# On the relationship between BMI and marital dissolution

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**Abstract**

The evolution of marital dissolutions has prompted researchers and policymakers to study their causes and consequences. While the effects of changes in the relationship status on the Body Mass Index (BMI) have been thoroughly documented (Selection, Protection, Social Obligation, and Marriage Market hypotheses), much less work has been done to analyze the impact of changes in the BMI on the probability of marital dissolution. We take advantage of the richness of the data on (pre) marital and biological history from the National Longitudinal Survey of Youth 79 (NLSY79) to estimate the effect of BMI on marital stability, following an Instrumental Variable approach. We find a small, but statistically-significant, negative effect of this indicator of health on the likelihood of marital dissolution. Supplemental analysis reveals that this effect depends on the category to which people belong according to their BMI (underweight, normal weight, and overweight-obese), and on their race.

**Keywords:** Body Mass Index, Health, Divorce, Family economics

**JEL:** I1, J12

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## 1.- Introduction

Although some authors consider that the data on marital dissolution in recent years, provided by both vital statistics and retrospective survey data, understate the true marital instability (Kennedy and Ruggles 2014), a decreasing trend has been maintained in recent decades in several developed countries. As can be seen for the divorce rate in the US, this has been the case since the early 1980s (Figure 1).[4] In spite of this decreasing trend, about 20% of white Americans between the ages of 50 and 59 have gone through a divorce (Bellido et al. 2016), which represents a substantial percentage of the US population. This supposes a worrying situation because of the economic and social consequences of experiencing a divorce or a separation, for both parents and their children, which have been fully documented (see Amato 2000 for a review). For example, Smock (1994) found a negative effect of marital dissolution on the wellbeing of both young men and women, but with this being worse for women regardless of their ethnic group. In a more extensive analysis of the consequences of divorce, Gruber (2004) showed that those who were exposed to the unilateral divorce laws were more likely to have lower levels of education, lower family incomes, a greater likelihood of separation, and higher odds of committing suicide.

The negative consequences of marital dissolution justify the efforts made to identify its determinants, among which we find divorce law liberalization (Friedberg 1998; González-Val and Marcén 2012; Wolfers 2006), the role played by income (Burgess et al. 2003), the cultural background (Furtado et al. 2013), oral contraception (Marcén 2015), and the presence of children conceived within or before first marriage (Bellido et al. 2016), among many others. We add to this growing literature by examining the effect of the BMI - an important indicator of health (Averett et al. 2008) - on the probability of marital dissolution.[5]

By simply plotting the evolution of the percentage of Americans who are defined as overweight, normal weight, or underweight as measured by their BMI (data come from WHO), Figure 1, we observe that, until the early 1980s, the number of individuals classified in all those categories remained quite stable. Since then, there has been a clear

[4] Crude Divorce Rate is defined as the annual number of divorcees per 1,000 mid-year population. Data come from the Demographic Yearbook (several issues) and the US Census Bureau. Data on the percentage of American adults classified as Overweight, Normal Weight, and Underweight come from the World Health Organization (WHO).

[5] According to the World Health Organization (WHO), the BMI is a simple index of weight-for-height, defined as the weight in kilograms divided by the square of the height in meters ($kg/m^2$). People are classified as underweight if their BMI is under 18.5, as normal weight if the BMI is between 18.5 and 24.99, and as overweight if the BMI is over 25.

increase in the percentage of overweight individuals, whereas the percentage of those included in the category normal weight has decreased. The evolution of the underweight also shows a smooth decline. Interestingly enough, those variations are contemporary with the changes in the evolution of the divorce rate described above, which may point to a possible relationship between the BMI and the likelihood of marital dissolution. Nevertheless, it is not clear whether the increase in the overweight (and the corresponding decrease in the normal and underweight individuals) affected the divorce rate, or whether the decrease in the divorce rate had an effect on that health indicator.

There is ample literature analyzing the impact of relationship status on health outcomes and longevity (see Wilson and Oswald 2005 for a review). Of particular interest to us, Averett et al. (2008) test the four hypotheses that may explain the impact of marital status transitions on changes in the BMI. The Selection hypothesis states that a low BMI makes a person more attractive to enter into marriage. The Protection hypothesis establishes that, since married individuals are less likely to follow risky patterns of behavior, they will enjoy better health. The Social Obligation hypothesis indicates that those involved in a relationship will eat more regularly, and richer and more elaborate dishes. Finally, the Marriage Market hypothesis states that individuals who anticipate a growing probability of suffering a divorce may prepare to become more attractive in the marriage market by losing weight. Averett et al. (2008) find empirical evidence to support the Social Obligation and the Marriage Market hypotheses. In a similar vein, Sobal et al. (2003) find that marital transitions affect physical characteristics, such as body weight, and, by extension, the BMI. Wilson (2012) concludes that marital transitions of men and women aged 51-70 have an impact on body weight: getting married is associated with weight gain, and exit from marriage with the opposite.

In this paper, we add to this literature by studying the impact of the BMI on the likelihood of marital dissolution. From a theoretical point of view, we can hypothesize that a high value of BMI of married individuals, which can be an indicator of poor health or of low attractiveness, decreases the opportunities to find a new partner after a separation or divorce, diminishing the probability of marital dissolution. This is quite important in a country such as the US, where the remarriage rate is quite high (Stevenson and Wolfers 2007), indicating that those who divorce do not remain without a partner for the rest of their lives, on the contrary, they search for a new partner in the marriage market. Consequently, it is not only the case that the relationship status has an impact on health outcomes, but also that the health outcomes can affect divorce decisions. To test this, we use data from the National Longitudinal Survey of Youth (NLSY79). The richness of this dataset allows us to explore several empirical approaches to account for the potential endogeneity problems that our analysis could generate.

Regardless of the methodological technique used (with/without instrumental variables) our results point to a negative relationship between the BMI and the likelihood of marital dissolution: the greater the BMI, the lower the probability of separation or divorce. However, our findings also suggest that this relationship depends on the BMI level, since we find a negative association between being overweight and the likelihood of marital dissolution, but a positive relationship between being of normal weight and underweight with the probability of marital dissolution. These findings indicate that married individuals with high levels of BMI, which normally implies more health problems, and/or reduced attractiveness to enter into a new marriage, are those who decide in greater proportions to stay married. The same is found when using a survival analysis, in which it is clearly observed that those who are overweight are much more likely to stay married, irrespective of the duration of the marriage. The analysis by race of individuals reveals some differences, since no effect is obtained for being Black, but the negative relationship is clear in the case of Hispanic and other races, which can be related to the out-of-marriage options for each of them.

The remainder of the paper is organized as follows. Section 2 presents the empirical strategy. Section 3 describes the data. Section 4 analyzes the baseline estimates, and several robustness checks. Finally, Section 5 concludes.

## 2.- Empirical Strategy

A priori, the relationship between the BMI and the probability of marital dissolution is not clear. Initially, let us assume the following linear model:[6]

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

where the dependent variable is a dummy that takes value 0 if individual *i* is married in year *t* and value 1 the year *t* in which the individual *i* divorces or separates. $BMI_{it}$ is our

[6] We use a linear probability model for simplicity, as does other research studying the likelihood of marital dissolution. Results are similar by using probit/logit models (see Appendix A).

variable of interest, and represents the BMI of individual *i* in year *t*, measuring by $\beta_2$ the effect of changes in the BMI on the likelihood of marital dissolution. We would expect that the higher the BMI, the lower the probability of marital dissolution, since the higher the BMI of married individuals, the greater the probability of having health problems and the greater the probability of being less attractive to a new partner in the marriage market. Then, if the BMI has an effect on marital dissolution decisions, $\beta_2$ should be negative. The vector $\boldsymbol{X_{it}}$ includes a range of individual (and partner) characteristics, such as 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 when young, the respondent´s and partner´s level of education, and the race. All these variables may have an impact on the likelihood of marital dissolution for reasons independent of the BMI. Thus, their inclusion in the specification is necessary to avoid the coefficient of our variable of interest, the BMI, picking up the effect of other variables.[7] The model also includes cohort and region fixed effects to control for unobserved characteristics that vary at the cohort level and at the regional level. $u_{it}$ is the error term.[8]

With the empirical strategy described above, we are only able to study the effect of the BMI on the transition out of marriage. However, other authors have suggested that the relationship status and even changes in that relationship status have an effect on the BMI (Averett et al. 2008; Sobal et al. 2003; Wilson 2012). To tackle the potential endogeneity that this methodology can generate, we implement an Instrumental Variable approach as follows:

$$Marital\ Dissolution_{it} = \gamma_1 + \gamma_2 BMI_{it} + \boldsymbol{\varphi X_{it}} + \varepsilon_{it} \quad (2)$$

$$BMI_{it} = \alpha + \boldsymbol{\theta IV_{it}} + \boldsymbol{\eta X_{it}} + \upsilon_{it} \quad (3)$$

where $\boldsymbol{IV_{it}}$ is the set of instruments for the potentially endogenous variable (the BMI). These instruments are correlated with the BMI, but exogenous with respect to the dependent variable in equation (2). $\boldsymbol{X_{it}}$ is a vector that includes the same explanatory variables as in Equation (1), and $\varepsilon_{it}$ and $\upsilon_{it}$ are the error terms of equations (2) and (3),

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

[8] Due to data availability, the US is divided into four regions: North East, North Central, South, and West (omitted variable). Note that "The Bureau of Labor Statistics (BLS) only grants access to geocode files for researchers in the United States", as stated by the BLS survey documentation. Prior research into the impact of different characteristics on the probability of divorce follow the same strategy (Bellido et al. 2016).

respectively. In the next subsection, we define and analyze the validity of the instruments from a theoretical point of view. In any case, as before, if the BMI is a relevant factor in marital dissolution by decreasing the possibilities of finding a new partner (after the marital break-up) for those having high BMI, we would expect a negative relationship between the BMI and the marital dissolution. So, $\gamma_2$ should be negative. Note that, as we mentioned in the Introduction, we have also implemented several variations of the models presented here, along with a survival analysis, to show convincing empirical evidence.

### *2.1.- Instrumental Variables*

In this subsection, we provide a theoretical discussion of the instruments used here, an ever-controversial point in an Instrumental Variable approach. As is common in the literature, the choice of instruments is based on their correlation with the supposedly endogenous variable, the BMI, and their independence of the error term of the main specification. Then, no relationship should be found with the likelihood of marital dissolution.

