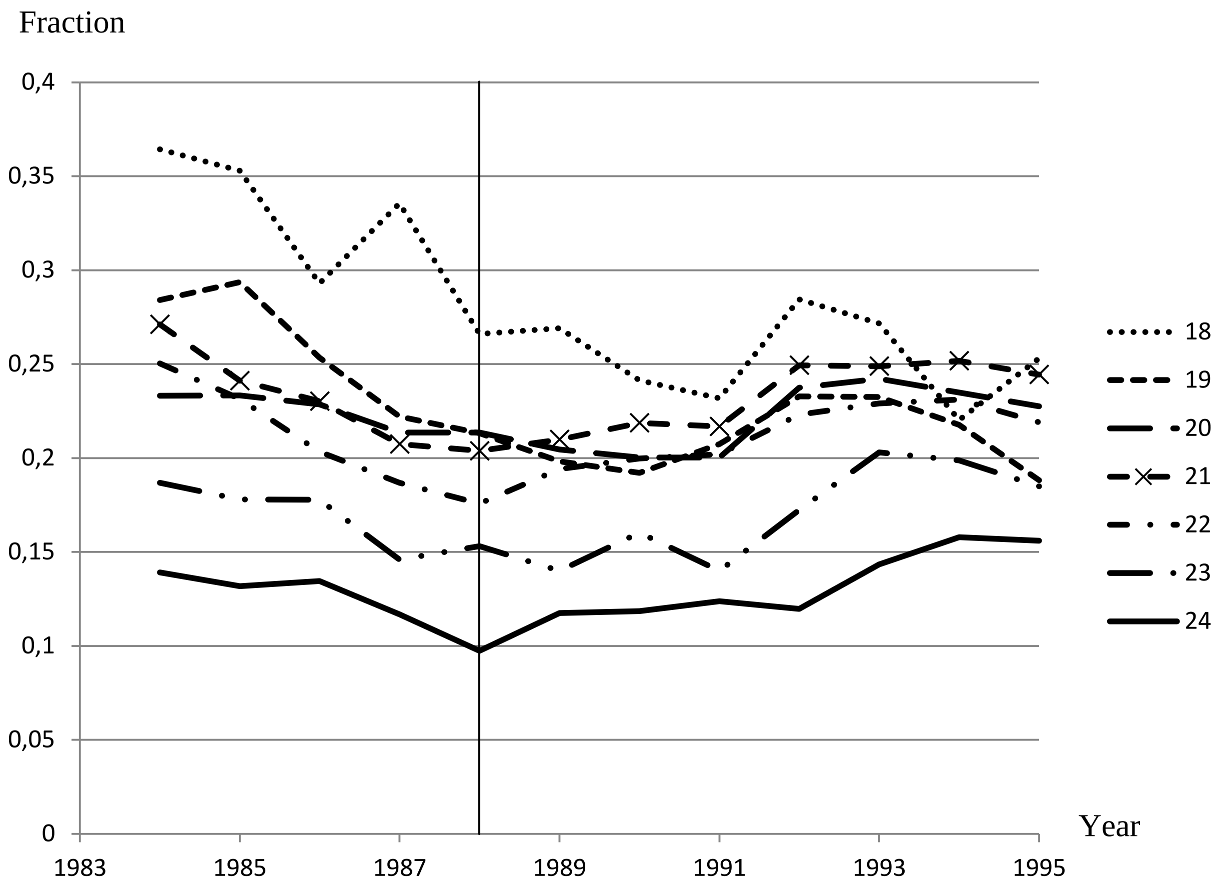
The significant increase in the Danish student grant scheme was one of major policy changes in the 1980s in Denmark aimed at the high and increasing unemployment, in particular amongst young people. The initiatives included subsidized employment[7] and a comprehensive follow-up amongst unemployed young people, with a focus on enrolment in education (Jonasen, 2008). A consequence of these policies was a significant increase in the number of young people enrolled at a higher education, taking place especially after 1986 (Velfærdskommissionen, 1995). Whilst the fraction of the population receiving social benefits increased in the 1980s, this fraction remained relatively constant amongst young people (Jonasen, 2008).

Figure 1 shows the enrolment rate amongst men with a high school degree by age group for each year from 1983 to 1994. Figure 1 shows a decreasing tendency in the enrolment rate for most age groups. Before the reform the agegroups with the highest enrolment rates are the 19 to 22 years old. After the reform the enrolment rate either stablilizes or increases (the 19 years of age increase later).

[6] Of the total grants given to students, the student grant takes up 2/3 of the total support. Loans take up 1/3. The interest rate for the loans is set by Parliament. Students must either start paying back state loans within one year after the end of the year in which they graduate or give up their studies. The loan must be repaid within 15 years. About half of all students make use of the state loan programme.

[7] However, the number of young people in subsidized employment decreased from 1983 (Jonasen, 2010).

Figure 1: Fraction of men with high school degree (gymnasium) enrolled in a higher education, by age



Note: Own calculations on the full Danish population. Denmark Statistics register data base.

4. Data and empirical model

4.1 Sample description

The results in this paper are based on the Danish Work Environment Cohort Study (DWECS), a survey from both 1995 (response rate 80%) and 2000 (response rate 75%), containing information on self-reported height and weight, and a number of self-reported health variables. The DWECS is a random sample of people living in Denmark who were aged 18-59 either in 1995 or 2000. Due to a unique personal identifier, the survey variables are merged with information from administrative registers which – in addition to holding thorough information on education, income and employment status – contain information on the same administrative register variable for family members. Thus we have information on both parental education and financial background.

