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Fat spouses and hours of work: are body and Pareto weights correlated?

Sonia Oreffice and Climent Quintana-Domeque[*]

*Correspondence:
climent.quintana@gmail.com
Universitat d'Alacant & IZA, Alicante,
Spain

Abstract

We explore the relationship between relative physical attractiveness in the household and the hours worked by married men and women. Using PSID data, we find that husbands who are thinner relative to their wives work fewer hours, while wives who are heavier relative to their husbands work more hours. These results are robust to controlling for individual, spousal characteristics, and conventional distribution factors, suggesting that high *body* weight leads to low *Pareto* weight in the household: fatter spouses may compensate with more hours of work. Our household bargaining interpretation is supported by the fact that we cannot statistically reject the collective proportionality restriction when including measures of the distribution of relative physical attractiveness in the population.

JEL codes: D1, J1, J22

Keywords: Hours worked, Body mass index, Collective model

1   Introduction

Economists have been inquiring about the determinants of labor supply, the intra-household allocation of resources, and the economic impact of physical attractiveness for decades. Is there any common link among all these different forces? As illustrated in the seminal work by Chiappori (1992), the family has considerable influence on the behavior of its members, and in particular on their labor supply choices. The wife's decision power, which depends on her characteristics and wellbeing outside marriage relative to her spouse's (relative age, wage, education, non-labor income, divorce laws, etc.), will affect both her own and her husband's allocation of hours of work. Although many studies have analyzed the role of spouses' differences along several dimensions, the literature has remained silent on the role of *differences in physical attractiveness*[1]. This is somewhat surprising, since *relative* attractiveness seems to be a relevant determinant of the bargaining power of each spouse, and existing works directly link physical attractiveness measures (e.g., photo ratings, body mass index) to several economic outcomes, such as individual employment status, earnings, and even criminal activity (e.g., Hamermesh and Biddle 1994; Mocan and Tekin 2010; Rooth 2009).

   In this paper, we explore the relationship of *relative physical attractiveness* within the household and the hours worked by married men and women, proxied by their relative body mass index (BMI, weight-for-height). By establishing a link between *body* weight

and *Pareto* weight in the household, our work is consistent with the long tradition in labor supply research that emphasizes the family context in which work decisions are made (e.g., Blau and Kahn 2007; Blundell and MaCurdy 1999; Chiappori et al. 2002). While own weight (BMI) has already been linked to labor supply (Lakdawalla and Philipson 2007; Loh 2009), evidence from psychology explicitly points to fatness being stigmatized by spouses, and that social pressures for slimness affect marital interaction (Sobal 1995). In particular, it is the *relative* attractiveness within the couple which is thought to affect *household behavior*. McNulty and Neff (2008) actually claim that how the discrepancy in spouses' attractiveness affects household outcomes and satisfaction is still an open question.

We use a standard collective labor supply model (Chiappori et al. 2002) in which relative physical attractiveness may influence the decision power of each spouse. It is known that spouses' relative characteristics and opportunities outside marriage shape their respective intrahousehold bargaining power and share of household resources (e.g., Browning et al. 2012). Following Gregory and Ruhm (2011), Mansour and McKinnish (2011), Chiappori et al. (2012), among others, we consider BMI as a proxy for physical attractiveness. Viewing relative physical attractiveness through the lens of a collective labor supply framework allows us to investigate its relationship with hours of work of both married men and women. In such a context, relatively high *body* weight transforms into low *Pareto* weight in the household, inducing individuals to compensate for their negative physical trait by working more hours, while their spouses work less. Discrepancies in physical appearance lead to a better position inside the household for the better-looking spouse, in terms of intrahousehold allocation of resources, and thus of hours worked by husbands and wives.

Using data from the Panel Study of Income Dynamics (PSID) on married heads and their wives from 1999 to 2007, we show how relative attractiveness proxied by wife's BMI relative to husband's BMI matters in explaining their annual hours of work. We find that husbands who are thinner relative to their wives work fewer hours, while wives who are heavier relative to their husbands work more hours. Acknowledging that individuals working more hours may work in sedentary jobs (Lakdawalla and Philipson 2007; Loh 2009) or consume more highly-caloric food to economize on the scarcity of their time (Chou et al. 2004), we present estimates controlling for sedentary job-type and the ratio of expenditures of food at home versus total food. We also account for spousal characteristics and conventional distribution factors, and obtain virtually identical results.

To uncover the bargaining power channel from the role of unobserved heterogeneity, one may think of linking changes in relative body weight to changes in hours of work. Unfortunately, (relative) body weight has weak time series variation in a short time span. In addition, this variation is likely to reflect noise (e.g., measurement error due to self-reporting). These two issues make first-differenced and within-OLS estimators unreliable (e.g., Deaton 1995), and even undesirable (e.g., Choi 2012). Although we cannot ultimately conclude that high body weight *causes* lower Pareto weight, we can offer indirect evidence on this underlying relationship. First, we cannot reject the collective model restriction of *proportionality* between the labor supply responses to the spouses' relative BMI and the ratio of means and standard deviations of these BMIs in the population. Second, we compare the spouses' labor supply responses to own BMI to those of *unmarried* individuals, to distinguish within-family mechanisms from alternative ones. Although own BMI is positively related to hours of work for both married men and married women, no statistically

significant relationship emerges for either unmarried men or unmarried women. Finally, marital sorting along a dimension potentially correlated with future labor supply (we focus on couples who have been married for at least 4 years) does not appear to interfere with our results and their interpretation, since this matching would predict a negative correlation between hours of work and own BMI, while we find positive correlations for both men and women.

Our analysis is also related to the literature on the marriage market penalties of low physical attractiveness. Heavier (or obese) men and women are found to be penalized in the marriage market by matching with partners who are weaker along socioeconomic dimensions, i.e., educational attainment and wages (Averett and Korenman 1996; Hamermesh and Biddle 1994; Oreffice and Quintana-Domeque 2010). While negative effects of *own* BMI on both labor- and marriage-market outcomes have been well-documented (e.g., Averett et al. 2008; Cawley 2004; Garcia and Quintana-Domeque 2007), our evidence indicates that the *relative* BMI within the couple reinforces these penalties through the *household decision process*. Relatively heavier married individuals work more hours to compensate their spouses for their defect, regardless of gender. More generally, this study contributes to the understanding of labor supply of married men and women. The estimated sizeable correlations of relative BMI and spouses hours of work, and with opposite signs, are all the more remarkable given the acknowledged rigidities in hours worked.

The paper is organized as follows. Section 2 discusses the conceptual framework. Section 3 describes the data. Section 4 presents the empirical results and discusses potential alternative explanations. Section 5 concludes.