First, we instrument the BMI with three different variables. One of these is the gender of the respondent. The relationship of the gender of an individual to the BMI has been documented in the literature. For example, Jackson et al. (2002) establish that gender is a determinant of the BMI and of the percentage of fat in the body. In the same vein, Gallagher et al. (1996) find a statistically significant effect of gender on the BMI and on the body fat. Both studies indicate that the BMI tends to be greater for men than for women, which may support the argument that gender could be related to our endogenous variable, the BMI. Nevertheless, in order for this to be a valid instrument, we also need to justify that the instrumental variable can be considered exogenous to the likelihood of marital dissolution of the individuals. Under the assumption that there are only heterosexual marriages, marital dissolution occurs at the same time for both members of the couple, so, logically, men are no more (or less) likely to break up their marriages than women. There is some prior evidence confirming this. For example, Bellido et al. (2016) show that there is no significant effect of the gender of an individual on the probability of marital dissolution. Then, being a man or a woman does not make any given individual more likely to divorce, since both of them are needed in a heterosexual couple to break up a marriage.[9] Of course, we recognise that, usually, women are more likely to remain divorced than men, but this is not relevant to our analysis, since we only consider the likelihood of marital dissolution of a couple.

In addition to gender, we use the BMI measured one year before marriage as an instrumental variable. As Must (2003) and Singh et al. (2008) show, the BMI one year before marriage is correlated with the BMI over the rest of the marital life, so this instrument would accomplish the first prerequisite of being a valid instrument. With respect to the lack of correlation between this instrument and the likelihood of marital dissolution, it is arguable that both variables are not likely to be related, due to the fact that the measure of BMI is considered in a pre-marriage period. Nonetheless, it is possible to surmise that the BMI in a period prior to marriage can affect the likelihood of divorce, through its impact on the age at first marriage (Malcolm and Kaya 2014), since the greater the age at first marriage, the lower the probability of subsequent divorce (Lehrer 2008). If individuals with high BMI tend to marry early in life because of their low expectations of finding a better partner in the future, it could be expected that those individuals who married earlier would be more likely to separate or divorce. Those with low BMI tend to marry later in life, which could positively affect their marriage stability. To explore whether this is driving our results, we re-run our main estimates after grouping our sample by age at first marriage.[10] In our sample, people mainly marry for the first time between 18 and 32 years old (around 97% of the people in our sample). We have split this range of 15 years into three different groups of five years, and results do not substantially change, as can be seen in Appendix B. The effect of our variable of interest, the BMI, is always negative and statistically significant, and the magnitude of the impact is similar in all three groups. Note that the BMI measured one year before marriage is introduced separately by gender, which is equivalent to the introduction of an interaction between the gender variable and the BMI of one year before marriage, since men tend to have greater BMI than women. We have also re-run the entire analysis without those who marry when they are older than 32, and our results are the same.

Although throughout the main analysis we only utilize the instruments mentioned above, to mitigate any possible concerns that the use of these instruments can generate, we have checked whether our results are maintained by using the BMI at the age of 45

[9] We want to clarify that we are not referring to how the divorce/separation decision is taken.
[10] Because of data availability, we cannot run estimates for every specific age at first marriage.

as an instrumental variable of the BMI at earlier stages of the marital life, limiting the sample to those under 40. As before, it is possible to hypothesize that that measure of the BMI is correlated with the BMI over the life-cycle. Here, it would be assumed that those with a high BMI when they are in their forties had a high BMI when they were younger, while those with a low BMI in their forties had a low BMI when they were younger. This is not a strong assumption, as we will show with our dataset in the next section. Therefore, the instrumental variable would fulfill the first prerequisite of being a valid instrument. In contrast to the BMI of one year before marriage, which can generate some concerns because of its potential correlation with the probability of marital break-up, the BMI measured at the age of 45 is not likely to have an effect on the likelihood of marital dissolution of individuals under 40. Surely, a couple who divorce when they are 30 years old do not take that decision because of the BMI that they will have at the specific age of 45, so satisfying the second prerequisite of being a valid instrument. In sum, at least in theory, these instrumental variables can be supposed to be valid. In the next section, we explain the dataset in detail.

## 3.- Data

We use data from the NLSY79, a database which 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 from then. The richness of the database comes from the historical information on individual family background, intimate relations, (pre)marital fertility, education and labour market experience, and biological characteristics (as well as partner's characteristics). We select for our main sample those individuals aged 18 or older who married at some point during the sample period, and we exclude higher order marriages and those individuals whose marriages end with the death of one of the spouses. Since our objective is to analyze the likelihood of marital dissolution, we consider that the marriage is ended the first time that the individual in the sample reports his marital status as divorced or separated, as in Bellido et al. (2016), and Chan and Halpin (2002).[11] Our final sample constitutes 5,372 individuals, with 51,157 observations.

Table 1 shows the summary statistics of our main sample, containing individuals aged 33 years old on average who married for the first time when they were around 24

[11] As a simple robustness check, we re-estimate our main model limiting the sample to those who marry when they are at least 21 years old, and our results do not vary (see Appendix B).

years old, and who tend to be of the same age as their partners (78% of the sample). Around 50% of the individuals have at least a college degree, a percentage quite similar to that of their partners. The majority of the individuals, 64%, are non-Black, non-Hispanic, while the percentage of Black and Hispanic is 18% in both cases. With respect to our variable of interest, the BMI, we have completed the height using information from the closest year in which this was reported (1981, 1982, and 1985). We also use the weight from each year since 1981, the first year in which the NLSY79 incorporates a question about each individual weight. The values of the BMI were restricted from 14 to 50 in order to avoid extreme values influencing our results (less than 0.3% of the observations).[12] The mean of the BMI is 25.8, which is in the overweight range but close to the upper end of the range that is considered normal. We describe its distribution below.

More interesting descriptive data can be observed in Table 2, in which we split the sample between those who break up their marriage at some point, and those in "intact" marriages during the sample period. As can be observed, 37.3% of the individuals break up their marriage at some point of the sample period, with marital dissolution taking place when individuals are aged 31.2, 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, with this being 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. The individuals who do not break up their marriages conceive 0.47 more children within marriage, which is not surprising since the duration of their marriages is greater, but they have 0.24 children less 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 is observed in the prior literature examining divorce issues (Isen and Stevenson 2010). That literature also detects differences by race, with

[12] Note that almost the whole sample is within those values. The gaps in the BMI were completed by linear interpolation, since the respondents do not answer the weight question every year. The summary statistics of the BMI before and after this do not change substantially. For example, the average BMI before filling-in the gaps is 25.764 and after filling-in the gaps is 25.771. Then, its impact is very small on our variable of interest and so it is not expected to have an effect on our results.

Black individuals being more likely to divorce (Kposowa 1998). In our case, Blacks represent only 18% of the whole sample, but 27% of the divorced or separated individuals. This is around 10 percentage points more than those Black individuals in intact marriages.

The differences in our variable of interest, the BMI, are not quite relevant since the BMI of those individuals in the sample of intact marriages is a little more than one point higher than the BMI of those divorced or separated. By looking at the histograms of the BMI for both groups (those who divorce/separate at some point of the sample and those in intact marriages), Figure 2, we observe a dissimilarity in the distribution of individuals. The proportion of individuals with lower BMI is slightly higher for those who divorce or separate, pointing to a possible positive relationship between the BMI and marital stability. The gap between the BMI of those in intact marriages and those whose marriages break up is detected, regardless of the duration of the marriage, see Figure 3, although the evolution of the BMI is quite similar in both cases; the longer the duration of the marriage, the higher the BMI.

In addition, Tables 1 and 2 show information on the instrumental variables. As explained above, we first consider the gender of the individuals to instrument the BMI. In our dataset, we see no significant differences between the proportion of men and women who respond to the survey, though the percentage of men is almost 3 percentage points higher (51.1 versus 48.2) in the sample of those who divorce or separate during the sample period than in that of intact marriages.[13] With respect to the relationship between gender and the BMI, the BMI for men is 26.5 on average whereas the BMI for women is 25, so only 1.5 points separate the two. The suggested differences between men and women are more obvious in Figure 4, where it can be seen that the distribution of women is concentrated in greater proportion around lower values of the BMI. So, it appears that there is a possible relationship between gender and the BMI. The second instrument that we propose is the BMI one year before first marriage. This variable is expected to be correlated with the BMI over the rest of the marital life (as we discuss in the empirical strategy section). The data used in this work reflects that relationship in Figure 5. It is observed that the greater the BMI of one year before marriage, the greater the BMI over the rest of the marital life. For that instrumental variable, we also find a

[13] In order to check whether the differences in the proportion of men and women who respond to the survey is driving our findings, the analysis has been repeated, separating the sample by gender, and our results are the same (see the following section).

difference by gender: men have a BMI one year before marriage that is 2 points higher than that of women, with women being located in the normal weight range while men are quite close to the overweight range, on average. Due to these differences, we consider in our specifications the BMI measured one year before marriage separately by gender. As mentioned above, this is equivalent to the incorporation of an interaction between the gender variable and the BMI of one year before marriage but, to more easily interpret our results, we prefer the separation by gender of the instrumental variable, rather than the introduction of the interaction. It is worth noting that there are no significant differences between the BMI in the period prior to first marriage of those men who divorce/separate during the sample period and that of those in intact marriages (see Table 2). Similarly, there are no differences in the case of women. This may reinforce our argument that the BMI measured in that period of time can be a valid instrument of the BMI for the rest of the marital life, since there do not appear to be differences one year before marriage between those who divorce or separate at some point, and those who stay married, regardless of the gender of the individuals. In any case, the empirical evidence in favour of our findings has been stepped-up by using an additional instrumental variable, the BMI at the age of 45, applying our analysis to a sample of individuals under 40. Although we have discussed in the empirical strategy section the validity of this instrument, the dataset appears to reveal a positive relationship between the BMI at age 45 and the BMI of those under 40 (see Figure 6), once again reinforcing our argument in favour of these instrumental variables.

## 4.- Results

### *4.1.- Estimates without considering potential endogeneity*

Table 3 presents the estimates for Equation (1) in Column (1), where the BMI is considered to be exogenous to the decision of marital dissolution. In that specification, we introduce controls for several socio-economic characteristics that have been suggested in the literature to impact the decision of marital dissolution for reasons independent of the BMI, such as the age at first marriage (Lehrer 2008), whether the members of the couple are in 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 youth (Corak 2001), the level of education of both the respondent and his/her partner (Isen and

Stevenson 2010), and the race (Kposowa 1998), in addition to cohort and region fixed effects.

Our first estimates show a negative relationship between the BMI and the probability of marital dissolution, but the coefficient capturing the effect of the BMI is small, albeit statistically significant. This empirical evidence may suggest that the evolution of the BMI could have an impact on marital stability, extending the four potential relationships between the marital status and the BMI described by Averett et al. (2008). Two possible factors may drive this result. On the one hand, in a country with a quite high remarriage rate where the divorce condition is a transition period from one marriage to the other, the low expectations of married individuals with high BMI of finding a possible new partner in the marriage market can make the separation or divorce situation less attractive for them. On the other hand, if a spouse is the family member who normally spends more time caring for his/her partner, the higher expectations of having serious health problems for those married individuals with high BMI can deter them from breaking up their marriage.[14] Of course, we recognize that these findings are derived from a simple approach, but our work is not limited to this specification. From here, we use different models to check whether this relationship between the BMI and marital stability is maintained. It is worth noting that the effect of the covariates on the probability of marital dissolution is consistent with prior research. We revisit this issue below.

