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The Value of a Slender Spouse: Couples Agree that Keeping the Wife Svelte is more Valuable than Keeping the Husband Fit
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ABSTRACT

According to the World Health Organization, obesity is one of the greatest public-health challenges of the 21st century. Body weight is also known to affect individuals' self-esteem and interpersonal relationships, including romantic ones. We estimate "utility-maximizing" Body Mass Index (BMI) and calculate the implied monetary value of changes in both individual and spousal BMI, using the compensating income variation method and data from the Swiss Household Panel. Two-stage least squares models are estimated for women and men separately, with mother's education as an instrument to account for the potential endogeneity in income. Results suggest that the optimal own BMI is 27.4 and 22.7 for men and women, respectively. The annual value of reaching optimal weight ranges from$3,235 for underweight women to $32,378 for obese women and from $19,088 for underweight men to $43,175 for obese men. Women on average value changes in their own BMI about three times higher than changes in their spouse's BMI. Men, on the other hand, value a reduction in their spouse's BMI almost twice as much compared to a reduction in their own BMI. Married couples therefore agree on one thing, that keeping the wife svelte is even more valuable than keeping the husband fit.

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1 Introduction

Obesity is one of the greatest public-health challenges of the 21st century according to the World Health Organization. Its prevalence has tripled in many European countries since the 1980s and continues to rise (World Health Organization, 2007). In addition to increasing a person's risk of various physical ailments, including cardiovascular disease, cancer, and diabetes (WHO, 2007), body weight is also known to affect individuals psychologically based on factors such as social norms that are formed through interactions with society at large and interpersonal relationships (Carr and Friedman, 2005).

Efficient resource allocation is a challenge within any health-care system. An important part of tackling this challenge is knowledge of the value of health itself together with the more easily measured costs and benefits of health interventions, such as medical expenses and changes in productivity. Policies that affect individuals' body weight alter individual well-being, which is likely to weigh heavily in many cost-benefit or cost-utility analyses, leaving studies that exclude or miscalculate such benefits severely biased. Furthermore, increasing allocation of resources to health care, highlights the importance of efficiency comparisons, not only within health-care systems, but also between health care and other uses of resources.

One way to determine individuals' value of improvements in intangible desiderata like body mass index (BMI) is to calculate the willingness to pay (WTP) for such improvements or the willingness to accept (WTA) compensation for losses. That is, to estimate how much money individuals would be willing to give up (or receive) in exchange for such improvements (losses). Studies determining the monetary value that individuals place on intangible goods are scarce because the methods traditionally used have limitations. This has led researchers to focus largely on non-monetary measures such as health-related quality of life (HRQoL), which limits efficiency evaluations to cost-effectiveness analyses that can only serve as a prioritization mechanism within health systems rather than cost-benefit analyses that allow for evaluation of efficiency in general.

A promising method to calculate the monetary value of health and other goods that do not have a revealed market price, and thus facilitate efficiency comparisons between health care and other uses of resources, is the compensating income variation (CIV) method. The method is firmly rooted in economic theory (Hicks, 1939) and has been used to estimate the monetary value of various non-market goods, although economists have only recently started using it for health-related conditions. Applications to health include some studies examining specific conditions, such as migraines (Groot and Maassen van den Brink, 2004) cardiovascular disease (Groot and Maassen van den Brink, 2006), and pain (Ferrer-i-Carbonell and van Praag, 2002; McNamee and Mendolia, 2014; Ólafsdóttir, Ásgeirsdóttir, and Norton, 2020), body composition (Asgeirsdottir, Buason, Jonbjarnardottir, and Olafsdottir, 2020), depression and anxiety (Buason, Norton, McNamee, Thordardottir and Asgeirsdottir, 2021), and studies examining a set of different health problems and diseases (Asgeirsdottir, Birgisdottir, Ólafsdóttir, and Olafsson, 2017; Asgeirsdottir, Birgisdottir, Henrysdottir and Ólafsdóttir, 2020, Powdthavee and van den Berg, 2011; Howley, 2017). In addition, the method has been used to estimate the dollar value of a quality-adjusted life-year (QALY) (Huang, Frijters, Dalziel and Clarke, 2018) and changes in HRQoL (McNamee and Mendolia; 2018).

Applications of the method to estimate the monetary compensation needed to offset the welfare loss associated with a sub-optimal Body Mass Index (BMI) is limited. Kuroki (2016) calculated the CIV for being overweight and obese. He concluded that life satisfaction of people who are overweight or obese is statistically significantly lower than people who are of normal weight, even after controlling for socioeconomic factors and obesity-related health variables. He also found the relationship to be greater for overweight women than men. Asgeirsdottir et al. (2020) also found gender differences using the method, but more importantly highlighted the importance of income measurement when using the method. Although Kuroki (2016) and Asgeirsdottir et al. (2020) mark important first attempts at estimating the CIV for body weight, we substantially improve upon their results in several important ways. First, we calculate the CIV for being below, as well as above the optimal body weight, defined as the weight that optimizes life satisfaction, which was not done by Kuroki and analysed in a limited manner by Asgeirsdottir et al. (2020), due to a small overall sample size, and with only under 1% of their sample being underweight. We furthermore estimate the CIV for the continuous measure of BMI for the first time. Second, and more importantly, we can implicitly account for endogeneity in income, which is not accounted for by Kuroki at all, and bias adjustments are only implemented manually by Asgeirsdottir et al. (2020), using information from the literature. Third, and maybe most interestingly, the study sheds light on the interplay between own and a spouses BMI and the corresponding CIVs, which to our knowledge has not been done before.

A benefit of the CIV method is that it can be applied to existing data, contrary to most valuation methods. Individual responses to questions about life-satisfaction, as well as BMI and income, are used for the direct estimation of a life-satisfaction equation. The estimation results are then used to calculate the income-BMI trade-off that keeps life satisfaction constant. The CIV thus represents the monetary compensation needed by an individual with a *sub-optimal* BMI to have the same level of well-being as with optimal BMI, *ceteris paribus*. Our definition of sub-optimal is any deviation from optimal BMI, where optimal BMI is defined as the BMI that maximizes life satisfaction.

We calculate CIVs for the individual's own and spouse's optimal BMI directly from the data and assess the concordance in couple's BMI preferences. Meylera, Stimpson and Peek (2007) performed a systematic review of 103 studies of health-concordance in mental health, physical health, and health behavior among couples. The review suggests evidence for concordant mental and physical health, as well as health behaviors among couples. Studies have furthermore found BMI to be highly correlated between spouses (Jeffery and Rick, 2002, The and Gordon-Larsen, 2009). Clark and Etilé (2011) found that the negative well-being effect of own BMI is lower when the individual's partner is heavier, which is consistent with social contagion effects in weight. This paper extends the analysis made by Clark and Etilé (2011) by producing CIV estimates and by including a separate underweight category for BMI. Furthermore, this paper calculates values for optimal own BMI conditional on spouse's BMI and optimal spouse's BMI conditional on own BMI.

We choose Switzerland for the context of our study due to the availability of exceptional data. The Swiss Household Panel is a rich dataset, which includes 21 waves and is well suited for estimation of CIVs, for example including a commonly used instrument for income. Two-stage least squares (2SLS) models are estimated for women and men separately, with mother's education as an instrument to account for the potential endogeneity in income, following Howley (2017) and Ólafsdóttir et al. (2020). Evidence suggests that endogeneity likely causes the effect of income on life satisfaction to be significantly understated without instrumentation and the derived CIVs might consequently be biased upwards (Groot and Massen van den Brink 2004, 2006; Powdthavee 2010, Powdthavee and van den Berg, 2011). Calculating CIVs for sub-optimal BMI using data from Switzerland adds to the existing CIV literature, as well as the literature on sub-optimal BMI that has been analyzed in different contexts. However, it should be kept in mind that results could be context specific, especially as Switzerland has a relatively low rate of obesity (OECD, 2017). It is therefore possible that there is a greater penalty in Switzerland for being above optimal BMI than in other countries.

