On the relationship between body mass index and marital dissolution

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Abstract[1]

The economic literature on body mass index (BMI) and marital dissolution uses simple correlations to suggest that it is the latter than alters the former. We argue here that the opposite is also potential because the higher the BMI, the lower the remarriage potential and the greater the demand for health care, which should decrease the probability of marital dissolution. We empirically explore the role of BMI on marital dissolution showing that those who are overweight are more likely to stay married. This is maintained when we examine causality by exploiting the exogeneity of the dates in which data are collected combined with BMI's seasonality. Although BMI appears to stabilize marriage, this implies a reduction in the bargaining power of individuals with a high BMI in marriage, which, according to our findings, has a greater impact on White women.

Keywords: Body mass index, Health, Divorce, Family economics, Marriage

JEL: I1, J12

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[1] The usual disclaimer applies. The authors bear sole responsibility for the analysis and the conclusions presented in this article.

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1.- Introduction

Since the early 1980s, the prevalence of adult obesity, measured using body mass index (BMI), has more than doubled in the U.S. (Centers for Disease Control and Prevention 2010) ranging from 23% in Colorado to 39.5% in Mississippi and West Virginia according to the most recent Behavioral Risk Factor Surveillance System data from 2019.[2] This is not a minor issue in that country since the estimated annual medical cost for obese individuals is $2,741 higher than those of normal weight according to data from 2000 to 2005 (Cawley and Meyerhoefer 2012). Interestingly, while obesity/overweight increased in the U.S., the divorce rate decreased. The dramatic increase in the overweight population of around 44% (20 percentage points) from the 1980s to the 21st century is concurrent with the drop in the U.S. divorce rate by almost 30% (Figure 1).[3] Despite this drop, divorce is still a worrisome phenomenon of huge impact in the U.S., with negative socio-economic consequences for ex-spouses (especially for women) and their children (Amato 2000; Gruber 2004), where from 40 to 50% of marriages are expected to end in dissolution (Cherlin 2010). The economic literature contains explanations for the rise in divorces in the 1960s and 1970s focusing on the liberalization of divorce laws (Friedberg 1998; González-Val and Marcén 2012a; 2012b; Wolfers 2006), but little is known on the factors affecting divorce decisions post-1980 (González-Val and Marcén 2012a).[4] In this paper, we contribute to the existing literature by exploring the potential link between BMI and the probability of marital dissolution, which could, at least in part, explain that opposite evolution of divorce and BMI. We then add to the literature by analyzing the potential causal impact of BMI on marital dissolution.

Prior works have analyzed the potential correlation between marital status (Averett at al. 2013; Shafer 2010) or marital transition (Averett et al. 2008; Wilson 2012) and BMI, but correlation does not confer causality. Strikingly, the channels described in

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[2] Obesity: the BMI of 30 or higher. BMI is a measure of an adult's weight in relation to his or her height, specifically the adult's weight in kilograms divided by the square of his or her height in meters.

[3] Figure 1 plots the evolution of the percentage of individuals living in the U.S. who are defined using BMI as overweight, normal weight, or underweight. Individuals are classified as underweight if their BMI is under 18.5, normal weight if their BMI is between 18.5 and 24.99, and overweight if their BMI is over 25. Data come from the World Health Organization (WHO).

[4] Other determinants of the evolution of divorce are: the role played by income and the business cycle (Burgess et al. 2003; González-Val and Marcén 2017; 2018a), the shocks affecting housing prices (Farnham et al. 2011; Klein 2017), the cultural background (Furtado et al. 2013), oral contraception (Marcén 2015), the presence of children conceived within or before the first marriage (Bellido et al. 2016), marriage structure (González-Val and Marcén 2018b), and inter-generational transfers (Andaluz et al. 2017), among many others.

those economic works through which marital status and BMI can be potentially related (e.g., the access to marriage, how individuals behave within a marriage, and potential out-of-marriage options (remarriage market)) might not be limited, in a theoretical way, to a one-direction-impact from marital transitions to BMI. However, most of the empirical work considers only one direction in that relationship.[5] Only Jeffery and Rick (2002) explore the potential influence of BMI on the likelihood of entering marriage and divorce in a restricted sample of 1,209 men and 1,319 women followed for 2 years. They find no association between BMI and the probability of divorce. We add to this almost unexplored line of research considering that it is BMI that, at least in part, is driving the marital status decisions of individuals. We surmise that the economic role of BMI in out-of-marriage options determines the potential negative impact of BMI on marital dissolution by way of changes in the bargaining power of those penalized by BMI.

Although we describe the potential economic channels through which BMI can impact marital dissolution extensively in the next section, we briefly present the two main mechanisms here: health care necessities and the remarriage market. Since high BMI can increase the demand for health care-related necessities as a consequence of health shocks (Gomis-Porqueras et al. 2016), the absence of a spouse who, at least in part, provides informal care activities (Marcén and Molina 2012) can decrease the attractiveness of marriage breakup (low expected utility in marital dissolution compared with that derived from marriage), which should decrease the probability of marital dissolution. However, the relationship between high BMI and health issues implies a reduced productive working life. Certain risk factors, including BMI, are strongly correlated with perceived health, which influences retirement age and market work (Giménez-Nadal and Molina 2015). This being true, expected household income would decrease, which would increase the probability of marital dissolution, especially if the individual with a high BMI is the breadwinner, traditionally the husband. Similarly, considering the remarriage market, out-of-marriage options can affect the likelihood of divorce/separation. Assuming that BMI is an indicator of physical attractiveness (Averett et al. 2008), it can be hypothesized that a high BMI makes an individual less attractive to potential partners in the remarriage market. Then, the higher the BMI, the lower the incentives to break up his/her marriage.

[5] We review in detail all of these channels in the next section.

To empirically examine whether BMI, at least in part, explains the likelihood of marital dissolution, we use U.S. data from the National Longitudinal Survey of Youth (NLSY79). Although this dataset focused on the U.S. case, it is worth noting that this is not only a major issue in that country, both marital dissolution and the evolution of BMI generates concerns especially in developed countries (Stevenson and Wolfers 2007). Our estimations point to a negative relationship: the higher the BMI, the lower the probability of separation/divorce. Our results also reveal that the relationship depends on the specific BMI level since the negative association is for those who are overweight. The potential mechanisms driving this negative relationship include the increase in the demand for health care and the decrease in out-of-marriage options caused by the rise in BMI. The same is found when using a survival analysis, developed to account for any potential time-variant factors in a marriage, from which it is clear that those who are overweight are much more likely to stay married, regardless of marriage duration.

When we split the sample by gender, we observe a clear negative association between BMI and marital dissolution for women, who traditionally suffer greater penalties related to being overweight (Oreffice and Quintana-Domeque 2010) but not for men. This reinforces our explanation that the decrease in out-of-marriage options is especially important for women. An analysis by race reveals substantial differences, with the negative relationship being apparent for non-Hispanics and non-Blacks and, to a lesser extent, Blacks (among whom being overweight is more common and accepted, which is probably why BMI has a lower impact on out-of-marriage options).

Potential sample selection and endogeneity concerns are also addressed in our work. Although the economic literature shows that a substantial amount of BMI evolution, especially obesity, depends on the access to fast-food, restaurant prices, and cigarette and alcohol consumption (Chou et al. 2004), it could be that reverse causality could be affecting our results (from expected marital dissolution to BMI). Individuals who anticipate a marital dissolution may prepare themselves for the marriage market by losing weight (Averett et al. 2008). Given the difficulties in finding appropriate instrumental variables in this setting (Averett et al. 2008), we consider the seasonality of BMI to define acceptable instrumental variables using the dates in which the NLSY79 is collected since this is unlikely related to our dependent variable (the probability of marital dissolution). This allows us to study the potential causal link between BMI and marital dissolution. Our findings point to the possibility that BMI could impact marital dissolution, with out-of-marriage options being the drivers of this effect. Sample selection problems related to the fact that we only consider a sample of married individuals have been addressed by extending our sample to include non-married individuals and estimating a Tobit Type II model. It is reassuring that our findings do not vary after these analyses.

The remainder of the paper is organized as follows: Section 2 describes the economic mechanisms behind the relationship between BMI and the marital dissolution, Section 3 presents the empirical strategy, Section 4 describes the data, Section 5 analyzes the results, and Section 6 concludes.

2.- The relationship between BMI and marital dissolution: Potential mechanisms

Averett et al. (2008) describe four mechanisms (selection, protection, social obligation, and marriage market) to describe the relationship between marital status and changes in BMI. The selection mechanism states that a low BMI makes a person more attractive to enter into marriage since that person can have more potential partners in the market. The protection mechanism establishes that since married individuals are less likely to follow risky patterns of behavior, they will enjoy better health, then the BMI of those married individuals should be lower than similar non-married individuals. This is made possible by the economies of scale and specialization in the labor market and home production, which give each spouse access to more resources than they would have being single. The social obligation mechanism indicates that those involved in a relationship will eat more regularly and those dishes will be richer and more elaborate, which suggests that marriage increases BMI. The marriage market mechanism states that individuals who anticipate a growing probability of divorce may prepare to become more attractive in the marriage market by losing weight. All of these mechanisms have been described to explain the potential impact of marital status on BMI (Averett et al. 2008). However, using also the arguments of this author, and including additional channels, it could be that BMI impacts marital dissolution.

BMI is primarily an indicator of health in adulthood but can also determine the attractiveness and self-esteem of individuals. Assuming that the level of utility of individuals depends on all of these factors (health, attractiveness, and self-esteem), and considering Becker’s (1981) theory that individuals divorce/separate when the utility derived from marriage is lower than that obtained by marital dissolution, it can be studied the role of BMI on all of these variables (health, attractiveness, and self-esteem) and so on the marriage vs. marital dissolution utility comparison.

Focusing on the health aspect, Averett et al. (2008) omit, under their protection and social obligation mechanism, that having a high BMI may increase the risk of having diabetes, hypertension, cardiovascular disease, certain forms of cancer, and even mortality, among others (Kinge and Morris 2014), which are health problems that can require informal care. Assuming that a large portion of informal care activities is carried out by partners or spouses (Marcén and Molina 2012), it can be surmised that, for the spouse with a high BMI, the likelihood of finding a new partner will decrease after separation or divorce, diminishing the probability of marital dissolution (Guner et al. 2018). This stems from the notion that health-related individual care needs are associated with a decrease in out-of-marriage options. If this is a valid mechanism, we would expect that all individuals do not react in a similar way to the health shock because this is conditioned to gender-based differences in unpaid health care activities. Since women are usually the main caregivers (Marcén and Molina 2012), we would expect that women with higher BMIs (more time-demanding of informal care) would encounter more difficulties in finding a new partner who would spend time caring for them. For men, we would expect a lower negative effect, or even no effect since their potential new partners (women) are more likely to engage in informal, unpaid, health-related care activities.