Taking advantage of the panel data structure of the dataset, we repeat this analysis using Random and Fixed Effects. Column (2) of Table 3 shows the estimates after using a Random Effects Model, while Column (3) displays results using a Fixed Effects Model. In both cases, we find that the BMI has a negative and statistically significant effect on the probability of marital dissolution. As before, the higher the BMI the lower the probability of marital dissolution. Also, for robustness purposes, and since our dependent variable is a dichotomous variable that takes value 0 while people remain married, and value 1 the year in which respondents report that they are separated or divorced, we re-run these estimates using logit and probit models. Results are shown in Appendix A, and as can be observed, are consistent. We find a negative and statistically significant effect of the BMI on the likelihood of marital dissolution. In sum, results are

[14] High levels of BMI are the cause of important and worrying diseases, and have an impact on mortality (Kinge and Morris 2014; Prospective Studies Collaboration 2009).

quite similar after changes in the methodology. These estimates point to a negative relationship between the BMI and the probability of marital dissolution. However, these findings can generate doubts due to the possible endogeneity of our variable of interest, the BMI, which is examined in the next subsection.

*4.2.- Main estimates: Endogeneity concerns*

Prior literature studying the impact of the relationship status on the BMI recognizes the potential endogeneity underlying this analysis, a concern that would potentially be solved using an Instrumental Variable approach, as Averett et al. (2008) suggest. In spite of this concession, those authors do not follow this approach because, as they state, they are not able to determine any possible instrumental variable. In our case, we turn back this analysis by examining the effect of the BMI on marital dissolution, while bearing in mind the endogeneity concerns, since, a priori, it is not clear whether the BMI has an effect on the marital status, or it is the relationship status which has an impact on the BMI. For that, we exploit the information available in the NLSY79 to instrument the potential endogeneous variable, the BMI. We use several instruments that, in theory, appear to be valid instruments (as explained in the empirical strategy section and as the descriptive analysis also suggests).

Our main estimates are presented in Table 4, Column (1), in which we instrument the BMI with the gender of the respondent (1: man, 0: woman), and with the BMI in the year prior to marriage, separately for men and women. Before analysing the results, let us discuss the validity of the instruments included in the analysis, relying on the idea that they have an effect on the potentially endogenous variable (BMI), but have no relation to the error term of our main specification. Focusing on the first-stage outcomes from this approach (Table 4, Column (2)), that includes the instruments in addition to the explanatory variables of the main estimate, we find, as expected, that the instruments have a statistically significant and positive effect on the BMI. Being a man has a positive impact on the BMI, and the higher the BMI in the period prior to getting married, the higher the BMI during the marital life-time, regardless of the gender of the individuals. These results provide evidence for the existence of a relationship between our instruments and the potential endogenous variable. To test this further, we also run a Sargan-Hansen test (Baum et al. 2007), in which the null hypothesis states that "the excluded instruments are valid instruments, that is, uncorrelated with the error term and correctly excluded from the estimated equations". The rejection of the null of this test, which is distributed as chi-squared with L – K degrees of freedom (number of excluded instruments minus number of regressors), would cast doubt on the validity of the instruments, annulling their selection. In our main model (Table 4, Column (1)), this test is distributed as chi-squared with 2 degrees of freedom, and its value is 0.590 (its p-value equals 0.7446). According to this result, we cannot reject the null at the 1% statistical significant level, which supports the use of those instrumental variables.

Under the Instrumental Variable approach, the estimated coefficient capturing the effect of the BMI is negative and statistically significant, although the magnitude of the effect is still small (see Column (1) of Table 4). Once again, this indicates that there is a negative relationship between the BMI and the probability of marital dissolution. Note that this coincides with the specifications presented in Table 3, to the extent that the coefficient is the same as that obtained using an OLS (see Column (1) of Table 3). The possible explanations, described in the previous subsection, of how the BMI can negatively affect the probability of marital break up are also applicable here. We have pointed to the reduction of options outside marriage that the increment in the BMI generates through worsening health and decreasing possibilities of finding a new partner.

The effect of the covariates included in the analysis on the probability of marital dissolution is in line with the findings of the existing literature, which gives us confidence in our approach. Age has an inverse U-shaped relationship with the likelihood of marital dissolution. We also find that the older the individual at first marriage, the lower the probability of marital dissolution, and that both members of the couple being in the same age range has a negative impact on the risk of marital dissolution. Children have a different effect, depending on whether they were conceived before or during first marriage: while the former are a destabilizing factor for marriage, the latter have a deterrent impact on the risk of marital dissolution. Being pregnant contributes to stabilizing the marriage. The family structure during youth also determines marital stability in adulthood, since the father´s presence at home lowers the risk of subsequent marital dissolution. The education level, for both members of the couple, reveals that the lower the level of education, the greater the likelihood of marital break up. Finally, we find no statistically significant differences in the risk of marital dissolution for Hispanic and other races, although being black does imply a greater risk of marital dissolution.

Since physical appearance appears to be an important issue for women, it is possible to surmise that a reduction of the out-of-marriage possibilities for women with high BMI is greater than that for men with the same high level of BMI. This argument is supported by the findings of Oreffice and Quintana-Domeque (2010), who detect significant penalties for fatter women, although they also find the same result for shorter men. With respect to our work, this would be problematic if the estimated coefficients primarily capture the reaction of women or of men when one of them is more likely to be ostracized out-of-marriage because of the BMI. To explore this possible gender discrimination, we repeat the analysis, splitting our sample between men and women. First stage outcomes are shown in Columns (4) and (6) of Table 4, and main specifications are presented in Columns (3) and (5), for men and women, respectively. Results are the same as those obtained for the full sample in terms of significance, direction, and magnitude of the impact of the BMI on the probability of marital dissolution, whence it may be inferred that gender differences are not driving our results. Thus, we use the whole sample in the rest of our analysis.

There is every indication that our instrumental variables are valid and the results are robust. Nevertheless, as we explain above, there may be some concerns about the relationship between the BMI before marriage and the likelihood of marital dissolution, because of the potential effect of the instrumental variable on the age at first marriage (Malcolm and Kaya 2014). To tackle this issue, we incorporate a different instrumental variable, the BMI at age 45.[15] Here, we focus on the relationship between the BMI and the likelihood of marital dissolution, but we must remember that the sample selection changes in this case. We only consider individuals under 40 in order to avoid the instrumental variable being correlated with marital dissolution. As explained above, it is difficult to maintain that a couple who divorce when they are, for example, 39 years old, take that decision because of the BMI that they will have at the specific age of 45. Then, there is a sufficient gap to mitigate concerns about the potential relationship between the BMI at 45 and the probability of marital dissolution of individuals under 40.[16] Table 5 displays our results. Since the sample has changed, Columns (1) and (2) include the estimations after using the BMI one year before marriage as instrument, in order to show that this is not driving our results, and also to facilitate the comparison with the

[15] The discussion about the validity of this variable is presented in the empirical strategy section.
[16] We have chosen the age of 45 because there is a sufficient gap between the BMI measure at that age and the average age at marital dissolution (31 years old) to mitigate any concerns about this issue.

new instruments. Columns (3) and (4) are the results after using the BMI at age 45 (separately by gender) as instrumental variable, rather than the BMI one year before marriage, and Columns (5) and (6) incorporate all the instrumental variables.[17] Regardless of the instrumental variables used, the estimated coefficients of the impact of the BMI on the likelihood of marital dissolution do not vary. The effect of the BMI on the probability of marital dissolution is always negative and statistically significant, although small.

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

Up to now, we have focused on analyzing the impact of the variations in the BMI on marital stability, and our findings are clear: the greater the BMI, the lower the probability of marital dissolution. Nevertheless, an increase of one unit in the BMI decreases the probability of marital dissolution by just 0.1%, which is almost irrelevant. So, it would require an increase in the BMI of 10 points to find a decrease of 1% in the probability of marital dissolution. This is still small, but what we want to underline with this example is the significant jump in the BMI needed to significantly decrease the likelihood of marital dissolution which, according to the World Health Organization (WHO), could be equivalent to passing from being, for instance, normal weight (BMI equal to 20) to being clearly overweight (BMI equal to 30). The WHO classifies individuals into three categories, depending on the health consequences of their weight. As explained above, individuals are considered underweight with a BMI under 18.5; this health indicator between 18.5 and 24.99 is considered normal weight; and a BMI over 25 is considered overweight. In this context, it can be argued that what matters is belonging to one category or another in lieu of small changes in the BMI. To explore this issue, we define three dummy variables - overweight, normal weight, and underweight - that take value 1 when the BMI of a person corresponds to that particular category, and 0 otherwise. Formally, we estimate the following expression:

$$Marital\ Dissolution_{it} = \gamma_1 + \gamma_2 BMI\_RANGE_{it} + \boldsymbol{\varphi X_{it}} + \varepsilon_{it} \quad (4)$$

$$BMI\_RANGE_{it} = \alpha + \boldsymbol{\theta IV_{it}} + \boldsymbol{\eta X_{it}} + \upsilon_{it} \quad (5)$$

[17] In this case, again we cannot reject the null of the Sargan-Hansen test at the 1% statistical significance level, which again provides evidence in favour of the use of our instrumental variables.

where BMI_RANGE is defined as overweight, normal weight, and underweight in three alternative specifications. The set of instruments used is the same as in the main estimate. The validity of these instruments has already been discussed in the *Empirical Strategy* section, in terms of exogeneity regarding the dependent variable in our main estimate (the probability of marital dissolution), and the relationship with the potentially endogenous variable (BMI), or, in this case, belonging to one of the categories in which individuals are classified according to their BMI.

Our results are shown in Table 6, Columns (1), (3) and (5), for overweight, normal weight, and underweight variables, respectively. We find different effects, depending on the category of BMI. Those defined as overweight by this health indicator are less likely to break up their marriages, and this deterrent effect is more than ten times greater than that found for the full sample. The impact of the instruments on the potentially endogenous variable (belonging to the overweight range) is as expected: women are more likely to belong to this group (Hedley et al. 2004), and the higher the BMI in the period prior to getting married, the greater the probability of being overweight. The effect is different for those considered as being of normal weight (Column (3)) and underweight (Column (5)). Belonging to one of these groups has a positive and statistically significant impact on the likelihood of marital dissolution, although the effect is almost six times greater for those considered underweight than for those whose weight is considered normal. With respect to the instrumental variables: men are more likely to belong to the normal weight range, and women more likely to be underweight. In both cases, a higher BMI in the period prior to marriage is linked to a lower probability of being underweight and normal weight. In all cases, the instruments are valid according to the Sargan-Hansen test.