2 Conceptual framework

2.1 Measuring (relative) physical attractiveness

Our study analyzes the role of relative physical attractiveness on hours of work. Hence, we first need to define how to measure physical attractiveness. There exists a considerable literature in which weight scaled by height (body mass index, BMI) is used as a proxy for socially defined physical attractiveness. Recent examples in economics include Chiappori et al. (2012), Gregory and Ruhm (2011) and Mansour and McKinnish (2011). Indeed, BMI is shown to be negatively related to physical attractiveness. Interestingly, Rooth (2009) found that photos that were manipulated to make a person of normal weight appear to be obese (BMI$\geq$30) caused a change in the viewer's perception, from attractive to unattractive. In particular, BMI is reported to be the dominant cue for female physical attractiveness, while the waist-to-chest ratio (WCR) plays a more important role than BMI in the case of male attractiveness (Swami 2008). However, it must be emphasized that BMI and WCR are strongly positively correlated, and, not surprisingly, BMI is correlated with the male attractiveness rating by women, though this correlation is lower than the one with WCR (Tovée and Cornelissen 2001; Tovée et al. 1999; Wells et al. 2007).

We are not aware of any study with detailed measures of body shape and socioeconomic characteristics which simultaneously provides these data for *both* spouses. Since BMI has been shown to constitute a good proxy for both male and female physical attractiveness, and evidence from psychology explicitly points to fatness being stigmatized by spouses (Sobal 1995), we will consider this measure in our analysis. Specifically, to capture relative attractiveness, we will use the wife's relative BMI (the wife's BMI divided by her husband's

BMI). Although BMI is neither the only nor the most important dimension of physical attractiveness our ratio contains two comparable objective measures, which would not be the case if using photo ratings or waist-to-hip ratio against waist-to-chest ratio.

2.2 A standard model

We apply the collective household labor supply model with distribution factors of Chiappori et al. (2002), in its general version. A household is composed of two decision makers, wife and husband, each having a distinct utility function on consumption and leisure, and making Pareto-efficient decisions. In general, each individual utility can also depend on his-her spouse's consumption and leisure, including altruism, public consumption, and positive or negative externalities. Let h_i and C_i for $i = 1, 2$ denote member i's hours of work and consumption of a private composite good (whose price is normalized to unity), with leisure time $l_i = 1 - h_i$, y the household non-labor income, w_i the wage rate of spouse i, and z_i possible preference parameters of spouse i. Finally, let s represent the *relative* attractiveness of the two spouses, specifically spouse 1's attractiveness with respect to spouse 2's. Opportunities outside marriage and personal qualities shape an individual's relative attractiveness, and are found to enhance a spouse's role and decision power in the household, affecting household choices[2]. The utility function of member i is $U^i(C_1, C_2, 1 - h_1, 1 - h_2, z_i)$[3].

The optimal allocations of hours of work are determined by the following program:

$$\max_{\{C_1, C_2, h_1, h_2\}} \lambda U^1(C_1, C_2, 1 - h_1, 1 - h_2, z_1) + (1 - \lambda)U^2(C_1, C_2, 1 - h_1, 1 - h_2, z_2)$$

subject to

$$C_1 + C_2 \leq w_1 h_1 + w_2 h_2 + y$$

$$0 \leq h_i \leq 1, \qquad i = 1, 2$$

where the corresponding (Pareto) weighting factor is $\lambda(w_1, w_2, y, z_1, z_2, s)$, representing the household decision process, and in particular spouse 1's bargaining power. The scalar function λ is assumed continuously differentiable in its arguments, non-negative, and can be normalized to belong to $[0, 1]$ without loss of generality. s measures the discrepancy in spouses' attractiveness, and we define it to be $s = \frac{BMI_1}{BMI_2}$, the BMI of individual 1 relative to the BMI of individual 2. In general, λ may also depend on other relative factors, such as incomes or prices and any other characteristic of the household environment that may affect the intra-household distribution of resources and thus the decision process (Browning and Chiappori 1998; Browning et al. 1994; Vermeulen 2002). Here, we focus on relative physical attractiveness, although we will include conventional as well as population distribution factors later on.

In this framework, relative physical attractiveness of individual 1 with respect to individual 2 increases the weighting factor λ (the weight on spouse 1's utility function in the household welfare function), while decreasing the relative importance of individual 2, and thus affects the household choices of consumption and leisure (assuming that leisure externalities are not too strong, i.e., an increase in λ has a negative (positive) effect on h_1 (h_2)). Therefore, we predict that $\frac{\partial \lambda}{\partial s} < 0$, given that higher relative BMI of individual 1 is associated with relatively lower physical attractiveness.

Assuming interior solutions, and following Chiappori et al. (2002), we can state that the couple's Pareto-efficient decisions yield the following equilibrium labor supply functions of the two spouses:

$$h_i = H_i(w_1, w_2, y, \lambda(w_1, w_2, y, z_1, z_2, s), z_1, z_2) \; \forall i = 1, 2 \text{ with } \frac{\partial H_1}{\partial \lambda} < 0 \text{ and } \frac{\partial H_2}{\partial \lambda} > 0$$

so that:

$$\frac{\partial h_1}{\partial s} = \frac{\partial H_1}{\partial \lambda} \frac{\partial \lambda}{\partial s} > 0 \tag{1}$$

and

$$\frac{\partial h_2}{\partial s} = \frac{\partial H_2}{\partial \lambda} \frac{\partial \lambda}{\partial s} < 0 \tag{2}$$

Therefore, the hours worked by *each* spouse are negatively related to his/her level of relative attractiveness, ceteris paribus, in particular controlling for own and spouse's wage, and for the couple's total non-labor income *y*. If having a relatively low BMI strengthens a spouse's relative outside opportunities and welfare, thus increasing his/her weight in household decisions, he/she will work *fewer* hours. At the same time, we should observe the *opposite* impact on the hours of his/her spouse, who would experience a decline in his/her decision power, and thus work *more*.

We will investigate these patterns for both married males and females, by testing whether a wife (individual 1)'s hours of work are positively related to the relative BMI, *s*, while her husband (individual 2)'s are negatively related to it. More *body* weight implies less *Pareto* weight in the household, compensating their spouse for the negative physical attribute by working more hours. In other words, lower (Pareto) weight of individual 1 in the decision process should, by standard income effects, lead to an increase in individual 1's labor supply and a reduction in individual 2's, all else equal. These differences in response to relative BMI would support the claim that hours of work are affected by the physical attractiveness of both spouses through its relevance in the household decision process, regardless of gender, and *in addition* to the individual and spousal characteristics that are traditionally thought to affect labor supply (Blau and Kahn 2007; Browning et al. 2012).

Our empirical analysis focuses on couples where *both* individuals are working, according to the predictions by Chiappori et al. (2002) which were developed for married working couples. In addition, Blundell et al. (2007) state that the case where both spouses work is the one yielding the strongest identifying power for preferences and for the impact of distribution factors on the division of household resources. Our labor supply analysis is exactly in terms of intra-household bargaining and allocation of resources[4].

3 Data description

Our empirical work uses data from the Panel Study of Income Dynamics (PSID). The PSID is a longitudinal household survey collecting a wide range of individual and household demographic, income, and labor-market variables. In addition, in the waves since 1999, the PSID provides the weights (in pounds) and heights (in feet and inches) of both household heads and wives, which we use to calculate the BMI of each spouse, defined

as an individual's body weight (in kilograms) divided by the square of his or her height (in meters)[5].