In a country such as the U.S., where the remarriage rate is particularly high (Stevenson and Wolfers 2007), the marriage (or remarriage) market is very important. In this setting, the selection mechanism proposed by Averett et al. (2008) can be applied not only to the entry into the first marriage but also to the likelihood of finding a partner in the remarriage market. Those who divorce do not usually remain without a partner for the rest of their lives. The live-together culture (Marcén and Morales 2019) makes the need to find a new partner important in the comparison between remaining married vs. divorcing and participating in the remarriage market. As a factor indicative of physical attractiveness, BMI can play a role here (Oreffice and Quintana-Domeque 2010), with a high BMI making individuals less attractive to potential partners. If this occurs, we would expect that the higher the BMI, the lower the incentive to break up a marriage. We refer to this as the "attractiveness channel" of BMI, which captures the options in the remarriage market. As before, gender-based differences may also arise. Women tend to be more concerned with attractiveness because obese women are stigmatized (Averett et al. 2008), making them more vulnerable to changes in BMI (Oreffice and Quintana-Domeque 2010). The loss of attractiveness can also generate self-esteem problems. High BMI values are related to lower levels of self-esteem. This can also affect the out-of-marriage opportunities since having low self-esteem reduces the likelihood of searching for and maintaining relationships (Cast and Burke 2002), diminishing the out-of-marriage possibilities in a comparison between the utility derived from marriage and that in a potential divorce/separation. Again, if this is the case, gender-based differences should be expected since men usually have higher self-esteem than women. Gender differences may provoke dissimilar effects of BMI on marital dissolution, with women being more affected than men.

Although theoretically, high BMI can stabilize a marriage by decreasing the out-of-marriage options for the spouse with a high BMI, this is just a partial analysis of marital situations, focusing on the out-of-marriage options of the partner for whom we have BMI information.[6] The level of utility of the other spouse may also be altered as a consequence of their partner's BMI, which would also impact the probability of marital dissolution. For example, the higher the BMI of spouse *a*, the lower the utility of spouse *b* in the marriage, because of the potential increase in the time that spouse *b* must spend in unpaid, health-related care activities, decreasing the time devoted to, for example, leisure. Also, because of the loss of attractiveness of spouse *a*, spouse *b* would feel less attracted to spouse *a*, decreasing spouse *b's* level of utility in the marriage. Then, to be able to find a negative impact of BMI on the likelihood of marital dissolution, it would be necessary that the spouse who loses utility in the marriage would be compensated by the other spouse (with a high BMI) to not break up the marriage. This implies a reduction in the bargaining power of individuals with high BMIs in their consumption and time allocation decisions.

3.- Empirical Strategy

A priori, the relationship between BMI and the probability of marital dissolution is not clear. Initially, let us assume the following linear model:[7]

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[6] Note that the available data on BMI is limited to that of one spouse in our dataset. Then, our study is conditioned by the existing information. We explain how this can affect our estimates below.

[7] Given that the dependent variable in our model is dichotomous, the use of a linear probability model is not the most appropriate empirical strategy. We use a linear probability model for simplicity, as do other researchers studying the likelihood of marital dissolution. Therefore, we replicate our main results (Table 3) using a logit model, which is more accurate given the nature of our dependent variable. These results are shown in Appendix A, where we distinguish again between the complete sample, and by gender. The main conclusions are maintained and again indicate a negative correlation between lagged BMI and the probability of marital dissolution. We do not include fixed effects in the logit model due to convergence problems.

$$Marital\ Dissolution_{it} = \beta_1 + \beta_2 BMI_{it-1} + \boldsymbol{\mu X_{it}} + u_{it} \tag{1}$$

where the dependent variable is a dummy given the value of 0 if the individual *i* is married in year *t* and 1 in the year *t* in which individual *i* divorces or separates. BMI_{it-1} is the variable of interest and represents the BMI of the individual *i* in year *t-1* with β_2 reflecting the magnitude of the relationship between the changes in BMI and the likelihood of marital dissolution.[8] As stated above, the sign of the parameter β_2 is not theoretically clear. We use the lagged value of this indicator since there are potential lags with the decision to divorce or separate (for example, as individuals are only interviewed once during the year, BMI could be collected after marital dissolution has already taken place). In addition, a period of time elapses between the decision to divorce or separate and the official dissolution. The vector $\boldsymbol{X_{it}}$ includes a range of individual (and partner) characteristics, such as gender, age, age at first marriage, whether both members of the couple are in the same age range, the number of children conceived within and before first marriage, whether the respondent is pregnant, family structure during childhood, the respondent´s and partner´s levels of education and race (these controls are described below). All of these variables could impact the likelihood of marital dissolution, for reasons independent of BMI. Thus, their inclusion in the specification is necessary to prevent the coefficient of our variable of interest, BMI, from picking up the effects of other variables.[9] The model also includes cohort and region-fixed effects to control for the unobserved characteristics that vary at these levels, with the cohort variables being dummy variables given a value of 1 for respondents born the same year and 0 otherwise.[10, 11] u_{it} is the error term.

In addition to the model presented above, we repeated our analysis using a fixed effect model. This accounts for unobserved individual characteristics that can be correlated with the observed independent variables. If the unobserved features (such as

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[8] We have included in the regressions the information available on the partner, and the results do not vary with/without those controls (below).

[9] Results do not change when we exclude all of these variables.

[10] All respondents were born between 1957 and 1964, so there are 8 cohort dummy variables, with cohort 1 (for 1957) being the reference.

[11] Due to data availability, the U.S. is divided into four regions: North East, North Central, South, and West (the omitted variable). Note that “The Bureau of Labor Statistics (BLS) only grants access to geocode files for researchers in the U.S.”, as stated by the BLS survey documentation. Prior research on the impact of different characteristics on the probability of marital dissolution follows the same strategy (Bellido et al. 2016).

family, psychological, and behavioral traits) do not change over the sample period, the individual-specific fixed effects will account for them. This assumption seems acceptable given that we are talking about characteristics that define individual character, and only adults are included in our sample.

Our study is limited to the analysis of the relationship between the BMI of an individual *i* and the probability of marital dissolution for individual *i*. Ideally, we would like to include the BMI of the spouse, because the BMI of both spouses could be important in marital dissolution. Unfortunately, the information on spouse BMI is not currently available.[12] In this context, it is possible that the coefficient picking up the BMI effect could be capturing the effect of the BMI of both spouses. If both, for example, are overweight, then the decrease in out-of-marriage options would be greater, decreasing the probability of marital dissolution more than would be expected if only one spouse is overweight. In this case, our estimated coefficient should be interpreted as a lower bound in the potential negative relationship between BMI and marital dissolution. When the BMI of each member of the couple moves in opposite directions, the potential effect on the estimated coefficients is not so clear since we cannot explore whether it is the difference in BMI that matters, or it is simply that each BMI has a separate impact on marital dissolution.[13]

4.- Data

We use data from the NLSY79, a database that dates back to 1979 when 12,868 individuals aged between 14 and 22 were first interviewed. The survey was repeated every year until 1994 and every two years since then. The richness of this database comes from the historical information on individual family background, intimate relations, (pre)marital fertility, education, labor-market experience, and biological characteristics (as well as partner characteristics). We select for our main sample individuals aged 18 years or older and in their first marriage and exclude higher-order marriages and individuals whose marriages end due to death.[14] Since our objective is to analyze the likelihood of marital dissolution, we consider that the marriage is ended the

[12] This work is not the only one that does not utilize information on the BMI of the partner. The absence of this information is common in the literature. For example, Averett et al. (2008) do not include the BMI of the partner because they also use the NLSY79.

[13] Existing literature shows evidence of a positive sorting in BMI, weight, and height (Oreffice and Quintana-Domeque 2010) among couples, and since some dietary healthy habits (Lalji et al. 2018) could convergence during marriage (protection mechanism of Averett et al. 2008), we would expect the first explanation to be dominant.

[14] This means that we exclude subsequent marriages from the dataset.

first time that the individual in the sample reports his marital status as divorced or separated, at which point they are removed from the sample, as in Bellido et al. (2016).[15] Our final sample constitutes 5,139 individuals with 45,598 observations.

Table 1 summarizes the statistics of our main sample by gender. Our sample consists of individuals aged 34.2 years old, on average, who married for the first time when they were approximately 24 years old, and who tend to be of the same age as their partners (79% of the sample). Around 50% of the individuals have at least a college degree, a percentage similar to that of their partners. The majority of the individuals, 64%, are non-Black, non-Hispanic, while the percentage of Black and Hispanic individuals is around 18% each. With respect to our variable of interest, BMI, we determine height using information from the closest year in which this was reported (1981, 1982, and 1985).[16] We use weight data from each year since 1981, the first year in which the NLSY79 incorporates a question about individual weight.[17] The values of BMI were restricted from 14 to 50 to avoid the influence of extreme values on our results (less than 0.3% of the observations).[18] The mean of the lagged BMI is 25.7, which is in the overweight range but close to the upper end of the range considered normal. Overweight individuals do not appear to be overrepresented in our sample since they are 50% of our sample, and according to Figure 1, they increased from around 45% to 65% of the adult U.S. population during the period considered (using data from the WHO). The mean of the difference between the maximum and minimum BMI for each person is 5.6, which represents significant intra-person BMI variation, 22% of the average BMI in our sample. Splitting the sample between men and women, we observe expected differences in BMI, with men having a higher BMI than women.

More interesting descriptive data are presented in Table 2, in which we divide the sample between individuals who break up their marriage at some point and those in "intact" marriages during the sample period, again for the whole sample population and

[15] As a simple robustness check, when we re-estimate our main model by limiting the sample to those who marry when they are at least 21 years old, the results do not vary (we revisit this issue below).
[16] We only use data from individuals aged 18 years or older. Height is not measured during childhood.
[17] Self-reported measures of height and weight may suffer from reporting errors, which can bias the estimated coefficients. To reduce the potential impact of those errors, we checked our dataset for potential errors in height and weight. For example, an individual is small in 1981, one year later (in 1982) he/she is very tall and he/she is small in 1985; such impossible changes were revised. When we rerun our estimates without individuals reporting abnormal changes in height and weight, our results do not change.
[18] Almost the whole sample is within those values. The gaps in BMI were completed by linear interpolation. The summary statistics of BMI before and after this do not change substantially. For example, the average BMI before filling in the gaps is 25.839 and after filling in the gaps is 25.465. Therefore, the impact is very small on our variable of interest and, as such, does not have an appreciable effect on our results.

by gender. We observed that 38.5% of individuals break up their marriage during the sample period, with marital dissolution taking place when individuals are aged 31.1 years, on average. This implies that respondents separate or divorce 8 years after getting married since they tend to marry at the age of 23.2, which is close to the ten-year duration of marriages before divorce suggested by Stevenson and Wolfers (2007). Comparing both groups, those in intact marriages tend to marry when they are 1 year older, in line with the work of Lehrer (2008) who suggests that those who marry early are more likely to divorce. Individuals who do not break up their marriages conceive 0.45 more children within their marriage, which is not surprising since the duration of their marriage is longer; moreover, they have 0.24 fewer children before marriage than those who separate or divorce, which coincides with the argument of Bellido et al. (2016) who found that the higher the number of children conceived before marriage, the lower the probability of marital stability. For both respondents and their partners, the level of education is higher for those in intact marriages, which has been described in the literature examining divorce (Isen and Stevenson 2010). That literature also detects differences by race, with Black individuals being more likely to divorce (Kposowa 1998). In our case, Black individuals represent only 18% of the whole sample but 26% of the divorced or separated individuals. This is around 10 percentage points more than Black individuals in intact marriages. Again, the results for men and women separately show a very similar pattern.