With the redefinition of the variable of interest by range of BMI, we find a greater impact on marital dissolution than that observed in previous analysis, but only for those who are overweight. In that case, we also detect a negative impact on the probability of marital dissolution relative to the rest of the categories. The possible explanations (mentioned above) for the negative relationship would also be applicable here. The attractiveness of the married individuals in the overweight range is lower, so their options out-of-marriage of finding a new partner are reduced, increasing the probability of remaining in the existing marriage. The expected health problems are also greater for those overweight married individuals, making the option of living without a partner, who cares for them, less attractive, and so reducing the probability of marriage break up. This is not incompatible with the results that we find for the rest of categories, since the individuals belonging to a less-than-overweight category (normal and underweight), may have more chances in the divorce/separation situation, for example, to establish a new couple in the marriage market, increasing the options of breaking up their existing marriage, whence it may be inferred that a positive effect on the probability of marital dissolution is possible for low values of the BMI.

Despite the fact that all our results indicate that the BMI plays a role in the probability of marital dissolution, our findings could differ depending on the duration of the marriages. For example, for those individuals who have spent many years married, physical appearance can be less important in dissolving their marriage than for those who have only been married for a few years, in terms of the likelihood of separation or divorce. We explore this issue by using a life table, which allows us to estimate the probability of survival to an additional year of marriage, depending on whether individuals are overweight or not. 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)). The figure indicates that the overweight married individuals appear to be associated with a greater probability of marital survival, regardless of the duration of marriage, compared to the married individuals in the normal and underweight categories. It is remarkable that the evolution of the probability of survival appears to be quite similar in the two figures, being greater for those who have been married for fewer years and lower for those in a long-term marriage. However, in accordance with the results obtained after applying a likelihood ratio test of homogeneity, we can reject that both are equivalent. 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 in which the BMI is important in marital dissolution, regardless of the number of years married.

*4.4.- Analysis by race*

Prior research has shown that the prevalence of overweight in the United States is unequally distributed among the races, with Blacks being more affected than Hispanics or Whites (Freedman et al. 2006; Ogden 2009). This difference in the incidence of overweight may lead us to suppose that the BMI differentially affects the likelihood of suffering a marital dissolution, depending on the individual's race. One may argue that, if Black people are more likely to be overweight, a high BMI would have a lower impact or even no impact on their marital stability, since their loss of attractiveness in the marriage market would be smaller when their BMI increases. It should be noted that more than 90% of marriages in the US are formed by members of the same race (Lofquist et al. 2012), and so they should tolerate weight increases in similar ways. To examine this issue, we split the full sample by the race of individuals, Hispanics, Blacks, and Others.

Results are shown in Table 7, Columns (1), (3) and (5), for Hispanics, Blacks, and Others, respectively. We find that variations in the BMI differentially affect the probability of marital dissolution. For Hispanics and Other races, the negative impact of BMI on marital stability is maintained, suggesting that their out-of-marriage options are reduced when their BMI increases. The prevalence of overweight is lower than for Blacks, and increases in their weight represent greater losses of attractiveness in finding a new partner in the marriage market, thus reducing the probability of marital dissolution. However, results show that the BMI has no statistically significant effect on the probability of marital dissolution for Blacks. Since the prevalence of overweight is more common in Blacks, their attractiveness in the marriage market is less affected by increases in their BMI, not affecting the probability of marital dissolution.

## 5.- Conclusions

This paper examines the effect of the BMI, a widely-used indicator of health, on the likelihood of marital dissolution. A priori, the relationship between these two variables is not clear. Much of the literature has focused on the effect of the relationship status on the BMI (Averett et al. 2008), but the opposite is also possible. Among all relationships, we concentrate on married couples to explore their probability of break-up, since there is an extensive literature on the determinants of divorce/separation that has not considered whether the BMI, as a proxy for physical appearance and as a health indicator, is a relevant factor, or not. Following the existing research, we justify the necessity of establishing the determinants of the marital dissolution because of the negative consequences that the change in marital status has, primarily, on women and children (Amato 2000).

The aggregate data appear to reveal some relationship between the BMI and marital dissolution, but it can also be a spurious relationship. Surprisingly, the drop in the US divorce rate that occurred since the early 1980s is contemporary with a considerable increase in the percentage of overweight individuals. This coincidence is not sufficient for us to deduce that the BMI has a direct effect on the divorce decisions of individuals in the US, neither do we suggest that the greater marital stability produced by the reduction of the divorce rate is causing increases in the BMI. The aggregate data, then, are not particularly useful to our work.

In our case, we consider microdata from the NLSY79 to study the association between the BMI and the likelihood of marital dissolution. First, we estimate simple specifications that point to a negative relationship: the lower the BMI, the greater the probability of marital dissolution. Our analysis does not end there, however. Departing from the prior literature, we consider the potential endogeneity concerns by developing an Instrumental Variable approach. After considering several possible valid instrumental variables, our results are always similar. Regardless of the methodology used, of the instrumental variables incorporated, of the samples used, and of the controls incorporated, the BMI is negatively associated with the probability of marital dissolution, and the magnitude of the effect does not vary substantially.

The possible explanations for that negative relationship are both related to the reduction of out-of-marriage options when the BMI increases. It can be argued that an increase in the BMI decreases 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 US, where divorce/separation can be considered a transition period from one marriage to another, since the percentage of individuals who remarry after a divorce is quite high. In this context, those with low opportunities to remarry would surely be less likely to break up their current marriage. In addition, the expected health problems that high levels of the BMI may generate deter individuals from dissolving their marriage, since spouses are normally those who care for each other; then, living without a partner would not be attractive for individuals with health problems.

Despite that our results are quite robust, the estimated impact of the BMI on the probability of marital dissolution is quite small. A significant increase in the 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 overweight. For that reason, we examine the importance of being overweight, normal weight, and underweight in terms of the likelihood of marital dissolution, finding mixed results. Belonging to the overweight category makes individuals less likely to divorce or separate, with the effect being sizable in this case.

However, people classified as normal weight and underweight are more likely to break up their marriages. The survival analysis, that allows us to explore whether there are differences by duration of marriages, also indicates that overweight individuals are much less likely to divorce or separate. In any case, these results provide additional evidence compatible with our previous explanations, for instance: the attractiveness of people in these latter groups (with low BMI) in the marriage market is greater than that of the former group (with high BMI) increasing their out-of-marriage possibilities, so the likelihood of marital dissolution should be greater for them.

Finally, we study whether BMI has the same impact on the probability of marital dissolution for different races. This is necessary, since Blacks are more likely to be overweight than Hispanics and Others, which can lead to opportunities for Blacks to find a new partner in the marriage market being less affected by a greater BMI. Our results support this hypothesis, since the BMI has no effect on the likelihood of marital dissolution for Blacks. However, increasing BMI is linked to a greater marital stability for Hispanics and Others, since their attractiveness is more affected, and their out-of-marriage options are reduced.

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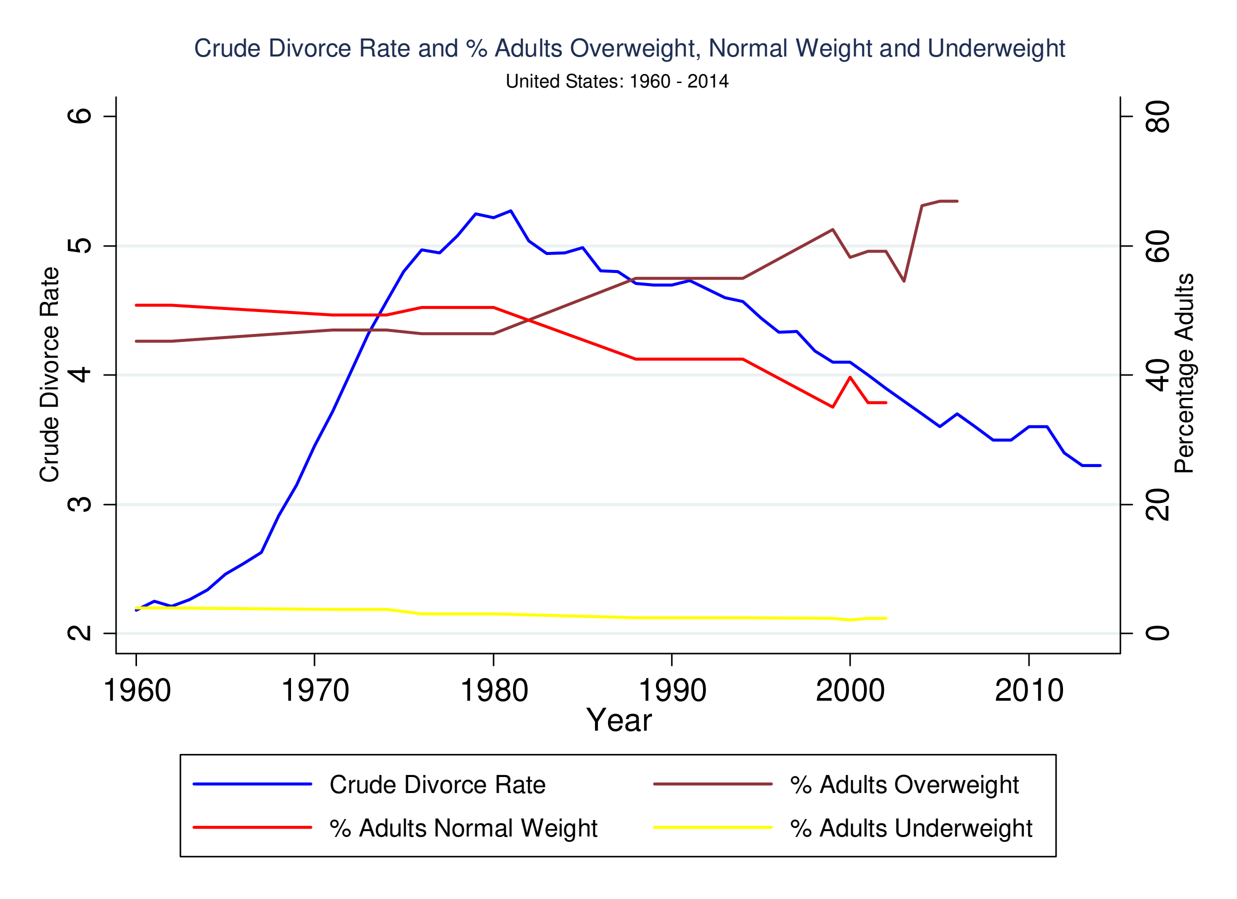
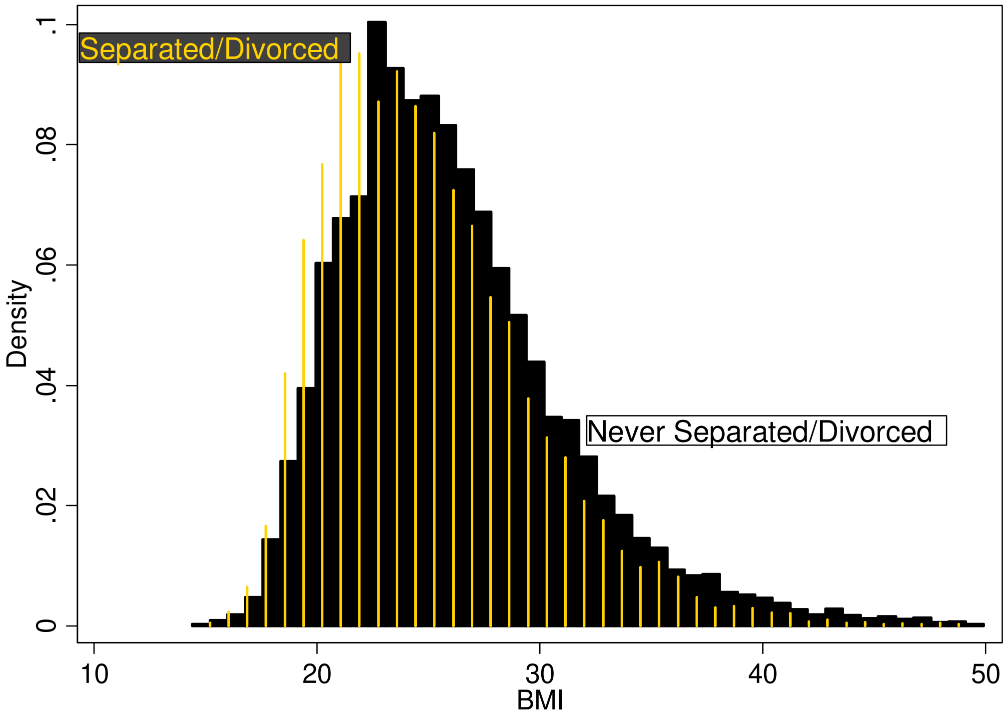
**Figure 1.- Crude Divorce Rate and Percentage of Adults Classified as Overweight, Normal Weight, and Underweight. United States. Sample: 1960 - 2014**



