DISCUSSION PAPER SERIES

IZA DP No. 4594

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November 2009

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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Discussion Paper No. 4594
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IZA Discussion Paper No. 4594
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ABSTRACT

Fatter Attraction: Anthropometric and Socioeconomic Characteristics in the Marriage Market*

We construct a matching model on the marriage market along more than one characteristic, where individuals have preferences over physical attractiveness (proxied by anthropometric characteristics) and market and household productivity of potential mates (proxied by socioeconomic characteristics), with a certain degree of substitutability between them. Men and women assess each other through an index combining these various attributes, so the matching is one-dimensional. We estimate the trade-offs among these characteristics using data from the PSID and the ECHP, finding evidence of compensation between anthropometric and socioeconomic characteristics. An additional unit of husband's (wife's) BMI can be compensated by a 0.3%-increase (0.15%-increase) in husband's (wife's) average (predicted) wage. Interestingly, these findings suggest that female physical attractiveness plays a larger role in men's assessment of a woman than male physical attractiveness does for women.

JEL Classification: D1, J1

Keywords: BMI, height, wages, earnings, marriage market

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* We thank the participants at the University of Edinburgh and Universitat d'Alacant seminars. We would like to thank Coralio Ballester, Maia Güell, Laura Hospido, Costas Meghir, Sevi Mora, and Enrique Sentana for their insightful suggestions. Oreffice and Quintana-Domeque acknowledge financial support from the Spanish Ministry of Science and Innovation (ECO 2008-05721/ECON). Errors are ours.

1 Introduction

In this study, we model the marriage-market mechanisms through which men and women match according to physical attractiveness and socioeconomic characteristics. Specifically, we examine how people sort in terms of body size and height on one hand, and wages and earnings on the other, to investigate the spousal trade-offs among these attributes that men and women face in the marriage market.

The goal of this paper is to investigate the relative importance in the marriage market of anthropometric and socioeconomic characteristics, and the extent to which men assess these characteristics differently from the way women do. Are marriage market forces allowing individuals to sort along both types of characteristics? Most importantly, is the marriage market allowing for individuals to compensate for their negative physical characteristics with their own positive socioeconomic characteristics and vice versa? Whether this compensation takes place at equilibrium depends on the determinants of the marriage market, but most of all on whether individuals are potentially willing and able to substitute their defects with their qualities, and on whether their mates are willing to accept this compensation across characteristics, i.e. whether they see them as actual substitutes. Our contribution is to model and estimate mate preferences along these dimensions and to theoretically and empirically show that they can generate equilibrium sorting and compensation in marriage.

We construct a matching model on the marriage market along more than one characteristic, where individuals have preferences over physical attractiveness (proxied by anthropometric characteristics) and market and household productivity of potential mates (proxied by socioeconomic characteristics), with a certain degree of substitutability between them. A crucial ingredient of our approach is that although each mate is characterized by a multidimensional vector of observable characteristics, the matching is one-dimensional, as men and women assess each other through an index combining these various attributes, of which we model the trade-offs. This is in sharp contrast with Galichon and Salanié (2009), where matching is explicitly multidimensional, and in line with Gunter et al. (2009) on online dating, where they model individual utility as a simple linear valuation of the mate's attributes.

Marriage is modeled as the outcome of a frictionless matching process; utilities are assumed transferable, so that the impact of the matching process on individual utilities and intra-household transfers can readily be assessed. Men are homogeneous in their preferences for women, and women are homogeneous in their preferences for men, so that we assume that each mate ranks all potential partners in the same way. However, men and women differ on their endowment of the physical and socioeconomic characteristics. Marital surplus is multiplicative in these one-dimensional indices summarizing a mate's quality in the market, so that the equilibrium generates assortative mating. Finally, households are able to commit, at least partially, on the division of resources during marriage. It follows that the socioeconomic environment and individual characteristics at the time of marriage have potentially lasting effects on intra-household allocation.