The differences in our variable of interest, BMI, do not appear to be that important since the BMI of individuals in intact marriages is only a little more than one percentage point higher than the BMI of divorced or separated individuals. However, we reject the null hypothesis of equality between those two means, with the p-value being less than 0.05, which indicates that they are statistically different. By looking at the histograms of BMI for both groups (those who divorce/separate at some point and those in intact marriages) in Figure 2, we observe dissimilarities in the distribution of the individuals. The proportion of individuals with a lower BMI is slightly higher for those who divorce or separate, pointing to a potential negative relationship between BMI and marital stability. Also, a small gap between the BMI of those in intact marriages and those whose marriages break up is detected, regardless of marriage duration (Figure 3), although the evolution of BMI is similar in both cases.

5.- Results

5.1.- Baseline Results

Table 3 presents the estimates for Equation (1) for the whole sample in Column (1). In that specification, we introduce controls for a range of socio-economic characteristics identified in the literature as affecting the decision of marital dissolution for reasons independent of BMI, such as gender, age at first marriage (Lehrer 2008), whether the members of the couple are within the same age range (Wilson and Smallwood 2008), the number of children conceived before and within first marriage (Bellido et al. 2016), whether the respondent is pregnant, the family structure of the respondent during childhood, measured by introducing a dummy variable for whether the respondent's father was living at home in 1979 (Corak 2001), the level of education of both the respondent and their partner (Isen and Stevenson 2010), and race (Kposowa 1998), in addition to cohort- and region-fixed effects.

Our first estimates show a negative relationship between BMI and the probability of marital dissolution, but the coefficient capturing the effect of BMI is small, albeit statistically significant.[19] We contextualize the magnitude of the negative correlation below. In any case, although this analysis does not establish causality, its result may highlight the importance of the decrease in out-of-marriage options in the maintenance of marriage since we do not find empirical evidence against this argument. As explained above, in a country with a high remarriage rate, where the divorce condition is a transition period from one marriage to the next, the low expectations of married individuals with high BMIs (linked to poor health, low self-esteem, and decreased attractiveness) for finding a potential new partner in the marriage market can make separation or divorce less attractive.

Concerning the remaining covariates, age has a U-shaped relationship with the likelihood of marital dissolution. We find that age at first marriage does not play a role and that both members of the couple being in the same age range has a negative impact on the risk of marital dissolution. The presence of children has a different effect, depending on whether they were conceived before or during the first marriage. While the former is a destabilizing factor for marriage, the latter has a deterrent impact on the

[19] Our conclusions are maintained when we include BMI and its square (which is not statistically significant) and when BMI is measured in logs (Appendix B). The results are unchanged by those different ways of introducing BMI in the analysis. The use of self-reported BMI (both height and weight) may also generate concerns since it could bias downward the estimated relationship between BMI and the probability of marital dissolution. If this is true, our results should be seen as a lower bound. However, as claimed by Ng (2019), there is a positive correlation between measured and self-reported BMI, with both indicators producing very similar estimations when treated as continuous variables.

risk of marital dissolution. Being pregnant contributes to stabilizing the marriage.[20] The family structure during childhood also determines marital stability in adulthood since the father's presence at home decreases the risk of future marital dissolution. The education level of both members of the couple reveals that the lower the level of education, the greater the likelihood of marital break-up.[21] We find no statistically significant differences in the risk of marital dissolution for Hispanics and other races, although being black does imply a greater risk of marital dissolution.[22]

The mechanisms described above for the potential relationship between BMI and marital dissolution also suggest potential gender-based differences, with women being more likely to suffer penalties due to BMI-related issues (Hamermesh and Biddle 1993; Oreffice and Quintana-Domeque 2010). Therefore, in our setting, it is possible that the estimated coefficients are picking up the reaction of women rather than of men. To explore this potential gender issue, we divide our sample between men and women in Columns (3) and (5), respectively. In both cases, the estimated coefficients coincide in pointing to non-gender-based differences. However, in this analysis, we do not control for the other unobservable characteristics that could potentially be driving our estimates.

Taking advantage of the panel structure of the dataset, we repeat this analysis using a fixed effects model in Columns (2), (4), and (6) for the whole sample, men, and women, respectively, to account for any unobserved time-invariant characteristics. We again find a statistically significant inverse association between BMI and the probability of marital dissolution, but this link is only statistically significant for women. For the whole sample, a one-standard-deviation increase in lagged BMI correlates with a

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[20] The pregnancy variable is calculated using the age of the children, which takes into account both current and previous pregnancies. The results do not vary when a control for the age of the youngest child is included as a robustness check in the analysis using a sample of individuals with children (Appendix B).

[21] We include the level of education among the explanatory variables because it may affect the probability of marital dissolution for reasons independent of BMI. Nevertheless, given that our sample consists of married individuals aged 18 years and older, one may think that education time-variant controls are concentrated in the younger population, which may cause concerns regarding the econometric identification of the empirical model. Although married individuals younger than 25 years old only represent 7% of our sample (those younger than 22 are less than 1%), when we address this situation by replicating the estimates to include only people aged 25 years and older, our main findings do not change. Results are available upon request.

[22] We have rerun our estimations including household income and employment status as controls (Appendix B). However, these variables can generate endogeneity concerns. For example, employment status might be driven by changes in relationship status. This is especially problematic for women (Schaller 2013). Therefore, we only included those controls for employment status (employed = 1, 0 otherwise; household income; % of household income of the respondent) in Appendix B. We also consider a sample of women only because employment status may differentially affect time constraints (e.g., grocery shopping, cooking), although this can also generate endogeneity concerns. In any case, it is reassuring that adding or deleting those controls does not alter the results.

decrease in the probability of marital dissolution of almost 1 percentage point (1.1 percentage points for women).[23] Similarly, Meltzer et al. (2011) find that only the BMI of women matters, and they also observe a negative correlation between women's weight and their spouses' satisfaction, which does not appear to fit with our findings. Following the argument of Meltzer et al. (2011), the higher the BMI, the lower the marital satisfaction level and, therefore, the higher the probability of marital dissolution. Our analysis indicates that the higher the woman's BMI, the lower the probability of marital dissolution. These findings support our argument regarding the impact of out-of-marriage options given that women suffer greater penalties from divorce than men. These gender-based differences are of particular interest for their potential implications concerning the impact of BMI on marriage. The negative relationship that we observe for women may indicate that women with high BMIs have to compensate their partner to avoid divorce/separation. Focusing on the bargaining power within a marriage which is a consequence of the gender income gap (Komura et al. 2019), women with high BMIs could compensate their partners with much lower bargaining power in marriage in consumption and time allocation decisions.

5.2.- Age analysis

The importance of physical appearance, body shape, and weight may decrease with age. Therefore, it is possible that our results are driven by the behavior of young individuals. To investigate this issue, we rerun our estimates according to age group. We group respondents in two-year age ranges. For this purpose, we create dummy variables given a value of 1 if the respondents are in the corresponding age range and 0 otherwise and interact them with BMI. Figures 4, 5, and 6 display the estimated coefficients on the interaction terms for the whole sample, men, and women, respectively. The inverse relationship between BMI and the probability of marital dissolution is statistically significant for younger individuals between 26-27 (28-29 for men) and 32-33 (38-39 for women) years old. This inverse relationship is also detected for those aged between 42-43 and 50-51 years old (48-49 and 54-55 for women). For men, this is not so clear since we only find statistically significant coefficients for those aged 42-43 and 50-51 years old.

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[23] For the whole sample, using estimates from Column (2) in Table 3 and Column (4) in Table 1, the value is calculated as follows: β_2 (-0.002) x lag BMI_{std} (4.946) = 0.0098. For women, the standard deviation of the lag BMI is 5.329, so the value is calculated as follows: $\beta_2^{\hat{}}$ (-0.002) x Lag female BMI_{std} (5.329) = 0.0107.

For young individuals, the "attractiveness channel" may be driving these estimates, whereas for those in their middle years (late 40s and 50s) the "health channel" could potentially explain these results. Women appear to be more ostracized in the remarriage market in terms of attractiveness and self-esteem when they are young. When women are in their late 40s and early 50s, they can be less likely to find someone to care for them.

5.3.- Classification by BMI: overweight, normal weight, and underweight

Up until now, we have focused on analyzing the relationship between BMI and marital stability, and our findings are clear: there is an inverse relationship between the two that is more pronounced for women. Nevertheless, a one-point increase in BMI is negatively associated with the probability of marital dissolution by just 0.1 – 0.2 percentage points on average, which is close to irrelevant. Thus, it would require an increase in BMI of 6.7 points to cause a decrease of 1 percentage point in the probability of marital dissolution. As mentioned above, this is equivalent to an increase of one standard deviation in BMI. A large jump in BMI is required to significantly decrease the likelihood of marital dissolution given that, according to the WHO, there is only a 3.25-point difference between a normal weight (BMI of 21.75, in the middle of the range) and being overweight (BMI of 25). The WHO classifies individuals into three categories, depending on the health consequences of their weight. As explained above, individuals with a BMI below 18.5 are considered underweight, between 18.5 and 24.99 are considered normal weight, and over 25 considered overweight. In this context, what matters is belonging to one category or another, rather than small changes in BMI. To explore this issue, we define three dummy variables - overweight, normal weight, and underweight - that take the value of 1 when the BMI of an individual corresponds to that particular category and 0 otherwise.[24] Formally, we estimate the following expression:

$$Marital\ Dissolution_{it} = \gamma_1 + \gamma_2 BMI\_RANGE_{it-1} + \boldsymbol{\varphi X_{it}} + \varepsilon_{it} \qquad (2)$$

[24] For individuals who misreport their weight and who are categorized in the margin between one category and another, there can be some concerns as to whether they are in the right category. When we rerun our analysis excluding individuals in the margins (with the BMI of 18-19 and 24.5-25.5) of the categories, not only because of the potential misreporting problem but also because individuals can lie about their weight and can be in the wrong category, the results are maintained (Column 6 in Appendix B).

where BMI_RANGE is defined as overweight, normal weight, and underweight (reference category).

Our results are shown in Table 4, with Columns (1), (2), and (3) corresponding to the whole sample, men only, and women only, respectively. The inverse relationship to the probability of marital disruption is greater (in absolute value) only for overweight individuals than those who are underweight. When we divide the sample according to gender, this effect is observed only for women, reinforcing our previous conclusions on gender issues. The potential explanation (mentioned earlier) for this negative relationship would be applicable here.