The total sample of men and women from the survey amounts to 13,722 observations. As we focus on the effect on body weight of completing a higher education whilst we take into account issues related to self-selection in education, we select men who were between 15 and 35 years of age in 1988. We restrict the sample to men with available information on parental income. Our main results are virtually the same when we impose other age restrictions. However, when we test the results by including older cohorts, we lose a significant amount of observations due to missing parental background information. We have excluded men with missing information on height or weight. The final pooled dataset for 1995 and 2000 consists of 3,007 men.

4.2 Defining body weight categories, higher education, and low income background

The primary body weight measure used in most empirical literature is the Body Mass Index (BMI), calculated as weight in kilograms (kg) divided by height in meters squared (m^2).[8] We use both a continuous measure of BMI and an indicator for people with a BMI in a healthy range, i.e. between 19 and 25. As the medical literature shows an increase in the probability of diseases and mortality for BMI's higher than 25, we use indicator variables for being overweight (BMI>=25) and obese (BMI>=30).

To identify the financial background of each respondent, we use paternal income. The respondent is categorized as coming from a low-income background if the paternal income was below 60% of the median average gross income among men in the same parental age group within the period 1994-2000.[9] If the paternal income is missing, we use maternal income. On average maternal income is lower than paternal income. Thus some respondents might be characterized as coming from low-income household because their financial background is identified from maternal income. However, when the respondent’s income background is identified from maternal income, the household was likely to be a single-parent household. Assuming that people from single-parent households come from relatively low-income backgrounds seems a reasonable assumption.

[8] Using BMI as a body weight measure has two drawbacks. First, medical research shows a tendency for people to under-report their true weight but over-report their height. Second, a number of studies find that BMI is a poor predictor of body fat (see e.g. Burkhauser and Cawley (2008)). Unfortunately, BMI is the only body weight measure available in the DWECS.

[9] Reliable parental income is not available before 1994. However, it is a realistic assumption that the average relative parental income in the seven-year period from 1994-2000 does not differ from the seven-year relative average relative parental income from 1988-1994 (i.e. in the treatment period).

When we estimate separate analysis by income background, we use information on parental income, not parental education or occupation.[10] As parental income is less related to the respondent's education than parental education and occupation, we expect the sample split to be less endogenous. Indeed, Kenkel et al. (2006) find that parental education is more strongly associated with individuals' BMI than with their education. This result indicates that parental education is important for investigating the relation between education and body weight, as differences in competencies in acquiring and understanding health information may appear, as well as differences in habits and norms related to health, depending on parental educational background. We control for parental education in all the estimations.

Whilst parental education is correlated with parental income, we find a significant number of parents with few years of education in the non-low-income group and a significant amount of parents with quite a few years of education in the low-income group. In addition to having few financial resources for purchasing healthy food, people coming from a low-income group are in general characterized by living in neighbourhoods with the lowest housing prices and less privileged environments. The results by subgroup of income background therefore suggest how the impact of a higher education differs according to the economic and social environment during child- and adulthood. Therefore, analysing the effect of higher education on body weight with respect to parental income, instead of parental education, makes good sense.

As the income distribution in Denmark is relatively compressed, the definition of low-income and non-low-income background might be significantly different in Denmark from that in many other non-Scandinavian countries. The non-low income group in particular consists of many middle-class families, as Denmark has very few wealthy people. Consequently, we expect the reform of the student grant scheme to have an impact on people from both the low- and the non-low-income groups.[11]

[10] We have tested the results by parental (highest) occupational status (white collar/blue collar worker) instead of income. However, no significant difference appears in the relation between education and body weight when we compare men having parents working as white-collar workers with men having parents working as blue-collar workers.

[11] We have tested different cutoff points for parental income, and the results are not significantly different around the threshold (i.e. 60 % of the average median income).

We use the Danish education register to define the binary indicator for having enrolled in higher education. We categorize people who have completed or started a higher education at a nationally recognized institution at the time of the interview as 'people with a higher education'.

4.3. Descriptive statistics

The descriptive statistics for all included variables for our restricted sample of men appears in Table 1. On average, men have a BMI of 25.0 when they are aged 23-47. The average BMI is a bit higher for men from low-income families (25.4) than for those from non-low-income families (24.9). The fraction of men in the healthy range category is 56.7% in the full sample, and 50.7% and 57.8% for men coming from low- and non-low-income backgrounds, respectively. Less than one per cent of the men in the sample are underweight. The prevalence of overweight and obesity is 35.2 and 7.6%, respectively, in the full sample. The prevalence of overweight and obesity differs significantly between men from low- and non-low-income families. In the full sample of men, 26.3% have a higher education. The fraction of men with a higher education is 20.6 and 27.4 when coming from low- and non-low-income backgrounds, respectively.

In addition to using a binary indicator for taking a higher education, we control for a set of attributes that may influence the tendency to have a higher body weight. These attributes include binary indicators for immigrant and marital status (including cohabiting couples), whether the parents had a higher education (e.g. a one-year certification program, bachelor's degree or post-graduate degree), and whether the individual grew up in a low-income family. Furthermore, we control for the income and age of the individual during the year that body weight is measured.[12]

[12] Measures of previous work experience and occupational and employment status have been included in the models but are left out because of low significance. Furthermore, maternal and paternal occupational status have been included. However, due to low significance we excluded these variables again. Age has been included without the square. Whilst the results are virtually the same with or without including age-squared in the empirical models, some of the explanatory variables become more significant when age-square is included.