In each of the survey years under consideration (1999, 2001, 2003, 2005, and 2007), the PSID comprises about 4,500 married households. We select households with a household head and a wife where both are actually present. In our sample years, all the married heads with spouse present are males, so we refer to each couple as husband and wife, respectively. We confine our study to white couples, and to those whose wife is between 26 and 48 years old, and whose husband is between 28 and 50 years old, given the average two-year intra-household age gap in the US (Chiappori et al. 2009). The lower and upper bounds are chosen to focus on prime-age individuals, since our analysis concerns labor supply behavior. We exclude individuals with work-limiting disability conditions, as measured by reporting a physical or nervous condition that limits an individual's type or amount of work.

The analysis comprises white individuals for two reasons. First, the sample size for black couples in the PSID is much smaller. Second, and more importantly, perceptions of attractiveness regarding BMI can be very different between blacks and whites. Several researchers argue that standards and experiences of beauty vary by gender and race (Craig 2006; Conley and McCabe 2011). Moreover, following Conley and Glauber (2007), we discard those individuals whose height and weight values include any extreme ones: a weight of more than 400 or less than 70 pounds, a height above 84 or below 45 inches. We focus on men whose BMI is between 20 and 40, and women between 18.5 and 40, thus excluding (medically) severely obese or underweight individuals (WHO 2009). In our sample, there are no observations hitting the bounds of the wife's relative BMI: the smallest value is 0.523 (>18.5/40), and the highest value is 1.628 (<40/20).

Our main sample consists of working men and women, married to one another. Unlike many previous studies (e.g., Averett and Korenman 1996; Averett et al. 2008; Hamermesh and Biddle 1994), the focus is on actual partnerships, rather than on groups of husbands and wives that are not necessarily associated to one another. This has the advantage to assess labor supply outcomes actually decided at the household level. In particular, we consider couples where both husbands and wives are working because our main predictions regarding the role of BMI in the household are in terms of hours worked by both spouses.

Because the PSID main files do not contain any direct question concerning the duration of the marriages, we rely on the "Marital History File: 1985-2007" Supplement of the PSID to obtain the year of marriage and number of marriages, to account for the duration of the couples' current marriage. We merge this information to our married sample using the unique household and person identifiers provided by the PSID, and we consider married couples who have been married for *at least* 4 years, to capture the role of intrahousehold allocation of resources rather than unobserved heterogeneity due to sorting at the time of the match.

In the PSID all the variables, including the information on the wife, are reported by the head of the household. Reed and Price (1998) found that family proxy-respondents tend to overestimate heights and underestimate weights of their family members, so that family proxy-respondent estimates follow the same patterns as self-reported estimates (see Gorber et al. 2007, for a review). The authors suggest that the best proxy-respondents are those who are in frequent contact with the target. Since we are considering married

couples, the best proxy-respondents are likely to be the spouses. Additionally, although it is well-known that self-reported anthropometric measures are likely to suffer from measurement error, Thomas and Frankenberg (2002) and Ezzati et al. (2006) showed that in the United States, self-reported heights exaggerate actual heights, on average, and that the difference is close to constant for ages 20–50[6].

In all of our regressions, the dependent variable is the log of annual hours worked, defined in the PSID as "total annual work hours on all jobs, including overtime". We focus on individuals working more than 1000 annual hours if male, and 750 if female, and on those earning more than $5 per hour. These restrictions are meant to exclude couples who are not really attached to the labor market. Specifically, those couples where the husband works less than part-time ($\leq$ 20 hours per week), and the wife works less than about 15 hours per week. Our final sample contains 2043 observations representing 997 couples (approximately, 2.05 observations per couple).

The main explanatory variable is the ratio of the wife's BMI to the husband's BMI. The control variables used in our analysis are: age; log hourly wage; non-labor income (constructed as total family income minus the labor income of each spouse); education (defined as the number of completed years of schooling and is top-coded at 17 for some completed graduate work); health status (1 if excellent, very good, or good; 0 if fair or poor); number of children in the household under 18 years; and a dummy variable for the presence of children aged 2 years old or less (to control for a recent pregnancy).

In addition, occupation categories are considered to create a categorical variable for sedentary job type, following the medical classification by Choi et al. (2010), and we also create the ratio of the expenditures of food at home versus total food. This is to account for the fact that individuals working more hours may work in sedentary jobs (Lakdawalla and Philipson 2007) or consume more highly-caloric food to economize on the scarcity of their time (Chou et al. 2004), and therefore exhibit a higher BMI. Finally, state dummy variables or Census Bureau Division indicators are included to capture constant differences in labor and marriage markets across geographical areas in the US, such as the proportion of obese men and women and cultural attitudes toward BMI and obesity. As our analysis concerns several PSID waves, year dummy variables are also used. The regression analysis uses the PSID-provided sample household weights[7].

Table 1 contains the main descriptive statistics for our sample of married couples. The average husband works 2361 hours per year, while the average wife works 1857 annual hours. Part of this difference is due to the fact that we are focusing on couples were husbands work more than 1000 hours (hence, excluding part-time husbands) and wives work more than 750 hours. The average husband in our sample has a BMI of 27.7, so he is overweight ($25 \leq BMI < 30$), while the average wife is almost overweight, with a BMI of 24.7. The average household has a non-labor income of approximately $9000 per year. The spouses' wage difference is $7, with the average husband earning $26.6 per hour and the average wife having an hourly wage of $19.6. No mean differences between husbands and wives are found in terms of either completed education, around 14 years, or health status, 97% and 98%, for married men and women, respectively. The average age is 40 for married men, and 38 for married women. The average number of children per household is 1.4, and in 10% of the cases, there has been a recent pregnancy. Finally, we note that nearly 60% of husbands work in sedentary jobs, while this percentage is almost 90% for wives.

Table 1 Descriptive statistics

	Mean	SD
Hours wife	1857.09	545.62
Hours husband	2361.24	512.81
BMI wife	24.68	4.38
BMI husband	27.69	3.82
Non-labor income	9224.45	34610.09
Hourly wage wife	19.61	13.15
Hourly wage husband	26.62	31.61
Age wife	38.53	5.91
Age husband	40.26	6.05
Education wife	13.97	2.07
Education husband	13.81	2.15
Good health wife	0.98	0.15
Good health husband	0.97	0.18
Recent pregnancy	0.10	0.30
Number of children	1.42	1.03
Sedentary job wife	0.86	0.34
Sedentary job husband	0.58	0.49
BMI wife/BMI husband	0.90	0.17
Food expenditure ratio[a]	0.70	0.17
N	2,043	

Note: All Tables use PSID data, 1999–2007. Men aged 28–50 and working more than 1000 hours per year, women aged 26–48 working more than 750 hours per year, both earning more than $5 per hour and non-disabled. Marital duration of at least 4 years. Sampling weights are used.
[a]For food ratio N=2,025.

4 Empirical evidence

We start exploring the relationship between annual hours of work and relative attractiveness in Table 2. We run two regressions, for married men and women separately, of an indicator of husband's (wife's) annual hours of work –which takes value 1 if the husband's (wife's) works more than the average husband's (wife's) work hours, i.e., 2361 (1857)– on a type of couple indicator –which takes value 1 if the relative wife's BMI is higher than the average relative BMI, i.e., 0.90– controlling for own age, state and year fixed effects. In 45% of the couples, the wife's BMI relative to her husband's is higher than the average BMI ratio. The main results of the table are that wives who are relatively heavier than their husbands are 6% more likely to work more hours than the average wife, while husbands who are relatively thinner than their wives are 8% less likely to work more hours than the average husband.