Despite the fact that all of our results indicate a negative relationship between BMI and the probability of marital dissolution, our findings could vary depending on marriage duration. There are potential time-variant, unobserved determinants of marriage dissolution that were not previously taken into consideration, such as lifestyle changes, or life events that trigger changes associated with BMI and marriage dissolution. For example, young couples are more likely to be involved in raising children, who are highly time-demanding (in terms of care activities), which may decrease BMI, but children are also considered to be family public goods who increase the value of marriage, decreasing the probability of marital dissolution. For older couples, children are more likely to leave the nest, which reduces the amount of time spent caring for them, rendering the parents more sedentary (thus increasing their BMI), but the absence of children also decreases the value of marriage, if they are treated as public goods. Although we controlled for the presence of children, life events that vary depending on the duration of a marriage drive our results. It could also be suggested that for individuals who have spent many years married, physical appearance may be less important (in terms of dissolving the marriage) than for those who have only been married for a few years.

We explore this issue using a life table, which allows us to estimate the probability of survival to an additional year of marriage, based on whether individuals are overweight. We graph the output of the life table in Figure 7, where the probability of survival is represented for each category ($BMI \geq 25$ (overweight) and $BMI < 25$ (normal and underweight)). This figure indicates that overweight married individuals appear to have a greater probability of marital survival, regardless of marriage duration, compared with married individuals in the normal and underweight categories. Although the evolution of the probability of survival appears to be similar in both panels of Figure

7, we can reject that both are equivalent, in line with the results obtained after applying the likelihood ratio test for homogeneity. From this analysis, we conclude that overweight individuals are much more likely to remain married than those with a lower BMI, reinforcing our previous findings that BMI is inversely related to marital dissolution, regardless of the number of years married.

5.4.- Analysis by race

Our sample indicates that the prevalence of being overweight in the U.S. is unequally distributed among races, with Blacks being more affected than Hispanics or Whites. However, the self-perception of being overweight is more common in women than men and in Whites compared with Hispanics or Blacks (Paeratakul et al. 2002). These differences may lead us to suppose that BMI is differentially associated with the likelihood of marital dissolution depending on race, as we observed for women/men. For example, it may be surmised that the attractiveness of Whites (especially women) in the marriage market is more affected by high BMI since they are more aware of being overweight (and more penalized for being female). To examine this issue, we split the full sample according to race: Hispanics, Blacks, and Others. It should be noted that over 90% of marriages in the U.S. are formed by members of the same race (Lofquist et al. 2012) and so they should tolerate weight increases similarly.

The results are shown in Table 5, Columns (1) to (3), (4) to (6), and (7) to (9) for Hispanics, Blacks, and Others, respectively.[25] As expected, we find differences in the relationship between BMI and the probability of marital dissolution. For non-Hispanics and non-Blacks (which includes Whites), the inverse relationship is observed, but only for women. We do not observe this link for Hispanics. For Blacks, the gender pattern changes to Black men being more likely to be penalized in the remarriage market than Black women for issues related to BMI.

5.5.- Analysis by age at first marriage

The existing literature states that the greater the age at first marriage, the lower the probability of divorce (Lehrer 2008). It could be that our estimations capture the behavior of those who marry at earlier stages in their life. To tackle this issue, we create dummy variables for those who marry before 21, between 21 and 29 (reference group),

[25] We do not include the OLS results here, but our findings are maintained. These estimations are available upon request.

and older than 29 years old.[26] The results are shown in Table 6. The inverse relationship for the reference group is the same as for the whole sample, men, and women with the effect being greater for those who married before age 21, especially for women. However, we find the opposite relationship when we focus on those who married when older than 29. This may be related to the fact that those who marry at age 30 years and older do so with a higher BMI (which increases with age), with BMI being a less important factor in their marital dissolution decision.

5.6.- Endogeneity concerns and sample selection

Which came first, the chicken or the egg? We point to the possibility that BMI may affect the probability of marital dissolution. Nevertheless, as mentioned above, most of the prior literature suggests just the opposite: marital status or marital transitions (Averett et al. 2008; Averett at al. 2013; Wilson 2012) seem to impact BMI. Possible concerns about reverse causality are warranted, which are also explained (but without empirical analysis) in most of these papers. Averett et al. (2008) briefly discuss endogeneity concerns, indicating that they do not follow an instrumental variable approach because they are unable to identify an acceptable instrumental variable.

Although we are aware of the difficulties that an instrumental variable approach may generate - because finding appropriate instruments is challenging (Averett et al. 2008) - here we attempt to find acceptable instrumental variables to not limit our work to a descriptive analysis of the relationship between BMI and marital dissolution. Ideally, variables concerning healthy eating habits (e.g., counting food calories when shopping, following a balanced diet) and exercise habits (e.g., the number of days spent practicing any sport) could be acceptable instruments since they can impact BMI, but are possibly independent of the probability of marital dissolution. Unfortunately, this information is not available. Alternatively, we propose the use of lagged values of BMI as potential instruments since lagged values are less likely to be influenced by current shocks. In addition, we incorporate information on the date of the NLSY79 interviews as a potential instrumental variable. We define dummy variables for each season, and interact these dummy variables with BMI lagged in period t-2. Are they valid instruments? On the one hand, the BMI in period t-1 (the potential endogenous variable) correlates with the BMI in period t-2 because BMI is persistent over time and weight

[26] Because of data availability, we cannot create dummies for every age at first marriage.

change is a long-term process ("*most variation in BMI is due to differences across people, not changes over time*", Wilson 2012). Nevertheless, some auhtors suggest that there is a seasonal component in different variables that affect BMI, such as food and dietary intake, physical activity, and body weight (Shephard and Aoyagi 2009), and BMI itself. On the other hand, those instruments are unlikely to be correlated with the dependent variable (the probability of marital dissolution). We instrument BMI one year before individuals report their marital status, so the season in which the NLSY79 took place in year t-1 is unlikely to determine the marital status when the interview takes place in year t. In addition, as mentioned above, lagged values of BMI are less likely to be affected by current marital status. Note that there are considerable variations in the dates (seasons) in which the interviews take place, not only between individuals but also over time.[27]

The results are shown in Table 7A. There appears to be seasonality in BMI since the coefficients are slightly lower for those who complete the NLSY79 interview in autumn and winter (autumn for women). Of course, we recognize that the seasonal differences in BMI are small. We checked the validity of these instruments, applying a test for overidentifying restrictions (orthogonality conditions). We can conclude that the excluded instruments are valid, i.e., uncorrelated with the error term, and aptly excluded from the estimated equation. With respect to the main estimates, we show, again, the negative effect of lagged BMI (instrumented by the BMI in t-2 multiplied by the season of the interview of the lagged BMI) and the probability of marital disruption. When we split the sample by gender, we observe similar patterns. Since there can also be differences in the date of the interview in t-2 and t-1 that can generate variations in BMI, we also redefined our instrumental variables taking this into account (considering whether BMI was reported in the same season in both periods or in different seasons). The results are displayed in Table 7B and do not vary from the original estimation.

We provide additional estimates using other potential instrumental variables including the BMI measured one year before marriage. The BMI one year before marriage correlates with BMI over the rest of the marital life, so this variable meets the

[27] NLSY79 fielding periods were: January-August (1979-80), January-July (1981-82), January-June (1983-1985), February-July (1986), March-October (1987), June-December (1988-1991), May-December (1992), June-November (1993), June-December (1994), April-October (1996), March-September (1998), April 2000-January 2001 (2000), January-December (2002) January 2004-February 2005 (2004), January 2006-March 2007 (2006), January 2008-March 2009 (2008), December 2009-February 2011 (2010), and September 2012-September 2013 (2012). https://www.nlsinfo.org/content/cohorts/nlsy79/intro-to-the-sample/interview-methods

first prerequisite of being a valid instrument. With respect to the lack of correlation between this instrument and the likelihood of marital dissolution, both variables are unlikely related, due to the fact that this measure of BMI is from the pre-marriage period and, as such, is unlikely to predict the exact date of the marital dissolution. Of course, that BMI measured one year before could affect the probability of marrying and thus, divorcing. Therefore, this is not our preferred instrumental variable approach; nonetheless, it is reassuring that the results are maintained, as shown in Columns (1) and (2) of Table 7C.

Another concern is related to the fact that our sample is formed only for married individuals (which is obvious, given that we analyze the relationship between BMI and marital dissolution). However, that we include only people with that characteristic could generate a selection bias. For example, Averett et al. (2008) indicate that those in poor health have an incentive to marry (adverse selection). To address this issue, we extend our sample to include non-married individuals and estimate a two-stage Heckman selection model (Tobit Type II) for panel data with two distinct steps in the estimation. In the first step, we estimate a probit model in which the dependent variable is a dummy that takes value 1 for individuals who married at some point and 0 for those who never married. This probit model is estimated for each of the 21 years available for our sample, following Semykina and Wooldridge (2010), to correct for any potential selection bias. Thus, we calculate the probability of someone marrying at some point, which allows us to construct a new variable – the inverse Mills ratio (IMR). Then, we include the IMR as an explanatory variable in the second step to account for the aforementioned sample-selection problem. We also add the interaction between the IMR and annual time-fixed effects in the second step, as Semykina and Wooldridge (2010) describe. The results are shown in Table 8, in which an OLS model with fixed effects is applied that incorporates all of the previous controls. We observe that our main result, the negative correlation between BMI and the probability of marital dissolution, remains unchanged after addressing sample-selection concerns, which is reassuring.

6.- Conclusions

This paper examines the relationship between BMI and the likelihood of marital dissolution. Although much of the literature has focused on the effect of a change in relationship status on BMI (Averett et al. 2008), the opposite is also possible. This study contributes to the existing literature by exploring the association between BMI and marital dissolution. Following the existing research, we justify the need to identify the determinants of marital dissolution by the negative consequences incurred by the change in marital status, primarily for women and children (Amato 2000).

The aggregate data reveal a certain relationship between BMI and marital dissolution, but it can also be a spurious relationship. Surprisingly, the drop in the U.S. divorce rate since the early 1980s is concurrent with a considerable increase in the percentage of overweight individuals. This coincidence is not sufficient for us to deduce the potential relationship between BMI and the marital dissolution decisions of individuals in the U.S. The aggregate data are not particularly useful for our work.

In the present study, we consider microdata from the NLSY79 to investigate the association between BMI and the likelihood of marital dissolution. First, we estimate simple specifications that point to a negative relationship: the higher the BMI, the lower the probability of marital dissolution. Further analysis shows that this inverse link is sensitive to the respondent's gender, race, and age at first marriage.