Table 1: Descriptive statistics, men, all and by parental income background. Mean and standard deviance (Std. dev.) in parentheses

	All		Low income		Non-low income	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Underweight (%)	0.005	(0.070)	0.006	(0.080)	0.005	(0.069)
Healthy weight (%)	0.567	(0.496)	0.507 [a]	(0.500)	0.578	(0.494)
Overweight (%)	0.352	(0.478)	0.386 [a]	(0.487)	0.346	(0.476)
Obese (%)	0.076	(0.265)	0.100 [a]	(0.300)	0.0719	(0.257)
BMI (kg/m^2)	25.019	(3.289)	25.426 [a]	(3.465)	24.944	(3.251)
Higher Education (0/1)	0.263	(0.441)	0.206 [a]	(0.405)	0.274	(0.446)
Age (years)	33.676	(6.066)	34.669 [a]	(6.635	33.492	(5.937)
Age squared (years)	1170.884	(416.017)	1245.849 [a]	(463.116)	1156.961	(405.245)
Married (0/1)	0.717	(0.450)	0.701	(0.458)	0.720	(0.449)
Low income background (0/1)	0.157	(0.364)				
Income in 1000 DKK	28.220	(14.193)	26.092 [a]	11.664)	28.616	(14.582)
Mother, higher education (0/1)	0.136	(0.343)	0.076 [a]	(0.266)	0.147	(0.354)
Father, higher education (0/1)	0.157	(0.364)	0.159	(0.366)	0.156	(0.363)
Number of observations		3,007		471		2,536

Notes: The sample includes men 15-35 years old in 1988. Standard t-tests of differences in means are conducted to determine the difference between men from low-income background and non-low income background. [a] indicates that the difference is significant at less than 5%.

4.5. Econometric approach

Previous literature shows a negative association between education and obesity. However, this result might be driven by unobserved individual characteristics related to education. These unobserved omitted variables may bias the relationship between education and obesity. As discussed in section 3, we use a reform of the Danish student grant scheme in 1988 and use instrumental variables method to handle the unobserved heterogeneity.

A good instrument satisfies two requirements. First, the instrument must be correlated with holding a higher education. Second, the instrument must be orthogonal to the error term. In other words, the instrument should not influence the outcome variable (body weight) other than through the variable measuring education. The major change in the Danish student grant scheme was introduced in 1988, increasing the student grants by approximately 60% and thereby creating an economic incentive for taking a higher education amongst the group of people who had not yet completed a higher education. As Figure 1 shows, an increase in the incentive to begin a higher education apparently occur by the time the changes in the student grant scheme occurred.

Not all people begin a higher education, despite the university's being free and the Danish student grant scheme and loans being favourable. In the short run, in term of earnings, enrolling in vocational education is relatively more beneficial than enrolment in a university or college education. However, the long-run return on a higher education is important. For example, the starting wage for an economist is significantly higher than that for a carpenter. Furthermore, the opportunity cost of postponing education, due to the high school or extra entry courses necessary for enrolling in universities, can be very extensive and can thus reduce lifetime earnings. Moreover, the personal cost of becoming a carpenter instead of an economist might be very extensive, depending on a person's aptitudes. Taking a choice against one's aptitudes could reduce one's lifetime earnings. The financial and personal costs and the lifetime earnings are therefore important factors in educational choices.

The increase in the student grant scheme increased student income. One might surmise that this increase could affect the young people's body weight, as they now would have better financial resources for purchasing either more healthy or unhealthy food. However, although the percentage increase in the student grant scheme were high and might have had an impact on those who considered to take a higher education, the increases in nominal value of the student grants are not very high and it is less likely that this increase will affect consumption possibilities to an extend that it has an impact on body weight.

The equation estimating the relationship between body weight and education, EDU, accounting for individual heterogeneity is the following:

$$(1) \qquad BW_{it} = \alpha_1 + EDU_{it}\beta + X_{it}\gamma + \varepsilon_{it}$$

In equation 1, X is a vector of variables that affects body weight (age, ethnicity, marital status, income and parental education), and ε is the residual. If education were strictly exogenous, the parameter estimate of β in an OLS (or probit) estimation would be a consistent estimate of the true effect of taking a higher education on body weight. However, it is likely that unobserved characteristics correlated with both body weight and holding a higher education will obfuscate the results and bias the estimates. The incidence of holding a higher education is estimated using the reform of the student grant scheme in 1988 in the following way:

$$(2) \qquad EDU_{it} = reform1988_{it}\lambda + X_{it}\vartheta + \eta_{it}$$

In equation 2, X is the same vector of variables that affect body weight, *reform1988* is a variable measuring how the 1988 reform affected the respondent's incentive to begin higher education.

We construct a continous instrument due to the idea that youth choose education at different life stages and with different budget restrictions. The idea is that men 18 years old and younger in 1988 are influenced the most by the reform because they probably have not yet made their final educational choice. The older the men are in 1988 the more men have already made their educational choice, and for some of them it will be too costly to change their educational choice due to the reform. Thus the effect of the reform is expected to decline with age.

To select individuals affected by the reform, we assigned all men who have not yet completed or been enrolled in a higher education in 1988 and who is below 22 years a value between 0 and 4. These values indicate how the student grant scheme can have an effect until age 22, the age by which most students are enrolled if they complete a higher education. According to OECD (1996) the median age of enrolment in Denmark is 21.2 in 1996. Thus the majority of the Danish population have already taken their education decision at age 22. We assigned men, not enrolled at a higher education at age 18 and less, 19, 20 and 21 in 1988 a value of 4, 3, 2 and 1, respectively. The maximum value of 4 corresponds to the average number of years with completed education above 12 years of education for the youngest men in the sample (own calculations on the full sample of men aged 15 to 35 in 1988). We assign men already enrolled in a higher education in 1988 a value corresponding to their expected number of years of education (above 12 years of education) minus the years they have already taken.[13] We assign men that already had completed a higher education in 1988 a value of 0 as they are assumed not to be affected by the reform.[14]

With this continuous instrumental variable we exploit the variation in the treatment. We have tested various instruments on various samples including different age groups. Some of the results are shown in the sensitivity analysis, and others are available from the authors upon request. I Tabel A3 we include results using a binary instrument, where those assigned a positive value get a value of 1.