The results suggest that both women and men would be willing to pay an increasing amount to reach the optimal BMI the further away from the optimal BMI they become, both when below and above the optimal weight. The values from women range from $59 and up to $1,203 per BMI unit per year (1-10 BMI units away from optimal), and from men the values range from $95 and up to $2,005 (see Table A1). Similarly, there is a positive value for changing the BMI of a spouse whose BMI is sub-optimal, which is conditional on one's own BMI (see Table A2 for amounts per BMI unit). This spousal analysis highlights the gender differences in own and spousal CIV for BMI changes, and shows how limited the individual analyses can be. Importantly, women's values are on average about three times as much for changes in their own BMI compared to changes in their spouse's BMI. Values from men, on the other hand, are almost twice as much for a reduction in their spouse´s BMI towards the optimal level compared to a reduction in their own BMI when above their optimal BMI.

2 Data

The Swiss Household Panel (SHP) data is a nationally representative annual survey conducted since 1999 with information on living conditions in Switzerland. All individuals aged 14 or older who live in the household are eligible to answer the individual questionnaire. We use waves 6 (2004) to 21 (2019) because they include the variables needed to calculate CIV for sub-optimal BMI. The original sample of the sixteen waves consisted of 124,700 observations on 19,031 individuals. Our final sample, after dropping observations with missing values, consisted of 112,710 observations on 18,012 individuals. The size of the sample is lower in the spousal analysis, or 49,784 observations on 8,099 individuals, because it includes only those who have spouses.

Well-being is measured with a question about satisfaction with life in general. The question is on an 11-point scale and the respondents are asked the following question: In general, how satisfied are you with your life if 0 means "not at all satisfied" and 10 means "completely satisfied"? As expected, the distribution of life satisfaction over the sample is highly skewed with an average of 8.0 and the interquartile range (IQR) is 2. Despite some criticism, measures of subjective well-being such as questions on life satisfaction have been widely used in social sciences and psychology, as well as in some economic studies. For a reference to discussion on the vast testing of the robustness of these subjective measures, we refer the reader to Clark, Frijters, and Shields (2006). To ease interpretation of the estimated coefficients and comparisons to previous results in the literature, the life satisfaction variable is standardized to having a mean of zero and a standard deviation of one.

BMI is calculated using respondents self-reported height and weight and is the ratio of weight, in kilograms, over height, in meters, squared. For the most part BMI is used in continuous form, although for certain purposes it is categorized into the traditional four categories using criteria from the WHO. Individuals are defined to be underweight if their BMI is under 18.5, normal weight if their BMI is between 18.5 and 25, overweight if their BMI is over 25 and up to 30, and obese if their BMI exceeds 30 (WHO, 2007). As the survey is a household survey, the spouses BMI is also available based on self-reported weight and height.

Income is yearly household income equivalized according to a modified OECD scale (Voorpostel et al., 2016). We use the log of income in our estimations to account for diminishing marginal utility of income (Layard, Nickell, and Mayraz, 2008). To prevent inflation from affecting the results, the income variable was CPI-adjusted to the 2019 price level (Federal Statistical Office of Switzerland, 2021), and we convert the results to US dollars to facilitate comparison with other studies, using the average exchange rate from 2019 of one CHF equaling 0.9937 US dollar (Board of Governors of the Federal Reserve System (U.S.), 2021).
Other control variables are years of education based on the International Standard Classification of Education (ISCED classification scheme), age, marital status, labor-force status, wave dummy, degree of urbanization, and number of children. We include age in 5-year brackets, as previous research suggests that it is important to include age in the model in a flexible form (Blanchflower and Oswald, 2008). Table 1 shows means, and standard deviations of continuous variables and percentage distributions of dummy variables used in the study. Table 2 shows within and between variance of the main variables of interest.

Table 1. Summary statistics.

	Women		Men	
Variable	Mean	SD	Mean	SD
Life satisfaction (unstandardized)	8.04	1.4	8.03	1.4
Yearly income in CHF	72,168[a]	59,162	80,573[a]	55,560
BMI categories %				
Underweight	5.2		0.9	
Normal weight	62.9		50.0	
Overweight	22.8		38.8	
Obese	9.1		10.3	
BMI	23.8	4.3	25.5	3.8
BMI of spouse	25.8	3.7	23.9	4.2
Age	50.6	17.5	49.7	17.6
Marital status %				
Single, never married (base)	24.5		28.0	
Married	54.5		60.4	
Separated	1.5		1.5	
Divorced	11.1		7.5	
Widower/widow	8.2		2.4	
Registered partnership	0.2		0.2	
Urbanization %				
Highly and moderately urbanized centers (base)	59.7		58.2	
Small, urbanized centers	9.4		9.9	
Communes of urbanized Centers	11.9		12.3	
Communes of small urbanized centers	10.2		10.6	
Communes remote from urbanized centers	8.9		9.0	
Number of children	0.5	0.9	0.5	0.9
Labor-market status%				
Employed (base)	64.2		73.7	
Unemployed	1.6		1.5	
Not in labor force	34.2		24.8	
Education in years	13.1	3.0	14.2	3.2

Source: Swiss Household Panel (SHP)
[a] Equivalent to $71,713 for women and $80,065 for men at the average 2019 exchange rates.

Table 2. Between and within statistics for main variables of interest.

		Women		Men	
Variable		Mean	Std Dev	Mean	Std Dev
Life satisfaction	overall	8.04	1.42	8.03	1.36
(unstandardized)	between		1.23		1.20
	within		0.92		0.86
Yearly income in CHF	overall	72,168	59,162	80,573	55,560
	between		41,274		49,923
	within		41,172		30,580
BMI category	overall	0.78	1.08	1.09	1.14
	between		0.99		1.06
	within		0.46		0.48
BMI	overall	23.82	4.31	25.46	3.80
	between		4.17		3.69
	within		1.29		1.30
BMI of spouse	overall	25.80	3.65	23.87	4.19
	between		3.55		4.08
	within		1.28		1.26
Height	overall	165.15	6.21	177.43	6.90
	between		6.29		6.98
	within		0.24		0.39
Weight	overall	64.88	11.92	80.14	12.86
	between		11.56		12.51
	within		3.50		4.03

Source: Swiss Household Panel (SHP)

3 Methods

We follow Groot and van den Brink (2004), Asgeirsdottir et al. (2017 & 2020), and Olafsdottir et al. (2020) and define an indirect well-being function W which is determined by household income Y, BMI status B, and other individual characteristics X as

$$W = W(Y, B, X). \tag{1}$$

Comparison of well-being with a sub-optimal BMI status B to that of optimal BMI status B^* can be expressed as follows:

$$\Delta W = W(Y, B|X) - W(Y, B^*|X). \tag{2}$$

The CIV is the additional amount of income that leaves the individual with the same level of well-being with the sub-optimal BMI status as without it so that:

$$W(Y + CIV|B, X) = W(Y|B^*, X). \tag{3}$$

Three different empirical estimations of equation (1) are considered. The first model represents B as dummy variables indicating a person's BMI category, i.e., whether a person is underweight, normal weight, overweight or obese. The model is empirically estimated using the following equation:

$$W_{it} = \beta_0 + \beta_1 logY_{it} + \sum_{j=1}^{3} \beta_{2,j} B_{it,j} + \sum_{k=1}^{q} \alpha_k X_{k,it} + \varepsilon_{it} \tag{4}$$

where W_{it} is life satisfaction of individual *i* at time *t*, and the α´s and β´s are coefficients measuring the relationship between the independent variables and life satisfaction. ε is the error term, and $X_{k,it}$ represents other individual characteristics. The benchmark BMI category in this model is normal weight. We can then use point estimates from equation (4) to calculate the CIV from equation (3) as follows:

$$CIV_j = \bar{Y} \left(exp \left(-\frac{\beta_{2,j}}{\beta_1} \right) - 1 \right) \tag{5}$$

where $\bar{Y}$ is average income and $\beta_{2,j}$ represents the coefficient of sub-optimal BMI category *j*.