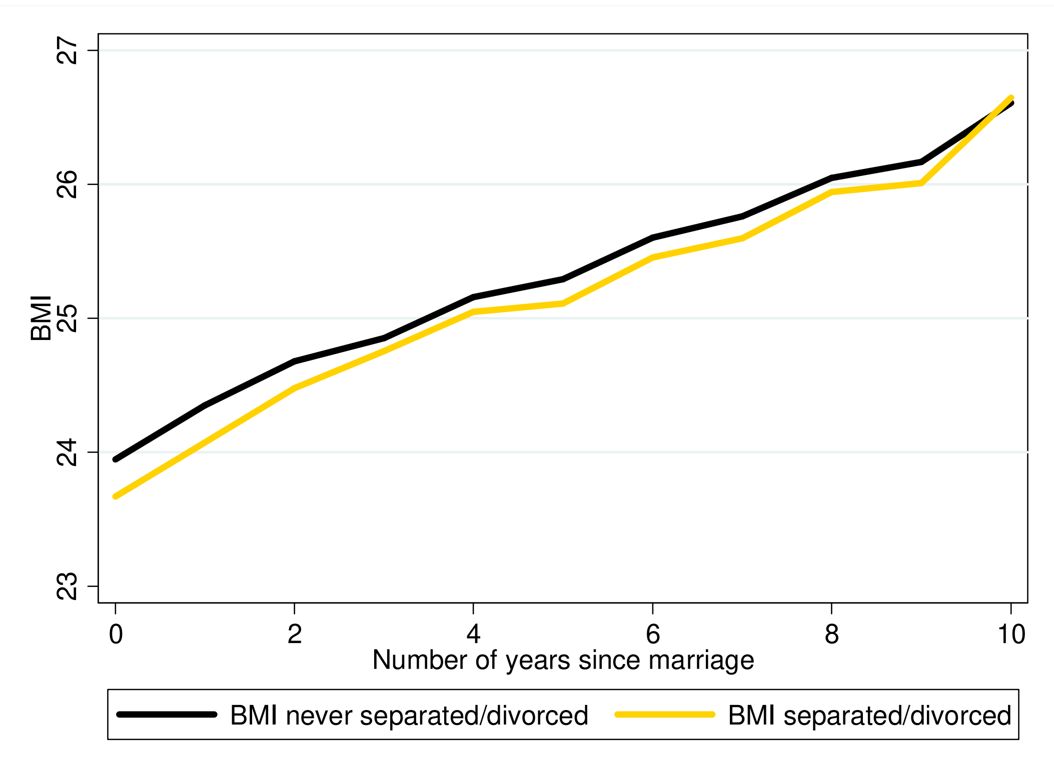

Notes: US Crude Divorce Rate, 1960-2014. Data on the percentage of adult individuals classified as overweight, normal weight or underweight come from the WHO and are only available until 2006 for overweight individuals, and until 2002 for normal and underweight individuals.

**Figure 2.- Histograms**
**Separated/Divorced vs. Never Separated/Divorced**



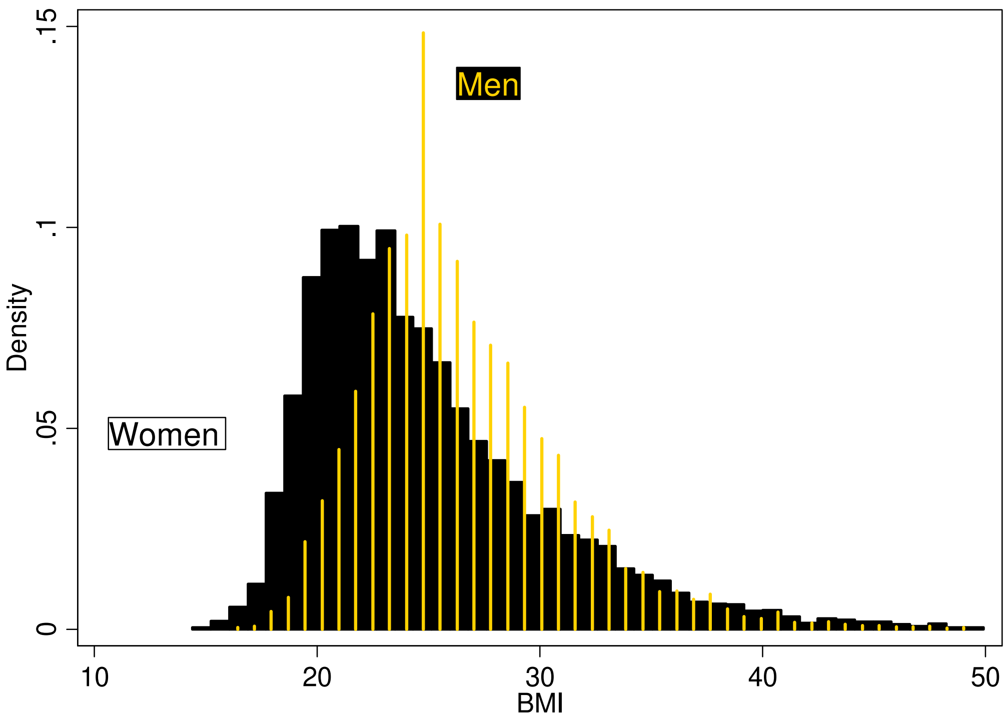

Notes: Data was obtained from the NLSY79 for the period 1982 to 2012.

**Figure 3.- BMI by duration of marriage**



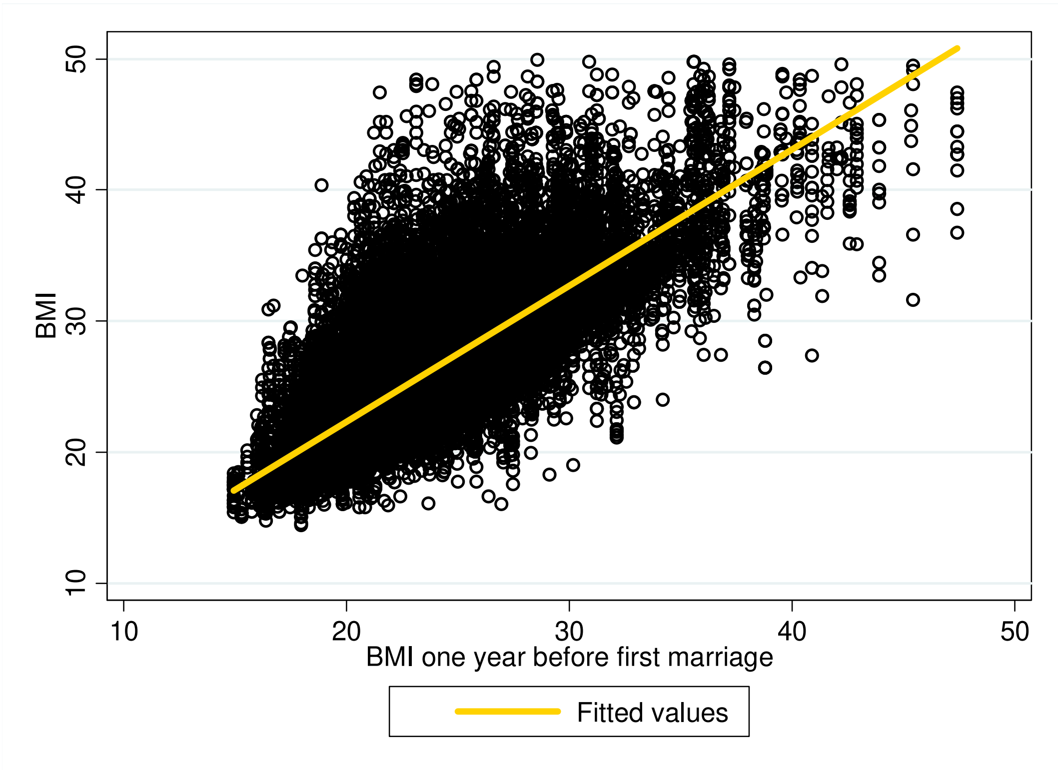

Notes: Data was obtained from the NLSY79 for the period 1982 to 2012.

