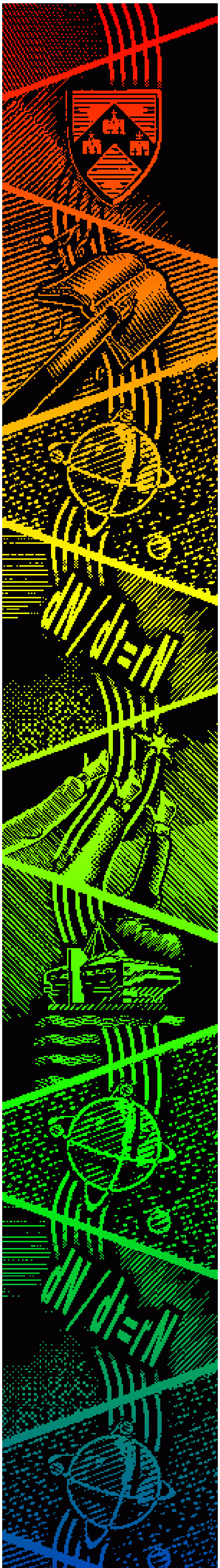

THE UNIVERSITY *of York*

Discussion Papers in Economics

No. 10/04

Education and Body Mass Index: Evidence from ECHP

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Education and Body Mass Index: Evidence from ECHP

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9 March 2010

Abstract

We study the association between education and body mass index across ten European countries (Denmark, Belgium, Greece, Spain, Ireland, Italy, Austria, Portugal, Finland and Sweden) using the European Community Household Panel. OLS and Probit estimation suggest that on average education is associated with lower BMI and a lower probability of being obese. For women, the difference of BMI between the lowest education group and the highest one ranges between -7.15% (Austria) and -2.43% (Finland). The reduction in the probability of being obese ranges between -7.18% (Spain) and -3% (Italy). For men, the reduction of BMI ranges between -4.29% (Denmark) and zero (Greece). The reduction in the probability of being obese ranges between -7.84% (Austria) and zero (Greece). Quantile regression suggests that the effect of education is larger at the upper quantiles than at the lower ones. Higher education also reduces the dispersion of the BMI distribution.

Keywords: Obesity, Body Mass Index, Education. JEL: I12, I20, C21.

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‡ *Acknowledgments.* The European Community Household Panel Users' Database (version of December 2003) was supplied by Eurostat. We would also like to thank Andrew Jones and participants to the Health Economics Data Group (HEDG) seminars at the University of York and the Economics of Obesity Workshop at the Paris School of Economics in December 2009 for helpful comments and suggestions.

1 Introduction

Obesity rates have been growing at an alarming rate in the last decades and have become a major health-policy concern in many developed and less developed countries. Obesity causes a large number of serious diseases and imposes substantial economic costs on healthcare systems. It is responsible for up to six percent of healthcare expenditure in Europe (WHO, 2006). The rise in obesity can be attributed to changes in the economic or social environment. Improved availability of food and sedentary life style are important factors (Cutler et al., 2003). Higher food availability may be due to the decline in its price, which also reduces the opportunity cost of preparing meals. Sedentary life-style is due to transition of occupational attainments from strenuous to sedentary ones (Cutler et al. 2003).

Some groups in the society may be more affected by obesity than others. Socioeconomic status may potentially play an important role. For example, individuals with higher income may be able to afford more expensive and less calory-intensive food (like fresh fruit and vegetable). Another dimension of socioeconomic status is education, which is the focus of this study.

There are different channels through which education may affect individuals' weight. Educated individuals may be more efficient in processing information about health and nutrition, and therefore be more aware of the adverse health effects from being overweight or obese. They are more likely to get secure jobs and therefore have less psychological distress that leads to overeating (Smith et al., 2009). They may also have educated peers, who are likely to behave healthily and exert pressure on each other's behaviour (Cutler and Lleras-Muney, 2006). It has been argued that the causality between education and weight may also be reversed, as obesity (in childhood) may adversely affect educational attainment (Ding et al, 2009). Moreover, there may be unobserved factors that can influence both education and weight. Time preference, risk aversion, will power, and general ability (or skills) are such factors. For example, individuals with low time-preference discount rate are more likely to attend higher education and, at the same time, avoid overeating because of the future health costs generated by obesity. It is also possible that education affects such unobserved factors. Becker and Mulligan (1997) suggest that higher education leads to lower time discount rates. It is not yet clear the extent to which reversed causality or unobserved factors explain the correlation between education and weight. However, some recent studies find that the effect of education on weight is causal (Grabner, 2009; Brunello et al., 2009; Webbink et al. 2010).[1]

In this study we investigate the association between education and Body Mass Index (BMI) in ten European countries (Denmark, Belgium, Greece, Spain, Ireland, Italy, Austria, Portugal, Finland and Sweden) using data from the European Community Household Panel (ECHP). We make use of OLS, probit and quantile regression. We also investigate how education affects the dispersion of the BMI distribution.

Our results suggest that more education is in general associated with lower average BMI and obesity rates. More precisely, for women, the difference in BMI between the lowest education group and the highest one ranges between -7.15% (Austria), which corresponds to a weight reduction of 4.68 kg for an average individual whose height is 165 cm, and -2.43% (Finland), which corresponds to a 1.61 kg reduction. The reduction in the probability of being obese ranges between -7.18% (Spain) and -3% (Italy). For men, the reduction of BMI ranges between -4.29% (Denmark), which corresponds to a 3.29 kg weight reduction for an average individual whose height is 175 cm, and zero (Greece). The reduction in the probability of being obese ranges between -7.84% (Austria) and zero (Greece).

Quantile regression confirms that higher education is associated with greater reductions of BMI at the upper quantiles than at the lower quantiles across the different countries. For women we find that the effect of education on BMI is

[1] Grabner (2009) and Brunello et al. (2009) use the reforms of compulsory education law (USA and pooled European data, respectively) in their instrumental variable estimation. Webbink et al. (2010) use the data of identical twins from Australia, and find the causal impact of education only for men. In addition, Sassi et al. (2009) find that the effect of reverse causality is very small using French data. However, in the same study they do not find a statistically significant effect of schooling which is instrumented by the compulsory education reform for England.

negative in several countries even at the lowest quantiles (though in others there is no effect), and then the effect gradually increases (in absolute value) at higher quantiles. For example, in Austria, the reduction in BMI for women with tertiary education amounts to -3.34% at the first decile (-1.98 kg), it becomes -6.95% (-4.66 kg) at the median, and it reaches -8.70% (-7.65 kg) at the ninth decile. For men the results are somewhat different. Secondary education *increases* BMI at the lowest quantiles and has no effect at the upper quantiles in Austria and Finland. For most of the other countries (Denmark, Ireland, Italy, Spain, Portugal and Sweden) secondary education has no effect at the lower quantiles, but it reduces BMI at the upper quantiles (a similar result is found for tertiary education across all countries). The results are consistent with the idea that educated individuals are more informed about the potential adverse health effects from being overweight as at high levels of BMI, where the health effect is likely to bite, the difference in weight between more and less educated individuals is higher than at low levels of BMI, where the health effect is less likely to bite. We also find that the BMI distribution of individuals with higher education is significantly less dispersed compared to that of individuals with lower education. For women, Austria exhibits the largest reduction in dispersion (-2.12 points of BMI), while for men Denmark displays the largest reduction (-2.11 points of BMI).

We contribute to the literature on education and obesity. Most of the existing studies show that higher education reduces BMI and the probability of being obese for both men and women (Nayga, 2001; Lakdawalla and Philipson, 2002; Chou et al., 2004; Cantarero and Pascual, 2007; Sassi et al., 2009; Grabner, 2009; Brunello et al., 2009; Webbink et al., 2010). Kenkel et al. (2006) is an exception: no significant evidence is found that high school completion reduces obesity. These studies use data mainly from the US, with the exception of Cantarero and Pascual (2007) who focus on Spain and Sassi et al. (2009) who focus on Australia, Canada, England and Korea. There seems therefore to be limited evidence for European countries.[2] Similarly to other studies, we make use of quantile regression. For example, Kan and

[2] Brunello et al. (2009) present the overview of the obesity problem in Europe.

Tsai (2004) use this method to study the relationship between BMI and health risk knowledge as well as other socioeconomic variables (including education) in Taiwan. Brunello et al. (2009) use quantile regression with instrumental variable to examine the effect of years of schooling on BMI for European females. Finally, Garcia Villar and Quintana-Domeque (2009) use the ECHP to examine the association between income and obesity. We complement their study by focusing on the net effect of education controlling for income.[3] More broadly, we also contribute to the literature which investigates the relationship between education and health (Cutler and Lleras-Muney, 2006).

The rest of this paper is organised as follows. Section 2 describes the data. Section 3 presents the econometric framework and empirical specification. The results are given in section 4. Section 5 concludes.

2 Data

We use data from the European Community Household Panel (ECHP). ECHP is designed and coordinated by Eurostat, the European Statistical Office. It is a set of national representative longitudinal surveys, which covers several EU member countries. It provides information on demographics (age, sex), socioeconomic status (household income, occupation, education and marital status), and other health-related information (height, weight). Since the design of the data set is the same across countries, the variables are comparable. Our sample includes ten countries (Denmark, Belgium, Greece, Spain, Ireland, Italy, Austria, Portugal, Finland and Sweden) and covers the four-years period from 1998 to 2001 (for Sweden only the last three years are available).