Using BMI categories has two notable disadvantages. First, the categorization of this continuous variable inevitably discards some within-category information. Second, this categorization is based on the medical literature and does not have to be in accordance with people's preferred weight. In the second model, the B in equation (1) is modelled as the continuous form of BMI and includes a square term of BMI as well. The motivation for including the square term in BMI comes from the hump-shape shown in Figure A1, where life satisfaction increases up to a peak level and then decreases again with increasing BMI after accounting for outliers. The following model is empirically estimated:

$$W_{it} = \beta_0 + \beta_1 logY_{it} + \beta_2 B_{it} + \beta_3 B_{it}^2 + \sum_{k=1}^{q} \alpha_k X_{k,it} + \varepsilon_{it} \tag{6}$$

where W_{it}, the α´s, β´s and the $X_{k,it}$ are the same as in equation (4). In this model, BMI is related to life satisfaction in a parabolic way, and the vertex of the parabola represents a well-being optimizing BMI, provided that $\beta_2 > 0$ and $\beta_3 < 0$. The optimal BMI is then found using the standard formula for the vertex of a parabola:

$$B^* = -\frac{\beta_2}{2\beta_3}. \tag{7}$$

Employing the point estimates from equation (6), one can calculate the CIV for moving to the optimal BMI from equation (3) as follows:

$$CIV = \bar{Y}\left(exp\left(-\frac{\beta_2(B-B^*)+\beta_3(B^2-B^{*2})}{\beta_1}\right)-1\right) \tag{8}$$

where $\bar{Y}$ is average income and B^* is found from equation (7). Note that the CIV is now a function of B so that for each value of B we get a specific CIV value.

In the third approach, we follow Clark and Etilé (2011) and define a model in terms of both individual's and spouse's BMI together with the square of both BMI levels and their interaction. The questions are then what BMI level for the spouse would maximize the individual's life satisfaction, given the BMI of the individual, and what the optimal BMI for the individual would be, given the BMI of the spouse. Representing the BMI of the individual as B_i and the BMI of the spouse as B_s, the third model is empirically estimated using the following equation:

$$W_{it} = \beta_0 + \beta_1 logY_{it} + \beta_2 B_{it} + \beta_3 B_{it}^2 + \beta_4 B_{st} + \beta_5 B_{st}^2 + \beta_6 B_{it} B_{st} + \sum_{k=1}^{q} \alpha_k X_{k,it} + \varepsilon_{it} \quad (9)$$

where W_{it}, the α´s, β´s and the $X_{k,it}$ have the same meaning as in equation (4). Both individual BMI and spouse's BMI have a squared term in the model, and the model also includes their interaction. Fixing all variables except B_i in equation (9), there is an optimal BMI for the individual that maximizes life satisfaction. As for equation (7), the optimal BMI is found using the standard formula for the vertex of a parabola:

$$B_i^* = -\frac{\beta_2 + \beta_6 B_s}{2\beta_3}, \quad (10)$$

provided that $\beta_2 + \beta_6 B_s > 0$ and $\beta_3 < 0$. The optimal BMI for the individual depends on the BMI of the spouse. If $\beta_6 > 0$ the optimal BMI for the individual increases with increasing BMI of the spouse. Employing the point estimates from equation (9), one can calculate the CIV for the individuals own weight changing to its optimal, given the weight of the spouse as follows:

$$CIV = \bar{Y} \left(exp \left(-\frac{(\beta_2 + \beta_6 B_s)(B_i - B_i^*) + \beta_3 (B_i^2 - B_i^{*2})}{\beta_1} \right) - 1 \right) \quad (11)$$

where $\bar{Y}$ is average income and B_i^* is found from equation (10). Note that the CIV is now a function of both B_i and B_s so that for each pair of values B_i and B_s we get a CIV value. Similarly, holding all variables except B_s in equation (9) constant, there is an optimal BMI for the spouse in the sense that the life satisfaction of the individual is maximized. The optimal BMI for the spouse is then

$$B_s^* = -\frac{\beta_4 + \beta_6 B_i}{2\beta_5}, \quad (12)$$

provided that $\beta_4 + \beta_6 B_i > 0$ and $\beta_5 < 0$. Note that the optimal BMI for the spouse depends on the BMI of the individual, allowing for exploration of potential social interaction in BMI between spouses (Clark &. Etilé, 2011). If $\beta_6 > 0$ the optimal BMI for the spouse increases with increasing BMI of the individual. Employing the point estimates from equation (9), one can calculate the CIV for changing the spouse's weight to its optimal from equation (3) as follows:

$$CIV = \bar{Y}\left(exp\left(-\frac{(\beta_4+\beta_6 B_i)(B_S-B_S^*)+\beta_5\left(B_S^2-B_S^{*2}\right)}{\beta_1}\right)-1\right) \qquad (13)$$

Previous studies have suggested that an OLS estimator may result in a substantial downward biased income effect in life-satisfaction equations as explained by Powdthavee (2010). Subsequently the derived CIVs might then be biased upwards if income is not instrumented for (Howley, 2017; Ólafsdóttir et al., 2020). Howley (2017) used parental education as an instrument for income and found that the estimated effect of income on life satisfaction more than tripled in size between OLS and the two-stage least squares (2SLS) model. Ólafsdóttir et al., (2020) found that, compared to the OLS results, the income coefficient was 3.6 times larger when they used mother's education as an instrument for income. The SHP data contains both parent's highest education level, which can be used as an instrument in accordance with the literature. The parental education did not pass the Sargan-Hansen test for overidentification, and the tests of endogeneity were somewhat more favorable for mother's education than for father's education. We therefore used mother's education as an instrument, which passed the Wu-Hausman test of endogeneity (p-values ranged from 0.00-0.04). F-statistics in the first-stage regressions ranged from 15 to 31, suggesting that mother's education is not a weak instrument (Stock, Yogo, and Wright, 2002). Besides passing statistical validation tests, previous research suggests that children of highly educated parents do not enjoy higher life satisfaction in their adulthood compared to other children (Frijters, Johnston, and Shields, 2014), and thus the instrument has continued to be used in the literature. There is thus empirical evidence to support our choice of instrument, but it is also reassuring that the changes in the income coefficient are very similar when other instruments are used (see for example Luttmer 2005). However, for comparison to our main estimations, and to facilitate comparisons to

Asgeirsdottir et al. (2020), we also report results in which the income endogeneity is adjusted for manually based on Lindqvist, Östling and Cesasrini (2020) (see Table A3).

Several endogeneity biases in the body-weight coefficients can be hypothesized. However, neither the direction of the body-weight bias nor its magnitude is as established in the literature as the well know income-endogeneity bias. In an earlier version (Clark and Etilé, 2010) of their paper, Clark and Etilé (2011) applied past changes in BMI as an instrument on the BMI variable. Their results were inconclusive, and they observed that finding a good instrument for BMI is very challenging (Clark and Etilé, 2011). Katsaiti (2012) tried to account for the endogeneity of BMI by using height as an instrument. That instrument is however unlikely to fulfill the exclusion restriction since height has been shown to have a significant effect on well-being (Deaton and Arora, 2009). Kuroki (2016) and Asgeirsdottir et al. (2020), the only two papers in the literature to calculate the CIV of BMI, were also unable to account for endogeneity due to similar data limitations. Asgeirsdottir et al. (2020) however, point out that although the endogeneity of body weight in subjective well-being regressions could hypothetically cause biases either way, some clues can be found in studies using polygenic risk scores as instruments for BMI when regressed on depression (Huang et al., 2014; Jokela et al., 2012; Lawlor et al., 2011; Tyrell et al., 2019; Walter et al., 2015; Willage et al., 2018). In all six studies the non-instrumented results showed a positive relationship between BMI and depression, while the BMI coefficient either increased with instrumentation or decreased. This suggests therefore that it is difficult to assess the direction of any endogeneity bias in the BMI coefficient, if such a bias exists. However, the mixed results on the direction of the bias in depression equations indicates that an extreme bias is unlikely to affect our results.