**Figure 4.- Histograms**
**Men vs. Women**



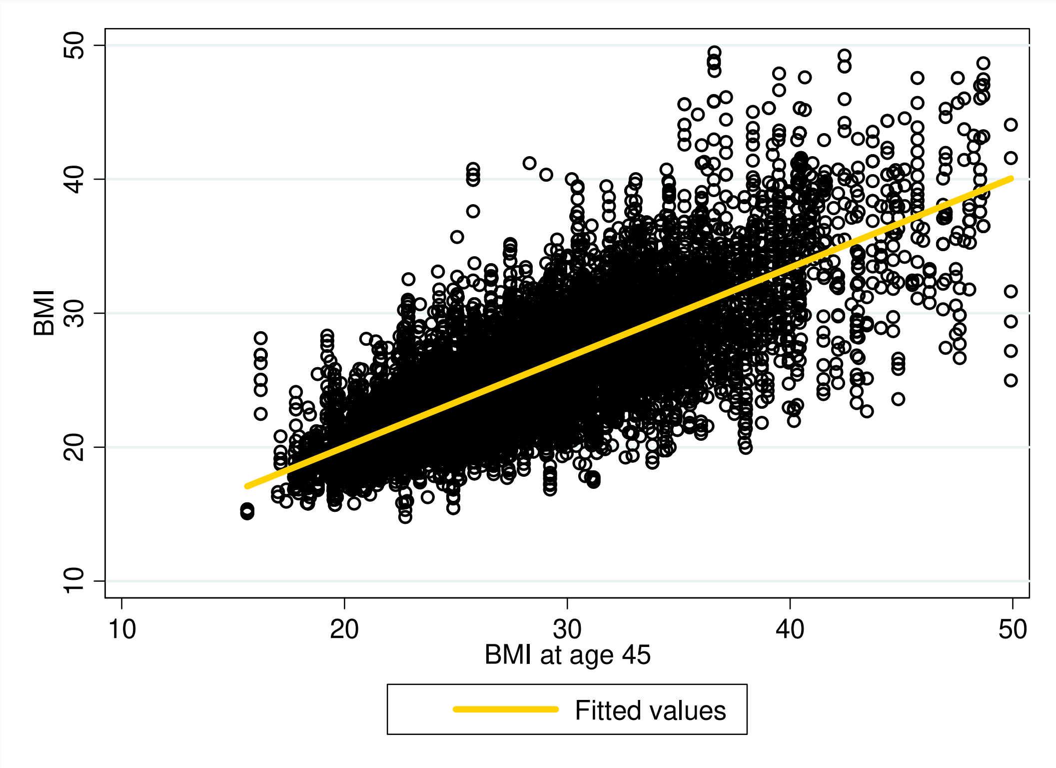

Notes: Data was obtained from the NLSY79 for the period 1982 to 2012.

**Figure 5.- BMI during marriage vs. BMI one year before first marriage**



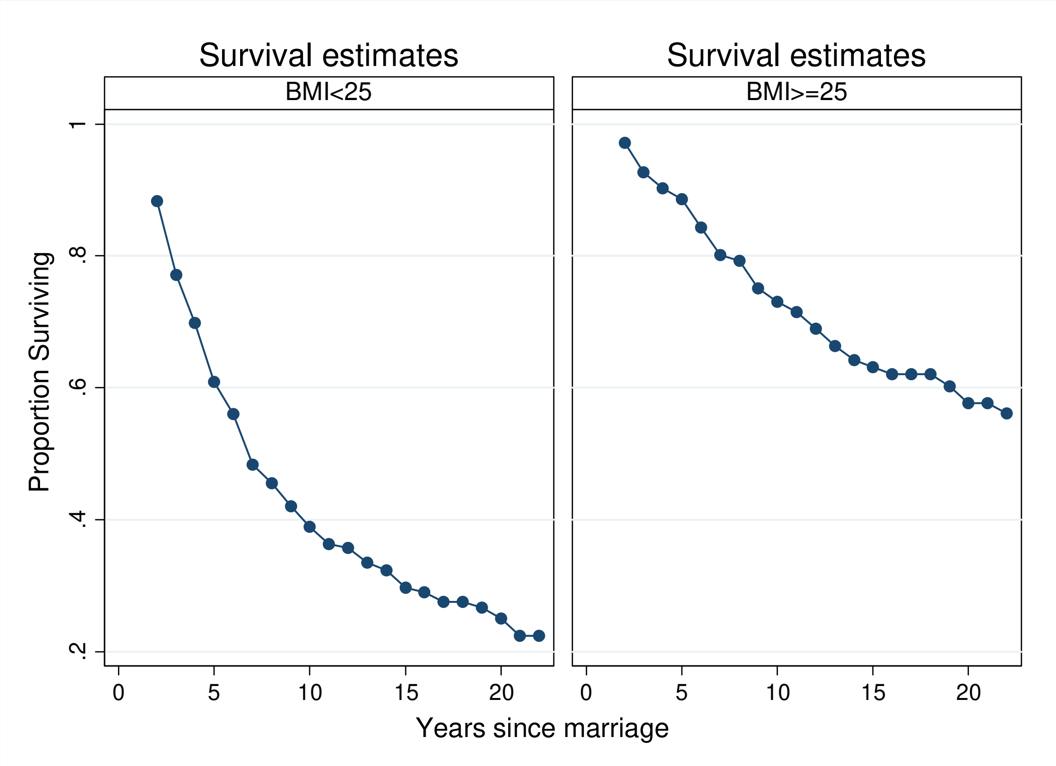

Notes: Data was obtained from the NLSY79 for the period 1982 to 2012.

**Figure 6.-BMI during marriage vs. BMI at age 45**




Notes: Data was obtained from the NLSY79 for the period 1982 to 2012. The BMI at marriage only includes individuals under 40.

**Figure 7.-Survival analysis by duration of marriage: Overweight (BMI>=25) vs. Others (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 | Minimum | Maximum |
|---|---|---|---|---|
| BMI | 25.771 | 4.987 | 14.4 | 49.9 |
| Age | 33.280 | 8.060 | 18 | 55 |
| Age at first marriage | 24.011 | 3.462 | 16 | 37 |
| Same age (couple) | 0.784 | 0.411 | 0 | 1 |
| Number of children conceived out of marriage | 0.350 | 0.682 | 0 | 8 |
| Number of children conceived within marriage | 1.153 | 1.097 | 0 | 10 |
| Pregnant | 0.040 | 0.197 | 0 | 1 |
| Father in household in 1979 | 0.727 | 0.446 | 0 | 1 |
| Education: less than high school | 0.093 | 0.291 | 0 | 1 |
| Education: high school | 0.394 | 0.489 | 0 | 1 |
| Education: college | 0.232 | 0.422 | 0 | 1 |
| Education: more than college | 0.280 | 0.449 | 0 | 1 |
| Spouse´s education: less than high school | 0.108 | 0.311 | 0 | 1 |
| Spouse´s education: high school | 0.398 | 0.489 | 0 | 1 |
| Spouse´s education: College | 0.231 | 0.422 | 0 | 1 |
| Spouse´s education: more than college | 0.263 | 0.440 | 0 | 1 |
| Race: Hispanic | 0.173 | 0.378 | 0 | 1 |
| Race: Black | 0.187 | 0.390 | 0 | 1 |
| Race: other | 0.640 | 0.480 | 0 | 1 |
| **Instrumental Variables** | | | | |
| % Men | 0.511 | 0.500 | 0 | 1 |
| BMI one year before first marriage (men) | 24.371 | 3.356 | 15.824 | 47.433 |
| BMI one year before first marriage (women) | 22.238 | 3.621 | 14.933 | 45.429 |
| Observations/Respondents | 51,157/5,372 | | | |

Table 2.- Summary Statistics. Main Sample
('Divorced or Separated' – 'Intact marriage' subsamples)

| Variables | 'Divorced or Separated' subsample | 'Intact marriage' subsample |
|---|---|---|
| Observations/respondents | 12,638/2,006 | 38,519/3,366 |
| Mean age at marital dissolution | 31.18 | - |
| Mean age at first marriage | 23.22 | 24.27 |
| Mean BMI | 24.88 | 26.06 |
| Mean number children conceived during first marriage | 0.80 | 1.27 |
| Mean number children conceived before first marriage | 0.53 | 0.29 |
| % with lowest level of education | 14.56 | 7.60 |
| % with high level of education | 48.31 | 36.51 |
| % with college level of education | 22.50 | 23.51 |
| % with more than college level of education | 14.62 | 32.39 |
| % with spouse lowest level of education | 15.90 | 9.17 |
| % with spouse high level of education | 48.44 | 36.91 |
| % with spouse college level of education | 21.41 | 23.67 |
| % with spouse more than college level of education | 14.25 | 30.24 |
| % with father in household in 1979 | 67.82 | 74.25 |
| % pregnant | 4.75 | 3.81 |
| % race: Black | 26.77 | 16.07 |
| % race: Hispanic | 19.25 | 16.61 |
| % race: Other | 53.98 | 67.32 |
| **Instrumental Variables** | | |
| % Men | 51.09 | 48.24 |
| BMI one year before first marriage (men) | 24.22 | 24.42 |
| BMI one year before first marriage (women) | 22.20 | 22.25 |

Table 3.- Results of estimation
(Non-instrumented estimates)

| | OLS<br>(1) | Random Effects<br>(2) | Fixed Effects<br>(3) |
|---|---|---|---|
| BMI | -0.001*** | -0.003*** | -0.005*** |
| | (0.0002) | (0.0003) | (0.001) |
| Age | 0.003*** | 0.021*** | 0.032*** |
| | (0.001) | (0.001) | (0.002) |
| Age squared/100 | -0.005*** | -0.025*** | -0.037*** |
| | (0.001) | (0.001) | (0.002) |
| Age at first marriage | -0.002*** | -0.008*** | |
| | (0.0003) | (0.001) | |
| Same age | -0.010*** | -0.016*** | |
| | (0.003) | (0.004) | |
| Number children conceived before marriage | 0.011*** | 0.014*** | 0.025 |
| | (0.002) | (0.003) | (0.019) |
| Number children conceived within marriage | -0.007*** | -0.014*** | -0.014*** |
| | (0.001) | (0.001) | (0.002) |
| Pregnant | -0.022*** | -0.014*** | -0.002 |
| | (0.003) | (0.003) | (0.004) |
| Father in household in 1979 | -0.006*** | -0.013*** | |
| | (0.002) | (0.003) | |
| Highest education: lowest level | 0.020*** | 0.031*** | -0.055** |
| | (0.005) | (0.006) | (0.023) |
| Highest education: high school level | 0.011*** | 0.026*** | 0.006 |
| | (0.003) | (0.004) | (0.011) |
| Highest education: college level | 0.006** | 0.020*** | 0.016** |
| | (0.002) | (0.003) | (0.006) |
| Highest education spouse: lowest level | 0.013*** | 0.022*** | -0.011 |
| | (0.005) | (0.006) | (0.010) |
| Highest education spouse: high school level | 0.007*** | 0.013*** | 0.002 |
| | (0.003) | (0.004) | (0.008) |
| Highest education spouse: college level | 0.006** | 0.007** | 0.002 |
| | (0.003) | (0.003) | (0.007) |
| Race: Hispanic | -0.0004 | -0.001 | |
| | (0.003) | (0.004) | |
| Race: Black | 0.017*** | 0.029*** | |
| | (0.003) | (0.005) | |
| Individual random effects | NO | YES | NO |
| Individual fixed effects | NO | NO | YES |
| Cohort fixed effects | YES | YES | NO |
| Region fixed effects | YES | YES | YES |
| Observations | 51,157 | 51,157 | 51,157 |
| Number of respondents | 5,372 | 5,372 | 5,372 |