Our measure of body mass is the self-reported Body Mass Index (BMI).[4] An individual with BMI over 30 is defined as obese. Tables 1 and 2 provide the

[3] The authors find that the effect of higher income on weight is negative for women, but it is positive or zero for men.

[4] BMI is calculated by the following formula: BMI=weight (kg)/height (m)^2.

descriptive statistics of BMI and obesity rates for the pooled (1998-2001) sample.

[**Table 1 and Table 2 here**]

In each country men have higher average BMI than women, while obesity rates are about the same. Average BMI is reasonably similar across countries: it ranges between 25 and 26 for men, and between 23 and 25 for women. Greece displays the highest BMI while Italy the lowest one. Spain and Finland have the highest obesity rate (about 12%). Ireland and Italy have the lowest one (about 8%). Differences in average BMI across countries may be due to different age structures. Tables 1 and 2 report the predicted BMI conditional on having an age equal to 40 years. Figure 1 shows a comparison between average BMI and the predicted BMI across countries.

[**Figure 1 here**]

Overall, they are similar within a country. For women, the gap is at most 0.1 points of BMI in all countries. For men, the predicted BMI for an individual who is 40 years old is slightly higher than the average BMI, i.e. the gap is between 0.3 and 0.6 points of BMI. This implies that international differences in body mass cannot be attributed to different age structures.

To measure educational attainment, we construct three dummy variables indicating individual's maximum level of formal education, based on the International Standard Classification of Education. They are: primary (less than second stage of secondary education); secondary (second stage of secondary education); tertiary (third level education).[5] Sample characteristics are given in Table 1 and 2. The gender gap in educational attainment is less prominent in Belgium, Ireland, Italy, Portugal and Sweden, where the gap is less than 3% in all categories. It is more prominent in Denmark, Greece, Spain and Finland (where the gap is less than 7%). The gender gap between primary and secondary education is most prominent in Austria (where it is as high as 16.3%), although the proportion of those who attend tertiary education is similar (6.0% for men and 5.7% for women).

[5] Primary education refers to ISCED level 2; secondary education refers to ISCED level 3; tertiary education refers to ISCED level 7.

Cross-country differences in educational attainment are substantial. The country with the highest proportion of individuals with primary education is Portugal (about 80%). Ireland, Italy, Greece and Spain follow (around 50%). The countries with the lowest proportion of individuals with primary education are Denmark, Belgium, Austria, Finland and Sweden (around 30%). The countries with highest proportion of individuals with secondary education are Denmark, Austria and Sweden (around 50%), followed by Belgium, Ireland, Italy and Finland (around 35%), and by Greece, Spain and Portugal (less than 30%). Finally, the proportion of those with tertiary education is highest in Denmark, Belgium, Finland and Sweden (around 30%), is intermediate in Ireland, Greece and Spain (around 15%) and is low in Italy, Portugal and Austria (less than 10%).

Other control variables include household income, occupation, marital status and age. Household income is adjusted by Purchasing Power Parities (PPPs) and the Consumer Price Index (CPI). We also adjust for household size and composition using the modified OECD scale (see Hernandez-Quevedo et al., 2008).[6] We have seven categories of occupations: employed (including military service), self-employed, unemployed, retired, housework, student and inactive. We have five categories of marital status: married, divorced, separated, widowed and never married. Age groups are represented by six categorical variables: individual is less than 30 years old, between 30 and 40 years old, ..., more than 70 years old. Descriptive statistics of these variables are given in the Appendix.

We now briefly investigate the relation between education and weight without controlling for other variables. Figure 2 presents the average BMI and the obesity rate by education groups for women.

[**Figure 2 here**]

There are large differences across education groups in both the average BMI and the obesity rates. In particular, the gap between those with primary education and

[6] The modified OECD scale assigns a value of 1 to the household head, 0.5 to each additional adult member, and 0.3 to each child.

those with secondary education are pronounced in Italy, Greece, Spain and Portugal. For example in Spain the obesity rate for those with primary education is 17.4%, whereas it is 4.3% for those with secondary education. Figure 3 provides the results for men.

[**Figure 3 here**]

In contrast to women, the average BMI across education groups for men are similar. However, we still find that the obesity rate is smaller when education is higher in all countries.

Figure 4 compares the BMI distribution across education groups by plotting the kernel density for women.

[**Figure 4 here**]

There are stark differences in the BMI distribution between those with primary education and those who completed secondary or tertiary education. The distribution for individuals with primary education is less skewed and it exhibits a higher dispersion. Figure 5 plots the results for men.

[**Figure 5 here**]

The differences across education groups are less pronounced. The BMI distribution for those with secondary and tertiary education exhibits less dispersion compared to those with primary education.

These differences however do not take into account other covariates which may also affect BMI, such as income and age. In the following analysis we control for such variables.

3 Econometric specification

Our first empirical specification is a pooled OLS regression:

$$\ln(\mathrm{BMI})_{it} = \alpha + \beta(\mathrm{secondary})_{it} + \gamma(\mathrm{tertiary})_{it} + \mathbf{z}'_{it}\boldsymbol{\delta} + \mathrm{u}_{it}. \tag{1}$$

We have three categories of educational attainment (primary, secondary and tertiary). We set primary education as the baseline category. The vector $\mathbf{z}$

includes the log of household income (subtracted by the log of average income of the country), occupation (baseline group: employed), marital status (baseline group: employed), age group (baseline group: 40 years old), and year dummies (baseline: year 2002). Since we have repeated information of individuals, the observations are not independent within the individual cluster. We therefore estimate cluster-robust standard errors.[7]

Second, we estimate the binary probit model with the same covariates. In this case, the dependent variable is a dummy variable equal to one if the individual is obese, and equal to zero otherwise.

Third, we examine if the effect of education on BMI varies across the distribution by employing linear quantile regression (Koenker, 2005). The specification is the following:

$$\mathrm{Q}_q(\ln(\mathrm{BMI})_{it}) = \alpha_q + \beta_q \mathrm{secondary}_{it} + \gamma_q \mathrm{tertiary}_{it} + \mathbf{z}'_{it}\boldsymbol{\delta}_q + \mathrm{u}_{it}. \qquad (2)$$

The covariates are the same as in the previous model. $\mathrm{Q}_q(\ln(\mathrm{BMI}))$ is the q^{th} quantile of the log of BMI. We estimate the coefficients for each of the 19 quantiles (q=0.05, 0.1,...,0.95). Standard errors are calculated using a bootstrap procedure (1000 times re-sampling).[8]

Finally, we examine differences in the degree of dispersion in the BMI distribution. We follow the method suggested by Hao and Naiman (2007) which makes use of the coefficients from quantile regression. We measure dispersion by the inter-quantile range between the first decile ($\mathrm{Q}_{0.1}$(BMI)) and the ninth decile ($\mathrm{Q}_{0.9}$(BMI)) of the conditional BMI distribution.[9] Define the inter-quantile range as IQR=$\mathrm{Q}_{0.9}$(BMI)-$\mathrm{Q}_{0.1}$(BMI). We compute the difference in the IQR across education groups in the following way. The estimated constant term α_q in Eq.(2) represents the q^{th} quantile of the log of BMI for the baseline category (i.e. an individual with primary education, average income, employed, married, forty years old in year 2002),

[7] This is implemented by using "cluster" command in Stata version 10.

[8] This is implemented by using "sqreg" command in Stata version 10.

[9] The results are qualitatively similar if we implement the same procedure using instead the distance between 25% quantile and 75% quantile.

which we refer to as the Reference group. To convert this into BMI, we simply take its exponential ($Q^R_{0.1}$(BMI)=$e^{\alpha_{0.1}}$ and $Q^R_{0.9}$(BMI)=$e^{\alpha_{0.9}}$). Similarly, $\alpha_q + \beta_q$ in Eq.(2) represents the q^{th} quantile of the log of BMI for the secondary education group, i.e. the Comparison group, which we also convert it into BMI ($Q^C_{0.1}$(BMI)=$e^{\alpha_{0.1}+\beta_{0.1}}$ and $Q^C_{0.9}$(BMI)=$e^{\alpha_{0.9}+\beta_{0.9}}$). The difference in the inter-quantile range between the Comparison and the Reference group is then given by:

$$\mathrm{IQR}^C - \mathrm{IQR}^R = \left[\mathrm{e}^{\alpha_{0.9}+\beta_{0.9}} - \mathrm{e}^{\alpha_{0.1}+\beta_{0.1}}\right] - \left[\mathrm{e}^{\alpha_{0.9}} - \mathrm{e}^{\alpha_{0.1}}\right]. \tag{3}$$

We implement the same procedure for tertiary education (using γ_q). The confidence interval for this statistic is estimated by a bootstrap procedure (with 1000 times re-sampling).[10] If the sign of Eq.(3) is positive the conditional distribution becomes more dispersed with higher education, whereas if it is negative the distribution becomes less dispersed.