Due the nature of the data, panel regressions were explored. However, the main variation in BMI is between individuals (see Table 2). Approximately 75% of participants were always in the same BMI category throughout the survey and 25% even had the exact same BMI every year they participated. Furthermore, as our instrument is time-invariant, it is not possible to implement fixed effects in our 2SLS estimations. Given the well-known endogeneity bias of the income, it is deemed of greater importance to tackle that endogeneity with a two-stage estimation. Although panel regression methods did not produce robust results they are reported in the Appendix for completeness (see Table A4).

4 Results

Table 3 shows point estimates for the key variables of interest, BMI categories, and household income, using our preferred model specification IV-2SLS along with the corresponding CIVs. Point estimates are statistically significant except for the overweight coefficients. The results for women suggest that higher income is associated with greater life satisfaction and that sub-optimal BMI categories impact life satisfaction in a negative way. The CIVs for underweight and obese women are in a similar range, but the CIV for overweight women is significantly lower.

Table 3. Point estimates for BMI categories and income, as well as corresponding CIV's.

	IV-2SLS	
	Women	Men
Underweight	-0.1015 ***	-0.3496 ***
	(0.0229)	(0.0743)
Overweight	-0.0210	0.0013
	(0.0133)	(0.0103)
Obese	-0.1013 ***	-0.0400 **
	(0.0204)	(0.0167)
Log(income)	0.9287 ***	0.8921 ***
	(0.1122)	(0.0983)
CIV Underweight	8,315 ***	38,518 ***
	(2,331)	(11,720)
CIV Overweight	1,644 ***	-113
	(1,178)	(929)
CIV Obese	8,300 ***	3,679 **
	(2,551)	(1,652)

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using IV-2SLS. The reference category for weight is normal weight. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status, and year dummies.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Men: N=43,628. Women: N=53,158.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Gender differences in CIVs are substantial. For men, being underweight produces the highest CIV but the CIV for obese men is much lower and being overweight is estimated to be more beneficial in terms of life satisfaction compared to being of normal weight. However, the point estimates for overweight are statistically insignificant and should thus be interpreted with caution.

Table 4 includes point estimates for the continuous form of BMI, BMI squared, and household income, using IV-2SLS along with the corresponding CIVs. All point estimates are highly significant ($p < 0.01$) in the IV-2SLS model both for men and women.

Table 4. Point estimates for BMI and income, as well as optimal BMI and corresponding CIVs for selected BMI levels.

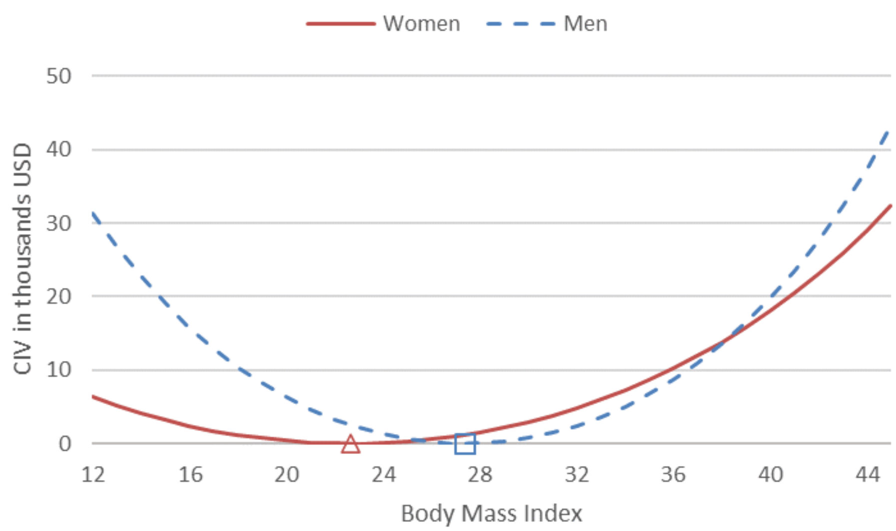
	IV-2SLS			
	Women		Men	
BMI	0.0312	***	0.0700	***
	(0.0095)		(0.0144)	
BMI squared	-0.0007	***	-0.0013	***
	(0.0002)		(0.0003)	
Log(income)	0.9237	***	0.9202	***
	(0.1126)		(0.0996)	
Optimal BMI value	22.7		27.4	
CIV BMI = 15	3,235	*	19,088	***
	(1,770)		(5,989)	
CIV BMI = 20	386		6,333	***
	(449)		(2,035)	
CIV BMI = 25	290		642	*
	(326)		(350)	
CIV BMI = 30	2,934	**	760	**
	(1,178)		(375)	
CIV BMI = 35	8,626	***	6,713	***
	(2,790)		(2,068)	
CIV BMI = 40	18,043	***	19,817	***
	(5,750)		(6,066)	
CIV BMI = 45	32,378	***	43,175	***
	(10,862)		(14,281)	

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using IV-2SLS. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status and year dummies. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Men: N=43,640. Women: N=53,158. CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Optimal BMI for women is 22.7 and 27.4 for men. This means that the optimal level for women is within the normal weight category but for men it is optimal to be slightly overweight.

Table 4 and Figure 1 show CIVs for selected BMI levels for men and women, showing that both women and men have higher CIVs the further away from the optimal BMI they are, both when below and above the optimal BMI.

Figure 1. CIV for different BMI levels using IV-2SLS.



Source: Swiss Household Panel (SHP).
Δ marks the optimal BMI for women
□ marks the optimal BMI for men

As seen in Table 3, men have a higher CIV than women when they are underweight, but women have higher CIVs than men when they are overweight or somewhat obese. It can also be seen from Table 4 that men whose BMI is 15 have a CIV value of $19,088 per year to achieve the well-being associated optimal BMI or 24% of their average yearly income, but on the other hand women´s CIV in the same situation is only $3,235 or 5% of their average annual income. Table 4 shows that women with a BMI of 40 have a higher CIV than women with BMI 15 to reach optimal BMI, with values of $18,043 (around 25% of their average annual salary) and $3,235, respectively. Men with BMI of 40 would have a CIV value of $19,817 to reach the optimal BMI of 27.9 (around 25% of average yearly salary), which is similar to their CIV if BMI is 15. Appendix Table A1 contains the CIV for 1-10 BMI units away from the optimal BMI and CIV per unit BMI.

Table 5 includes point estimates for individual's own BMI and spouse's BMI, as well as the squared BMI levels and their interactions, using IV-2SLS for both men and women. The point estimates for men show a greater statistical significance than for women.