We estimate models on BMI, a binary indicator for being in a healthy range (BMI between 19 and 25), a binary indicator for being overweight (BMI above 25) and a binary indicator for being obese (BMI above 30). As the results for being overweight are virtually the same as for being in the healthy range, the results for being overweight are in the Appendix. Furthermore, the results for being obese also appear in the Appendix. Only 47 men are categorized as obese; therefore, the estimated parameters in models estimating the probability of being obese are sensitive to outliers.

We estimate ordinary least square and instrumental variable models when using BMI as outcome, and use probit and bivariate probit models when estimating the probability of being in the healthy

[13] To calculate the expected number of years in a higher education among men already enrolled in a higher education we use exit dates from the highest education achieved and the official duration of the education program in months. The entry date is constructed from the exit date and the official duration records. If the exit date was missing for men starting a higher education before 1980, a predicted exit date was used.

[14] We have tested different definitions of the continuous instrument, without significant differences in the estimated results. The instrument does not exactly follow the age distribution and business cycle.

range, being overweight and obese.[15] To test for exogeneity in the instrumental variable models, we use a Durbin-Wu-Hausmann chi-square test.

In the bivariate probit model the correlation between the error terms in the first-stage equation and the structural equation, ρ, indicates independence between the two equations. However, rejecting the hypothesis that the two equations are independent is difficult for small samples, and one therefore needs to be careful to draw strong conclusions in these situations. The coefficient ρ gives insight into the correlation between the unobserved abilities and body weight term. If the coefficient is significant in the structural body weight equation, then unobserved abilities related to education are correlated with body weight.

Under the assumption of monotonicity, i.e. that no one will lower his educational choice because of the reform, our estimates can be interpreted as local average treatment effects (Imbens and Angrist, 1994). Thus the effect estimated in the IV models apply only to those people who – due to the reform in the student grant scheme – take a higher education but who would not have done so in the absence of the reform. This group might differ depending on their parental income background. Men coming from a non-low income might be less credit constrained, and therefore react less on the increase in the student grant scheme, while men coming from a low income might have less support from home and therefore react more on the increase in the student grant scheme. The compliers might therefore be different when we examine the effect of a higher education on body weight by parental income background.

To test the validity of the reform, we perform a placebo test. We construct an instrumental variable assuming an imaginary reform in 1982 and test how the results from the first stage and the instrumental variables models differ from the results when we use the 'true' reform.

[15] This approach assumes that the residuals from the probit estimation and from the first step regression are independent and identically distributed multivariate normal. Linear probability models have also been estimated for all binary outcomes, with virtually the same results.

5. Results

5.1 Baseline results

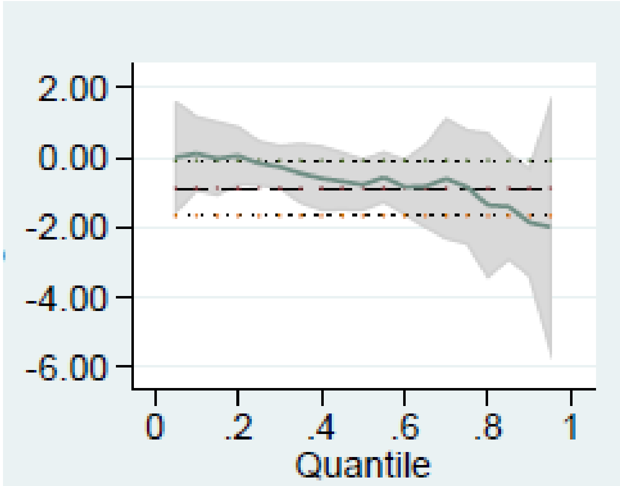
Table 2 presents the OLS estimation results where education is regressed on BMI, including variables measuring age, income, marital status, income and parental education. The OLS results show a significant relationship between education and BMI. People with a higher education tend to have a lower BMI. The parameter estimate is larger among people from low-income backgrounds compared to people coming from non-low-income backgrounds. Whereas parental education is negatively associated with BMI in the full sample and amongst men from non-low income backgrounds, the relationship is not significantly different from zero amongst men from low-income backgrounds.

Table 2: Body mass index (BMI) and higher education – OLS results. Men, all and by income background

	All	Low income	Non-low income
Higher education (0/1)	-0.817	-0.867	-0.825
	(0.154)***	(0.400)**	(0.165)***
Low income background (0/1)	0.379		
	(0.204)*		
Age (years)	0.296	0.404	0.245
	(0.105)***	(0.274)	(0.111)**
Age^2 (years)	-0.004	-0.006	-0.003
	(0.002)**	(0.004)	(0.002)*
Married (0/1)	0.235	-0.405	0.368
	(0.166)	(0.482)	(0.169)**
Income in 1000 DKK	0.005	-0.008	0.006
	(0.005)	(0.015)	(0.005)
Mother, higher education (0/1)	-0.545	-0.773	-0.551
	(0.194)***	(0.644)	(0.202)***
Father, higher education (0/1)	-0.342	-0.448	-0.295
	(0.185)*	(0.456)	(0.202)*
Constant	19.242	19.163	19.821
	(1.712)***	(4.578)***	(1.817)***
R-squared	0.04	0.03	0.04
Number of observations	3,007	471	2,536