4 Results

Figure 6 shows the effect of education on BMI from OLS regression, after controlling for household income, occupation, marital status, and age structure.

[**Figure 6 here**]

It provides point estimates at 95% confidence intervals. Since the OLS coefficients for different education levels represent the expected difference in the log of BMI, we rescale the coefficients in order to obtain the proportionate difference in the conditional mean BMI, which is easier to interpret (Wooldridge, 1999).[11]

The vertical axis gives the magnitude of the effect. The effect of *secondary* education for women is negative and statistically significant for most countries. Spain exhibits the greatest proportionate reduction (-4.26%) whereas Finland exhibits no effect. Consider a woman whose height is 165 cm. In Spain this

[10] A sample Stata code for the computation is given in Hao and Naiman (2007, pp113). For the re-sampling procedure we use “bsample” in Stata version 10.

[11] Suppose that the estimated coefficient is β. The proportionate difference is given by exp(β)-1.

corresponds to a weight reduction of 2.81 kg. The effect of *tertiary* education is systematically greater compared to secondary education. The reduction in BMI is highest in Austria (-7.15%) and smallest in Finland (-2.43%). Consider again a woman whose height is 165 cm. The weight reduction for a women with tertiary education is 4.68 kg for Austria, whereas it is only 1.61 kg for Finland. Overall, higher education is generally associated with lower BMI, which is in line with previous findings (Nayga, 2001; Lakdawalla and Philipson, 2002; Chou et al., 2004; Cantarero and Pascual, 2007; Sassi et al. 2009; Grabner, 2009; Brunello et al., 2009).

The effect of education on BMI for men is systematically smaller than for women. Also, the ranking across countries for women does not necessarily carry over for men (notably Denmark and Greece). The effect of *secondary* education for men is mostly negative but statistically insignificant (and it is positive in Greece and Austria). The largest proportionate reduction is -1.80% in Denmark. Consider a man whose height is 175 cm. The expected weight reduction amounts to 1.38 kg. The effect of *tertiary* education is negative in all countries. The magnitude of the effect is again larger compared to secondary education. Denmark displays the largest reduction (-4.29%, which is equivalent to -3.29 kg) while there is no effect for Greece.

Figure 7 presents the results from the probit model.

[**Figure 7 here**]

It provides the difference in the probabilities of being obese between different groups. Similarly to the OLS results, a higher educational attainment mostly reduces the probability of being obese. For women, the reduction in the probability of being obese if she attended secondary education ranges between -5.18% (Spain) and zero (Finland), whereas for tertiary education it ranges between -7.18% (Spain) and -3.00% (Italy). It should be noted that the descriptive statistics showed much larger discrepancy in the obesity rate across education groups. For example, in Spain, the gap between primary and secondary education group was -14.1%. A large portion of such discrepancy is absorbed by other confounding factors (income, age, occupation and marital status). However, we find that the effect of education is still reasonably large after controlling for such factors. For men, the reduction in the probability of being obese if the individual has secondary education ranges between -3.85% (Denmark) and zero (Belgium). One exception is Greece: the probability increases by 1.23%. In the case of tertiary education, the reduction ranges between -7.84% (Austria) and zero (Greece). Differently from OLS results, the effect of education on obesity for women is not always greater than the effect for men, particularly for tertiary education.

Finally, Figure 8 to Figure 11 show the results from quantile regression, by plotting the effect of education at different points of the BMI distribution.

[**Figure 8 to Figure 11 here**]

They show the proportionate difference in BMI, at 95% confidence interval, for each of the 19 BMI quantiles (from 5% to 95%). The horizontal axis gives the quantiles and the vertical axis provides the effect of education on BMI. Two vertical lines show where BMI equal to 25 and 30 (respectively the thresholds for overweight and obesity) intersect the conditional distribution. We also add for reference the effect from the OLS estimates (dash-dot horizontal line).

We find that the effect of education on BMI typically increases (in absolute values) when moving from lower to higher quantiles. Figure 8 shows the effect of secondary education for women. The result is typically characterised by a small negative effect at the lower quantile, and a larger effect at the upper quantile in all countries except for Finland. It is noteworthy that the reduction in BMI is statistically significant even at the lowest quantile in Italy, Greece, Spain, Portugal and Austria. Figure 9 provides the results for tertiary education. The magnitude of the effect shows a sharp increase (in absolute value) from the lower to the upper quantiles (with the exception of Portugal). For example, in Austria, the reduction of BMI amounts to -3.34% at the first decile (-1.98 kg if height is 165 cm), whereas it becomes -6.95% (-4.66 kg) at the median, and it reaches -8.70% (-7.65 kg) at the ninth decile.

Figure 10 shows the effect of secondary education for men. While secondary education has little effect at the lowest quantiles, it reduces BMI at the upper quantiles in Denmark, Ireland, Italy, Spain, Portugal and Sweden. In contrast, secondary education increases BMI at the lowest quantiles but has no effect at the upper quantiles in Austria and Finland. Finally, the effect is fairly uniform across the distribution in Belgium and Greece. Figure 11 gives the result for tertiary education. The sign of the effect is negative across most of the distribution in all countries (except for Greece and Ireland). Again, the magnitude of the effect becomes larger at the upper quantiles. In Denmark for example while the reduction in BMI is zero at the first decile, it is -4.80% (-3.66 kg if height is 175 cm) at the median, and it amounts to -7.10% (-6.43 kg) at the ninth decile.

Finally, we discuss differences in the dispersion of BMI across education groups. The results from quantile regression suggest that higher education is associated with a reduced dispersion of the conditional BMI distribution. We measure the dispersion with the range between the first and the ninth deciles of the conditional BMI distribution (as described in Section 4). Figure 12 provides the difference in such inter-quantile ranges across education groups, and the associated 95% confidence interval.

[**Figure 12 here**]

If the difference is negative it implies less dispersion in the BMI distribution for the higher-education group and if it is positive it implies more dispersion.

We find that the difference in the inter-quantile range is systematically negative and statistically significant. Thus the BMI distribution for more educated individuals is less dispersed compared to that of less educated ones. For women, the reduction in the dispersion from attending secondary education is largest in Spain, where the inter-quantile range diminishes by 1.14 points of BMI, and smallest in Sweden (where it is essentially zero). The BMI for individuals with tertiary education is even less dispersed. Differences are statistically significant for all countries. Austria exhibits the largest reduction in dispersion (-2.12 points of BMI) whereas Italy exhibits the smallest one (-1.04 points of BMI). For men, Denmark displays the largest reduction in dispersion for secondary education (-0.95 points of BMI) whereas Sweden and Belgium display the smallest one (it is essentially zero). In Greece the dispersion increases but is not statistically significant. Attending tertiary education significantly reduces the dispersion of the BMI distribution in all countries except Greece. Again Denmark displays the largest reduction (-2.11 points of BMI).

5 Concluding remarks

We have studied the relationship between BMI and education using data from ten European countries. Our OLS results suggest that on average education is associated with lower BMI. Similarly, the probit results suggest that higher education is associated with lower probability of being obese. We find that the magnitude of the effect varies substantially across countries. The effect is in general larger for women than for men. Quantile regression suggests that the effect of education is larger at the upper quantiles than at the lower quantiles in most cases. Moreover, higher levels of education make the conditional BMI distribution less dispersed.

In this study we did not address explicitly the potential endogeneity between education and weight, either due to reversed causality (obesity may reduce educational attainment) or omitted variable (like time preferences discount). Recent studies which make use of instrumental variables suggest that the effect of education on weight is indeed causal (Grabner, 2009; Brunello et al., 2009; Webbink et al. 2010). Note however that addressing causality often comes of at the cost of sacrificing sample size and therefore its representativeness. Our study instead makes use of large representative samples, therefore complementing the existing studies and providing additional insights on the relation between education and weight. If the effect of education is indeed causal (as the literature seems to suggest), then there might be scope for educational policies to contribute to the reduction in obesity across a range of countries.

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Table 1 Descriptive statistics (Women)

	Denmark	Belgium	Ireland	Italy	Greece
BMI	24.02 (4.1)	24.12 (4.4)	24.1 (4.1)	23.63 (3.9)	24.9 (4.1)
Predicted BMI at age 40s	24.05	24.04	24.22	23.71	24.78
Obesity rate	9.0%	10.5%	8.6%	7.4%	10.0%
Education level					
Primary education	28.9%	35.9%	46.8%	58.5%	61.9%
Secondary education	46.6%	33.3%	37.5%	34.6%	27.8%
Tertiary education	24.4%	30.8%	15.7%	7.0%	10.3%
Sample size	7778	9964	10129	29651	19664

	Spain	Portugal	Austria	Finland	Sweden
BMI	24.6 (4.5)	24.76 (4.1)	24.39 (4.2)	24.69 (4.3)	24.42 (3.9)
Predicted BMI at age 40s	24.63	24.71	24.32	24.75	24.25
Obesity rate	12.6%	10.7%	10.4%	12.7%	9.3%
Education level					
Primary education	65.0%	80.7%	43.0%	30.1%	23.8%
Secondary education	16.7%	11.7%	51.4%	39.3%	46.8%
Tertiary education	18.3%	7.5%	5.7%	30.6%	29.4%
Sample size	24592	23121	12109	12474	7587

Notes: Standard deviation in parenthesis.