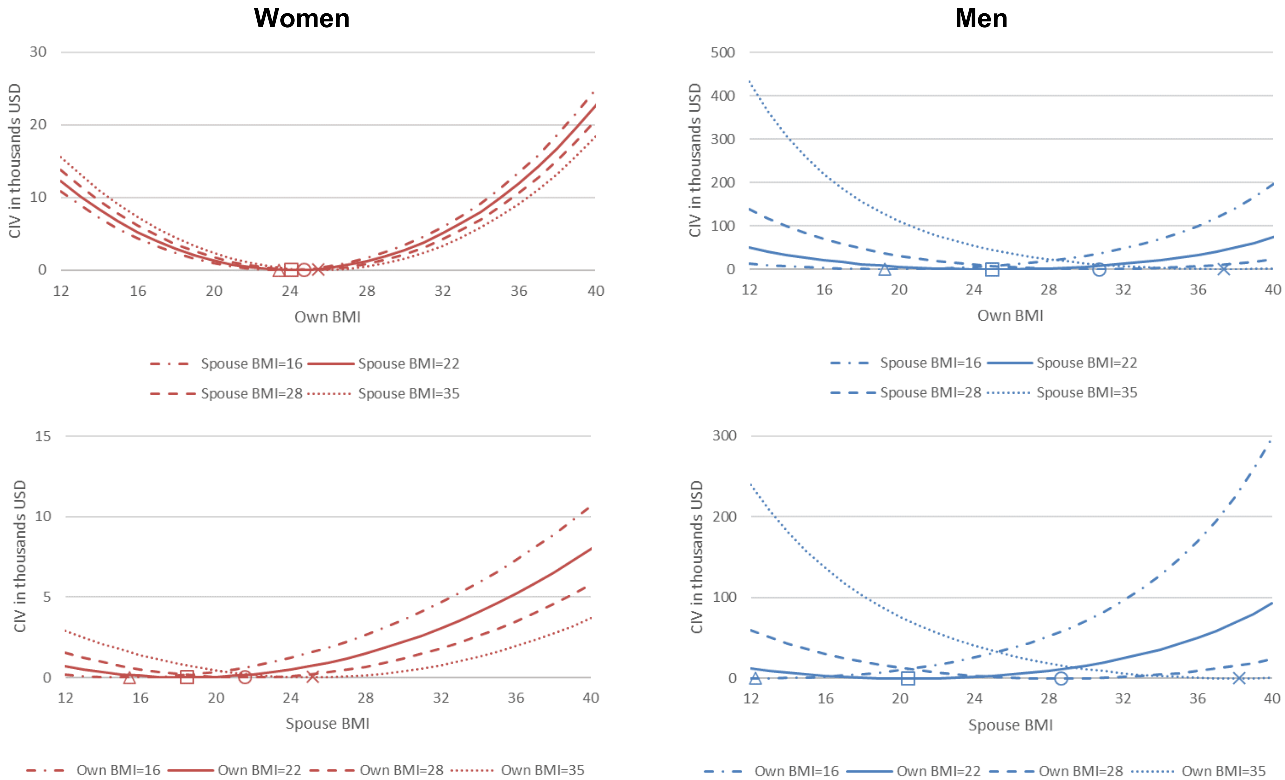
Table 5. Point estimates for own BMI, spouse's BMI, BMI interaction and income, as well as optimal own and spouse's BMI and corresponding CIVs.

	IV-2SLS							
	Women				Men			
BMI	0.0402 **				0.0094			
	(0.0175)				(0.0169)			
BMI squared	-0.0009 ***				-0.0012 ***			
	(0.0003)				(0.0003)			
BMI spouse	0.0028				-0.0163			
	(0.0191)				(0.0129)			
BMI spouse squared	-0.0002				-0.0008 ***			
	(0.0004)				(0.0002)			
Interaction	0.0002				0.0023 ***			
	(0.0004)				(0.0004)			
Log(income)	0.8593 ***				0.4171 ***			
	(0.1633)				(0.1131)			
Section A BMI spouse	16	22	28	35	16	22	28	35
Optimal own BMI	23.4	24.1	24.7	25.5	19.2	25.0	30.7	37.4
CIV: Own BMI = 15	5,721	6,685	7,733	9,068	4,267	26,626	83,063	259,945
CIV: Own BMI = 20	914	1,300	1,755	2,377	131	5,943	31,439	111,704
CIV: Own BMI = 25	194	67	6	18	8,005	0	7,930	44,783
CIV: Own BMI = 30	3,443	2,781	2,194	1,599	31,618	6,008	122	13,769
CIV: Own BMI = 35	11,206	9,898	8,684	7,383	83,446	26,786	4,321	1,366
CIV: Own BMI = 40	24,854	22,662	20,604	18,366	196,272	73,080	22,485	1,544
Section B Own BMI	16	22	28	35	16	22	28	35
Optimal spouse BMI	15.4	18.5	21.6	25.2	12.2	20.4	28.7	38.3
CIV: Spouse BMI = 15	3	201	716	1,727	1,258	4,907	36,453	157,242
CIV: Spouse BMI = 20	347	37	42	446	10,367	31	13,046	76,390
CIV: Spouse BMI = 25	1,524	695	190	1	31,113	3,413	2,195	33,950
CIV: Spouse BMI = 30	3,575	2,199	1,166	377	71,031	16,127	286	11,783
CIV: Spouse BMI = 35	6,572	4,600	3,004	1,588	146,915	42,475	6,714	1,736
CIV: Spouse BMI = 40	10,623	7,984	5,768	3,676	296,803	92,495	23,553	484

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using IV-2SLS. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status, and year dummies. *** p < 0.01, ** p < 0.05, * p < 0.10. Men (IV-2SLS): N=22,604. Women (IV-2SLS): N=22,929. The shaded numbers indicate the higher CIV of the two values, own or spouse´s.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Table 5 and Figure 2 furthermore include individual's own optimal BMI and CIV given the spouse's BMI, and then spouse's optimal BMI and CIV given the individual's own BMI (Table A5 in the Appendix shows standard errors in CIVs).

Figure 2. CIV for different own and spouse BMI levels using IV-2SLS.



Source: Swiss Household Panel (SHP).
Δ marks the optimal own BMI when spouse's BMI 16
□ marks the optimal own BMI when spouse's BMI is 22
○ marks the optimal own BMI when spouse's BMI is 28
X marks the optimal own BMI when spouse's BMI is 35

For example, Table 5, section A for women shows that when the spouse's BMI is fixed at 22 or 28 the corresponding optimal own BMI levels are 24.1 and 24.7. If a woman's BMI is for example 15 and her spouse has a BMI of 28, then she has a CIV of $7,733 to reach the optimal BMI of 24.7. However, she has a CIV of $20,604 to reach the optimal BMI of 24.7 if her actual BMI is 40 and her spouse has a BMI of 28. The results for section A can also be seen in the upper half Figure 2.

Table 5, section B for men shows that when their own BMI is fixed at 28 or 35, the corresponding spouse's optimal BMI levels are 28.7 and 38.3. If a man´s own BMI is for example at 28 and his spouse has a BMI of 15, the man has a CIV of $36,453 for his spouse to achieve the optimal BMI of 28.7. However, the same man has a CIV of $23,553 for his spouse to achieve the optimal BMI of 28.7 if his spouse has an actual BMI of 40. The results for section B can also be seen in the lower half of Figure 2.

Comparing sections A and B for women in Table 5 shows that women are generally affected more severely by their own BMI being above their optimal BMI than by their spouses BMI being above the optimal as indicated by the shaded area in Table 5. The CIV values for men, on the other hand, show them to be affected by their spouse´s BMI being above the optimal point for a spouse. In other words, they are more concerned (from the perspective of negative impact on their own life satisfaction) about reducing their spouse´s BMI towards the optimal than reducing their own BMI to the optimal level.

For example, a woman with a BMI of 22 (section B, women) whose spouse has a BMI of 35 has a CIV of $4,600 to reach the same well-being as someone whose spouse's BMI is at the optimal of 18.5. However, if the woman had a BMI of 35 (section A, women) and her spouse had a BMI of 22, she has a CIV of $9,898 to reach the same well-being as if her BMI were at the optimal of 24.1. Table A2 contains the CIV for 1-10 BMI units away from own optimal BMI and spouse optimal BMI and CIV per unit BMI.