This table is consistent with the basic story presented above. A wife's lower relative physical attractiveness (or higher relative BMI) leads her to work more hours and her

Table 2 Regressions of annual hours of work indicators on type of couple indicator

	I(Hours husband $\geq$ 2361)	I(Hours wife $\geq$ 1857)	Mean
I(Wife's BMI/Husband's BMI $\geq$ 0.90)	−0.081[***]	0.056[**]	45%
	(0.028)	(0.028)	
Means	42%	55%	
N	2,043	2,043	

Note: I (·) takes value 1 if the condition (·) is satisfied, and 0 otherwise. The regressions include own age, year and state fixed effects. Robust standard errors clustered at the household id level are reported in parentheses. Sampling weights are used.
[***] p-value< 0.01, [**] p-value< 0.05, [*] p-value< 0.1.

husband to work fewer hours, and conversely. However, while these findings are support-ive of a standard collective model, they do not constitute clean tests of it because hours worked depend at least on wages, which may be related to the BMI ratio.

4.1 Relative BMI in the household and hours worked

Table 3 presents the results of several regressions where the dependent variable is the log annual hours of work of married men. In the first column we estimate a standard labor supply equation, which postulates a log-linear relationship between hours of work and wages controlling for a vector of demographic characteristics (age, education, house-hold non-labor income, number of children, recent pregnancy, and health status), state and year fixed effects. This is a prototype empirical specification that encompasses many economic models of labor supply (Blundell and MaCurdy 1999). In the second column, we add our measure of relative attractiveness between spouses, namely the ratio of wife's BMI to her husband's. Consistently with our predictions, we find a *negative* significant correlation between relative BMI and hours worked by married men, which corresponds to an elasticity of roughly 6.5%, significant at the 5% level, while the estimated coefficients associated to the hourly wage and other variables (results available upon request) do not exhibit any significant change with respect to the previous column.

Acknowledging that individuals working more hours may work in sedentary jobs, we also present estimates controlling for sedentary job-type, column (3). The estimated rela-tionship between hours worked and relative BMI remains the same. In column (4), we add the food expenditure ratio to account for the possibility that individuals working more hours may consume more highly-caloric food to economize on the scarcity of their time. This does not alter the estimated association between hours of work and relative BMI, which is reassuring, although this variable may not directly capture the food caloric content.

Finally, and in the spirit of the collective model of labor supply, in columns (5) and (6) we present estimates that account for both spousal characteristics (age, education, log

Table 3 Regressions of husband's log annual hours of work on wife's BMI relative to husband's BMI

	(1)	(2)	(3)	(4)	(5)	(6)
Wife's BMI/Husband's BMI	--	-0.069^{**}	-0.069^{**}	-0.076^{**}	-0.080^{**}	-0.088^{***}
		(0.034)	(0.034)	(0.034)	(0.033)	(0.033)
Log(Husband's Wage)	-0.041^{***}	-0.044^{***}	-0.044^{***}	-0.048^{***}	-0.040^{*}	-0.046^{**}
	(0.014)	(0.014)	(0.014)	(0.014)	(0.022)	(0.022)
Demographic characteristics	YES	YES	YES	YES	YES	YES
Sedentary-job type	NO	NO	YES	YES	NO	YES
Food ratio	NO	NO	NO	YES	NO	YES
Spousal characteristics	NO	NO	NO	NO	YES	YES
Conventional distribution factors	NO	NO	NO	NO	YES	YES
N	2,043	2,043	2,043	2,025	2,043	2,025
Adj. R^2	0.065	0.068	0.068	0.076	0.076	0.088

Note: All regressions include year and state fixed effects. Demographic characteristics include age, completed years of education, a good health status indicator, household non-labor income, number of children, and a recent pregnancy indicator. Spousal characteristics include age, completed years of education, a good health status indicator, and log hourly wage. Conventional distribution factors include the spouses' wage ratio, their age ratio, and their years of education ratio. Robust standard errors clustered at the household id level are reported in parentheses. Sampling weights are used.
*** p-value< 0.01, ** p-value< 0.05, * p-value< 0.1.

wage, and health status) and three conventional distribution factors (the spouses' wage ratio, their age ratio, and their years of education ratio). Our results are robust to these additional adjustments.

Table 4 displays the same set of regressions for married women. As expected, relatively heavier wives tend to work more hours. The relationship is robust and present in all the specifications, as it is the case for married men, albeit not statistically significant in the last column (p-value= 0.114). Although the wife's estimated correlations between hours of work and relative BMI are similar in magnitude, their standard errors are higher. This is not surprising, and it can be understood in a classical measurement error world, as long as the variance of the classical measurement error is higher when the household head reports the measure of his/her spouse than when he reports his own.

We have explored the possibility that certain ranges are more important than others for the relationship between hours of work and relative BMI. In particular, we have not found evidence of differential correlations depending on the relative BMI of the couples being within or out of the range from 0.74 (18.5/25) to 1.25 (25/20)[8]. These results are available upon request.

Note that in columns (5) and (6) of Tables 3 and 4 we have included spousal characteristics and conventional distribution factors. However, by estimating labor equations separately for husbands and wives, we were not using all the available information, since the error terms in these equations are likely to be correlated. To account for this correlation, we estimate in Table 5 the system of labor supply equations of husbands and wives by SUR, i.e., allowing the errors terms to be correlated. The table contains two panels –according to the controls included– with three rows each, corresponding to a different specification in terms of geographic and time fixed effects. The estimated correlation between the error terms, not reported in the table, is around $0.05 - 0.06$, depending on the controls included, and it is statistically different from zero at conventional levels. The same picture emerges, and the precision of the estimates increases (in general): wife's relative BMI is negatively correlated with her husband's hours of work but positively with hers.

Table 4 Regressions of wife's log annual hours of work on wife's BMI relative to husband's BMI

	(1)	(2)	(3)	(4)	(5)	(6)
Wife's BMI/Husband's BMI	--	0.106**	0.103**	0.102*	0.087*	0.082
		(0.052)	(0.052)	(0.052)	(0.052)	(0.052)
Log(Wife's Wage)	0.046**	0.048**	0.045**	0.038*	0.079**	0.070**
	(0.021)	(0.021)	(0.021)	(0.021)	(0.031)	(0.031)
Demographic characteristics	YES	YES	YES	YES	YES	YES
Sedentary-job type	NO	NO	YES	YES	NO	YES
Food ratio	NO	NO	NO	YES	NO	YES
Spousal characteristics	NO	NO	NO	NO	YES	YES
Conventional distribution factors	NO	NO	NO	NO	YES	YES
N	2,043	2,043	2,043	2,025	2,043	2,025
Adj. R^2	0.098	0.101	0.102	0.106	0.116	0.122

Note: All regressions include year and state fixed effects. Demographic characteristics include age, completed years of education, a good health status indicator, household non-labor income, number of children, and a recent pregnancy indicator. Spousal characteristics include age, completed years of education, a good health status indicator, and log hourly wage. Conventional distribution factors include the spouses' wage ratio, their age ratio, and their years of education ratio. Robust standard errors clustered at the household id level are reported in parentheses. Sampling weights are used.
*** p-value< 0.01, ** p-value< 0.05, * p-value< 0.1.