One of the main contributions of our study is to consider multidimensional characteristics, and the corresponding marriage market trade-offs between physical and socioeconomic characteristics. In fact, almost all matching models are one dimensional, analyzing the sorting patterns and assortative mating by one attribute at a time, such as income or education (e.g. Becker, 1991, Pencavel, 1998, with the exception of Galichon and Salanié, 2009), and hardly considering physical attractiveness in marital sorting (Chow and Siow, 2006; Wong, 2003, Flinn and Del Boca, 2007 do not use measures of physical attributes in their analysis, and Becker, Pencavel either). One exception is the literature on online dating. Recently, Gunter et. al. (2009) use detailed information on weight, height, facial looks, and income, but they lack the relevant information on the matches actually formed. Moreover, the psychology literature at most analyzes the existence of an exchange between physical and socioeconomic attributes emphasizing trade-offs between mates (e.g. Stevens et al., 1990), whereas we also take into account "exchanges" across characteristics of the same mate.

Our model predicts that thinner ("richer") men and women match with thinner ("richer") mates, everything else being equal in terms of other attributes. Compensation between your own qualities and defects is possible in equilibrium, provided you possess the characteristics that are considered substitutes in your mate's assessment. We assume that the ability wives care about is well proxied by their husbands' wage and earnings, whereas the ability husbands care about is well proxied by their wives' potential wages, so that we allow for men and women to differ on which socioeconomic dimensions they consider as substitutes for physical attractiveness, and on the magnitudes of this substitutability. Additionally, we predict the constancy of these trade-offs for each mate across the relevant characteristics of the other mate.

Our main findings are that female BMI and potential wages matter for men, and male BMI, height and wage (or actual earnings) matter for women. Specifically, men prefer thinner women and women with higher potential wages. Women prefer taller men, thinner men and men with higher wages (earnings).

We are not aware of any previous study exploring the role of marriage market forces with respect to both anthropometric and socioeconomic characteristics. The importance of our novel approach is twofold: first, we explore a potential mechanism between BMI and earnings that has not yet been analyzed, modeling the role of marriage market penalties of anthropometric characteristics; second, we analyze an additional aspect of the actual marriage market impact that body size have on individuals, focusing on the extent to which (potential) wages and earnings can provide individuals with means of compensating their higher BMI. We investigate whether this compensation exists, estimate its magnitude and assess whether it varies by gender.

Spouses tend to share a variety of characteristics, including age, education, race, religion, and anthropometric characteristics such as height and weight (Gunter et al., 2009; Becker, 1991; Weiss and Willis, 1997; Qian, 1998; Silventoinen et al., 2003). Assortative mating in body weights has been established in the medical and psychological literatures, which document significant and positive interspousal correlations for weight (Schafer and Keith, 1990; Allison et al., 1996; Speakman et al., 2007), and the importance of examining the effect of both spouses' characteristics on their marriage (Fu and Goldman, 2000; Jeffrey and Rick, 2002; McNulty and Neff, 2008).

A large body of literature using National Longitudinal Survey of Youth data links women's weight to lower spousal earnings or lower likelihood of being in a relationship (Averett and Korenman, 1996; Averett et al., 2008; Mukhopadhyay, 2008; Tosini, 2009). However, these data provide anthropometric measures of the respondent only, so that the weight-income trade-off across spouses is estimated without controlling for the men's physical attributes. The same can be said about the influential work by Hamermesh and Biddle (1994), which shows that physically unattractive women are matched with less educated husbands, and about studies considering height as a determinant of marriage rates. For instance, Herpin (2005) shows that the probability of being in a relationship is lower for shorter men.