The potential explanations for this negative relationship are related to the reduction of out-of-marriage options when BMI increases, which may also explain the gender-based differences. An increase in BMI can decrease the attractiveness of individuals in the marriage market, which makes it more difficult to find a new partner if they decide to dissolve their marriage. This is important in the U.S., where divorce/separation can be considered a transition period from one marriage to the next given that the percentage of individuals who remarry after a divorce is particularly high. In addition, the expected health problems that high levels of BMI can generate can also contribute to the inverse link between BMI and the likelihood of marital disruption since spouses are usually those who care for each other; then, living without a partner would not be attractive for individuals with health problems.

Despite the robustness of our results, the magnitude of the negative association is small. A significant increase in BMI is necessary before we can observe a meaningful change in the likelihood of marital dissolution. That significant increase may correspond with, for example, passing from being normal to being overweight. For that reason, we examine the importance of being overweight, normal weight, and underweight in terms of the likelihood of marital dissolution. We find that the negative association is observed for the overweight, taking as reference the underweight. The survival analysis, which allows us to explore whether there are differences associated with marriage duration, also indicates that overweight individuals show a negative link to the probability of marital dissolution. In any case, these results provide additional evidence in support of our previous explanations.

We study the inverse relationship within different races. This is warranted since Blacks are more likely to be overweight than Hispanics and Others, and Whites more often perceive themselves as overweight. Our results suggest that race plays a role in the relationship between BMI and the probability of marital dissolution, with non-Hispanics and non-Blacks clearly showing this negative relationship (for women). This is also true to a lesser extent among Blacks while there is no empirical evidence for Hispanics.

Finally, we consider the implementation of an instrumental variable approach. We recognize that this analysis is tricky and has not been applied by other authors because of the difficulties in finding reliable instruments (Averett et al. 2008). We make use of the seasonality component of BMI to define our instrumental variables through the date in which the NLSY79 is completed every year. Since there is considerable variation in those dates across individuals and over time, it is unlikely to be correlated with our dependent variable, the likelihood of marital dissolution, taking into account that BMI is measured one year before individuals report their marital status. We also use other instruments, and, in all of the cases tested, the results point to a negative impact of BMI on marital dissolution. Although having a high BMI appears to deter marital dissolution, this is not without cost because individuals with a high BMI have to compensate their partners to not divorce/separate. This implies a loss of bargaining power for individuals with a high BMI in marriage, especially for married women who are more ostracized as a consequence of their BMI in the remarriage market. This is not a minor economic issue since it implies a loss in the bargaining power among the individuals with high BMIs in consumption and time-allocation decisions within marriage.

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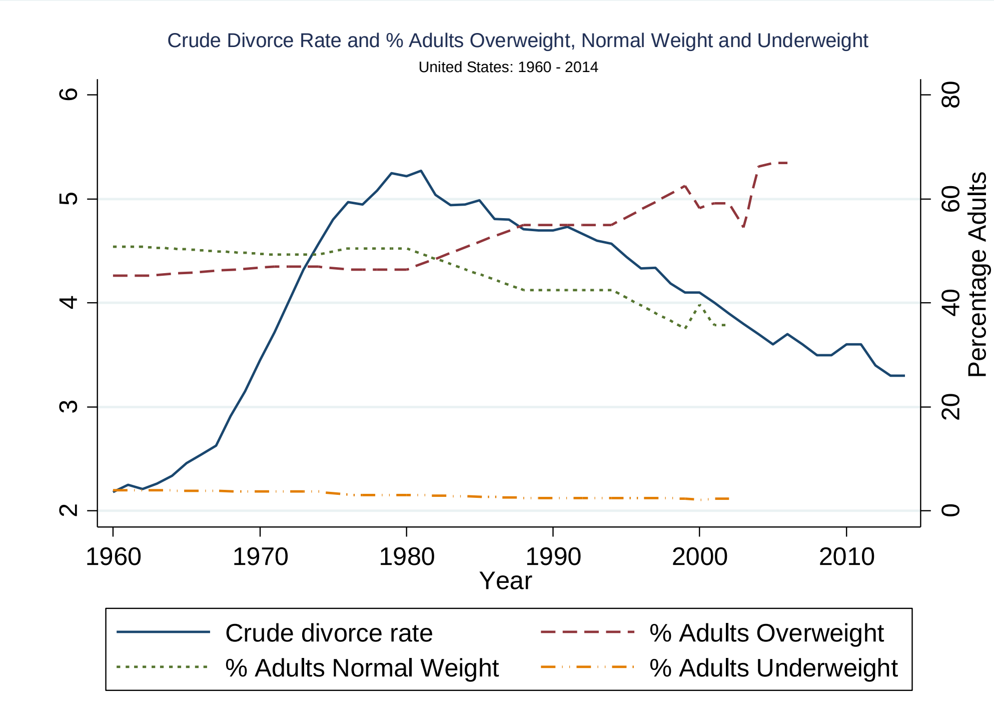
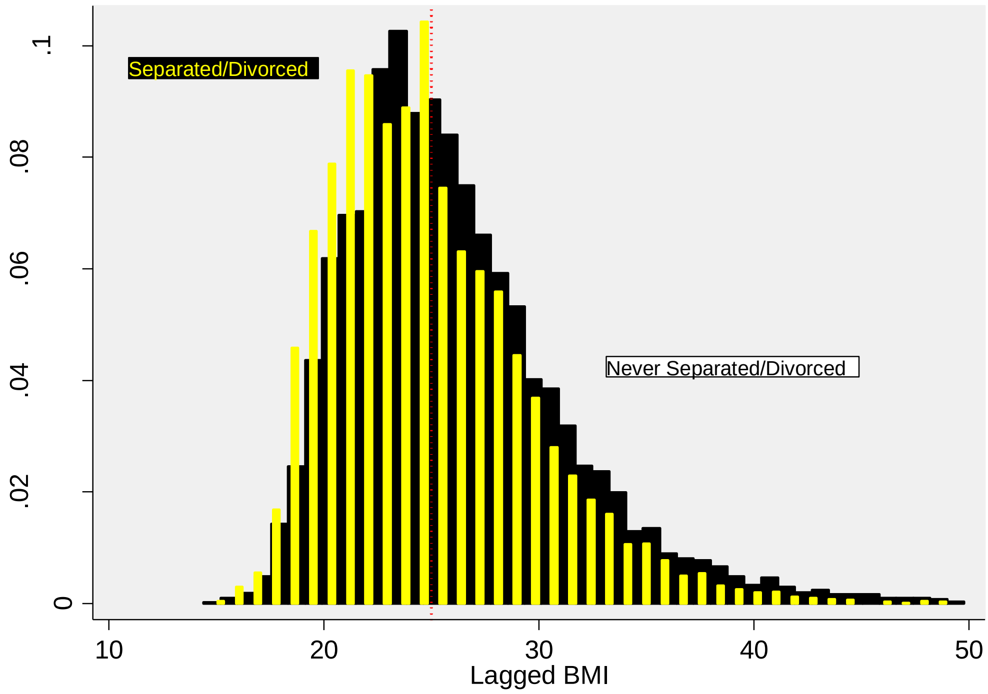
Figure 1.- Crude Divorce Rate and Percentage of Adults Classified as Overweight, Normal Weight, and Underweight

(United States. Sample: 1960 – 2014)



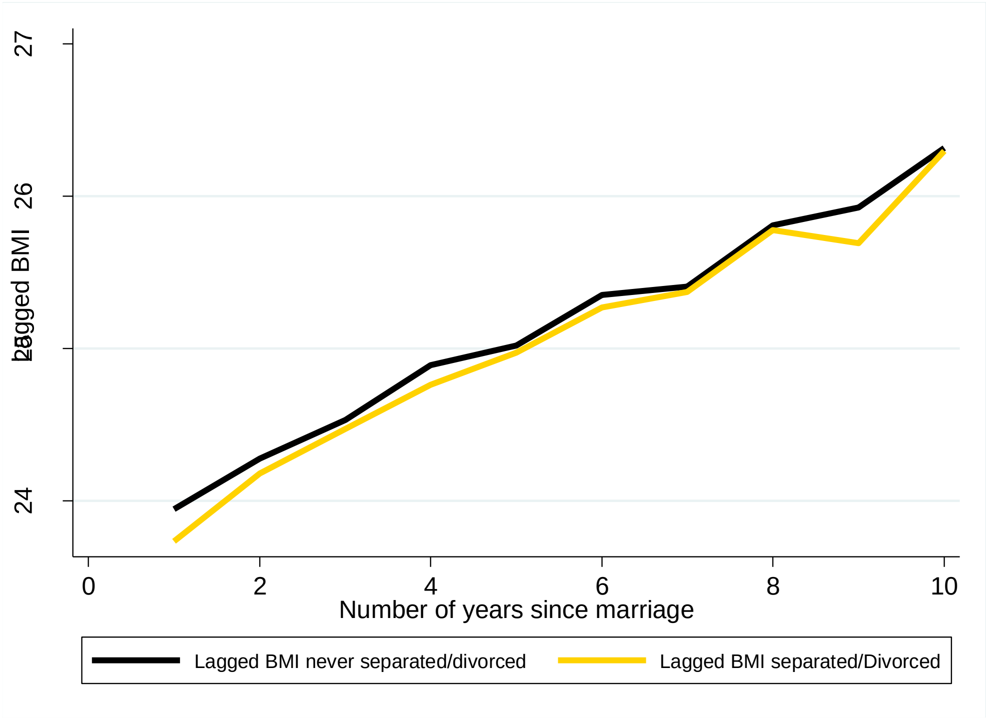
Notes: US Crude Divorce Rate, 1960-2014. Crude Divorce Rate is defined as the annual number of divorces per 1,000 mid-year population. Data come from the Demographic Yearbook (several issues) and the US Census Bureau. Data on the percentage of adults classified as overweight, normal weight, or underweight come from the WHO and are only available until 2006 for overweight individuals, and until 2002 for normal and underweight individuals.