Table 5 SUR estimated coefficients on wife's BMI/husband's BMI

	With weights		Without weights	
	Log (Husband's hours)	Log (Wife's hours)	Log (Husband's hours)	Log (Wife's hours)
Panel I. Spousal characteristics				
a. State and year fixed effects	−0.090	0.079	−0.088	0.075
	(0.026)***	(0.038)**	(0.026)***	(0.037)**
			[0.031]***	[0.047]
b. Region and year fixed effects	−0.065	0.081	−0.066	0.077
	(0.026)**	(0.038)**	(0.026)**	(0.037)**
			[0.033]**	[0.048]
c. Region, year, and region-by-year fixed effects	−0.065	0.079	−0.066	0.076
	(0.026)**	(0.038)**	(0.026)**	(0.037)**
			[0.033]**	[0.048]
Panel II. Spousal characteristics and distribution factors				
d. State and year fixed effects	−0.088	0.082	−0.087	0.078
	(0.026)***	(0.038)**	(0.026)***	(0.037)**
			[0.031]***	[0.048]
e. Region and year fixed effects	−0.064	0.085	−0.065	0.080
	(0.026)**	(0.038)**	(0.026)**	(0.037)**
			[0.033]*	[0.048]*
f. Region, year, and region-by-year fixed effects	−0.064	0.083	−0.065	0.078
	(0.026)**	(0.038)**	(0.026)**	(0.037)**
			[0.033]*	[0.049]
N	2,025		2,025	

Note: Each row corresponds to a different SUR regression. All regressions include own log wage, food ratio, and demographic characteristics (age, completed years of education, a good health status indicator, household non-labor income, number of children, and a recent pregnancy indicator). Each husband's (wife's) regression includes a husband's (wife's) sedentary-job type indicator. In addition, panel I includes spousal characteristics (age, completed years of education, a good health status indicator, and log wage), and panel II includes both spousal characteristics and three conventional distribution factors (the spouses' wage ratio, their age ratio, and their years of education ratio). Standard errors are reported in parentheses. Bootstrapped standard errors clustered at the household id level based on 300 replications are reported in brackets.
*** p-value< 0.01, ** p-value< 0.05, * p-value< 0.1.

Overall, the evidence reported in Tables 3, 4 and 5 suggests that both men and women are responsive to their relative BMI within marriage, and willing to alter their labor supply behavior. Although we cannot conclude that these correlations reflect *causality*, we can provide indirect evidence of this compensation mechanism (i.e., a relative defect is compensated with a quality) by looking at the relationship between individuals' hours of work and measures of the distribution of attractiveness in the population. This is the aim of the next subsection.

4.2 The role of the distributions of physical attractiveness in the population

If relative attractiveness *in the household* matters for the allocation of resources, as our results suggest, then the attractiveness distribution of men and women in the population may also be relevant in shaping the intra-household allocation of resources, in terms of outside opportunities. Hence, if our previous findings capture the fact that relative BMI in the household affects spouses' hours of work, we may find that the distributions of BMIs in the marriage market matter as well. In this subsection we provide further evidence on the link between relative physical attractiveness and the spouses' hours of work, and assess the plausibility of the intrahousehold bargaining mechanism by testing a

simple restriction imposed by the collective model, namely the proportionality constraint (Chiappori et al. 2002).

We characterize the distribution of physical attractiveness in the population by its mean and standard deviation. The relevance of these moments can be easily understood in a standard search model, where individuals look for suitable marriage partners and the propensity to (re)marry falls as the reservation marriage proposal rises[9]. The key determinants of the reservation marriage proposal in our context are the means and the standard deviations of male and female BMI. While an increase in the mean male (female) BMI will decrease the reservation marriage proposal and search duration of women (men), the effect of the standard deviation of BMI on the reservation marriage proposal can only be unambiguously signed under the assumption of risk-neutral searchers and a mean-preserving spread. In this case, the effect is positive. Reassuringly, the available empirical evidence suggests that this is likely to be the case. Gould and Paserman (2003), Loughran (2002), and more recently Bellou (2012) and Coughlin and Drewianka (2011), find evidence that higher dispersion of male quality (measured by wage inequality) increases the option value of waiting for potential better candidates for women.

In our framework, if an increase in the standard deviation of male BMI increases the reservation marriage proposal and search duration of women, this will increase the bargaining power of married men, decreasing their labor supply. Conversely, if an increase in average male BMI decreases the reservation marriage proposal and search duration of women, this will decrease the bargaining power of married men, increasing their labor supply. However, because reservation marriage proposals should decrease slightly less than proportionally to increases in the mean of the BMI distribution, we expect a small effect for the mean (Loughran 2002). Hence, in terms of relative ratios of means and standard deviations, $s_\mu = \frac{\mu_1}{\mu_2}$ and $s_\sigma = \frac{\sigma_1}{\sigma_2}$, the following predictions arise:

$$\frac{\partial h_1}{\partial s_\sigma} = \frac{\partial H_1}{\partial \lambda} \frac{\partial \lambda}{\partial s_\sigma} < 0 \tag{3}$$

$$\frac{\partial h_2}{\partial s_\sigma} = \frac{\partial H_2}{\partial \lambda} \frac{\partial \lambda}{\partial s_\sigma} > 0 \tag{4}$$

$$\frac{\partial h_1}{\partial s_\mu} = \frac{\partial H_1}{\partial \lambda} \frac{\partial \lambda}{\partial s_\mu} \geq 0 \tag{5}$$

$$\frac{\partial h_2}{\partial s_\mu} = \frac{\partial H_2}{\partial \lambda} \frac{\partial \lambda}{\partial s_\mu} \leq 0 \tag{6}$$

where μ_1 (μ_2) is the mean BMI of married women (men) and σ_1 (σ_2) is the standard deviation of BMI for married women (men), which are computed at the age-education-region level. We consider the nine Census Bureau Divisions (New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific), two educational levels (above and below the median years of education, 14, which is the same for men and women in our sample), and two age levels (for women, above and below the median age, 39; for men, above and below the median age, 41). Thus, how favorable the relative BMI distribution is to men or women

will depend on 2^4 combinations in each region, given that the search outcome depends not only on the available partners but also on own "competitors" . Hence, the total number of "marriage markets" is expected to be 144 (16×9).

In addition, given (1)-(4) the following testable proportionality constraint arises (see Chiappori et al. 2002)[10]:

$$\frac{\left(\frac{\partial h_1}{\partial s}\right)}{\left(\frac{\partial h_1}{\partial s_\sigma}\right)} = \frac{\left(\frac{\partial h_2}{\partial s}\right)}{\left(\frac{\partial h_2}{\partial s_\sigma}\right)} \tag{7}$$

This prediction is very unlikely to be fulfilled unless the bargaining power explanation and the collective household approach presented here are correct and applicable to relative physical attractiveness as well.