Recently, Oreffice and Quintana-Domeque (2009) use PSID data on anthropometric and socioeconomic characteristics of both spouses, and find that female physical attractiveness plays a larger role in the marriage market than does men's, with the result that heavier women are thrice penalized, with husbands of lower socioeconomic and physical status (poorer, less educated, and shorter). Heavier husbands pay a marriage-market penalty only in terms of the lower educational level attained by their wives. Shorter women tend to marry men with lower socioeconomic status (less educated or poorer). Shorter husbands, on the other hand, are penalized on both the physical and socioeconomic dimensions, in that their wives are heavier and less educated. Their finding suggest that men and women may differ in their evaluation of mates' anthropometric and socioeconomic characteristics, men putting more weight on female body and less on female actual economic resources and women putting more weight on male ability to generate income and less on their physical appeal. In addition to this sorting penalty, there could be a compensation mechanism across own individual characteristics, so that a defect is compensated with a quality. Everything else being equal, if an individual has a higher BMI, he/she may work and earn more to compensate for the poor physical attribute and still match with a socially desirable spouse. These trade-offs among own attributes may differ by gender, as the corresponding compensating schemes could occur across different dimensions for men and women.

In this paper, we estimate marital trade-offs in the US and several European countries. For the US, we use data from the Panel Study of Income Dynamics (PSID), which contains anthropometric and socioeconomic characteristics on married men and women from 1999 to 2005. For Europe, we use the European Community Household Panel (ECHP), which contains similar information on married men and women from 1998 to 2001 for 9 European countries. We find evidence of compensation between anthropometric and socioeconomic characteristics. In the US, an additional unit of husband's (wife's) BMI can be compensated by a 0.3%-increase (0.15%-increase) in husband's (wife's) average (predicted) wage. Interestingly, these findings suggest that female physical attractiveness plays a larger role in men's assessment of a woman than male physical attractiveness does for women

Our findings are in line with research in psychology and economics linking body size, obesity, attractiveness, and the desirability of a potential mate. For instance, Braun and Bryan (2006) found that men differed from women in the greater extent to which they reported that physical features, including face, body shape, and weight, were important in their assessments of the desirability of a potential mate. Conversely, women gave much greater consideration than did men to personality, intelligence, and career choice. Recently, using data from the PSID, Gregory and Rhum (2009) suggest that BMI may serve as a proxy for socially-defined physical attractiveness. Indeed, Rooth (2009) found that photos that were manipulated to make a person of normal weight appear to be obese caused a change in the viewer's perception, from attractive to unattractive.

Our results can also be contextualized in the economic research agenda on the effects of anthropometric measures. Many economists have been working on assessing the effects of height, weight and BMI on labor-market outcomes. The consensus is that BMI in the overweight or obese range has negative effects on the probability of employment and on hourly wages, particularly for women (Han, Norton, and Stearns, 2009), while height has a positive effect on hourly wages, perhaps reflecting the fact that taller people are more likely to have reached their full cognitive potential (Case and Paxson, 2008) and/or may possess superior physical capacities (Lundborg, Nystedt, Rooth, 2009). On top of these labor-market effects, not to mention the well-known negative health effects of being overweight, we provide an equilibrium analysis of how the marriage market values these anthropometric characteristics relatively to socioeconomic characteristics, providing also empirical evidence of the additional consequences that BMI and height may have for individuals.

The paper is organized as follows. Section 2 presents a marriage market model of attractiveness and provides the equilibrium analysis. Section 3 discusses how to measure attractiveness that mates care about. Section 4 describes the data used in the empirical analysis. Section 5 presents the empirical results. Finally, section 6 concludes.

2 The model

2.1 The basic framework

We consider a continuous population of men and a continuous population of women of equal mass, which we normalize to one. Each potential husband, say $i \in I$, is characterized by a vector $X_i = \left(X_i^1, ..., X_i^K\right)$ of observable characteristics, and by some unobservable characteristic ε_i, the distribution of which is centered and independent of X. Similarly, woman $j \in J$ is defined by a vector of observable variables $Y_j = \left(Y_j^1, ..., Y_j^L\right)$ and some unobservable characteristic η_j which is centered and independent of Y.