Table 2 Descriptive statistics (Men)

	Denmark	Belgium	Ireland	Italy	Greece
BMI	25.29 (3.5)	25.28 (3.9)	25.28 (3.5)	25.22 (3.3)	25.98 (3.3)
Predicted BMI at age 40s	25.69	25.61	25.84	25.74	26.42
Obesity rate	9.7%	10.8%	8.2%	8.6%	10.0%
Education level					
Primary education	22.4%	33.3%	49.0%	56.6%	55.8%
Secondary education	52.0%	35.1%	35.0%	35.2%	30.0%
Tertiary education	25.6%	31.6%	16.0%	8.2%	14.2%
Sample size	7549	8744	9770	28307	17642

	Spain	Portugal	Austria	Finland	Sweden
BMI	25.86 (3.7)	25.47 (3.4)	25.57 (3.6)	25.62 (3.7)	25.49 (3.3)
Predicted BMI at age 40s	26.45	26.07	26.04	26.05	25.76
Obesity rate	13.1%	9.3%	11.3%	11.4%	9.7%
Education level					
Primary education	61.6%	83.0%	26.3%	32.0%	23.1%
Secondary education	19.1%	11.5%	67.7%	43.3%	48.6%
Tertiary education	19.3%	5.5%	6.0%	24.7%	28.3%
Sample size	23127	20718	11326	12242	7169

Notes: Standard deviation in parenthesis.

Figure 1 Average BMI and predicted BMI at age 40s.

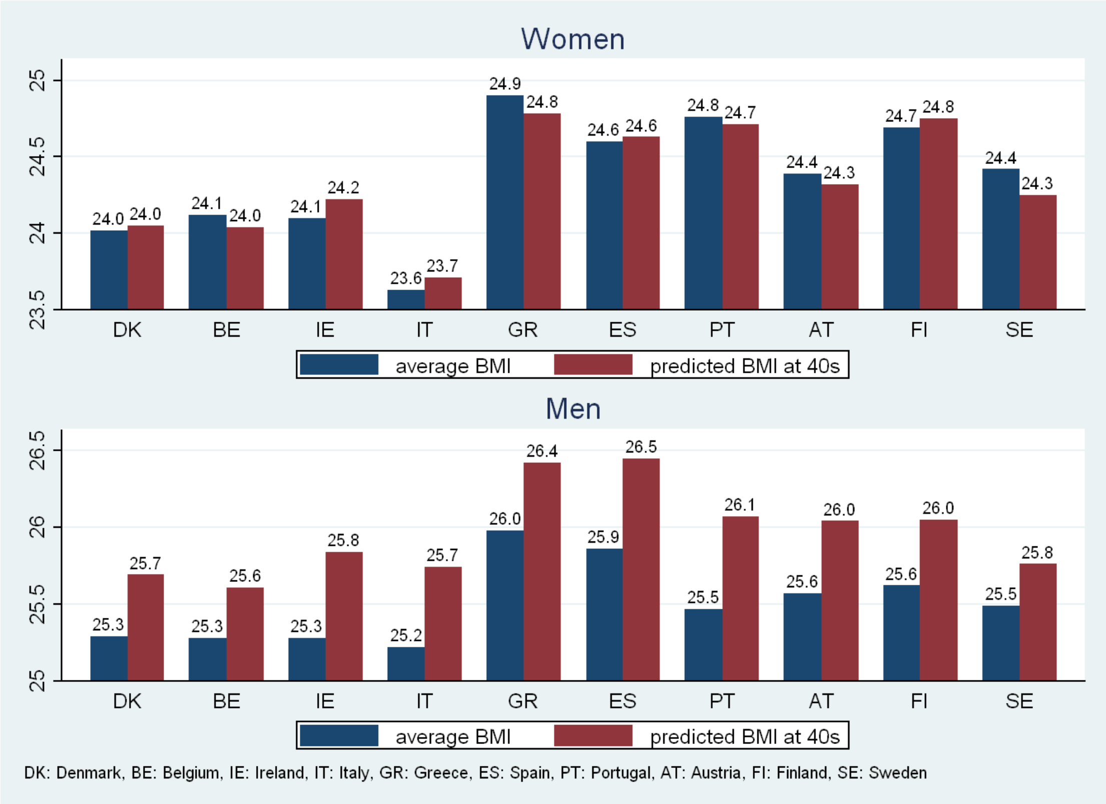


Figure 2 Average BMI and obesity rate by education groups (Women)

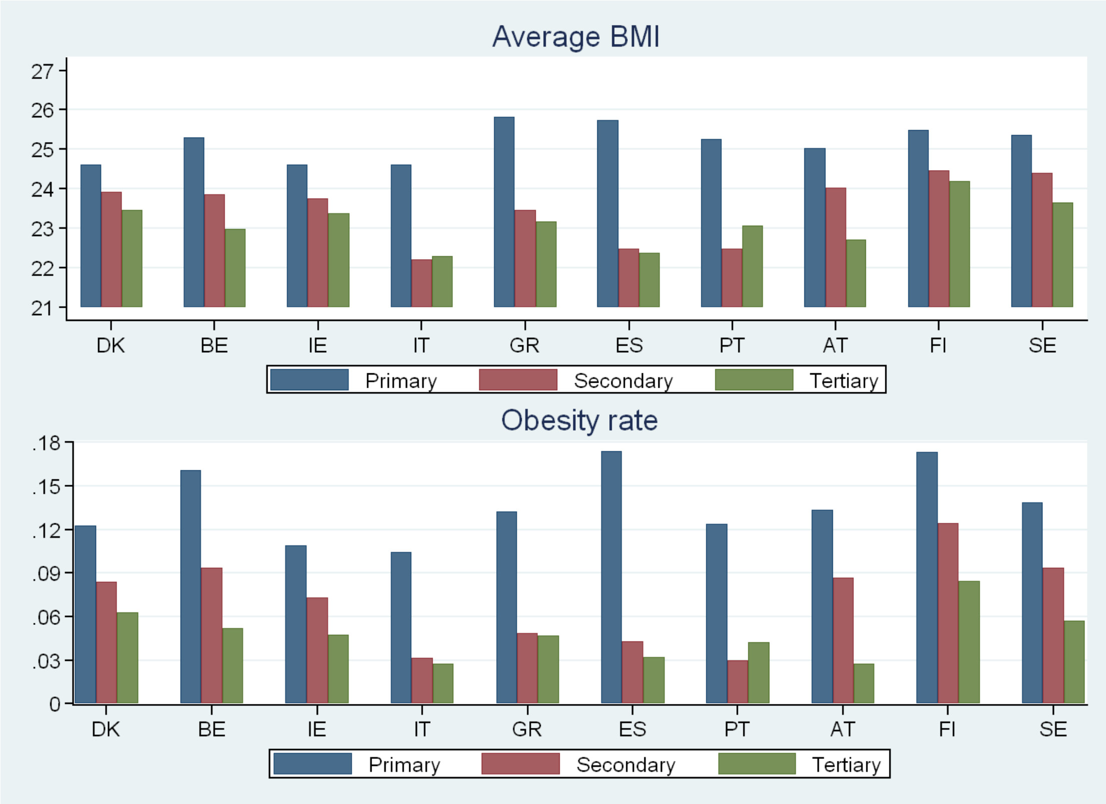


Figure 3 Average BMI and obesity rate by education groups (Men)

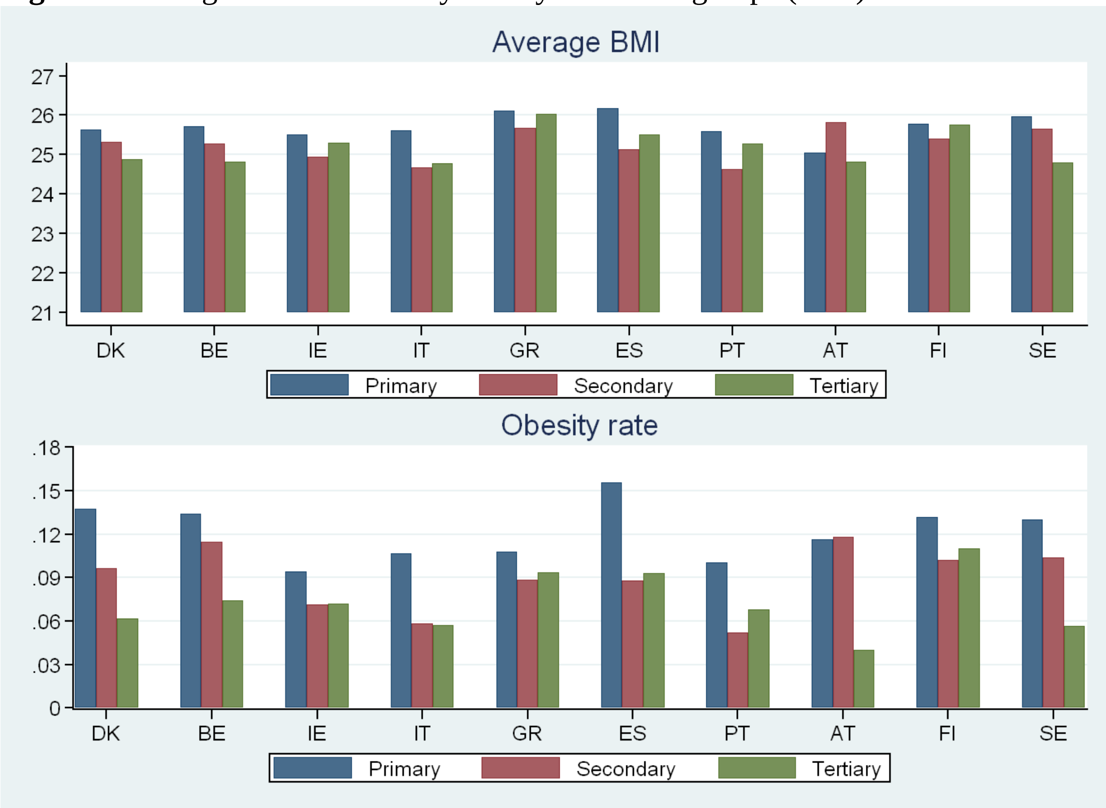


Figure 4 Kernel density plot of BMI by education groups (Women)