In order to test these predictions, we estimate the regressions of row (b) of Table 5 adding s_μ and s_σ. We estimate the equations for husbands and wives simultaneously (SUR), with and without weights, and report the estimated coefficients on the relative BMI in the household, the corresponding ratio of the average BMIs in the population, and the ratio of the standard deviations of these distributions. We can see in Table 6 that our qualitative predictions are satisfied. The coefficients of relative physical attractiveness in the household keep the expected opposite signs for married men and women. In addition, the coefficients associated to the ratios of the averages and standard deviations exhibit the signs predicted by equations (3)-(6), and the estimates of s_σ are statistically significant in all specifications. We then turn to test the proportionality constraint implied by equation (7). The point estimates of the ratios are almost identical when using weights, −0.768 and −0.751, and very similar without weights (−0.905 and −0.788). Not surprisingly, we cannot statistically reject their equality (p-values of the Wald tests always higher than 0.86), supporting our household bargaining interpretation that the spouses' relative BMI is a bargaining-power force in the household decision process, and in labor supply decisions in particular. We also present the corresponding proportionality tests of the product of the coefficients. The same patterns arise, and the corresponding proportionality test does not reject. These results are robust to excluding the ratio of BMI population means, including conventional distribution factors, as well as to focusing only on couples belonging to age-education-region cells with more than 35 observations (results available upon request).

We conclude with an important remark. Our discussion of the role of the distribution of physical attractiveness in the population highlights the challenge of implementing a valid instrumental variable strategy for the relative spouses' BMI in the household. The corresponding ratios in the population, which in principle could be thought of as possible instruments (e.g., Morris 2006,2007), are instead potential factors affecting household bargaining power by themselves, and not only through the spouses' relative BMI, which invalidates them as instruments.

4.3 Alternative explanations

4.3.1 Alternative non-marriage market explanations: the unmarried

We have acknowledged that own weight (or BMI) has already been linked to labor supply –individuals working more hours may work in sedentary jobs (Lakdawalla and Philipson 2007) or consume more highly-caloric food to economize on the scarcity of their time

Table 6 SUR regressions of log annual hours of work on measures of relative attractiveness in the household and in the population

	With weights		Without weights	
	Log (Husband's Hours)	Log (Wife's Hours)	Log (Husband's Hours)	Log (Wife's Hours)
Coefficients on measures of relative attractiveness				
$s =$ wife's BMI/husband's BMI	−0.072	0.081	−0.072	0.077
	(0.027)***	(0.039)**	(0.026)***	(0.038)**
			[0.027]***	[0.047]
$s_\mu =$ average wife's BMI/average husband's BMI	−0.014	0.290	−0.010	0.321
	(0.151)	(0.219)	(0.153)	(0.218)
			[0.169]	[0.257]
$s_\sigma =$ SD of wife's BMI/SD of husband's BMI	0.094	−0.108	0.080	−0.097
	(0.027)***	(0.038)***	(0.026)***	(0.038)**
			[0.030]***	[0.052]*
Collective model proportionality constraint				
Within columns: Ratio of coefficients on s and s_σ	−0.768	−0.751	−0.905	−0.788
	(0.356)**	(0.446)*	(0.447)**	(0.493)
			[0.513]*	[0.663]
Wald Test of equality of ratios	$\chi^2(1) = 0.00$		$x^2(1) = 0.03$	
	$p-value = 0.9773$		$p-value = 0.8642$	
Based on bootstrapped standard errors	--		$\chi^2(1) = 0.02$	
			$p-value = 0.9004$	
Across columns: Product of coefficients on s and s_σ	0.008	0.008	0.007	0.006
	(0.004)*	(0.004)*	(0.004)*	(0.004)*
			[0.005]	[0.005]
Wald Test of equality of products	$\chi^2(1) = 0.00$		$\chi^2(1) = 0.03$	
	$p-value = 0.9773$		$p-value = 0.8653$	
Based on bootstrapped standard errors	--		$\chi^2(1) = 0.02$	
			$p-value = 0.9017$	
N	2,025		2,025	

Note: All regressions include year and region fixed effects, log wage, food ratio, demographic (age, completed years of education, a good health status indicator, household non-labor income, number of children, and a recent pregnancy indicator) and spousal characteristics (age, completed years of education, a good health status indicator, and log wage). In addition, husband's (wife's) regression includes a husband's (wife's) sedentary-job type indicator. Conventional distribution factors: spouses' wage ratio, their age ratio, and their years of education ratio. Standard errors are reported in parentheses. Bootstrapped standard errors clustered at the age-education-region level (136 groups) based on 300 replications are reported in brackets.
*** p-value< 0.01, ** p-value< 0.05, * p-value< 0.1.

(Chou et al. 2004)– and we have controlled for sedentary job-type and the food ratio. However, these controls may not fully address the underlying correlations.

To single out the family-origin correlation of BMI and labor supply from alternative explanations, we implement a *placebo* test using the *unmarried*. If our bargaining power mechanism is at work, ceteris paribus, we should find a positive relationship between own BMI and own hours of work for both married men and married women. Conversely, *no relationship* for either unmarried men or unmarried women should emerge since they have no spouse to relate to, and therefore are not involved in any intra-household bargaining.

In Table 7 we compare own-effects of BMI on hours of work between unmarried and married individuals. Both for men and women, no statistically significant relationship emerges between BMI and hours of work, and the magnitudes are smaller. In the first panel, we use log(own BMI): the coefficient for married men is 2.5 times bigger than the

one corresponding to unmarried men, while the coefficient for married women is 1.4 times bigger than the one corresponding to unmarried women. Similar results arise in the second panel, where we use own BMI[11]. These comparisons should be interpreted with some caution, though, given the small sample size of the unmarried and the potential unobserved heterogeneity by marital status.

4.3.2   Alternative marriage market explanations: unobserved heterogeneity at the time of the match

We now explore the possibility that potential unobservable factors are biasing our previous estimates. In particular, we consider the possibility that labor supply is correlated with some characteristic x (not observable to the econometrician) that is fixed but varies across individuals, and is a relevant attribute at the time of the match. More specifically, say that individuals match along two (observable to them) characteristics: *BMI* and x. It can be shown that under some reasonable assumptions (see Appendix), if hours worked is a proxy for x, own labor supply should be negatively related to own BMI –the intuition being that x and BMI are *substitutes* in determining the attractiveness of an individual– and that the ratio of coefficients on own and spousal BMI should be positive. However, Table 8 suggests that none of these conditions is satisfied: own labor supply is positively related to own BMI, and the ratio of coefficients on own and spousal BMI is negative. Hence, it does not seem that matching along an unobserved trait potentially correlated with future labor supply (we focus on couples who have been married for at least 4 years) seriously jeopardizes our results and their interpretation.

Finally, while one may think of controlling for x (or indeed any other fixed characteristic) using couple fixed effects, we need to bear in mind two important issues: First, this strategy cannot account for reverse causality from changes in labor supply to changes in body weight. Second, fixed-effect regressions suffer from several drawbacks: the variation in the right-hand side variable is reduced, and the attenuation bias of white noise measurement error is exacerbated (e.g., Choi 2012, Deaton 1995). Indeed, controlling for couple fixed effects, a regression of the log husband's hours of work on his own weight (in pounds) and her wife's weight (in pounds) gives us the following coefficient estimates: 0.0002 (SE=0.0005) for own weight, and −0.00006 (SE=0.0006) for wife's weight. These qualitative results are consistent with our bargaining power mechanism, but the magnitudes are very small (virtually zero), reflecting an exacerbation of the attenuation bias.