Our model involves frictionless matching under transferable utility a la Becker-Shapley-Shubik. Whenever man i is matched with woman j, they generate a surplus $\Sigma\left(X_i, \varepsilon_i, Y_j, \eta_j\right)$ that can be freely shared between them. Our key assumption is the following:

Assumption I *(Index Assumption) There exists two functions F from R^K to R and G from R^L to R such that*

$$\Sigma\left(X_i, \varepsilon_i, Y_j, \eta_j\right) = S\left[F\left(X_i^1, ..., X_i^K\right) + \varepsilon_i, G\left(Y_j^1, ..., Y_j^L\right) + \eta_j\right]$$

In words, the 'attractiveness' of male i (resp. female j) on the marriage market is fully summarized by a one-dimensional index:

$$I_i = F\left(X_i^1, ..., X_i^K\right) + \varepsilon_i$$

and

$$J_j = G\left(Y_j^1, ..., Y_j^L\right) + \eta_j$$

In particular, the surplus generated by the match of i and j only depends on the two indices I_i and J_j. This implies that although each agent is characterized by a multidimensional vector of observables (plus one unobservable shock), the matching is one-dimensional: individual characteristics only matter through some factors F and G that have to be estimated. This is in sharp contrast with Galichon and Salanié (2009), in which matching is explicitly multidimensional.

Another important implication of this assumption is that one can easily model the trade-off between various characteristics. Indeed, attractivity is fully summarized by the indices I and J, which are moreover the sum of a deterministic function of the variables and a random shock representing unobserved heterogeneity. Therefore, we can define 'iso-attractive' profiles, i.e. profiles of observable characteristics that generate the same (distribution of) attractiveness. These are defined, for men, by $F\left(X_i^1, ..., X_i^K\right) = K$, where K is a constant, and similarly for women by $G\left(Y_j^1,...,Y_j^L\right)=L$. Then the marginal rate of substitution between characteristics n and m can be defined (for male i) by:

$$MRS_i^{m,n}=\frac{\partial F/\partial X^n}{\partial F/\partial X^m}$$

where the partials are taken at $\left(X_i^1,...,X_i^K\right)$ (and a similar definition can be given for women). The key remark, here, is that these MRSs do not depend on the realization of the heterogeneity shock ε; they are identical for all individuals with identical profile of observables.

2.2 Stable match

The existence of a stable match follows from standard results. For some results, we will need an additional assumption, that is common in the matching literature:

Assumption SM *(Super Modularity): The surplus function S is supermodular: if $f>f'$ and $g>g'$ then*

$$S\left(f,g\right)+S\left(f',g'\right)>S\left(f,g'\right)+S\left(f',g\right)$$

As it is well known, Assumption SM implies that the stable match is unique and strictly assortative; i.e., if male i is matched with female j and male i' is matched with female j' then the male with higher index must be matched with the female with higher index (i.e., $i>i'$ implies that $j>j'$ and conversely).

2.3 Testability and identification

We now address the identification issue. Assume that we observe the marital patterns in the population under consideration; i.e., we observe the joint density of observables among married couples. To what extend is it possible to recover the underlying, attractiveness indices? In particular, can one quantify the trade-off described before? The answer is given by the following result.

Proposition 1 *Assume that Assumption I is satisfied. Then the joint distribution of marital characteristics across couples only depends on the factors $F(X)$ and $G(Y)$. Moreover, the factors are identified from the joint distribution up to a transform; in particular, the marginal rates of substitution are exactly identified. Finally, testable restrictions are generated.*

Proof. *Note, first, that any two agents with similar indices are equivalent for matching purposes. Since the distribution of ε and η is independent of the observables, the value of $F(X)$ (resp. $G(Y)$) is a sufficient statistic for the distribution of I (J). Next, note that the expected value of the kth characteristic of the wife, conditional on the vector of characteristics of the husband, is of the form:*

$$E\left[Y^l \mid X_i^1, ..., X_i^K\right] = \phi\left[F\left(X_i^1, ..., X_i^K\right)\right]$$

which shows that the factor F is identified up to some transform ϕ. Finally, the MRS are given by:

$$\frac{\partial F/\partial X^n}{\partial F/\partial X^m} = \frac{\partial E\left[Y^l \mid X_i^1, ..., X_i^K\right]/\partial X^n}{\partial E\left[Y^l \mid X_i^1, ..., X_i^K\right]/\partial X^m}$$

First, they are exactly identified. Second, the left hand side of the expression above does not depend on l, so neither should the right hand side, which generates overidentifying restrictions.