Figure 2.- Histograms
(Separated/Divorced vs. Never Separated/Divorced)



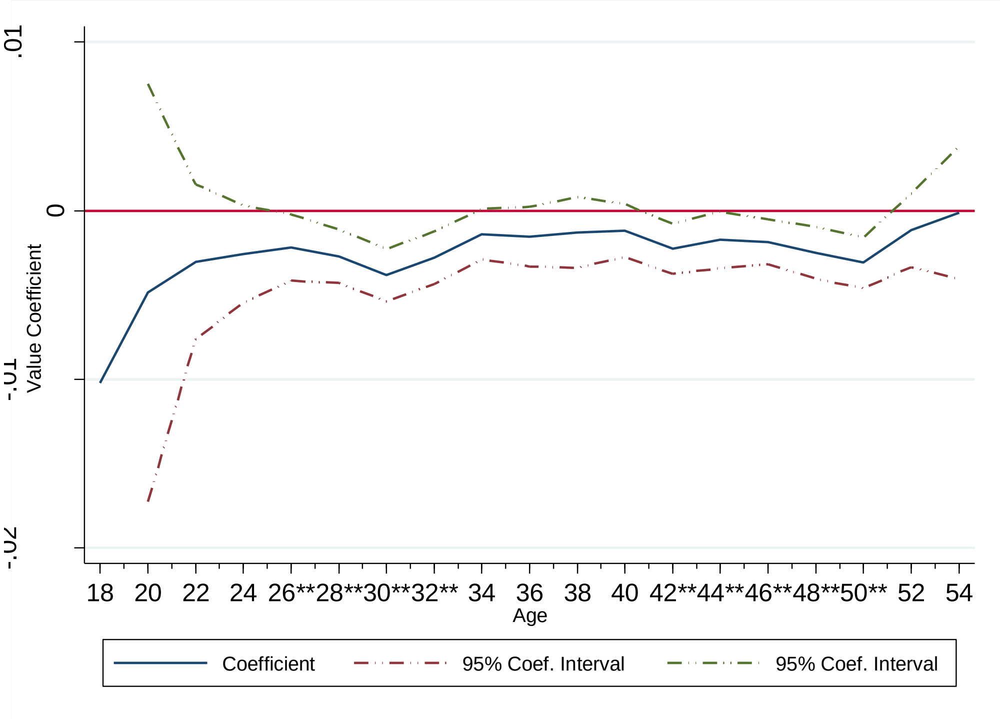
Notes: Data were obtained from the NLSY79 for the period 1982 to 2012. Reference line at lagged BMI = 25

Figure 3.- Lagged BMI by duration of marriage



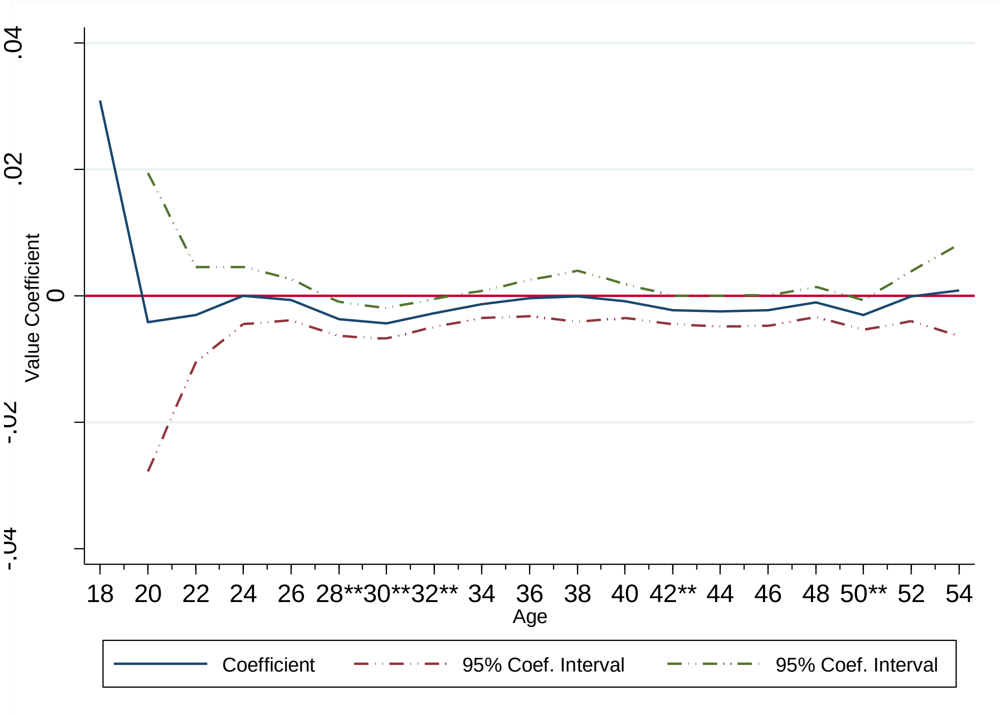
Notes: Data were obtained from the NLSY79 for the period 1982 to 2012.

Figure 4.- Results of regression by age of respondent. Whole Sample



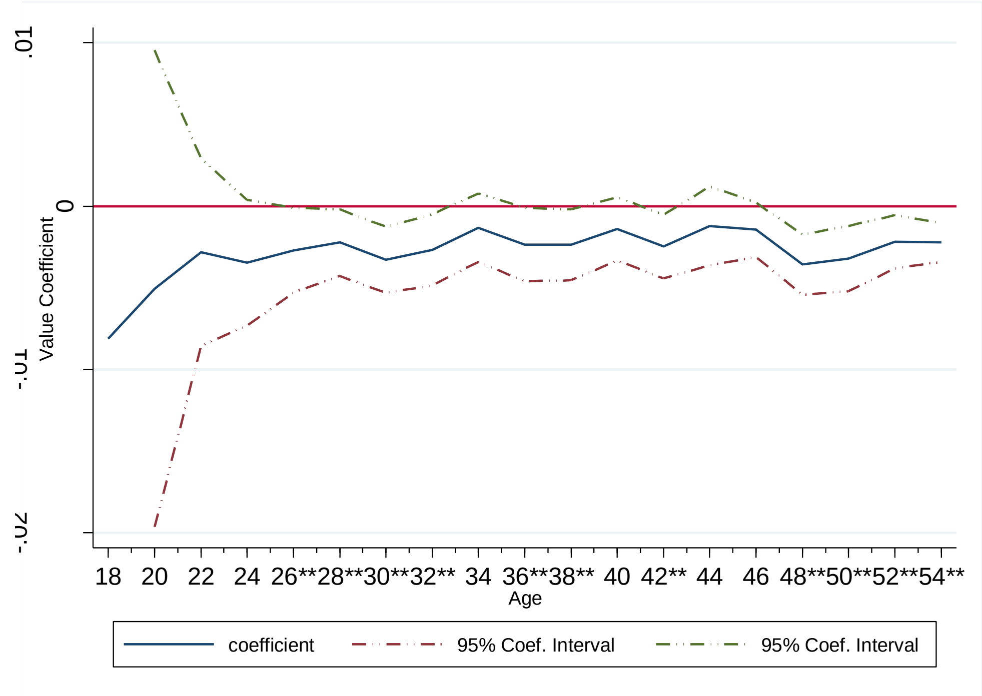
Coefficients statistically significant at 5% show the superscript **.

Figure 5.- Results of regression by age of respondent. Sample: Men



Coefficients statistically significant at 5% show the superscript **.

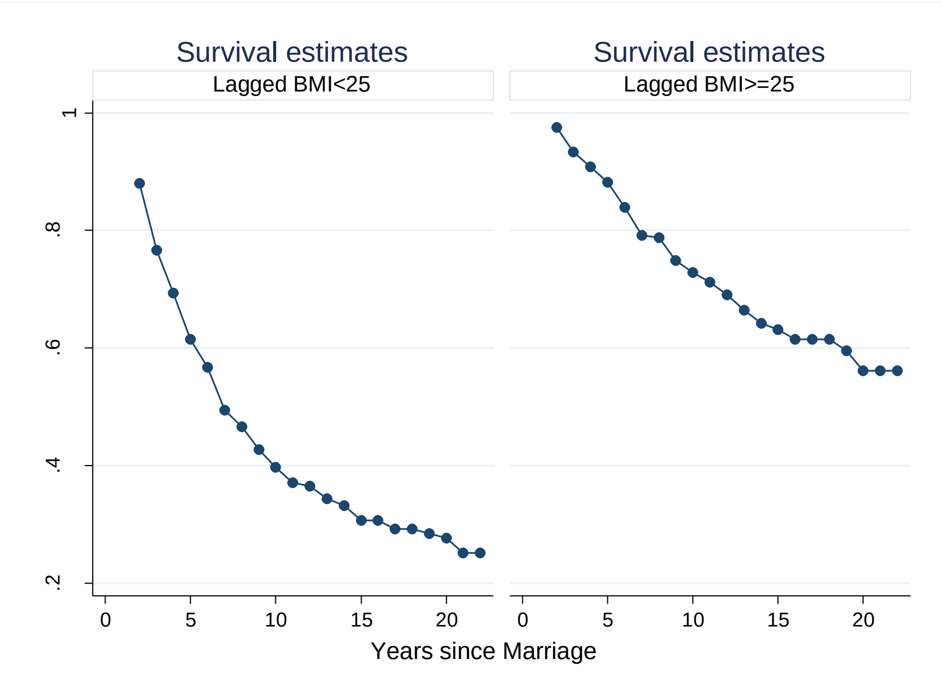
Figure 6.- Results of regression by age of respondent. Sample: Women



Coefficients statistically significant at 5% show the superscript **.

Figure 7.-Survival analysis by duration of marriage:

(Overweight (Lagged BMI>=25) vs. Others (Lagged BMI<25))



Notes: These estimates are statistically significant at the 5% level. The likelihood ratio test of homogeneity rejects the null hypothesis that the failure function is equivalent across individuals who do and do not report being overweight. The log-rank test for quality rejects the null at the 1% level.

Table 1.- Summary Statistics: Main Sample

Variables	Mean			Std. deviation	Min.	Max.
Sample	All	Men	Women	All	All	All
Lagged BMI	25.723	26.487	24.927	4.946	14.4	49.8
Overweight (%)	0.499	0.598	0.397	0.500	0	1
Normal Weight (%)	0.477	0.397	0.561	0.499	0	1
Underweight (%)	0.023	0.006	0.041	0.150	0	1
Men	0.510	1	0	0.500	0	1
Age	34.195	34.653	33.717	7.947	19	55
Age at first marriage	23.989	24.442	23.517	3.441	16	36
Same age (couple)	0.788	0.772	0.806	0.408	0	1
Number of children conceived out of marriage	0.341	0.345	0.337	0.671	0	8
Number of children conceived within marriage	1.274	1.273	1.274	1.094	0	10
Pregnant	0.036	0	0.074	0.187	0	1
Father in household in 1979	0.733	0.725	0.741	0.442	0	1
Education: less than high school	0.088	0.110	0.064	0.283	0	1
Education: high school	0.391	0.409	0.372	0.488	0	1
Education: college	0.233	0.206	0.262	0.423	0	1
Education: more than college	0.288	0.274	0.302	0.453	0	1
Spouse´s education: less than high school	0.104	0.101	0.108	0.306	0	1
Spouse´s education: high school	0.392	0.408	0.376	0.488	0	1
Spouse´s education: college	0.233	0.236	0.229	0.423	0	1
Spouse´s education: more than college	0.270	0.255	0.287	0.444	0	1
Race: Hispanic	0.174	0.182	0.166	0.379	0	1
Race: Black	0.183	0.181	0.186	0.387	0	1
Race: other	0.642	0.637	0.648	0.479	0	1
Observations/Respondents	45,598/5,139	23,258/2,658	22,340/2,481			

Table 2.- Summary Statistics: 'Divorced or Separated' – 'Intact marriage'