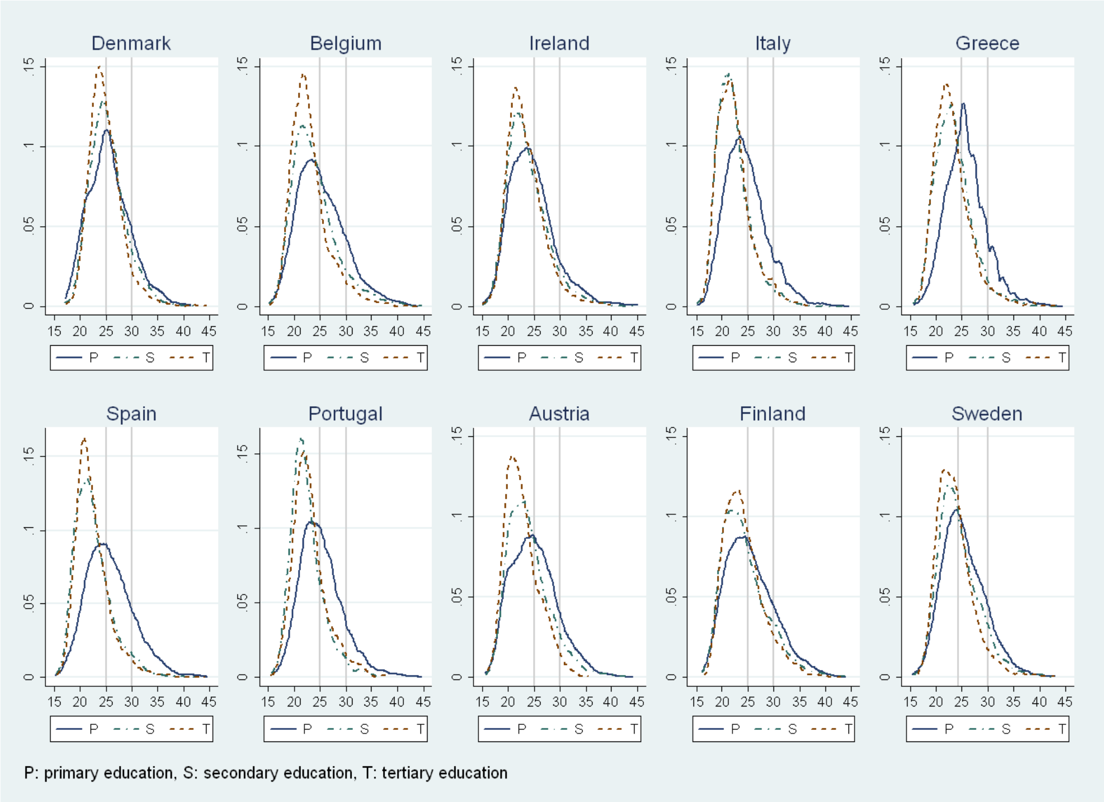


Figure 5 Kernel density plot of BMI by education groups (Men)

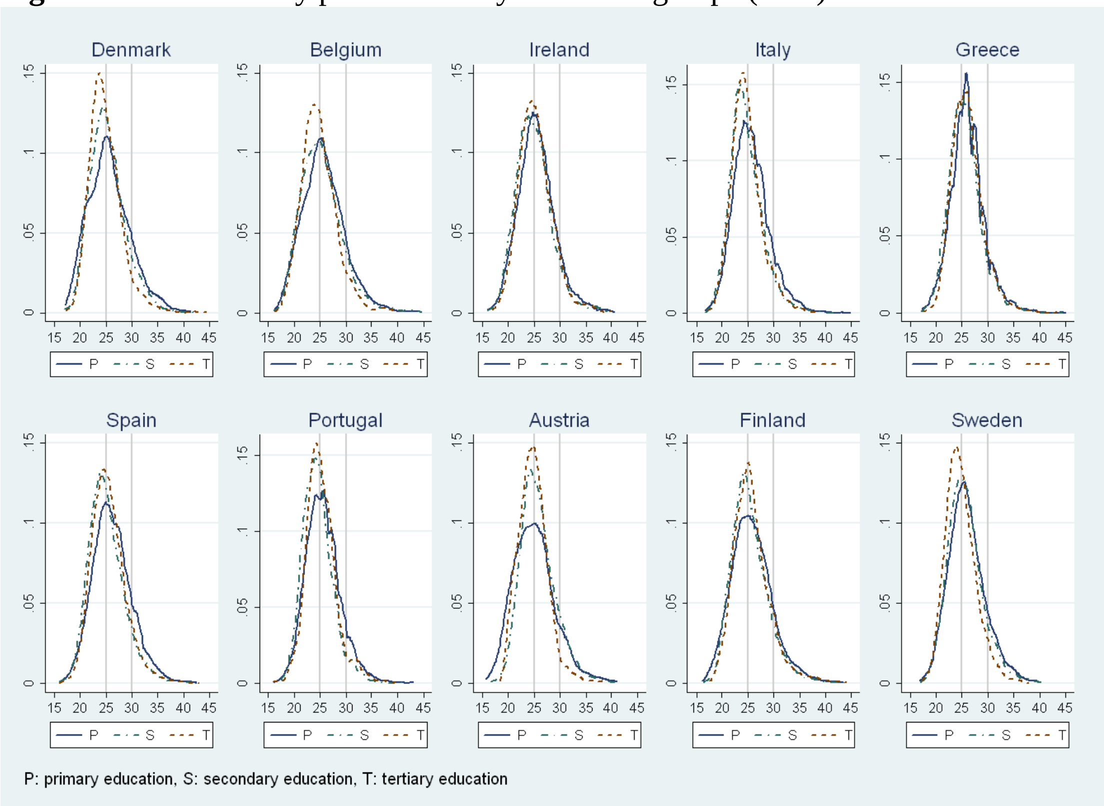


Figure 6 Proportionate difference in BMI by education groups, OLS (baseline: primary education)

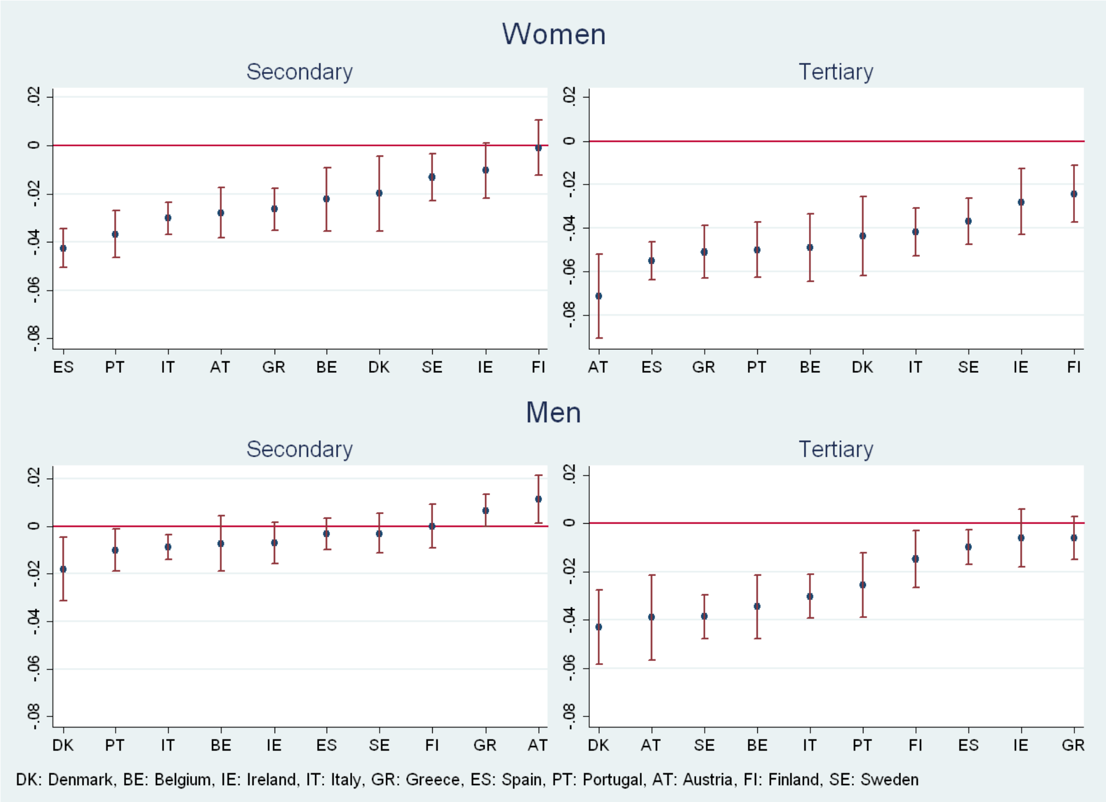


Figure 7 Difference in probability of being obese by education groups, probit (baseline: primary education)