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

Table 4.- Results of estimation
(Instrumented estimates)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | I.V. Model Divorce Outcome | First Stage BMI | I.V. Model Divorce Outcome (Men) | First Stage BMI | I.V. Model Divorce Outcome (Women) | First Stage BMI |
| BMI | -0.001*** | | -0.001** | | -0.001*** | |
| | (0.0003) | | (0.0004) | | (0.0004) | |
| Age | 0.010*** | | 0.010*** | | 0.009*** | |
| | (0.001) | | (0.002) | | (0.002) | |
| Age squared/100 | -0.012*** | | -0.012*** | | -0.011*** | |
| | (0.001) | | (0.002) | | (0.002) | |
| Same age | -0.011*** | | -0.011*** | | -0.012*** | |
| | (0.003) | | (0.004) | | (0.004) | |
| Age at first marriage | -0.004*** | | -0.005*** | | -0.003*** | |
| | (0.0004) | | (0.001) | | (0.001) | |
| Number children conceived before marriage | 0.012*** | | 0.005* | | 0.017*** | |
| | (0.002) | | (0.002) | | (0.002) | |
| Number children conceived within marriage | -0.010*** | | -0.009*** | | -0.010*** | |
| | (0.001) | | (0.002) | | (0.002) | |
| Pregnant | -0.020*** | | | | -0.021*** | |
| | (0.004) | | | | (0.005) | |
| Father in household in 1979 | -0.010*** | | -0.008** | | -0.010*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Highest education: lowest level | 0.026*** | | 0.020*** | | 0.031*** | |
| | (0.005) | | (0.006) | | (0.007) | |
| Highest education: high school level | 0.019*** | | 0.018*** | | 0.019*** | |
| | (0.003) | | (0.005) | | (0.004) | |
| Highest education: college level | 0.013*** | | 0.014*** | | 0.012*** | |
| | (0.003) | | (0.005) | | (0.004) | |
| Highest education spouse: lowest level | 0.016*** | | 0.022*** | | 0.012* | |
| | (0.004) | | (0.006) | | (0.006) | |
| Highest education spouse: high school level | 0.009*** | | 0.010** | | 0.008* | |
| | (0.003) | | (0.005) | | (0.004) | |
| Highest education spouse: college level | 0.004 | | 0.006 | | 0.002 | |
| | (0.003) | | (0.004) | | (0.004) | |
| Race: Hispanic | -0.002 | | -0.002 | | -0.002 | |
| | (0.003) | | (0.004) | | (0.004) | |
| Race: Black | 0.021*** | | 0.026*** | | 0.015*** | |
| | (0.003) | | (0.004) | | (0.004) | |
| Men | | 1.541*** | | | | |
| | | (0.184) | | | | |
| BMI one year before marriage (men) | | 1.013*** | | 1.014*** | | |
| | | (0.006) | | (0.005) | | |
| BMI one year before marriage (women) | | 1.100*** | | | | 1.107*** |
| | | (0.005) | | | | (0.006) |
| Cohort fixed effects | YES | YES | YES | YES | YES | YES |
| Region fixed effects | YES | YES | YES | YES | YES | YES |
| Observations | 51,157 | 51,157 | 26,120 | 26,120 | 25,037 | 25,037 |
| Number of respondents | 5,372 | 5,372 | 2,795 | 2,795 | 2,577 | 2,577 |

Notes: For the first stage of regressions, only the estimates of the coefficients of the instruments are shown, for the sake of concision. ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table 5.- Results of estimation with individuals younger than 40
(Other Instrumental Variables)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | I.V. Model Divorce Outcome IV: BMI at age of first marriage | First Stage BMI | I.V. Model Divorce Outcome IV: BMI at age 45 | First Stage BMI | I.V. Model Divorce Outcome IV: BMI at age 45 and BMI at age of first marriage | First Stage BMI |
| BMI | -0.001** | | -0.001** | | -0.001** | |
| | (0.0005) | | (0.0005) | | (0.0004) | |
| Age | 0.012*** | | 0.012*** | | 0.012*** | |
| | (0.004) | | (0.004) | | (0.004) | |
| Age squared/100 | -0.016** | | -0.016** | | -0.016** | |
| | (0.007) | | (0.007) | | (0.007) | |
| Same age | -0.007* | | -0.007* | | -0.007* | |
| | (0.004) | | (0.004) | | (0.004) | |
| Age at first marriage | -0.003*** | | -0.003*** | | -0.003*** | |
| | (0.001) | | (0.001) | | (0.001) | |
| Number children conceived before marriage | 0.010*** | | 0.010*** | | 0.010*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Number children conceived within marriage | -0.013*** | | -0.013*** | | -0.013*** | |
| | (0.002) | | (0.002) | | (0.002) | |
| Pregnant | -0.024*** | | -0.024*** | | -0.024*** | |
| | (0.008) | | (0.008) | | (0.008) | |
| Father in household in 1979 | -0.008** | | -0.008** | | -0.008** | |
| | (0.004) | | (0.004) | | (0.004) | |
| Highest education: lowest level | 0.027*** | | 0.027*** | | 0.027*** | |
| | (0.008) | | (0.008) | | (0.008) | |
| Highest education: high school level | 0.019*** | | 0.019*** | | 0.019*** | |
| | (0.005) | | (0.005) | | (0.005) | |
| Highest education: college level | 0.014*** | | 0.014*** | | 0.014*** | |
| | (0.005) | | (0.005) | | (0.005) | |
| Highest education spouse: lowest level | 0.019*** | | 0.019** | | 0.019** | |
| | (0.007) | | (0.007) | | (0.007) | |
| Highest education spouse: high school level | 0.005 | | 0.005 | | 0.005 | |
| | (0.005) | | (0.005) | | (0.005) | |
| Highest education spouse: college level | 0.002 | | 0.002 | | 0.002 | |
| | (0.005) | | (0.005) | | (0.005) | |
| Race: Hispanic | -0.005 | | -0.005 | | -0.006 | |
| | (0.005) | | (0.005) | | (0.005) | |
| Race: Black | 0.016*** | | 0.016*** | | 0.016*** | |
| | (0.005) | | (0.005) | | (0.005) | |
| Men | | 1.422*** | | 0.067 | | 1.228*** |
| | | (0.284) | | (0.232) | | (0.241) |
| BMI one year before marriage (men) | | 1.053*** | | | | 0.669*** |
| | | (0.008) | | | | (0.010) |
| BMI one year before marriage (women) | | 1.140*** | | | | 0.732*** |
| | | (0.009) | | | | (0.010) |
| BMI at age 45 (men) | | | | 0.674*** | | 0.358*** |
| | | | | (0.006) | | (0.007) |
| BMI at age 45 (women) | | | | 0.655*** | | 0.363*** |
| | | | | (0.005) | | (0.006) |
| Cohort fixed effects | YES | YES | YES | YES | YES | YES |
| Region fixed effects | YES | YES | YES | YES | YES | YES |
| Observations | 15,291 | 15,291 | 15,291 | 15,291 | 15,291 | 15,291 |
| Number of respondents | 1,883 | 1,883 | 1,883 | 1,883 | 1,883 | 1,883 |

Notes: For the first stage of regressions, only the estimates of the coefficients of the instruments are shown, for the sake of concision. ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table 6.- Results of estimation
(Instrumented Estimates: people classified by BMI)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | I.V. Model Divorce Outcome "Overweight" | First Stage BMI | I.V. Model Divorce Outcome "Normal Weight" | First Stage BMI | I.V. Model Divorce Outcome "Underweight" | First Stage BMI |
| Overweight | -0.013*** | | | | | |
| | (0.004) | | | | | |
| Normal | | | 0.015*** | | | |
| | | | (0.004) | | | |
| Underweight | | | | | 0.081*** | |
| | | | | | (0.026) | |
| Age | 0.010*** | | 0.010*** | | 0.010*** | |
| | (0.001) | | (0.001) | | (0.001) | |
| Age squared/100 | -0.012*** | | -0.012*** | | -0.013*** | |
| | (0.001) | | (0.001) | | (0.001) | |
| Same age | -0.011*** | | -0.011*** | | -0.011*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Age at first marriage | -0.004*** | | -0.004*** | | -0.004*** | |
| | (0.0004) | | (0.0004) | | (0.0004) | |
| Number children conceived before marriage | 0.012*** | | 0.012*** | | 0.012*** | |
| | (0.002) | | (0.002) | | (0.002) | |
| Number children conceived within marriage | -0.010*** | | -0.010*** | | -0.010*** | |
| | (0.001) | | (0.001) | | (0.001) | |
| Pregnant | -0.020*** | | -0.020*** | | -0.020*** | |
| | (0.004) | | (0.004) | | (0.004) | |
| Father in household in 1979 | -0.010*** | | -0.010*** | | -0.010*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Highest education: lowest level | 0.026*** | | 0.026*** | | 0.024*** | |
| | (0.005) | | (0.005) | | (0.005) | |
| Highest education: high school level | 0.019*** | | 0.019*** | | 0.019*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Highest education: college level | 0.013*** | | 0.013*** | | 0.012*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Highest education spouse: lowest level | 0.016*** | | 0.016*** | | 0.016*** | |
| | (0.004) | | (0.004) | | (0.004) | |
| Highest education spouse: high school level | 0.009*** | | 0.009*** | | 0.008*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Highest education spouse: college level | 0.004 | | 0.004 | | 0.004 | |
| | (0.003) | | (0.003) | | (0.003) | |
| Race: Hispanic | -0.002 | | -0.002 | | -0.003 | |
| | (0.003) | | (0.003) | | (0.003) | |
| Race: Black | 0.021*** | | 0.021*** | | 0.021*** | |
| | (0.003) | | (0.003) | | (0.003) | |
| Men | | -0.100*** | | 0.389*** | | -0.289*** |
| | | (0.026) | | (0.028) | | (0.010) |
| BMI one year before marriage (men) | | 0.082*** | | -0.080*** | | -0.003*** |
| | | (0.001) | | (0.0001) | | (0.0003) |
| BMI one year before marriage (women) | | 0.076*** | | -0.062*** | | -0.014*** |
| | | (0.0001) | | (0.0001) | | (0.0003) |
| Cohort fixed effects | YES | YES | YES | YES | YES | YES |
| Region fixed effects | YES | YES | YES | YES | YES | YES |
| Observations | 51,157 | 51,157 | 51,157 | 51,157 | 51,157 | 51,157 |
| Number of respondents | 5,372 | 5,372 | 5,372 | 5,372 | 5,372 | 5,372 |

Notes: For the first stage of regressions, only the estimates of the coefficients of the instruments are shown, for the sake of concision. ***, **, * Significant at the 1%, 5%, 10% level, respectively.