Variables	'Divorced Separated' subsample	'Divorced Separated' subsample	'Divorced Separated' subsample	'Intact marriage' subsample	'Intact marriage' subsample	'Intact marriage' subsample
Sample	All	Men	Women	All	Men	Women
Observations/respondents	10,445	5,110	5,335	35,153	18,148	17,005
Respondents	1,978	990	988	3,161	1,668	1,493
Mean age at marital dissolution	31.11	31.38	30.84	-	-	-
Mean age at first marriage	23.18	23.62	22.75	24.23	24.67	23.76
Mean Lagged BMI	24.89	25.71	24.11	25.97	26.71	25.18
Mean children conceived out of marriage	0.53	0.49	0.56	0.29	0.30	0.27
Mean children conceived within marriage	0.93	0.95	0.91	1.38	1.36	1.39
% with less than high school	13.87	16.22	11.62	7.26	9.57	4.8
% with high school	48.28	50.1	46.54	36.36	38.32	34.27
% with college	22.85	19.84	25.74	23.49	20.81	26.35
% with more than college	14.99	13.84	16.1	32.88	31.30	34.57
% with spouse less than high school	15.42	14.32	16.48	8.96	8.87	9.06
% with spouse high school	48.18	50.31	46.13	36.59	38.11	34.97
% with spouse college	21.70	22.62	20.82	23.73	23.94	23.52
% with spouse more than college	14.70	12.74	16.57	30.71	29.08	32.46
% with father in household in 1979	68.18	68.32	68.04	74.86	73.74	76.05
% pregnant	4.11	0	8.04	3.48	0	7.19
% race: Black	26.11	28.02	24.27	16.03	15.27	16.84
% race: Hispanic	19.66	19.88	19.44	16.75	17.72	15.72
% race: Other	54.24	52.09	56.29	67.22	67.01	67.44

Table 3.- Baseline Regression Results

	OLS (1)	Fixed Effects (2)	OLS (3)	Fixed Effects (4)	OLS (5)	Fixed Effects (6)
	Whole Sample		Sample: Men		Sample: Women	
Lagged BMI	-0.001***	-0.002***	-0.001**	-0.001	-0.001***	-0.002***
	(0.0002)	(0.001)	(0.0003)	(0.001)	(0.0003)	(0.001)
Men	-0.002					
	(0.002)					
Age	-0.004***	0.029***	-0.005***	0.027***	-0.003*	0.032***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age squared/100	0.005***	-0.034***	0.006***	-0.031***	0.004	-0.037***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Age at first marriage	-0.001		-0.001		-0.001	
	(0.0004)		(0.001)		(0.001)	
Same age	-0.011***		-0.012***		-0.009**	
	(0.003)		(0.004)		(0.004)	
Children before marriage	0.013***		0.006*		0.020***	
	(0.002)		(0.003)		(0.004)	
Children within marriage	-0.008***	-0.013***	-0.007***	-0.010***	-0.008***	-0.016***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Pregnant	-0.029***	-0.006*			-0.028***	-0.006*
	(0.004)	(0.004)			(0.004)	(0.004)
Father in household in 1979	-0.007***		-0.004		-0.010**	
	(0.003)		(0.004)		(0.004)	
Less than high school	0.023***	-0.041*	0.018**	-0.031	0.028***	-0.051
	(0.006)	(0.024)	(0.008)	(0.029)	(0.010)	(0.042)
High school	0.012***	0.010	0.009**	0.020	0.014***	-0.002
	(0.003)	(0.012)	(0.004)	(0.012)	(0.004)	(0.021)
College	0.006**	0.014**	0.003	0.017**	0.008**	0.010
	(0.003)	(0.007)	(0.004)	(0.008)	(0.004)	(0.012)
Spouse: less than high school	0.013**	-0.007	0.019**	-0.014	0.010	0.0003
	(0.005)	(0.011)	(0.008)	(0.015)	(0.007)	(0.017)
Spouse: high school	0.007***	0.002	0.011***	-0.002	0.004	0.008
	(0.003)	(0.009)	(0.004)	(0.012)	(0.004)	(0.012)
Spouse: college	0.006**	0.001	0.013***	0.0002	-0.003	0.002
	(0.003)	(0.007)	(0.004)	(0.010)	(0.004)	(0.010)
Race: Hispanic	-0.001		-0.001		-0.002	
	(0.003)		(0.004)		(0.005)	
Race: Black	0.018***		0.022***		0.016***	
	(0.004)		(0.005)		(0.005)	
Individual fixed effects	NO	YES	NO	YES	NO	YES
Cohort fixed effects	YES	NO	YES	NO	YES	NO
Region fixed effects	YES	YES	YES	YES	YES	YES
Observations	45,598	45,598	23,258	23,258	22,340	22,340
Number of respondents	5,139	5,139	2,658	2,658	2,481	2,481

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table 4.- Individuals Classified by BMI Category

	(1)	(2)	(3)
	Whole Sample	Sample: Men	Sample: Women
Overweight	-0.018*	0.016	-0.027**
	(0.010)	(0.025)	(0.012)
Normal	-0.008	0.021	-0.012
	(0.010)	(0.025)	(0.011)
Age	0.029***	0.027***	0.031***
	(0.002)	(0.002)	(0.002)
Age squared/100	-0.033***	-0.031***	-0.036***
	(0.002)	(0.003)	(0.003)
Number children conceived within marriage	-0.013***	-0.010***	-0.015***
	(0.002)	(0.002)	(0.003)
Pregnant	-0.006*		-0.007*
	(0.004)		(0.004)
Less than high school	-0.040*	-0.032	-0.049
	(0.024)	(0.029)	(0.041)
High school	0.010	0.020	-0.001
	(0.012)	(0.012)	(0.021)
College	0.014**	0.017**	0.010
	(0.007)	(0.008)	(0.012)
Spouse: less than high school	-0.008	-0.014	-0.001
	(0.011)	(0.015)	(0.017)
Spouse: high school	0.002	-0.002	0.008
	(0.009)	(0.012)	(0.012)
Spouse: college	0.001	-0.0003	0.002
	(0.007)	(0.010)	(0.010)
Individual fixed effects	YES	YES	YES
Cohort fixed effects	NO	NO	NO
Region fixed effects	YES	YES	YES
Observations	45,598	23,258	22,340
Number of respondents	5,139	2,658	2,481

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table 5.- Individuals Classified by Race

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Race: Hispanic			Race: Black			Race: Other		
	Whole sample	Sample: Men	Sample: Women	Whole sample	Sample: Men	Sample: Women	Whole sample	Sample: Men	Sample: Women
Lagged BMI	-0.001	-0.002	0.0001	-0.004**	-0.005*	-0.003	-0.002***	-0.001	-0.002***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)
Age	0.034***	0.035***	0.033***	0.048***	0.056***	0.043***	0.027***	0.024***	0.030***
	(0.004)	(0.005)	(0.006)	(0.004)	(0.006)	(0.006)	(0.002)	(0.002)	(0.003)
Age squared/100	-0.039***	-0.040***	-0.038***	-0.056***	-0.064***	-0.051***	-0.031***	-0.028***	-0.035***
	(0.005)	(0.006)	(0.007)	(0.005)	(0.007)	(0.007)	(0.002)	(0.003)	(0.003)
Number children within marriage	-0.017***	-0.016***	-0.019***	-0.017***	-0.019**	-0.017***	-0.011***	-0.008***	-0.015***
	(0.004)	(0.005)	(0.006)	(0.005)	(0.007)	(0.007)	(0.002)	(0.002)	(0.003)
Pregnant	0.002		0.002	-0.020*		-0.026**	-0.006		-0.006
	(0.010)		(0.011)	(0.011)		(0.011)	(0.004)		(0.004)
Less than high school	-0.019	-0.008	-0.038	-0.058	-0.038	-0.083	-0.039	-0.036	-0.041
	(0.034)	(0.041)	(0.056)	(0.053)	(0.079)	(0.068)	(0.030)	(0.034)	(0.056)
High school	-0.004	-0.020	0.016	-0.006	0.022	-0.030	0.014	0.022*	0.003
	(0.022)	(0.026)	(0.035)	(0.028)	(0.045)	(0.036)	(0.013)	(0.013)	(0.026)
College	0.013	0.012	0.011	0.024	0.043*	0.011	0.013*	0.014*	0.011
	(0.011)	(0.010)	(0.019)	(0.017)	(0.026)	(0.023)	(0.008)	(0.008)	(0.014)
Spouse: less than high school	0.010	0.028	-0.021	-0.009	-0.014	0.021	-0.008	-0.017	0.001
	(0.025)	(0.028)	(0.042)	(0.027)	(0.036)	(0.042)	(0.013)	(0.018)	(0.019)
Spouse: high school	0.024	0.044*	-0.008	0.010	-0.006	0.052*	0.0004	-0.004	0.005
	(0.021)	(0.024)	(0.031)	(0.018)	(0.024)	(0.027)	(0.010)	(0.014)	(0.013)
Spouse: college	0.019	0.018	0.023	0.0003	-0.010	0.031*	-0.001	-0.00001	-0.002
	(0.016)	(0.017)	(0.026)	(0.016)	(0.023)	(0.017)	(0.008)	(0.011)	(0.012)
Individual fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cohort fixed effects	NO	NO	NO	NO	NO	NO	NO	NO	NO
Region fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	7,942	4,232	3,710	8,362	4,203	4,159	29,294	14,823	14,471
Number of respondents	834	443	391	1,095	568	527	3,210	1,647	1,563

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table 6.- Interaction with Age at First Marriage