Comparing the income coefficients from the IV-2SLS and OLS models (see OLS results in the Appendix Tables A6-A8), shows an increase by approximately two to threefold with instrumentation, which is in line with previous results (Howley,2017; Ólafsdóttir et al., 2017; Powdthavee, 2010). Table A3 contains the comparison of IV-2SLS, OLS and adjustments according to Lindqvist et al (2020) who used lottery winnings in Sweden to estimate the treatment effect of one unit of log household income on standardized life-satisfaction, which is only about 30% higher than our OLS coefficient.

5 Discussion

We find that the life satisfaction of people who are underweight or obese is lower than for people with normal or slightly overweight BMI levels. Women have a higher value for not being in the obese category than men, while men have a stronger preference than women to avoid being underweight. When accounting for spouse's BMI, men are more sensitive to their spouse´s BMI being above its optimal than to their own BMI. Women on the other hand have a higher WTP for changes in their own BMI than their spouse's BMI. To our knowledge, CIVs for sub-optimal BMI levels conditional on spouse's BMI have not been estimated before.

Kuroki (2016) calculated the CIV for being overweight and obese using separate OLS models but did not consider the CIV for being underweight as underweight individuals were excluded from his study. Although Asgeirsdottir et al. (2020) included the underweight category in their analyses, that was mainly for completeness, as power issues in their estimations prevented any meaningful interpretations for that category. According to our results, including underweight individuals is crucial to get the full picture of BMI preferences, especially in the case of males. While we find women to be more sensitive to being overweight than men, we find the opposite to be true in the case of underweight. Using the point estimates in Kuroki (2016), which does not account for endogeneity, the CIV for overweight women was \$39,434 and \$54,401 for obese women compared to our finding of \$1,644 (overweight) and \$8,300 (obese) using IV-2SLS models (see Table 3). Similarly, Kuroki (2016) estimates the CIV for overweight men to be \$13,730 and obese men to be \$37,128 while our findings suggest that men do not require a CIV for being overweight, and our CIV for obese men is \$3,679. While Asgeirsdottir et al. (2020) do not find statistically significant estimates for overweight, which may be due to power issues in their small sample, their point estimates are in accordance with our results, showing males not to be impacted (from a life satisfaction perspective) from being overweight, whilst they are impacted if they are living with obesity. Table A6 shows our results using OLS which are closer to the results from Kuroki. That is in line with other research that also reports lower CIVs when using IV-2SLS models (Howley, 2017; Ólafsdóttir et al., 2020) and highlights the importance of accounting for the endogeneity of income. In addition to accounting for endogeneity and meaningfully including underweight in the analyses, this study extends the work of Kuroki (2016) and Ásgeirsdóttir et al. (2020) exploring both the individual's own and spouse's optimal BMI taking into consideration their interactions. Kuroki (2016) uses a 4-point life satisfaction scale while this study applies a more granular 11-point scale. Furthermore, this paper applies a single regression where the reference group is normal weight while Kuroki (2016) performed a regression for obese where the reference group consisted of both normal weight and overweight and then a separate regression for overweight where the reference group is normal weight and obese, making his results difficult to interpret. As with Asgeirsdottir et al. (2020), all our comparisons are to the normal weight category only, when BMI categories are used or to optimal BMI when continuous BMI is used. Finally, Kuroki (2016) applies the median income of the whole sample when calculating the CIV while this paper applies the average income of men and women separately, as in Asgeirsdottir et al. (2020).

Clark and Etilé (2011) explored the association of sub-optimal BMI levels and life satisfaction controlling for spouse's BMI but did not produce CIV estimates. In their semi-parametric approach, they find that the optimal BMI for women is in the range of 22-23, and 24-25 for men (both unconditional on spouse's BMI). Our unconditional optimal BMI for women is 22.7 and 27.4 for men as seen in Table 4. They also find spouse's BMI to be negatively correlated with own life satisfaction above a certain level and that own BMI is positively correlated with life satisfaction in underweight men and negatively correlated with life satisfaction above a certain threshold. Furthermore, the threshold increases with spouse's BMI when the individual is overweight. These findings are consistent with the quadratic model employed in equation (9) and with the point estimates given in Table 5. Our findings also show that optimal BMI increases with spouse's BMI.

Clark and Etilé (2010) remarked that BMI instrumentation is remarkably difficult to carry out in this context. This paper does not include an instrumental variable for BMI and conclusions on causality can thus not be made. Instrumentation might impact the results in a similar manner as in Clark and Etilé (2011), and this could be explored further in future studies. Although depression and life satisfaction are clearly measuring different aspects of an individual's well-being, it is reassuring that instrumentation of BMI in depression regressions does not consistently create biases in one direction (Huang et al., 2014; Jokela et al., 2012; Lawlor et al., 2011; Tyrell et al., 2019; Walter et al., 2015; Willage et al., 2018).

When comparing results from different studies on valuation of relief from sub-optimal health conditions, a few things should be kept in mind. The specific type of model used has a significant impact on the CIV estimates. Other factors include size of the data sets and the number of waves collected, as well as the inclusion or exclusion of specific control variables. One take-away from the above comparisons is that simple OLS models are likely to substantially overestimate CIVs. Thus, when putting the results in context, it makes sense to compare them to other findings that account for the well-known endogeneity of income. Ólafsdóttir et al. (2020) studied the sub-optimal health condition of chronic pain and used mother's education as an instrument for income. They found the CIV for chronic pain to range between $20,444 and $52,925 per year depending on models used (Ólafsdóttir et al., 2020). Howley (2017) used parental education as an instrument for income in a health application of the CIV method and found the CIV's that range from approximately $7,600 per annum for asthma to approximately $41,500 for congestive heart failure. Comparing these results to our CIV estimates for the obese category, suggests that the CIV for obesity is somewhat below the findings of Ólafsdóttir et al. (2020) while being within the range reported by Howley (2017) for women, with the CIV for obese men below this range (see Table 3).

It is quite remarkable how similar differences between OLS and instrumented results are between studies. Our income coefficient generally increases on average by a multiple of 3.2, by 3.6 in the case of Ólafsdóttir et al. (2020) and by 3.5 by Howley (2017), even though different data, contexts, and instruments are used. The multiples are even quite similar to ones found in studies using happiness as the dependent variable and completely different instruments. Luttmer (2005) for example instrumented the log of household income using industry and occupation information of the respondent and their spouses together with national earnings information, and they concluded that the income coefficient was 2.9 times higher than that found using OLS. Although instruments are rarely perfect, this consistency provides some comfort. However, a recent study using lottery winnings in Sweden to assess the impact of money on well-being does not produce a similar result. Lindqvist et al. (2020) estimated the treatment effect of one unit of log household income on standardized life-satisfaction to be 0.377, which is only about 30% higher than our OLS coefficient. For completeness, we followed Asgeirsdottir et al. (2020) and estimated our models for BMI categories, forcing the income coefficient to match the coefficient reported by Lindquist et al. (2018). Those comparisons can be found in the Appendix, Table A3. Although general patterns of results remain similar, calculated CIV amounts increase. Given the similarity between the Lindqvist et al. (2020) coefficient and our OLS coefficient, the CIV from this exercise is naturally similar to our OLS estimates and higher than our IV-2SLS results (Table A3). The value of the Lindqvist et al. (2020) study is that it is based on income variations that are convincingly exogenous, that is lottery outcomes. However, the concern is that the study does not concurrently measure life satisfaction and lottery winnings but uses life satisfaction lagged by between 5 and 22 years, under the assumption of consumption smoothing.