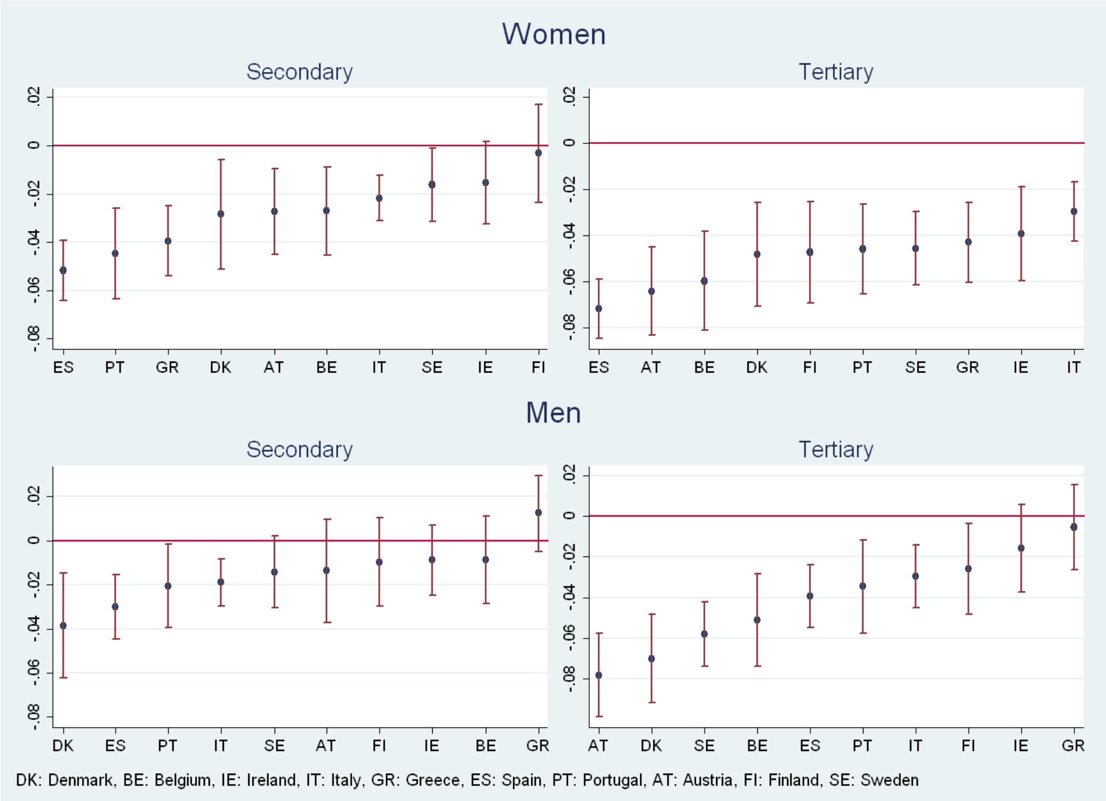


Figure 8 Proportionate difference in BMI by secondary education (Women), quantile regression (baseline: primary education)

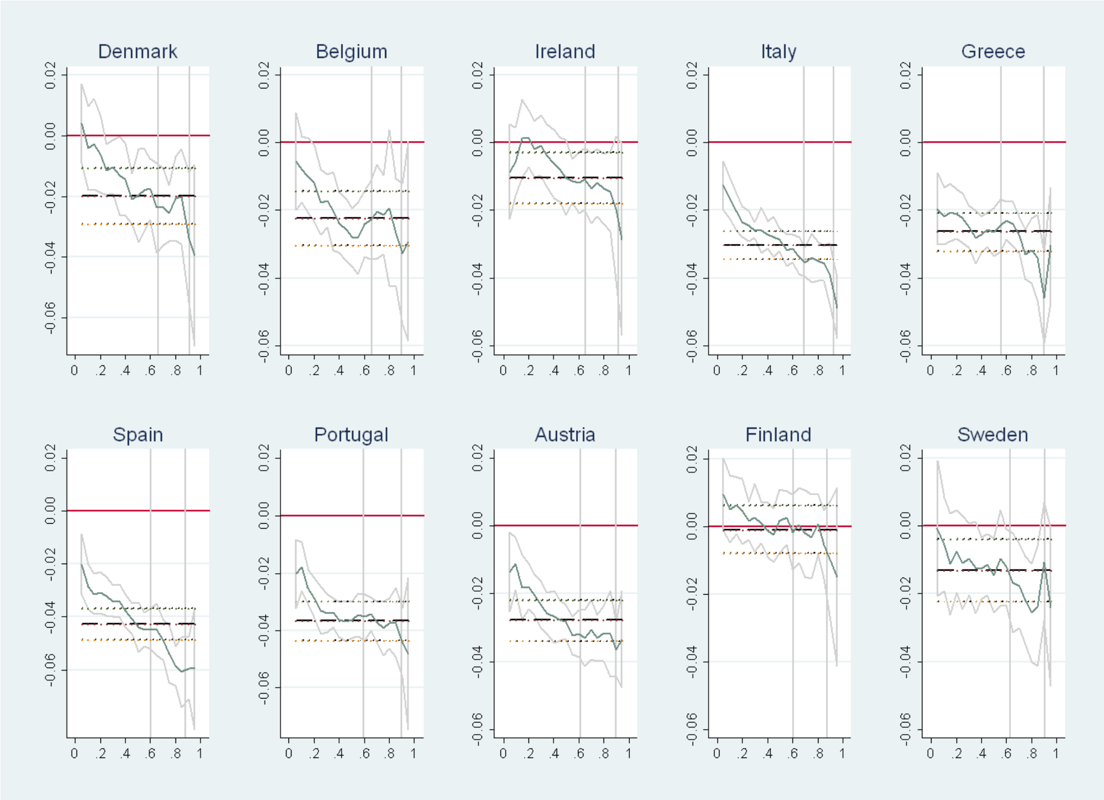


Figure 9 Proportionate difference in BMI by tertiary education (Women), quantile regression (baseline: primary education)

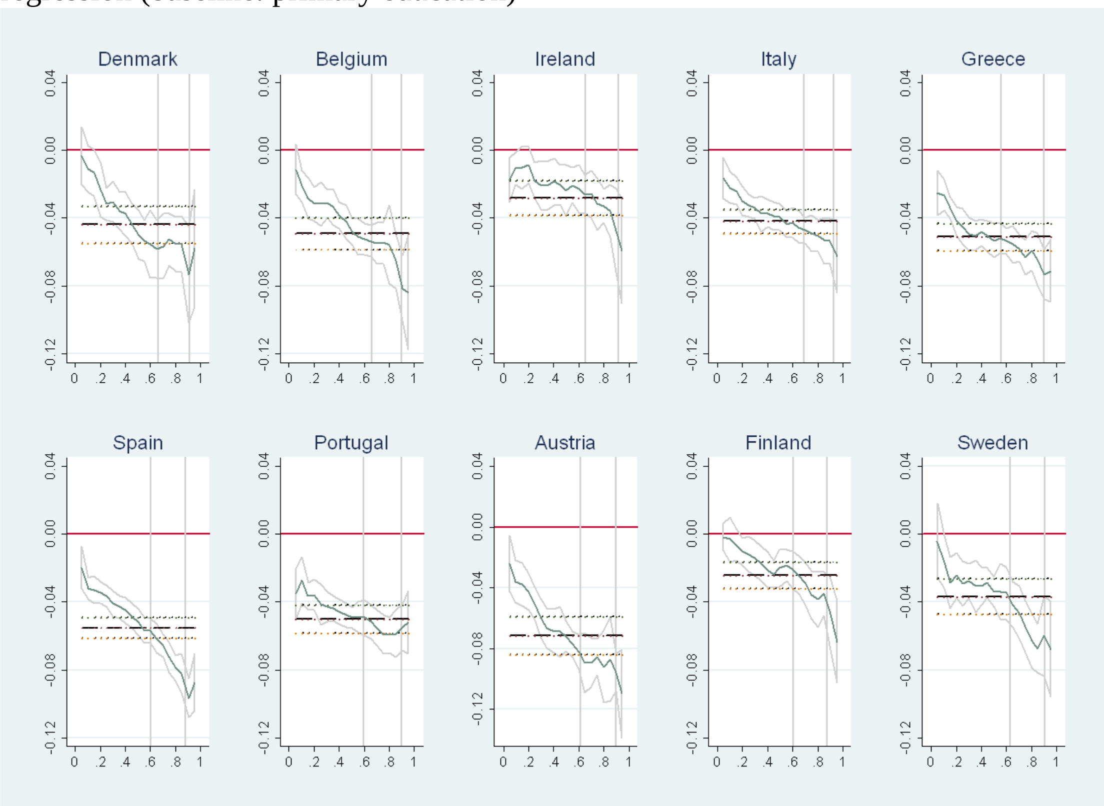


Figure 10 Proportionate difference in BMI by <u>secondary</u> education (<u>Men</u>), quantile regression (baseline: primary education)