Table 7 Regressions of log annual hours of work on own-BMI measures by marital status

	Men		Women	
Panel I.	Married	Unmarried	Married	Unmarried
Log(Own BMI)	0.076[*]	0.030	0.096[*]	0.067
	(0.043)	(0.087)	(0.055)	(0.061)
Panel II.				
Own BMI	0.003[*]	0.001	0.004[*]	0.002
	(0.002)	(0.003)	(0.002)	(0.002)
N	2,043	838	2,043	1,020

Note: All regressions include own characteristics (age, log-hourly wage, completed years of education, a good health status indicator, a sedentary-job type indicator, and -for women- a recent pregnancy indicator), household non-labor income, number of children, state and year fixed effects. Robust standard errors clustered at the household id level are reported in parentheses. Sampling weights are used.
[***] p-value< 0.01, [**] p-value< 0.05, [*] p-value< 0.1.

Table 8 SUR of log annual hours of work of husbands and wives on log own BMI and log spousal BMI

	Log(Husband's hours)	Log(Wife's hours)
Panel I. Individual and household characteristics		
Log(Wife's BMI)	−0.054[*]	0.111[***]
	(0.029)	(0.042)
Log(Husband's BMI)	0.098[***]	−0.063
	(0.035)	(0.051)
Panel II. Individual, household and spousal characteristics		
Log(Wife's BMI)	−0.074[***]	0.081[*]
	(0.029)	(0.042)
Log(Husband's BMI)	0.097[***]	−0.052
	(0.035)	(0.051)
N	2,025	

Note: Regressions, which are simultaneously estimated, include state and year fixed effects, individual (age, log-hourly wage, completed years of education, and a good health status indicator) and household characteristics (household non-labor income, food ratio, number of children and a recent pregnancy indicator. In addition, husband's (wife's) regression includes a husband's (wife's) sedentary-job type indicator. Spousal characteristics: age, log-hourly wage, completed years of education, and a good health status indicator. Standard errors in parentheses.
[***] p-value< 0.01, [**] p-value< 0.05, [*] p-value< 0.1.

5   Conclusions

Our paper relies on the simple idea that *body* weight and *Pareto* weight are negatively related, i.e., relative physical attractiveness matters for the intra-household allocation of resources, and therefore for the hours worked by both spouses. This is appealing, we think, in light of the absence in the literature of a link between the existing work highlighting the family context in which work decisions are made and those studies estimating the impact of physical attractiveness in the labor market.

Using data from the Panel Study of Income Dynamics (PSID) on married heads and their wives from 1999 to 2007, we find that wives who are heavier relative to their husbands work more hours, while husbands who are thinner relative to their wives work fewer hours, also when controlling for sedentary job-type, the ratio of expenditures of food at home versus total food, spousal characteristics, and conventional distribution factors. Our household bargaining interpretation is reinforced by the fact that we cannot statistically reject the collective proportionality restriction when including measures of the distribution of relative physical attractiveness in the population, and by the evidence that no statistically significant relationship emerges for unmarried individuals.

Appendix

Unobserved heterogeneity at the time of match

Matching on x and BMI

Chiappori et al. (2012) consider a model in which individual "attractiveness" on the marriage market is fully determined by a set of observable, say x (e.g., talent) and *BMI* , and unobservable characteristics. Assuming that attractiveness is separable in the observable characteristics, i.e., it depends on these variables only through some (unknown) index, and that, conditional on the same indices, the distributions of observables and unobservables are independent, and using an additively separable model for the attractiveness indices:

$$I(BMI_1, x_1) = a_1 BMI_1 + b_1 x_1$$

$$J(BMI_2, x_2) = a_2 BMI_2 + b_2 x_2$$

where I (resp. J) is the attractiveness index for men (resp. women), a_1, $a_2 < 0$ and b_1, $b_2 > 0$ –being fatter makes an individual *less attractive*, while being more talented makes and individual *more attractive*, ceteris paribus–, they show that the marginal rates of substitution between x and BMI (i.e., $\dfrac{a_1}{b_1}$ and $\dfrac{a_2}{b_2}$), can be identified by regressing each wife (husband) characteristic on her (his) spouse characteristics *at the time of the match*. For spouse 1, one could simultaneously estimate the following two equations:

$$\log(BMI_1) = \alpha_0 + \beta_1 \log(BMI_2) + \gamma_1 \log(x_2) + \varepsilon_1 \tag{8}$$

$$\log(x_1) = \alpha_1 + \beta_2 \log(BMI_2) + \gamma_2 \log(x_2) + \varepsilon_2 \tag{9}$$

where ε_1 and ε_2 capture some sort of randomness.

And similarly for spouse 2:

$$\log(BMI_2) = \pi_0 + \delta_1 \log(BMI_1) + \rho_1 \log(x_1) + \nu_1 \tag{10}$$

$$\log(x_2) = \pi_1 + \delta_2 \log(BMI_1) + \rho_2 \log(x_1) + \nu_2 \tag{11}$$

where ν_1 and ν_2 capture some sort of randomness. In particular, the model by Chiappori et al. (2012) would predict:

$$\frac{\beta_1}{\gamma_1} = \frac{\beta_2}{\gamma_2} = \frac{a_1}{b_1}$$

$$\frac{\delta_1}{\rho_1} = \frac{\delta_2}{\rho_2} = \frac{a_2}{b_2}$$

"Matching" on hours of work and BMI

Suppose that x is not observed, but assume that it is *positively* related with hours of work h. Specifically, and for simplicity, x and h are related in the following way:

$$\log(h_1) = \log(x_1) + u_1 \tag{12}$$

$$\log(h_2) = \log(x_2) + u_2 \tag{13}$$

where u_1 and u_2 are classical measurement errors.

Replacing expressions (12) and (13) into (8)-(11) we obtain:

$$\log(BMI_1) = \alpha_0 + \beta_1 \log(BMI_2) + \gamma_1 \log(h_2) + (\varepsilon_1 - \gamma_1 u_2) \tag{14}$$

$$\log(h_1) = \alpha_1 + \beta_2 \log(BMI_2) + \gamma_2 \log(h_2) + (\varepsilon_2 + u_1 - \gamma_2 u_2) \tag{15}$$

$$\log(BMI_2) = \pi_0 + \delta_1 \log(BMI_1) + \rho_1 \log(h_1) + (\nu_1 - \rho_1 u_1) \tag{16}$$

$$\log(h_2) = \pi_1 + \delta_2 \log(BMI_1) + \rho_2 \log(h_1) + (\nu_2 + u_2 - \rho_2 u_1) \tag{17}$$

The estimates in panels I and II of Table 9 are consistent with $a_1/b_1 < 0$ and $a_2/b_2 < 0$, i.e., *substitutability* between *BMI* and *x*. Note, however, that the estimates of $\gamma_1, \gamma_2, \rho_1$ and ρ_2 reported in table 9 below suffer from attenuation bias due to (12) and (13). Not surprisingly, the ratios of coefficients are very different.