Our research has some limitations. The results are based on self-reported key variables such as life satisfaction, income, height and weight which may be biased. However, a strength of this study is the rich dataset, which made for opportunities to estimate different models, instrument for income, as well as to explore both the individual's own and spouse's optimal BMI accounting for their interactions. The results therefore add to the expanding literature applying the CIV method and shed light on aspects of the method, opportunities, and challenges. The main contributions are fourfold. Firstly, the study adds to the existing literature by estimating CIV´s for all BMI categories, not only the overweight and obese categories as in Kuroki (2016) or Asgeirsdottir et al. (2020) who only do so in underpowered estimations. This has proved important to shed light on gender differences and is especially important for males. Secondly, the study estimates the CIV for the continuous form of own BMI, allowing for optimal BMI to differ from the health-maximizing BMI on which WHO results are based. Thirdly, the study calculates the CIV for BMI conditional on spouse's BMI, which to our knowledge has not been done before, and highlights important gender differences and relative effects based on spousal BMI. Lastly, the study makes several methodological improvements to the previously published results.

The main methodological take-away from the study is the importance of adjusting for the endogeneity of income. The main implications for policy are the systematic gender differences in weight preferences, with females being more sensitive to being over the optimal weight than under, while men would be willing to forego considerable consumption possibilities to not be underweight. Similarly, it is interesting how females are quite sensitive to their own weight, while males are more sensitive to the weight of their spouses when above their optimal. This study sheds light on the monetary value individuals put on being near their optimal BMI and on the value of concordance in couple's BMI levels.

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Appendix

Table A1. CIV for 1-10 BMI units away from optimal BMI and CIV per unit BMI

	IV-2SLS			
	Women		Men	
BMI units from optimal	CIV	CIV per unit	CIV	CIV per unit
1	54	54	112	112
2	215	161	447	336
3	485	270	1,010	562
4	864	379	1,803	794
5	1,354	490	2,836	1,032
6	1,958	604	4,115	1,279
7	2,678	720	5,652	1,537
8	3,518	840	7,460	1,809
9	4,481	963	9,556	2,096
10	5,572	1,091	11,958	2,402

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using IV-2SLS.
Men: N=43,628 observations. Women: N=53,158 observations.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted.

Table A2. CIV for 1-10 BMI units away from own optimal BMI and spouse optimal BMI and CIV per unit BMI

	IV-2SLS			
Section A	Women		Men	
BMI units from own optimal	CIV	CIV per unit	CIV	CIV per unit
1	78	78	231	231
2	311	234	927	697
3	702	391	2,102	1,174
4	1,253	551	3,775	1,673
5	1,968	715	5,976	2,201
6	2,851	883	8,744	2,768
7	3,908	1,057	12,130	3,386
8	5,146	1,238	16,198	4,068
9	6,574	1,428	21,025	4,827
10	8,201	1,627	26,706	5,681
Section B				
BMI units from spouse optimal	CIV	CIV per unit	CIV	CIV per unit
1	16	16	161	161
2	66	49	646	485
3	148	82	1,461	815
4	263	115	2,615	1,155
5	411	148	4,124	1,508
6	592	181	6,005	1,881
7	807	215	8,282	2,277
8	1,056	249	10,984	2,702
9	1,339	283	14,146	3,162
10	1,657	318	17,810	3,664

Source: Swiss Household Panel (SHP).
Men: N=22,604 observations. Women: N=22,929 observations.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted.

Table A3. Point estimates for BMI categories using different approaches

	IV-2SLS				OLS				Lindquist adjusted			
	Women		Men		Women		Men		Women		Men	
Underweight	-0.1015	***	-0.3496	***	-0.0980	**	-0.2908	**	-0.0951	**	-0.2864	**
	(0.0229)		(0.0743)		(0.0387)		(0.1138)		(0.0387)		(0.1129)	
Overweight	-0.0210		0.0013		-0.0631	***	0.0060		-0.0559	***	0.0050	
	(0.0133)		(0.0103)		(0.0187)		(0.0181)		(0.0187)		(0.0181)	
Obese	-0.1013	***	-0.0400	**	-0.1886	***	-0.0620	*	-0.1772	***	-0.0596	*
	(0.0204)		(0.0167)		(0.0313)		(0.0316)		(0.0312)		(0.0316)	
log(income)	0.9287	***	0.8921	***	0.2845	***	0.2864	***	0.377		0.377	
	(0.1122)		(0.0983)		(0.0171)		(0.0205)					
CIV Underweight	8,315		38,518		29,602		141,323		20,656		91,310	
CIV Overweight	1,644		-113		17,876		-1,655		11,502		-1,054	
CIV obese	8,300		3,679		67,729		19,407		43,217		13,753	

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using IV-2SLS. The reference category for weight categories is normal weight. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status, and year dummies.
*** p < 0.01, ** p < 0.05, * p < 0.10.
Men (IV-2SLS): N= 43,628. Women (IV-2SLS): N=53,158.
Men (OLS, Lindqvist): N=51,561. Women (OLS, Lindqvist): N=61,011.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Table A4. Point estimates for BMI categories using individual fixed effects

	FE			
	Women		Men	
Underweight	-0.1440	***	-0.1069	
	(0.0331)		(0.0721)	
Overweight	0.0431	***	0.0503	***
	(0.0158)		(0.0168)	
Obese	0.0879	***	0.0599	**
	(0.0305)		(0.0304)	
Log(income)	0.1335	***	0.0888	***
	(0.0137)		(0.0158)	
CIV Underweight	139,668		187,072	
CIV Overweight	-19,853		-34,726	
CIV Obese	-34,716		-39,396	

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using FE. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status, and year dummies. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.
Men (OLS): N=51,561. Women (OLS): N=61,011.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Table A5. Optimal own and spouse's BMI, corresponding CIVs and standard error in CIV using IV-2SLS

Section A BMI spouse	16	22	28	35	16	22	28	35
Optimal own BMI	23	24	25	25	19	25	31	37
CIV: Own BMI = 15	5,721	6,685**	7,733**	9,068	4,267	26,626	83,063*	259,945
	(4,203)	(3,362)	(3,594)	(5,632)	(6,123)	(16,982)	(44,537)	(164,351)
CIV: Own BMI = 20	914	1,300	1,755	2,377	131	5,943	31,439**	111,704**
	(1,524)	(1,175)	(1,207)	(2,277)	(765)	(4,384)	(13,863)	(55,640)
CIV: Own BMI = 25	194	67	6	18	8,005	0	7,930**	44,783**
	(725)	(264)	(61)	(176)	(5,217)	(6)	(3,367)	(20,056)
CIV: Own BMI = 30	3,443	2,781	2,194	1,599	31,618**	6,008**	122	13,769*
	(3,514)	(2,109)	(1,440)	(1,698)	(13,657)	(2,662)	(333)	(8,080)
CIV: Own BMI = 35	11,206	9,898*	8,684**	7,383*	83,446*	26,78*6	4,321	1,366
	(7,871)	(5,403)	(4,108)	(4,396)	(39,072)	(11,784)	(3,571)	(2,646)
CIV: Own BMI = 40	24,854	22,662*	20,604**	18,366**	196,272*	73,080*	22,485	1,544
	(15,250)	(11,393)	(9,210)	(9,129)	(115,857)	(38,604)	(14,768)	(3,652)
Section B Own BMI	16	22	28	35	16	22	28	35
Optimal spouse BMI	15	19	22	25	12	20	29	38
CIV: Spouse BMI = 15	3	201	716	1,727	1,258	4,907	36,453***	157,242**
	(286)	(2,191)	(4,057)	(7,084)	(3,401)	(4,415)	(13,078)	(73,873)
CIV: Spouse BMI = 20	347	37	42	446	10,367	31	13,046***	76,390**
	(2,640)	(714)	(737)	(2,909)	(10,152)	(278)	(4,137)	(31,840)
CIV: Spouse BMI = 25	1,524	695	190	1	31,113	3,413	2,195*	33,950**
	(4,475)	(2,212)	(1,111)	(94)	(21,069)	(2,994)	(1,143)	(15,005)
CIV: Spouse BMI = 30	3,575	2,199	1,166	377	71,031	16,127**	286	11,783
	(5,733)	(2,663)	(1,875)	(1,902)	(43,386)	(8,776)	(602)	(7,666)
CIV: Spouse BMI = 35	6,572	4,600	3,004	1,588	146,915	42,475**	6,714	1,736
	(7,450)	(3,390)	(2,809)	(3,934)	(94,059)	(21,821)	(4,863)	(3,103)
CIV: Spouse BMI = 40	10,623	7,984	5,768	3,676	296,803	92,495**	23,553	484
	(11,027)	(6,498)	(5,716)	(7,006)	(217,141)	(51,974)	(14,579)	(1,956)