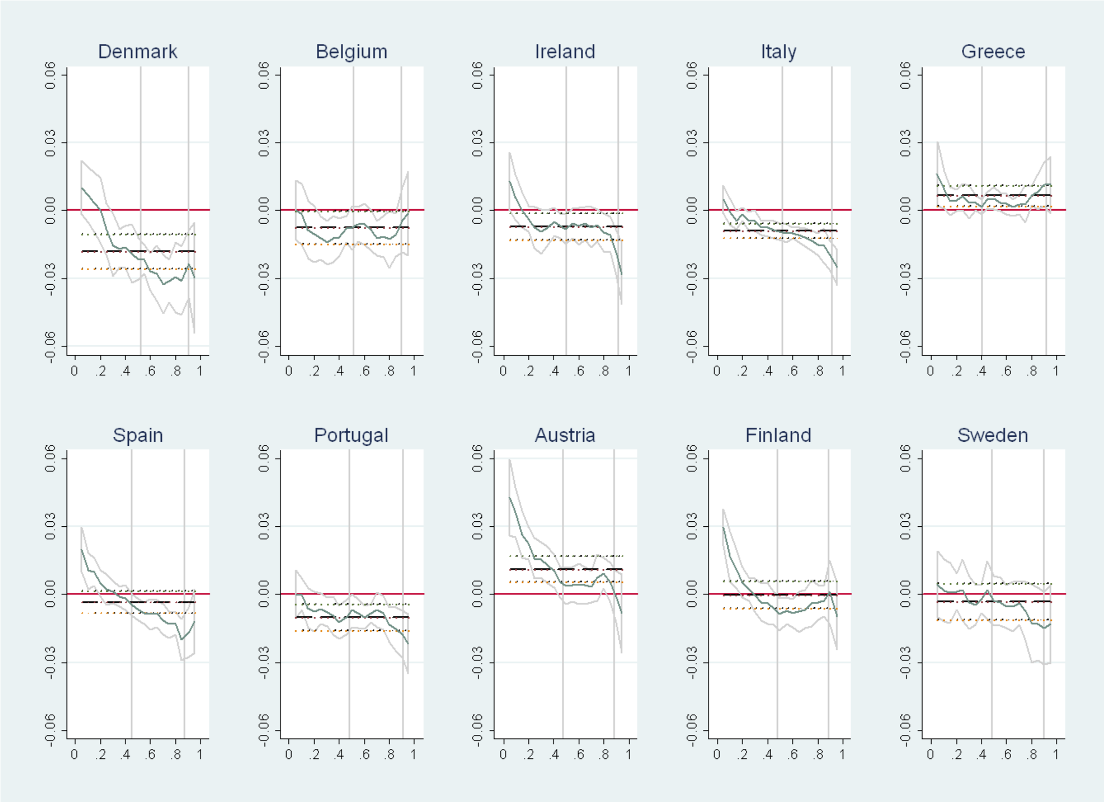


Figure 11 Proportionate difference in BMI by <u>tertiary</u> education (<u>Men</u>), quantile regression (baseline: primary education)

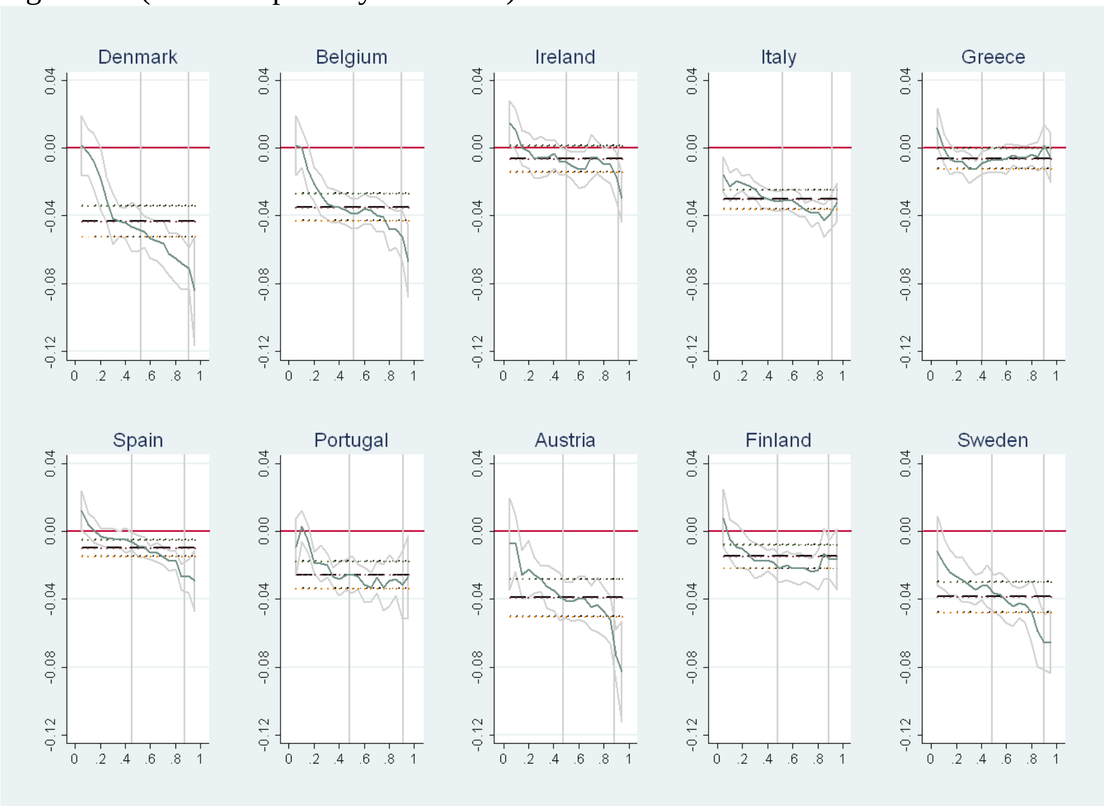
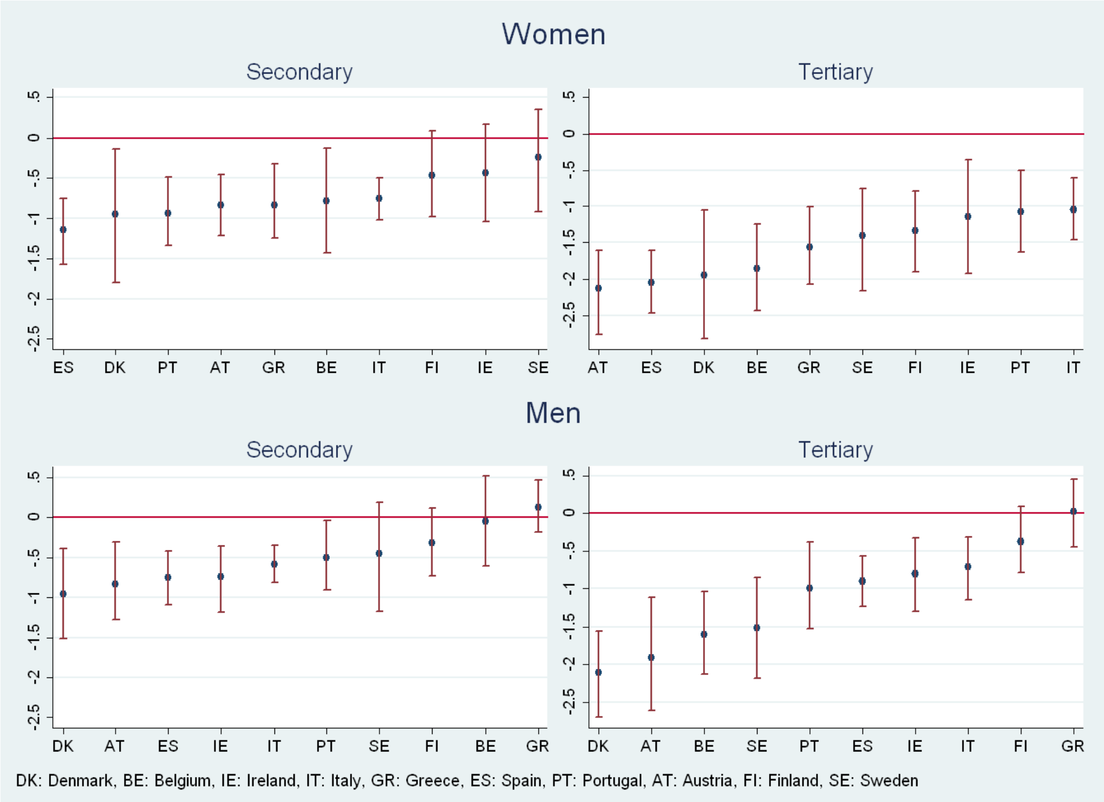