Implications for our main results

What would happen if we were just capturing matching on *x* (i.e., an unobservable trait correlated to future labor supply) when regressing labor supply on both own and spousal BMI?

Replacing (17) into (15), we obtain:

$$\log(h_1) = \varphi_1 + \left(\frac{\beta_2}{1 - \gamma_2 \rho_2} \right) \log(BMI_2) + \left(\frac{\gamma_2 \delta_2}{1 - \gamma_2 \rho_2} \right) \log(BMI_1) + \eta_1 \tag{18}$$

Similarly, replacing (15) into (17), we obtain:

$$\log(h_2) = \varphi_2 + \left(\frac{\delta_2}{1 - \gamma_2 \rho_2} \right) \log(BMI_1) + \left(\frac{\rho_2 \beta_2}{1 - \gamma_2 \rho_2} \right) \log(BMI_2) + \eta_2 \tag{19}$$

where $\varphi_1 = \left(\frac{\alpha_1 + \gamma_2 \pi_1}{1 - \gamma_2 \rho_2} \right), \varphi_2 = \left(\frac{\pi_1 + \rho_2 \alpha_1}{1 - \gamma_2 \rho_2} \right), \eta_1 = \gamma_2 \left(\frac{\nu_2 - \rho_2 u_1}{1 - \gamma_2 \rho_2} \right) + \left(\frac{\varepsilon_2 + u_1}{1 - \gamma_2 \rho_2} \right), \eta_2 = \rho_2 \left(\frac{\varepsilon_2 - \gamma_2 u_2}{1 - \gamma_2 \rho_2} \right) + \left(\frac{\nu_2 + u_2}{1 - \gamma_2 \rho_2} \right).$

Table 9 SUR of log annual hours of work and log BMI

Panel I. Husband's SUR regressions	Log(Husband's Hours)	Log(Husband's BMI)
Log(Wife's Hours)	0.039[**]	−0.011
	(0.015)	(0.010)
Log(Wife's BMI)	−0.062[**]	0.161[***]
	(0.028)	(0.018)
Panel II. Wife's SUR regressions	**Log(Wife's Hours)**	**Log(Wife's BMI)**
Log(Husband's Hours)	0.080[**]	−0.045[***]
	(0.032)	(0.017)
Log(Husband's BMI)	−0.039	0.242[***]
	(0.050)	(0.027)
N		2,025

Note: Regressions, which are simultaneously estimated, include own and spousal characteristics (age, log-hourly wage, completed years of education, a good health status indicator, and a recent pregnancy indicator), food ratio, household non-labor income, number of children, state and year fixed effects. In addition, husband's (wife's) regression includes a husband's (wife's) sedentary-job type indicator Standard errors in parentheses.
[***] p-value< 0.01, [**] p-value< 0.05, [*] p-value< 0.1.

Hence, according to this simple model of matching along x and *BMI*, if $1 - \gamma_2 \rho_2 > 0$, $\left(\frac{\beta_2}{1-\gamma_2\rho_2}\right) < 0$, $\left(\frac{\gamma_2\delta_2}{1-\gamma_2\rho_2}\right) < 0$, $\left(\frac{\delta_2}{1-\gamma_2\rho_2}\right) < 0$, $\left(\frac{\rho_2\beta_2}{1-\gamma_2\rho_2}\right) < 0$. But even if $1 - \gamma_2 \rho_2 < 0$, the ratio of coefficients should be positive. The estimates reported in Table 8 indicate that none of these conditions is satisfied: own labor supply is positively related to (not negatively), and the ratio of coefficients is negative (not positive). It does not seem that matching along a dimension potentially correlated with future labor supply (we focus on couples who have been married for at least 4 years) seriously jeopardizes our results and their interpretation[12].

Endnotes

[1]For example, Browning et al. (1994) have shown that differences in age and income among the members of the household appear to be determinants of household outcomes, such as consumption expenditures. Lundberg, Pollak and Wales (1997) estimate that which spouse receives the child allowance affects household decisions. See Vermeulen (2002) and Browning et al. (2012) for a survey of bargaining power measures in collective models.

[2]Spouses' relative age, relative income, relative education, relative wages are examples of distribution factors that have been studied in the literature (Browning et al. 2012; Chiappori et al. 2002; Lundberg and Pollak 1996; Oreffice 2011; Vermeulen 2002).

[3]Following convention, the utility from companionship is assumed to be additive and not to influence the trade-off between leisure and consumption.

[4]Excluding domestic production does not necessarily bias the estimated effects of distribution factors on welfare (Donni 2008).

[5]Weight and height are originally reported in pounds and inches, respectively, in the PSID. The pounds/inches BMI formula is: Weight (in pounds) $\times$ 704.5 divided by Height (in inches) $\times$ Height (in inches). Oreffice and Quintana-Domeque (2010) shown that non-response to body size questions appears to be very small in the PSID data. Specifically, item non-response for husband's height is below 1.4% in each year, for wife's height is below 1.4% in each year, and for husband's weight is below 2.2% in each year. Regarding wife's weight, item non-response is below 5.5% in each year.

[6]We note that Cawley (2000,2004) used the National Health and Nutrition Examination Survey III (NHANES III) to estimate the relationship between measured height and weight and their self-reported counterparts. First, he estimated regressions of the corresponding measured variable to its self-reported counterpart by age and race. Then, assuming transportability, he used the NHANES III estimated coefficients to adjust the self-reported variables from the NLSY. The results for the effect of BMI on wages were very similar, whether corrected for measurement error or not. Hence, we rely on his findings, and we are confident that our results (based on unadjusted data) are unlikely to be significantly biased. Recent papers confirm that the BMI-adjustment makes no difference (see Kelly et al. 2011).

[7]Longitudinal weights are available throughout the period 1999–2007, whereas cross-sectional weights are absent for the most recent waves of 2005 and 2007. Consequently, we consider the entire time period 1999–2007 using longitudinal weights.

[8]We thank one anonymous referee for this suggestion.

[9]Explicit modeling of the marital search process can be found in numerous articles (e.g.,

Becker 1973; Grossbard-Shechtman 1993).

[10]Note that we do not consider the overidentifying restrictions implied by (5) and (6) because the corresponding labor supply responses to μ_1 and μ_2 may be negligible.

[11]We have also estimated the same regressions including the square of log(own BMI), without finding evidence of non-linearities (results available upon request).

[12]Note that estimation of (18) and (19) by LS (or SUR) will lead to biased estimates of the *cross*-effects, $\left(\frac{\beta_2}{1-\gamma_2\rho_2}\right)$ and $\left(\frac{\delta_2}{1-\gamma_2\rho_2}\right)$, since $corr(\log(BMI_2), u_1) \neq 0$ and $corr(\log(BMI_1), u_2) \neq 0$, but *not* of the *own*-effects $\left(\frac{\gamma_2\delta_2}{1-\gamma_2\rho_2}\right)$ and $\left(\frac{\rho_2\beta_2}{1-\gamma_2\rho_2}\right)$.

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