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using IV-2SLS. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status, and year dummies.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.
Men: N=22,604 observations. Women: N=22,929 observations.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Table A6. OLS point estimates for BMI categories and income, as well as corresponding CIV's

	OLS			
	Women		Men	
Underweight	-0.0980	**	-0.2908	**
	(0.0387)		(0.1138)	
Overweight	-0.0631	***	0.0060	
	(0.0187)		(0.0181)	
Obese	-0.1886	***	-0.0620	*
	(0.0313)		(0.0316)	
Log(income)	0.2845	***	0.2864	***
	(0.0171)		(0.0205)	
CIV Underweight	29,602		141,323	
CIV Overweight	17,876		-1,655	
CIV Obese	67,729		19,407	

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using OLS. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status and year dummies. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.
Men (OLS): N=51,561. Women (OLS): N=61,011.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Table A7. OLS point estimates for BMI and income, as well as optimal BMI and corresponding CIVs for selected BMI levels

	OLS			
	Women		Men	
BMI	0.0270		0.0975	***
	(0.0172)		(0.0245)	
BMI squared	-0.0007	**	-0.0018	***
	(0.0003)		(0.0004)	
Log(income)	0.2853	***	0.2847	***
	(0.0171)		(0.0205)	
Optimal BMI value	18.2		26.7	
CIB BMI = 15	1,980		113,820	
CIB BMI = 20	586		27,130	
CIB BMI = 25	9,091		1,578	
CIB BMI = 30	31,151		5,637	
CIB BMI = 35	77,398		43,912	
CIB BMI = 40	174,369		166,958	

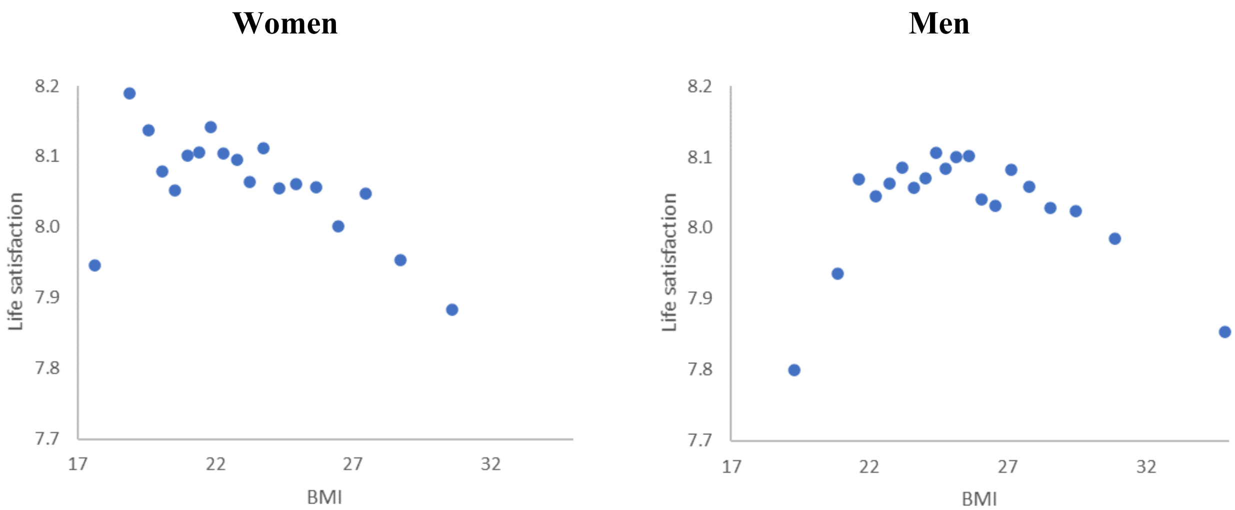
Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using OLS. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status, and year dummies. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.
Men (OLS): N=51,574. Women (OLS): N=61,011.
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Table A8. OLS point estimates for own BMI, spouse's BMI, BMI interaction and income, as well as optimal own and spouse's BMI and corresponding CIVs

	OLS							
	Women				Men			
BMI	0.0192				0.0456	***		
	(0.0149)				(0.0166)			
BMI squared	-0.0009	***			-0.0016	***		
	(0.0003)				(0.0003)			
BMI spouse	0.0354	**			-0.0078			
	(0.0165)				(0.0127)			
BMI spouse squared	-0.0010	***			-0.0007	***		
	(0.0003)				(0.0002)			
Interaction	0.0007	*			0.0017	***		
	(0.0004)				(0.0004)			
Log(income)	0.2151	***			0.2018	***		
	(0.0143)				(0.0144)			
Section A BMI spouse	16	22	28	35	16	22	28	35
Optimal own BMI	16	19	21	24	23	26	29	33
CIV: Own BMI = 15	683	4,641	12,675	28,900	49,547	130,949	326,467	1,000,707
CIV: Own BMI = 20	3,988	455	389	4,705	4,993	26,705	78,582	231,485
CIV: Own BMI = 25	26,686	13,091	4,875	436	3,346	627	12,363	53,975
CIV: Own BMI = 30	87,206	52,135	29,414	12,975	42,169	11,075	386	6,043
CIV: Own BMI = 35	247,045	152,955	94,191	51,829	187,428	73,736	24,590	2,593
CIV: Own BMI = 40	722,202	434,387	266,301	152,152	793,626	307,417	123,285	38,510
Section B Own BMI	16	22	28	35	16	22	28	35
Optimal spouse BMI	23	25	27	30	14	21	28	36
CIV: Spouse BMI = 15	25,968	45,728	75,657	131,006	552	10,226	66,154	328,502
CIV: Spouse BMI = 20	3,278	9,802	20,778	41,429	12,872	151	20,070	126,581
CIV: Spouse BMI = 25	1,284	13	1,857	8,295	48,693	5,593	2,339	45,485
CIV: Spouse BMI = 30	18,389	8,318	2,490	14	134,253	29,869	1,442	11,582
CIV: Spouse BMI = 35	69,245	41,496	23,184	9,828	348,449	89,464	16,834	332
CIV: Spouse BMI = 40	207,629	131,186	82,095	45,800	949,081	233,991	58,368	4,707

Source: Swiss Household Panel (SHP).
Estimates are based on life-satisfaction equations using OLS. Controls included for age, marital status, the degree of urbanization where the individual resides, the number of children in the household, education, labor-market status, and year dummies.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.
Men: N= 24,900. Women: N=24,884.
The shaded numbers indicate the higher CIV of the two values, CIV for own or spouse´s BMI for men and women separately
CIVs are reported in USD per year: 1 CHF=0.9937 USD. Results are unweighted. Standard errors (in parentheses) are clustered on individuals.

Figure A1. Binscatter plots of life satisfaction vs BMI



Source: Swiss Household Panel (SHP).
Men: N= 55,003. Women: N=66,560.