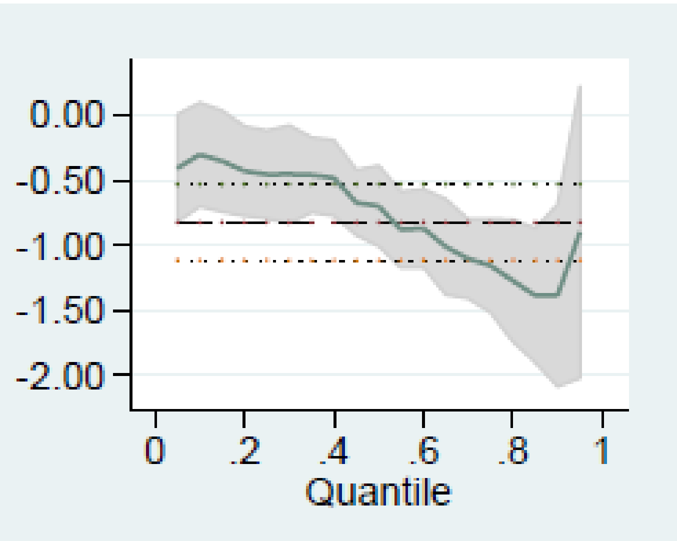
Notes: The sample consists of men 15-35 years old in 1988.
Significance: *** p<0.01; **p<0.05, * p<0.10.

Figure 2: Quantile regression plot. Estimated parameter for higher education on BMI. Men, low income



Note: The sample consists of all men 15-35 years old in 1988 coming from low-income background. The following control variables are added but not shown: age, age squared, married, income, maternal and paternal higher education. Standard errors are obtained using bootstrapping method.

Figure 3: Quantile regression plot. Estimated parameter for higher education on BMI. Men, non-low income



Note: The sample consists of all men 15-35 years old in 1988 coming from non-low-income background. The following control variables are added but not shown: age, age squared, married, income, maternal and paternal higher education. Standard errors are obtained using bootstrapping method.

Figures 2 and 3 show the plots of the quantile regressions for the education variable by parental income background. In the quantile regressions we also control for the list of variables included in Table 2. The quantile regression results indicate that higher education is not correlated with the lower quantiles of BMI, whilst higher education is negatively correlated with the higher quantiles of BMI. These results suggest that a linear regression model is not the optimal solution for assessing the relation between higher education and unhealthy body weight, as the results at the mean differ from results in higher quantiles. Unfortunately, an instrumental approach in a quantile regression model demands more data than we have available.

Table 3: Probability of being in the healthy weight range (BMI>19 and >25) - probit results. Parameter estimates, standard errors in parentheses. All men and by parental income background.

	Men		
	All	Low income	Non-low income
Higher education (0/1)	0.340	0.250	0.357
	(0.056)***	(0.165)*	(0.071)***
Low income background (0/1)	-0.136		
	(0.064)**		
Number of observations	3,007	471	2,536

Notes: The sample consists of men 15-35 years old in 1988. The following control variables are added but not shown: age, age squared, married, income, maternal and paternal higher education. See also Table 2. Significance: *** p<0.01; **p<0.05, * p<0.10.

Table 3 presents the probit results with a binary outcome for being in a healthy weight category (BMI between 19 and 25). All models include the same control variables as presented in Table 2. Amongst all men, those who took a higher education have a significantly higher probability of being in the healthy weight category. In Table 3, columns 2 and 3, the results are shown by parental income background. For both income groups, completing a higher education is positively associated with the probability of being in the healthy weight category.

5.2 Results from the instrumental variable and bivariate probit models

Table 4 presents the estimation results from the instrumental variable regression method with BMI as outcome. For each sample the F-statistics and parameter estimates for the instrumental variable in the first stage regression and the test of exogeneity appear at the bottom of the table. The 1988

Table 4: Body mass index (BMI) and taking a higher education – 2SLS results using the Danish student grant reform in 1988 as an instrument

	Men		
	All	Low income background	Non-low income background
Higher education	1.569	0.723	1.790
	(1.081)	(2.472)	(1.192)
Low income background	0.477		
	(0.177)***		
F-test, first stage	56.35	13.25	44.98
Parameter estimate: Reform 1988 on Higher education	0.058	0.072	0.057
	(0.008)***	(0.020)***	(0.008)***
Durbin-Wu-Hausman test	5.464 **	0.448	5.507**
Number of observations	3,007	471	2,536

Notes: The sample consists of men 15-35 years old in 1988. The following control variables are added but not shown: age, age squared, immigrant, married, income and parental education. Significance: *** p<0.01; **p<0.05,** p<0.10.

reform of the Danish student grant scheme had the expected positive impact on enrolment into higher education and the impact seems to be a bit larger among men from a low income background than from a non-low income background. If the intensity in the instrument increases by one unit on average the share that take a higher education will increase by 7.2 and 5.7 percentage points among men from low and non-low income background, respectively. For the whole sample the share will increase with 5.8 percentage points. For the full sample of men and the sample of men from low income and non-low-income background the F-statistics are above the suggested threshold on 10 (Staiger and Stock, 1997). These results indicate that the instrument is strong.

The results in Table 4 all show a positive effect of enrolling in higher education on BMI but the education effect is not significant different form zero. To test for endogeneity, we apply Durbin-Wu-Hausman chi-square test that compares the OLS and IV estimates. The significance of the

Durbin-Wu-Hausman test indicates that the IV and OLS estimates of higher education on BMI differ significantly in the full sample of men and for men in the non-low-income group, whereas these estimates do not differ for men from low-income backgrounds. However, the IV estimate only shows the effect for a group of compliers and this effect may differ from the estimated OLS effect because the latter is based on the entire sample and not only on the compliers.