■

In other words, the trade-offs discussed above can readily be recovered from matching patterns. One can, for instance, (non parametrically) regress a female characteristic over the set of male characteristic for married couples. The ratio of the effects of any two male characteristics is the MRS; moreover, this ratio should not depend on the particular female characteristic considered, which generates overidentifying restrictions.

3 Measuring Attractiveness

In our model, individual attractiveness is fully summarized by a one-dimensional index that is a function of a multidimensional vector of anthropometric and socioeconomic characteristics. Anthropometric characteristics (height and BMI) are measures of physical attractiveness (i.e., beauty), while socioeconomic characteristics (wages, potential wages and earnings) are measures of socioeconomic attractiveness (i.e., ability/productivity in the labor market or in the household). We allow for different sets of anthropometric and socioeconomic characteristics to matter in men's and women's valuation of their mates' attractiveness.

3.1 Physical Attractiveness: BMI and Height

One of the main contributions of our paper is to model mates' preferences over both socioeconomic and anthropometric characteristics, and to empirical analyze this information on both spouses. Specifically, we consider BMI as a measure of both male and female physical attractiveness, whereas height is only a measure of male physical attractiveness. In this section, we address the validity of our main measure of physical attractiveness, namely, BMI. The validity of height as a measure of male physical attractiveness, but not of female physical attractiveness, has been extensively discussed in the literature (see Herpin (2005) for detailed references).

Both body shape and body size are important determinants of physical attractiveness. While BMI provides information on body size, the waist-to-hip ratio (WHR) and the waist-to-chest ratio (WCR) provide information on body shape. The available empirical evidence indicates that weight scaled for height (BMI) is a far more important factor than WHR of female physical attractiveness (Toveé, Reinhardt, Emery and Cornelissen, 1998; Toveé et al., 1999). The literature review on body shape, body size and physical attractiveness by Swami (2008) seems to point to BMI being the dominant cue for female physical attractiveness, with WHR (the ratio of the width of the waist to the width of the hips) playing a more minor role. However, for male physical attractiveness WCR (waist-to-chest) plays a more important role than either the WHR or BMI, although it must be emphasized that BMI and WHR are strongly positively correlated. Indeed, BMI is correlated with the male attractiveness rating by women, though this correlation is lower than the one with WCR.

Ideally we would like to have information on BMI for women and WCR for men. However, it should be noted that we are not aware of any study with detailed measures of body shape and socioeconomic characteristics which are also simultaneously available for both spouses. Moreover, despite that the review by Swami (2008) suggests that WCR is a better proxy for male attractiveness than BMI, BMI can still be considered a good proxy for male physical attractiveness. Wells, Treleaven and Cole (2007) using a large survey of adults in the UK (more than 4,000 men and more than 5,000 women) and a sophisticated technique to assess body shape (three-dimensional body scanning), investigated the relationship of shape and BMI. They found that BMI conveys different information about men and women: the two main factors associated with weight in men after adjustment for height are chest and waist, whereas in women they are hip and bust. They suggested that chest in men but hips in women reflect physique (the form or structure of a person's body, i.e., physical appearance), whereas waist in men and bust in women reflects fatness. Hence, it is reasonable to assume that BMI is a good proxy for male physical attractiveness. Thus, in our empirical analysis, we will use BMI as our measure of physical attractiveness, for both men and women, consistent also with Gregory and Ruhm (2009), who suggest that BMI may serve as a proxy for socially-defined physical attractiveness.