Table 7.- Results of estimation
(Instrumented Estimates: people classified by race)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | I.V. Model Divorce Hispanic | First Stage BMI | I.V. Model Divorce Black | First Stage BMI | I.V. Model Divorce Other | First Stage BMI |
| BMI | -0.002*** | | 0.0003 | | -0.001*** | |
| | (0.001) | | (0.001) | | (0.0003) | |
| Age | 0.010*** | | 0.009*** | | 0.010*** | |
| | (0.003) | | (0.003) | | (0.001) | |
| Age squared/100 | -0.011*** | | -0.013*** | | -0.012*** | |
| | (0.003) | | (0.004) | | (0.002) | |
| Same age | -0.005 | | -0.005 | | -0.015*** | |
| | (0.006) | | (0.006) | | (0.003) | |
| Age at first marriage | -0.005*** | | -0.001 | | -0.004*** | |
| | (0.001) | | (0.001) | | (0.001) | |
| Number children conceived before marriage | 0.007* | | 0.004 | | 0.020*** | |
| | (0.004) | | (0.003) | | (0.003) | |
| Number children conceived within marriage | -0.010*** | | -0.007** | | -0.010*** | |
| | (0.003) | | (0.003) | | (0.001) | |
| Pregnant | -0.003 | | -0.050*** | | -0.017*** | |
| | (0.011) | | (0.013) | | (0.005) | |
| Father in household in 1979 | -0.007 | | -0.010** | | -0.008** | |
| | (0.005) | | (0.005) | | (0.003) | |
| Highest education: lowest level | 0.028*** | | 0.051*** | | 0.019*** | |
| | (0.010) | | (0.011) | | (0.006) | |
| Highest education: high school level | 0.028*** | | 0.034*** | | 0.014*** | |
| | (0.009) | | (0.008) | | (0.004) | |
| Highest education: college level | 0.019** | | 0.029*** | | 0.007** | |
| | (0.008) | | (0.008) | | (0.004) | |
| Highest education spouse: lowest level | 0.012 | | 0.031** | | 0.019*** | |
| | (0.010) | | (0.012) | | (0.006) | |
| Highest education spouse: high school level | 0.023*** | | 0.002 | | 0.008** | |
| | (0.008) | | (0.008) | | (0.004) | |
| Highest education spouse: college level | 0.005 | | -0.002 | | 0.007* | |
| | (0.008) | | (0.008) | | (0.004) | |
| Men | | 0.974** | | 0.383 | | 2.232*** |
| | | (0.442) | | (0.411) | | (0.235) |
| BMI one year before marriage (men) | | 1.021*** | | 1.036*** | | 1.003*** |
| | | (0.013) | | (0.013) | | (0.007) |
| BMI one year before marriage (women) | | 1.078*** | | 1.075*** | | 1.122*** |
| | | (0.014) | | (0.011) | | (0.007) |
| Cohort fixed effects | YES | YES | YES | YES | YES | YES |
| Region fixed effects | YES | YES | YES | YES | YES | YES |
| Observations | 8,832 | 8,038 | 9,573 | 9,336 | 32,752 | 30,749 |
| Number of respondents | 858 | 879 | 1,145 | 1,309 | 3,369 | 3,475 |

Notes: For the first stage of regressions, only the estimates of the coefficients of the instruments are shown, for the sake of concision. ***, **, * Significant at the 1%, 5%, 10% level, respectively.

APPENDIX A. Logit-Probit estimates

Table Appendix A.- Results of estimation
(Non-instrumented estimates; Logit-Probit models)

| | Logit<br>Model (1) | Probit<br>Model (2) |
|---|---|---|
| BMI | -0.053*** | -0.024*** |
| | (0.006) | (0.003) |
| Age | 0.273*** | 0.119*** |
| | (0.041) | (0.019) |
| Age squared/100 | -0.354*** | -0.153*** |
| | (0.053) | (0.024) |
| Age at first marriage | -0.086*** | -0.039*** |
| | (0.014) | (0.007) |
| Same age | -0.267*** | -0.128*** |
| | (0.063) | (0.029) |
| Number children conceived before marriage | 0.182*** | 0.090*** |
| | (0.035) | (0.017) |
| Number children conceived within marriage | -0.284*** | -0.128*** |
| | (0.036) | (0.017) |
| Pregnant | -0.799*** | -0.362*** |
| | (0.173) | (0.073) |
| Father in household in 1979 | -0.217*** | -0.101*** |
| | (0.058) | (0.027) |
| Highest education: lowest level | 0.717*** | 0.322*** |
| | (0.112) | (0.052) |
| Highest education: high school level | 0.607*** | 0.268*** |
| | (0.089) | (0.040) |
| Highest education: college level | 0.478*** | 0.204*** |
| | (0.089) | (0.040) |
| Highest education spouse: lowest level | 0.480*** | 0.223*** |
| | (0.109) | (0.050) |
| Highest education spouse: high school level | 0.333*** | 0.154*** |
| | (0.088) | (0.039) |
| Highest education spouse: college level | 0.226** | 0.103*** |
| | (0.090) | (0.040) |
| Race: Hispanic | 0.019 | 0.009 |
| | (0.076) | (0.035) |
| Race: Black | 0.457*** | 0.218*** |
| | (0.073) | (0.034) |
| Cohort fixed effects | YES | YES |
| Region fixed effects | YES | YES |
| Observations | 51,157 | 51,157 |
| Number of respondents | 5,372 | 5,372 |

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

APPENDIX B. Different Subsamples

Appendix B.- Subsamples by age and age at first marriage
(Instrumented Estimates)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | I.V. Model Divorce Age >21 | First Stage BMI | I.V. Model Divorce Age at First Marriage: 18-22 | First Stage BMI | I.V. Model Divorce Age at First Marriage: 23-27 | First Stage BMI | I.V. Model Divorce Age at First Marriage: 28-32 | First Stage BMI |
| BMI | -0.001*** | | -0.002*** | | -0.001* | | -0.001** | |
| | (0.0003) | | (0.001) | | (0.0003) | | (0.001) | |
| Age | 0.013*** | | 0.010*** | | 0.009*** | | 0.022*** | |
| | (0.001) | | (0.002) | | (0.002) | | (0.004) | |
| Age squared/100 | -0.015*** | | -0.013*** | | -0.012*** | | -0.025*** | |
| | (0.002) | | (0.003) | | (0.002) | | (0.005) | |
| Same age | -0.012*** | | -0.011* | | -0.012*** | | -0.001 | |
| | (0.003) | | (0.006) | | (0.003) | | (0.006) | |
| Age at first marriage | -0.004*** | | | | | | | |
| | (0.000) | | | | | | | |
| Number children conceived before marriage | 0.011*** | | 0.015*** | | 0.010*** | | 0.009** | |
| | (0.002) | | (0.003) | | (0.002) | | (0.004) | |
| Number children conceived within marriage | -0.011*** | | -0.008*** | | -0.008*** | | -0.015*** | |
| | (0.001) | | (0.002) | | (0.001) | | (0.003) | |
| Pregnant | -0.018*** | | -0.022*** | | -0.020*** | | -0.019 | |
| | (0.005) | | (0.007) | | (0.006) | | (0.014) | |
| Father in household in 1979 | -0.010*** | | -0.016*** | | -0.007** | | -0.0002 | |
| | (0.003) | | (0.005) | | (0.003) | | (0.007) | |
| Highest education: lowest level | 0.017*** | | 0.040*** | | 0.013** | | 0.006 | |
| | (0.005) | | (0.009) | | (0.006) | | (0.013) | |
| Highest education: high school level | 0.019*** | | 0.024*** | | 0.015*** | | 0.028*** | |
| | (0.003) | | (0.007) | | (0.004) | | (0.008) | |
| Highest education: college level | 0.013*** | | 0.020*** | | 0.011*** | | 0.012 | |
| | (0.003) | | (0.007) | | (0.004) | | (0.008) | |
| Highest education spouse: lowest level | 0.019*** | | 0.009 | | 0.018*** | | 0.018 | |
| | (0.005) | | (0.008) | | (0.006) | | (0.013) | |
| Highest education spouse: high school level | 0.009*** | | 0.003 | | 0.012*** | | 0.006 | |
| | (0.003) | | (0.007) | | (0.004) | | (0.008) | |
| Highest education spouse: college level | 0.005* | | -0.004 | | 0.007* | | 0.009 | |
| | (0.003) | | (0.007) | | (0.004) | | (0.008) | |
| Race: Hispanic | -0.001 | | -0.001 | | -0.004 | | -0.002 | |
| | (0.003) | | (0.005) | | (0.004) | | (0.009) | |
| Race: Black | 0.025*** | | 0.015*** | | 0.020*** | | 0.024*** | |
| | (0.003) | | (0.006) | | (0.004) | | (0.008) | |
| Men | | 1.252*** | | 1.825 | | 0.843*** | | 3.272*** |
| | | (0.195) | | (0.365) | | (0.251) | | (0.422) |
| BMI one year before marriage (men) | | 1.017*** | | 1.006*** | | 1.050*** | | 0.914*** |
| | | (0.006) | | (0.012) | | (0.008) | | (0.012) |
| BMI one year before marriage (women) | | 1.093*** | | 1.113*** | | 1.113*** | | 1.068*** |
| | | (0.006) | | (0.010) | | (0.008) | | (0.012) |
| Cohort fixed effects | YES | YES | YES | YES | YES | YES | YES | YES |
| Region fixed effects | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 43,426 | 43,426 | 18,151 | 18,151 | 24,558 | 24,558 | 7,356 | 7,356 |
| Number of respondents | 4,539 | 4,539 | 1,847 | 1,847 | 2,475 | 2,475 | 902 | 902 |

Notes: For the first stage of regressions, only the estimates of the coefficients of the instruments are shown, for the sake of concision. ***, **, * Significant at the 1%, 5%, 10% level, respectively.