The results from the bivariate probit model (table 5) show that enrolling in a higher education increases the probability of being healthy-weighted in the full sample and in the sample of men from low-income background (only significantly different from zero amongst the latter group). Amongst the men from low-income background that are affected by the instrument, the probability of being health-weighted increases with 8.8% when they complete a higher education. Amongst men from a non-low-income background enrolling in a higher education reduces the probability of being healthy-weighted. However, the marginal effect is small and insignificant indicating that for the men from a non-low-income background that are affected by the instrument, the probability of being health-weighted is not affected by their education. The parameter ρ for all three samples indicates that the two equations in the IV approach can be estimated separately, as in Table 3. However, as the sample sizes are small, we have to be careful with the interpretation of the ρ result.

Table 5: The probability of being in the healthy weight range and taking a higher education – bivariate probit results using the Danish student's grant reform in 1988 as an instrument

	Full sample	Low income background	Non-low income background
Healthy weight outcome			
Higher education (parameter estimates)	0.148	1.705	-0.006
	(0.379)	(0.090)***	(0.391)
Higher education, marginal effects (at sample means)	0.012 (0.029)	0.088	-0.004
	(0.115)	(0.014)***	(0.030)
Higher education, outcome			
Reform 1988	0.185	0.171	0.178
	(0.025)***	(0.052)***	(0.027)***
ρ	0.114	-16.747	0.217
	(0.223)	(920.049)	(0.235)
Obs.	3,007	471	2,536

Notes: Being in the healthy weight range is defined as 18<BMI<25. The sample consists of men 15-35 years old in 1988. The following control variables are included but not shown: age, age squared, married, income and parental education, see Table 3. Significance: *** p<0.01; **p<0.05,* p<0.10.

5.3 Sensitivity analysis

We conduct several extensions to our basic model and test the robustness of our results. First, we re-estimate our original model, using an indicator for being overweight or obese. Second, we test our results for sample selection. Third, we test the robustness of the instrument.

Tables A1 and A2 present the estimation results on the relation between higher education and the binary outcomes for being overweight (BMI above 25) or being obese (BMI above 30). As very few men are underweight, the results for being overweight are almost the same as those for being in the healthy-weighted category. However, the signs of all parameter estimates are reversed. The marginal effects amongst men from low-income backgrounds in the probit model (see table A1) show that a higher education reduces the probability of being overweight by approximately 12 per cent. The results from the bivariate probit model in Table A2 also show that completing a higher education reduces the probability of being overweight. However, the result is only significantly different from zero amongst men from low-income background. The probability of being overweight is reduced by 9.2% amongst men from low-income backgrounds that are affected by the reform.

Table 6: The probability of being in the healthy weight range and higher education – bivariate probit results – test of sample. Men aged 15-29 in 1988

	Full sample	Low-income background	Non-low-income background
Healthy weight outcome			
Higher education, Parameter estimates	-0.175	1.844	-0.357
	(0.397)	(0.114)***	(0.408)
Higher education, outcome			
Reform 1988	0.166	0.167	0.159
	(0.026)***	(0.056)***	(0.028)***
ρ	0.305	-2.669	0.414
	(0.247)	(1.797)	(0.272)
Obs.	3,007	471	2,536

Notes: Being in the healthy weight range is defined as 18<BMI<25. The sample consists of men 15-29 years old in 1988. The following control variables are included but not shown: age, age squared, married, income and parental education, see Table 3. Significance: *** p<0.01; **p<0.05,* p<0.10.

Table 7: The probability of being in the healthy weight range and higher education – bivariate probit results – test of instrument. Placebo reform in 1982

	Full sample	Low-income background	Non-low-income background
Healthy weight outcome			
Higher education, Parameter estimates	1.289	1.714	0.497
	(3.823)	(0.103)***	(0.804)
Higher education, outcome			
Reform 1988	0.026	-0.013	0.047
	(0.171)	(0.039)	(0.033)
ρ	-0.656	-15.431	-0.057
	(3.985)	(822.746)	(0.480)
Obs.	3,007	471	2,536

Notes: Being in the healthy weight range is defined as 18<BMI<25. The sample consists of men 15-35 years old in 1988. The following control variables are included but not shown: age, age squared, married, income and parental education, see Table 3. Significance: *** p<0.01; **p<0.05,* p<0.10.

The probit results in Table A1 show that a higher education is negatively associated with the probability of being obese in all samples of men. The bivariate probit results in Table A2 show that a higher education increases the probability of being obese in all samples of men, but all results are insignificant, indicating that there is no effect of a higher education on obesity for the men that are affected by the reform. This could be due to too few observations. Both for the full sample of men and in the sample of men with low and non-low-income backgrounds the ρ parameters indicate that the two equations should be estimated simultaneously. However, due to small sample sizes and few observations in the obese category, further research and data are necessary for making any further conclusions on this outcome.

Sections 5.1 and 5.2 include results on men who were between 15 and 35 years of age in 1988. We chose that age group because it was most likely to be affected by the reform. Table 6 presents the biprobit results on a sample of men who were between 15 and 29 years of age in 1988. When we change the age range the results are virtually the same as the results we present in Table 5.

In Table 7 we present a placebo test where we construct an instrument using 1982 as a fictive reform year. The results from the placebo test show that the placebo instrument is not significantly related to higher education. Thus the instrument does not control for potential bias in the relation between higher education and being in the healthy-weighted category when we use a placebo reform as instrument. In Tables A3 we test the results with a binary instrument. The results are virtually the same as the results presented in Table 5

6. Summary and conclusion

We contribute to the existing literature on the relation between higher education and body weight by accounting for parental income background. To uncover the causal relation, we use a reform of the 1988 Danish student grant scheme, which involved a grant increase of approximately 60%.