	OLS (1)	Fixed Effects (2)	OLS (3)	Fixed Effects (4)	OLS (5)	Fixed Effects (6)
	Whole Sample		Sample: Men		Sample: Women	
Lagged BMI	-0.001***	-0.002***	-0.001**	-0.001	-0.001***	-0.002***
	(0.0002)	(0.001)	(0.0004)	(0.001)	(0.0003)	(0.001)
Married before 21	0.046**		0.013		0.058***	
	(0.018)		(0.036)		(0.021)	
Lagged BMI x Married before 21	-0.001*	-0.003**	-0.000005	-0.002	-0.002**	-0.004**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Married after 29	-0.012		0.007		-0.029	
	(0.019)		(0.026)		(0.027)	
Lagged BMI x Married after 29	0.001	0.006***	-0.000	0.006**	0.001	0.006***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Men	-0.002					
	(0.002)					
Age	-0.003***	0.031***	-0.005***	0.028***	-0.002	0.033***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age squared/100	0.004**	-0.035***	0.006**	-0.032***	0.002	-0.039***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Same age	-0.010***		-0.012***		-0.009**	
	(0.003)		(0.004)		(0.004)	
Children before marriage	0.012***		0.006*		0.019***	
	(0.002)		(0.003)		(0.004)	
Children within marriage	-0.008***	-0.013***	-0.007***	-0.011***	-0.008***	-0.016***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)
Pregnant	-0.029***	-0.006*			-0.027***	-0.006*
	(0.004)	(0.004)			(0.004)	(0.004)
Father in household in 1979	-0.007***		-0.005		-0.010**	
	(0.003)		(0.004)		(0.004)	
Less than high school	0.022***	-0.043*	0.017**	-0.032	0.026***	-0.054
	(0.006)	(0.024)	(0.008)	(0.029)	(0.010)	(0.041)
High school	0.011***	0.009	0.009**	0.019	0.013***	-0.002
	(0.003)	(0.012)	(0.004)	(0.012)	(0.004)	(0.021)
College	0.006**	0.014**	0.003	0.017**	0.007**	0.011
	(0.003)	(0.007)	(0.004)	(0.008)	(0.004)	(0.012)
Spouse: less than high school	0.012**	-0.008	0.017**	-0.014	0.009	-0.001
	(0.005)	(0.011)	(0.008)	(0.015)	(0.007)	(0.017)
Spouse: high school	0.007**	0.002	0.011***	-0.001	0.003	0.007
	(0.003)	(0.009)	(0.004)	(0.012)	(0.004)	(0.012)
Spouse: college	0.005**	0.001	0.013***	0.001	-0.003	0.001
	(0.003)	(0.007)	(0.004)	(0.010)	(0.004)	(0.011)
Race: Hispanic	-0.001		-0.001		-0.002	
	(0.003)		(0.004)		(0.005)	
Race: Black	0.019***		0.022***		0.016***	
	(0.004)		(0.005)		(0.005)	
Individual fixed effects	NO	YES	NO	YES	NO	YES
Cohort fixed effects	YES	NO	YES	NO	YES	NO
Region fixed effects	YES	YES	YES	YES	YES	YES
Observations	45,598	45,598	23,258	23,258	22,340	22,340
Number of respondents	5,139	5,139	2,658	2,658	2,481	2,481

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table 7A.- Instrumental Variable Approach (Season)

	First Stage	IV Estimation	First Stage	IV Estimation	First Stage	IV Estimation
	Whole Sample		Sample: Men		Sample: Women	
Lagged BMI		-0.001***		-0.001**		-0.001**
		(0.0004)		(0.001)		(0.001)
Two lag BMI * Spring	0.828***		0.844***		0.811***	
	(0.003)		(0.004)		(0.005)	
Two lag BMI * Summer	0.827***		0.843***		0.811***	
	(0.003)		(0.004)		(0.005)	
Two lag BMI * Autumn	0.825***		0.844***		0.803***	
	(0.003)		(0.004)		(0.005)	
Two lag BMI * Winter	0.825***		0.844***		0.811***	
	(0.003)		(0.004)		(0.005)	
Observations	40,459	40,459	20,600	20,600	19,859	19,859
Number of respondents	4,690	4,690	2,418	2,418	2,272	2,272

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively. The estimates include the same explanatory variables than previous regressions

Table 7B.- Instrumental Variable Approach (Same Seasons)

	First Stage	IV Estimation	First Stage	IV Estimation	First Stage	IV Estimation
	Whole Sample		Sample: Men		Sample: Women	
Lagged BMI		-0.001***		-0.001**		-0.001**
		(0.000)		(0.001)		(0.001)
BMI(t-2) * (lag:W/Sp; Two lags:Su/A)	0.828***		0.844***		0.810***	
	(0.003)		(0.004)		(0.005)	
BMI(t-2) * (lag:Su/A; Two lags:W/Sp)	0.829***		0.844***		0.812***	
	(0.003)		(0.004)		(0.005)	
BMI(t-2) * same (Su/A)	0.826***		0.843***		0.808***	
	(0.003)		(0.004)		(0.005)	
BMI(t-2) * same (W/Sp)	0.828***		0.844***		0.812***	
	(0.003)		(0.004)		(0.005)	
Observations	40,459	40,459	20,600	20,600	19,859	19,859
Number of respondents	4,690	4,690	2,418	2,418	2,272	2,272

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively. The estimates include the same explanatory variables than previous regressions. W: Winter; Sp: Spring; Su: Summer; A: Autumn.

Table 7C.- Instrumental Variable Approach (BMI before first marriage)

	First Stage	IV Estimation
Lagged BMI		-0.002***
		(0.001)
BMI before first marriage	1.051***	
	(0.006)	
Observations	45,598	45,598
Number of respondents	5,139	5,139

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively. The estimates include the same explanatory variables than previous regressions

Table 8.- Sample Selection Results

	OLS (1)	OLS (2)	OLS (3)
	Whole sample	Men	Women
Lagged BMI	-0.001***	-0.001**	-0.001***
	(0.0002)	(0.0003)	(0.0003)
Observations	44,916	23,043	21,873
Number of respondents	5,052	2,632	2,420

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively. The estimates include the same explanatory variables than previous regressions

Appendix A.- Logit Models

	Logistic (1)	Panel Logistic (2)	Logistic (3)	Panel Logistic (4)	Logistic (5)	Panel Logistic (6)
	Whole Sample		Sample: Men		Sample: Women	
Lagged BMI	-0.025***	-0.037***	-0.018*	-0.032***	-0.032***	-0.039***
	(0.007)	(0.007)	(0.011)	(0.010)	(0.009)	(0.009)
Men	-0.040	-0.010				
	(0.059)	(0.060)				
Age	-0.018	0.119**	-0.050	0.101	0.009	0.118*
	(0.039)	(0.050)	(0.058)	(0.072)	(0.052)	(0.070)
Age squared/100	-0.008	-0.157***	0.030	-0.140	-0.036	-0.151*
	(0.053)	(0.061)	(0.078)	(0.088)	(0.071)	(0.086)
Age at first marriage	-0.020	-0.071***	-0.018	-0.078***	-0.026	-0.062**
	(0.012)	(0.019)	(0.018)	(0.027)	(0.017)	(0.027)
Same age	-0.280***	-0.299***	-0.325***	-0.297***	-0.226**	-0.316***
	(0.070)	(0.071)	(0.108)	(0.101)	(0.098)	(0.101)
Children before marriage	0.193***	0.199***	0.094	0.066	0.285***	0.292***
	(0.041)	(0.041)	(0.066)	(0.060)	(0.053)	(0.058)
Children within marriage	-0.305***	-0.358***	-0.299***	-0.348***	-0.322***	-0.369***
	(0.039)	(0.039)	(0.055)	(0.053)	(0.056)	(0.059)
Pregnant	-1.059***	-0.780***			-1.038***	-0.765***
	(0.226)	(0.179)			(0.230)	(0.181)
Father in household in 1979	-0.189***	-0.250***	-0.113	-0.217**	-0.261***	-0.256***
	(0.068)	(0.065)	(0.097)	(0.090)	(0.096)	(0.094)
Less than high school	0.592***	0.788***	0.510***	0.666***	0.630***	0.852***
	(0.130)	(0.130)	(0.185)	(0.177)	(0.188)	(0.191)
High school	0.446***	0.680***	0.360**	0.630***	0.516***	0.692***
	(0.099)	(0.102)	(0.147)	(0.145)	(0.133)	(0.143)
College	0.301***	0.540***	0.206	0.517***	0.365***	0.535***
	(0.100)	(0.101)	(0.152)	(0.148)	(0.136)	(0.138)
Spouse: less than high school	0.422***	0.513***	0.593***	0.632***	0.307*	0.426**
	(0.125)	(0.122)	(0.194)	(0.179)	(0.164)	(0.167)
Spouse: high school	0.320***	0.353***	0.483***	0.404***	0.183	0.319**
	(0.098)	(0.097)	(0.154)	(0.142)	(0.127)	(0.133)
Spouse: college	0.274***	0.230**	0.552***	0.324**	-0.002	0.129
	(0.102)	(0.098)	(0.152)	(0.140)	(0.140)	(0.137)
Race: Hispanic	0.007	0.008	0.018	0.008	-0.024	0.009
	(0.079)	(0.085)	(0.112)	(0.117)	(0.116)	(0.122)
Race: Black	0.375***	0.492***	0.457***	0.601***	0.311***	0.397***
	(0.076)	(0.083)	(0.108)	(0.113)	(0.107)	(0.120)
Individual fixed effects	NO	NO	NO	NO	NO	NO
Cohort fixed effects	YES	YES	YES	YES	YES	YES
Region fixed effects	YES	YES	YES	YES	YES	YES
Observations	45,598	45,598	23,258	23,258	22,340	22,340
Number of respondents	5,139	5,139	2,658	2,658	2,481	2,481

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Appendix B.- Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
	Whole Sample	Whole Sample	Individuals with children	Individuals reporting income and employment status	Women reporting employment status	Without those with a BMI of 18-19 and 24.5-25.5
Lagged BMI	-0.006**		-0.002***	-0.002**	-0.003***	-0.002***
	(0.002)		(0.001)	(0.001)	(0.001)	(0.001)
Lagged BMI squared/100	0.006					
	(0.004)					
Log of Lagged BMI		-0.055***				
		(0.014)				
Age	0.029***	0.029***	0.023***	0.042***	0.051***	0.027***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)
Age squared/100	-0.034***	-0.034***	-0.030***	-0.049***	-0.063***	-0.031***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.002)
Children within marriage	-0.013***	-0.013***	0.003	-0.021***	-0.023***	-0.012***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Pregnant	-0.006*	-0.006*	-0.011**	-0.008*	-0.005	-0.003
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
Less than high school	-0.041*	-0.041*	-0.037	0.014	-0.054	-0.026
	(0.024)	(0.024)	(0.025)	(0.030)	(0.058)	(0.022)
High school	0.010	0.010	0.009	0.033*	0.011	0.007
	(0.012)	(0.012)	(0.014)	(0.019)	(0.028)	(0.012)
College	0.014**	0.014**	0.013	0.043***	0.023	0.013*
	(0.007)	(0.007)	(0.009)	(0.011)	(0.015)	(0.007)
Spouse: less than high school	-0.008	-0.007	-0.009	-0.041**	-0.003	-0.007
	(0.011)	(0.011)	(0.012)	(0.018)	(0.020)	(0.012)
Spouse: high school	0.002	0.002	0.009	-0.018	0.003	-0.001
	(0.009)	(0.009)	(0.009)	(0.015)	(0.015)	(0.009)
Spouse: college	0.001	0.001	0.003	-0.035**	-0.001	-0.002
	(0.007)	(0.007)	(0.008)	(0.014)	(0.015)	(0.008)
Months youngest child/10			0.003***			
			(0.001)			
% hh. income				0.252***		
				(0.015)		
Household income				-0.033***		
				(0.005)		
Employed				-0.024***	0.009*	
				(0.005)	(0.005)	
Individual fixed effects	YES	YES	YES	YES	YES	YES
Cohort fixed effects	NO	NO	NO	NO	NO	NO
Region fixed effects	YES	YES	YES	YES	YES	YES
Observations	45,598	45,598	35,722	23,462	17,011	40,806

Number of respondents	5,139	5,139	4,121	4,682	2,478	5,029

Notes: ***, **, * Significant at the 1%, 5%, 10% level, respectively.