Figure 12 Difference in within-group dispersion of conditional BMI distribution by education groups (baseline: primary education)



Appendix 1: Full descriptive statistics for Women (including body mass index, education, household income, occupation, marital status, age)

	Denmark	Belgium	Ireland	Italy	Greece	Spain	Portugal	Austria	Finland	Sweden
BMI	24.02 (4.1)	24.12 (4.4)	24.1 (4.1)	23.63 (3.9)	24.9 (4.1)	24.6 (4.5)	24.76 (4.1)	24.39 (4.2)	24.69 (4.3)	24.42 (3.9)
Predicted BMI at age 40s	24.05	24.04	24.22	23.71	24.78	24.63	24.71	24.32	24.75	24.25
Obesity rate	9.0%	10.5%	8.6%	7.4%	10.0%	12.6%	10.7%	10.4%	12.7%	9.3%
Education level										
Primary education	28.9%	35.9%	46.8%	58.5%	61.9%	65.0%	80.7%	43.0%	30.1%	23.8%
Secondary education	46.6%	33.3%	37.5%	34.6%	27.8%	16.7%	11.7%	51.4%	39.3%	46.8%
Tertiary education	24.4%	30.8%	15.7%	7.0%	10.3%	18.3%	7.5%	5.7%	30.6%	29.4%
Income										
Household income	13.94 (7.2)	15.04 (18.0)	13.53 (16.1)	10.41 (6.3)	7.71 (5.7)	9.52 (6.5)	7.65 (5.9)	13.26 (7.1)	11.95 (6.6)	12.45 (6.8)
Occupation										
Employed	57.2%	41.0%	37.2%	26.4%	18.8%	25.9%	34.7%	36.7%	48.7%	57.1%
Selfemployed	2.3%	4.6%	2.9%	6.4%	12.5%	4.9%	10.1%	6.7%	7.4%	4.1%
Unemployed	4.6%	7.0%	2.4%	6.9%	5.3%	6.9%	3.9%	2.3%	6.1%	4.8%
Retired	23.8%	21.4%	3.8%	16.5%	20.9%	7.9%	21.4%	19.3%	20.7%	25.2%
Housework	1.9%	16.4%	43.2%	32.9%	35.8%	39.0%	18.4%	27.7%	5.0%	2.2%
Student	8.5%	7.8%	8.3%	8.6%	5.2%	9.3%	6.9%	6.7%	11.9%	5.5%
Inactive	1.7%	1.8%	2.1%	2.3%	1.5%	6.1%	4.5%	0.5%	0.2%	1.0%
Marital status										
Married	52.9%	56.2%	55.4%	60.5%	62.8%	56.9%	59.7%	56.7%	56.6%	49.8%
Separated	1.1%	2.3%	3.1%	1.4%	0.5%	1.7%	1.4%	0.6%	0.5%	0.3%
Divorced	9.3%	8.1%	0.4%	0.9%	1.7%	1.2%	2.2%	5.6%	7.8%	12.4%
Widowed	9.9%	11.4%	11.0%	11.7%	16.8%	13.0%	15.6%	13.0%	7.0%	7.5%
Never married	26.8%	21.9%	30.1%	25.5%	18.2%	27.2%	21.1%	24.2%	28.1%	30.0%
Age group										
Age	45.87 (17.7)	46.91 (18.1)	45.00 (18.8)	45.92 (18.5)	49.17 (19.5)	46.61 (19.8)	48.09 (19.6)	47.24 (18.9)	44.12 (17.2)	48.42 (16.9)
-29	21.0%	18.7%	26.7%	23.7%	20.6%	25.4%	23.8%	21.6%	24.3%	15.6%
30-39	20.8%	21.1%	16.1%	19.0%	15.7%	17.5%	14.4%	17.4%	17.3%	19.4%
40-49	18.3%	19.9%	16.9%	16.2%	15.4%	15.0%	14.8%	16.5%	20.2%	19.1%
50-59	16.8%	13.7%	15.5%	15.3%	14.3%	12.7%	14.7%	15.5%	18.5%	19.0%
60-69	23.1%	26.6%	24.7%	25.8%	34.1%	29.5%	32.4%	29.0%	19.7%	26.9%
70-	12.1%	14.6%	12.7%	13.2%	18.8%	16.5%	17.6%	15.3%	8.7%	14.7%
Sample size	7778	9964	10129	29651	19664	24592	23121	12109	12474	7587

Notes: Standard deviation in parenthesis.

Appendix 2: Full descriptive statistics for Men (including body mass index, education, household income, occupation, marital status, age)

	Denmark	Belgium	Ireland	Italy	Greece	Spain	Portugal	Austria	Finland	Sweden
BMI	25.29 (3.5)	25.28 (3.9)	25.28 (3.5)	25.22 (3.3)	25.98 (3.3)	25.86 (3.7)	25.47 (3.4)	25.57 (3.6)	25.62 (3.7)	25.49 (3.3)
Predicted BMI at age 40s	25.69	25.61	25.84	25.74	26.42	26.45	26.07	26.04	26.05	25.76
Obesity rate	9.7%	10.8%	8.2%	8.6%	10.0%	13.1%	9.3%	11.3%	11.4%	9.7%
Education level										
Primary education	22.4%	33.3%	49.0%	56.6%	55.8%	61.6%	83.0%	26.3%	32.0%	23.1%
Secondary education	52.0%	35.1%	35.0%	35.2%	30.0%	19.1%	11.5%	67.7%	43.3%	48.6%
Tertiary education	25.6%	31.6%	16.0%	8.2%	14.2%	19.3%	5.5%	6.0%	24.7%	28.3%
Income										
Household income	14.51 (6.9)	16.05 (19.0)	14.22 (23.7)	10.82 (6.8)	8.07 (5.9)	9.93 (6.7)	7.93 (6.0)	14.22 (7.5)	12.56 (7.4)	13.01 (8.1)
Occupation										
Employed	64.1%	52.8%	48.9%	41.8%	32.9%	44.7%	48.9%	54.6%	50.0%	58.4%
Selfemployed	6.4%	9.2%	18.1%	17.5%	28.4%	12.7%	18.4%	9.0%	14.9%	10.4%
Unemployed	2.8%	4.1%	5.1%	7.7%	4.3%	7.2%	2.9%	3.1%	5.5%	4.8%
Retired	19.7%	22.8%	17.0%	23.4%	27.2%	21.2%	20.7%	27.8%	19.9%	21.9%
Housework	0.0%	0.1%	0.2%	0.0%	0.0%	0.1%	0.0%	0.2%	0.0%	0.2%
Student	6.3%	8.8%	6.8%	7.5%	5.1%	9.1%	5.8%	5.0%	9.3%	3.7%
Inactive	0.6%	2.3%	4.0%	2.2%	2.0%	4.9%	3.2%	0.4%	0.3%	0.6%
Marital status										
Married	55.7%	63.4%	56.8%	63.4%	69.7%	60.9%	65.9%	61.2%	58.0%	51.3%
Separated	1.0%	1.6%	1.3%	1.3%	0.4%	1.3%	1.3%	0.6%	0.4%	0.0%
Divorced	6.8%	6.0%	0.2%	0.7%	0.7%	0.6%	1.4%	3.1%	5.8%	9.7%
Widowed	3.8%	3.3%	3.0%	2.5%	2.9%	3.4%	3.5%	3.3%	1.9%	2.3%
Never married	32.7%	25.7%	38.6%	32.1%	26.2%	33.8%	28.0%	31.7%	33.9%	36.6%
Age group										
Age	45.28 (17.1)	45.86 (17.4)	44.34 (18.6)	44.68 (17.7)	47.63 (18.5)	44.44 (18.9)	45.42 (19.0)	45.09 (18.1)	43.85 (16.8)	48.17 (16.5)
-29	20.8%	19.5%	28.0%	24.4%	20.9%	27.6%	27.9%	24.2%	24.4%	15.2%
30-39	21.2%	20.2%	15.8%	20.6%	17.0%	19.1%	15.9%	18.4%	17.5%	20.1%
40-49	19.7%	21.7%	17.2%	16.3%	16.5%	15.3%	15.6%	17.6%	20.0%	18.6%
50-59	17.4%	15.2%	14.9%	15.3%	15.5%	12.7%	13.1%	15.0%	18.5%	19.9%
60-69	21.0%	23.3%	24.1%	23.4%	30.1%	25.3%	27.5%	24.8%	19.6%	26.2%
70-	10.0%	12.1%	11.7%	10.6%	14.6%	13.0%	14.2%	11.3%	7.0%	13.1%
Sample size	7549	8744	9770	28307	17642	23127	20718	11326	12242	7169

Notes: Standard deviation in parenthesis.