Previous studies all find a positive association between education and a healthy body weight (and a negative association between education and being overweight). Several explanations have been proposed for a causal relation between education and a healthy body weight. For example a higher education leads to higher income, higher occupational status, better housing, and healthier environmental conditions, all of which lead to a healthy body weight. However, even in regressions controlling for these mediators a significant relation exists between education and body weight. In our reduced form estimates we also find a positive relation between a higher education and the probability of being healthy-weighted (and a negative relation for the probability of being overweight).

Because unobserved factors are likely to explain the relation between education and body weight, a number of papers have examined the causal effect of education on body weight. Although different results exist for different countries, many of these studies find that the relation between education and body weight disappears when controlling for unobserved heterogeneity. In our paper amongst all men, who are affected by the reform, we find no effect of completing a higher education on being overweight or healthy-weighted. However, when we analyse the effect of higher education by subgroup of parental income background and take unobserved heterogeneity into account, our results are significantly different from zero. Amongst men from low-income parental backgrounds, who are affected by the reform, our results show a positive effect of completing a higher education on the probability of being healthy-weighted. Furthermore, our results showed that for this group completing a higher education reduced the probability of being overweight by 9%. Amongst men from non-low-income parental backgrounds our results show no effect of a higher education on neither the probability of being healthy-weighted nor the probability of being overweight.

Our analysis and results focus on the policy relevant group of men from low-income parental backgrounds, thereby adding to the literature on the mechanism through which education has an impact on body weight. Whilst cognitive abilities and health knowledge are factors related to enrolling in a higher education for all socioeconomic groups, we expect people from low-income backgrounds to differ from their non-low-income background peers because of the social environment in which they grew up. Thus increasing the number of years in school significantly amongst people from economically disadvantaged backgrounds might give them a different social network from the one in which they grew up. As educated people in general eat more healthily, exercise more and are less likely to be obese, people from disadvantaged families might be motivated by their educated peers to adjust to the social norm for a healthy lifestyle.

Whilst the previous literature primarily studied the effect of one more year of compulsory education, completion of high school or educational categories, we extend the literature by focusing on enrolling in a higher education, i.e. 2 to 5 years added to 12 years of education. If the impact of education is higher at higher levels of education, our results suggest a limited effect of fewer years of education, e.g. one extra year of compulsory education, on body weight. However, this effect might differ according to socioeconomic background. These questions are left for future research.

References

Arendt, J. 2005. Does education cause better health? A panel data analysis using school reforms for identification. Economic of Education Review 24, 149-160

Bendixen, H. et al. 2004. Major increase in prevalence of overweight and obesity Between 1987 and 2001 among Danish adults. Obesity Research

Blanden, J., Gregg, P., Machin, S. 2005. Intergenerationsl Mobility in Europe and North America. Working paper Centre for Economic performance

Brunello, G., Fabbri, D. Fort, M. 2013. The Causal Effect of Education on the Body Mass Index: Evidence from Europe. Journal of Labor Economics

Burkhauser, R., Cawley, J. 2008. Beyond BMI: The value of more accurate measures of fastness and obesity in social science research. Journal of Health Economics 27,2: 519-29

Cawley, J. 2004. The Impact of Obesity on Wages. Journal of Human Resources 39,2: 451-74

Clark, A.E., Loheac, Y. 2007. It wasn't me, it was them! Social influence in risky behavior by adolescents. Journal of Health Economics 26: 763–784.

Clark, D., Royer, H. 2010. The Effect of Education on Adult Health and Mortality: Evidence from Britain. NBER working paper No 16013

Cutler D., Lleras-Muney, A. 2008. Education and Health: Evaluating Theories and Evidence. In, Robert F. Schoeni, James S. House, George Kaplan and Harold Pollack, editors, New York, Russell Sage Foundation

Denmark Statistics. 2006. Statistisk Årbog 2006 [Statistic yearbook 2006]. Denmark Statistic

Fuchs, V. R. 1982. Time Preference and Health: An Exploratory Study, in: Fuchs, V.R., (ed.), Economic Aspects of Health, University of Chicago Press, Chicago, 93-120.

Grabner, M. 2009. The Causal effect of Education on Obesity: Evidence form Compulsory Schooling Laws. Available at SSRN.

Grimard, F., Parent, D. 2007. Education and smoking: Were Vietnam war draft avoiders also more likely to avoid smoking? Journal of Health Economics, 26(5), 896-926

Grossman, M. 1972. On the concept of Health Capital and the Demand for Health. Journal of Political Economy 80,2, 223-55

Halliday, T.J., Kwak, S. 2012. What is a peer? The role of network definitions in estimation of endogenous peer effects. Applied Economics 44(3): 289–302

Harris, J.E., González, B. 2008. Asymmetric social interaction in economics: cigarette smoking among young people in the United States, 1992–1999. Journal of Health Economics 27(2): 249–264.

Imbens, G.W., Angrist, J.D. 1994. Identification and estimation of local average treatment effects. Econometrica 62, 467-475.

Jonasen, V. 2008. Dansk Socialpolitik 1708-2008. 10. Udgave. www.viggojonasen.dk

Jürges, H., Reinhold, S., Salm, M. 2011. Does schooling affect health behavior? Evidence from the educational expansion in western Germany. Economics of Education Review, 30(5), 862-872

Kemptner, D., Jürges, H., Reinhold, S. 2011. Changes in compulsory schooling and the causal effect of education on health: Evidence from Germany. Journal of Health Economics, 30(2), 340-354

Kenkel, D. 1991. Health Behavior, Health Knowledge and Schooling. Journal of Political Economy 99(2), 287-305

Kenkel, D., Lillard, D., Mathios, A. 2006. The roles of high school completion and GED receipt in smoking and obesity. Journal of Labor Economic 24(3), 635-659

Lundborg, P. 2006. Having the wrong friends? Peer effects in adolescent substance use. Journal of Health Economics. 25: 214–233.

Lundborg, P. 2012. The health returns to education – what can we learn from twins? J. Popul Econ. DOI 10.1007/s00148-012-0429-5

MacInnis, B. 2008. Does college education impact health? Evidence from pre-lottery Vietnam draft. Mimeo

Mazumder, B. 2008. Does Education improve health? A reexamination of the evidence from compulsory schooling laws. Economic Perspectives. 2Q/2008

Mora, T., Gill, J. 2012. Peer effects in adolescent BMI: Evidence from Spain. Health Economics. doi: 10.1002/hec.2817

Nayga, R.M. 2000. Schooling, health knowledge, and obesity. Applies Economics, 32, 815-832

Norton, E.C., Lindrooth, R.C., Ennett, S.T. 1998. Controlling for the endogeneity of peer substance use on adolescent alcohol and tobacco use. Health Economics 7(5): 439–453.

OECD (2012). Education at a Glance 2012: OECD Indicators, OECD Publishing. http://dx.doi.org/10.1787/eag-2012-en

Reinholt, S., Jürges, H. 2009. Secondary School Fees and the Causal Effect of Schooling on Health Behaviour. Mannheim Research Institute for the Economics of Aging working paper 181-2009

Rosenzweig, M. R., Schultz, P. 1982. The Behavior of Mothers as Inputs to Child Health: the Determinants of Birth Weight, Gestation, and Rate of Fetal Growth., in: Victor R. Fuchs, ed., Economic Aspects of Health (University of Chicago Press for the National Bureau of Economic Research, Chicago) 53-92.

Sassi, F. et al. 2009. The Obesity Epidemic: Analysis of Past and Projected Future Trends in Selected OECD Countries. OECD Health Working Papers, No. 45, OECD Publishing

Staiger, D., Stock, J.H. 1997. Instrumental variables regression with weak instruments. Econometrica 63,3, 557-86

SU-styrelsen (1999). SU-støtte og SU-gæld 1999, SUS nr. 7, Oktober 2000, SUstyrelsen

NIH, NHLBI Obesity Education Initiative. 1998. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. Available online http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf

Velfærdskommisionen (1995) Uddannelse og kvalitet, bilag 9.

Von H.K. Scholder, S. et al. 2012. The effect of fat mass on educational attainment: examining the sensitivity to different identification strategies. Economics and Human Biology 10,4, 405-18

Webbink, D., Martin, N.G., Visscher, P.M. 2009. Does Education reduce the probability of being overweight? Journal of Health Economics 29, 29-38.

Yakusheva, O., Kapinos, K., Weiss, M. 2011. Peer Effects and the Freshman 15: Evidence from a Natural Experiment. Economic and Human Biology, 9,2: 119-132

Appendix:

Table A1: Completing a higher education and the probability of being overweight (OW) and obese (OB) – probit results. Marginal effects.

	Full sample		Low-income		Non-low-income	
	(1)	(2)	(3)	(4)	(5)	(6)
	OW	OB	OW	OB	OW	OB
Higher education (0/1)	-0.126	-0.034	-0.117	-0.115	-0.129	-0.025
	(0.020)***	(0.0125)***	(0.057)**	(0.039)**	(0.021)***	(0.013)**
Low income background (0/1)		0.028				
		(0.018)				
Number of obser-vations	3,007	3,007	471	471	2,536	2,536

Notes: Being overweight (OW) is defined as BMI>25 and being obesity (OB) is defined as BMI>30. The sample consists of men 15-35 years old in 1988. The following control variables are included but not shown: age, age squared, married, income and parental education, see also Table 2. Significance: *** p<0.01; **p<0.05, * p<0.10.

Table A2: Completing a higher education and the probability of being overweight (OW) and obese (OB) – Bivariate probit results, marginal effects (at sample means)

	Full sample		Low income		Non-low income	
	OW	OB	OW	OB	OW	OB
Overweight/ obesity outcome						
Higher education, marginal effects	-0.015	0.010	-0.092	0.005	-0.002	0.009
	(0.029)	(0.023)	(0.026)***	(0.052)	(0.031)	(0.022)
Higher education, outcome						
Reform 1988, parameter estimate	0.002	0.122	0.039	0.002	0.170	0.002
	(0.001)**	(0.028)***	(0.013) ***	(0.003)	(0.003)***	(0.001)**
ρ	-0.089	-0.528	13.704	-0.683	-0.192	-0.427
	(0.223)	(0.326)	(763.057)	(0.771)	(0.235)	(0.381)
Number of obsevations	3,007	3,007	471	471	2,536	2,536

Notes: Being overweight (OW) is defined as BMI>25 and being obesity (OB) is defined as BMI>30. The sample consists of men 15-35 years old in 1988. The following control variables are included but not shown: age, age squared, married, income and parental education, see also Table 2. Significance: *** p<0.01;**p<0.05, * p<0.10.

Table A3: The probability of being in the healthy weight range and taking a higher education – bivariate probit results using the Danish student's grant reform in 1988 as an instrument (0/1)

	Full sample	Low income background	Non-low income background
Healthy weight outcome			
Higher education, (parameter estimates)	-0.048	1.711	-0.260
	(0.280)	(0.092)***	(0.283)
Higher education, outcome			
Reform 1988	0.735	0.776	0.703
	(0.076)***	(0.165)***	(0.081)***
ρ	0.235	-5.769	0.383
	(0.170)	(96.828)	(0.185)**
Obs.	3,007	471	2,536

Notes: Being in the healthy weight range is defined as 18<BMI<25. The sample consists of men 15-35 years old in 1988. The following control variables are included but not shown: age, age squared, married, income and parental education, see also Table 2. Significance: *** p<0.01; **p<0.05,* p<0.10.

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