3.2 Socioeconomic Attractiveness: Wages, Predicted Wages and Earnings

In our model, men and women observe potential mates' ability in the labor market and in the household, such as ability to generate income, disutility from work, earnings capacity and household productivity. However, the econometrician does not observe these abilities (predetermined with respect to marriage), but socioeconomic characteristics (outcomes). Male socioeconomic characteristics are thought to directly reflect labor market ability (productivity), while female socioeconomic characteristics are thought to capture housework ability (productivity) and perhaps a general attitude toward market work. Women may actually value ability to generate income in men, while men may put less emphasis on this quality in a woman, and instead appreciate a more general ability in terms of household production and just potential ability to generate earnings. It could also be the case that there is more heterogeneity in the ability to work hard in the male population rather than in the female, so that there is not enough variation in the women's population to be captured as a dimension of the index. In general, all potential husbands participate in the labor market, so working is not a signal of ability per se in women's assessment of a man. Conversely, for women participation in the labor market may signal their ability.

For men, wages and earnings are good proxies for the ability that women care about in a man, i.e. labor market productivity. Wages and earnings are strongly related to ability. Moreover, earnings are also likely to capture disutility from work.

For women, potential wage is a good proxy for the ability that men care about in a woman, i.e. ability to generate quality household public goods and potential ability to work in the market. We measure potential wage as the predicted wage for all wives (working and non-working) from a wage equation estimated for married women who are working. The specification we use to predict potential wage uses age (in categories), education (in categories), number of children, health status, age interacted with number of children and state fixed effects. Although these characteristics are observed during marriage, we claim that individuals and their potential spouses are able to anticipate them, so they use such information to make the prediction.

Therefore, we can investigate the relative importance in the marriage market of anthropometric and socioeconomic characteristics and the extent to which men and women differ in their assessments. Specifically, we can analyze whether marriage market forces allow individuals to sort along both types of characteristics, and, most importantly, whether the marriage market allows individuals to compensate their defects with their qualities. In other words, if physical attractiveness (beauty) and socioeconomic attractiveness (ability) are the characteristics entering the index with which men and women assess potential mates, then, according to our model, we should observe the following patterns:

(1) Beautiful (or able) husbands marry beautiful (or able) wives, ceteris paribus.

(2) Ugly (or unable) husbands who marry beautiful (or able) wives are more able (or more beautiful), ceteris paribus.

These sorting and compensation mechanisms can then be tested by running a regression of a female (male) characteristic over the set of the spouse characteristics to estimate the marginal rate of substitution among the characteristics of the spouse. Moreover, this ratio should not depend on the particular female (male) characteristic considered, so that we can additionally test for the equality of these rates of substitution across different female (male) characteristics.

4 Data description

Estimation is carried out on the basis of data from the Panel Study of Income Dynamics (PSID) for the US and the European Community Household Panel (ECHP) for 9 European Countries.

4.1 The 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 all the most recent waves since 1999 (1999, 2001, 2003 and 2005), the PSID provides the weights (in pounds) and heights (in 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 squared).[1]

In each of the survey years under consideration, 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 those couples whose wife is between 25 and 40 years old, because for this group body size (BMI, height) as a proxy for physical attractiveness should be more relevant in explaining socio-economic outcomes. Our analysis comprises white husbands and wives, because blacks are disproportionately overrepresented in low-income households ("poverty/SEO sample"). Following Conley and Glauber (2007), we discard those couples 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. Our sample thus consists of 5,807 observations, a sample size consistent with those of previous studies using PSID data to analyze obesity and the labor market (Cawley, Grabka, Lillard, 2005; Conley and Glauber, 2007; Kano, 2008).

We rely on the longitudinal structure of the PSID to account for how recently a couple got married. This demographic group is worth analyzing because the marriage-market penalties for BMI should arise through sorting at the time of the match and thus be more visible for recently married couples rather than for our entire sample.

In the PSID all the variables, including the information on the wife, are reported by the head of the household. Although it is well-known that self-reported anthropometric measures are likely to suffer from measurement error, the error seems to be constant for the 25-55 age group according to the analyses in Thomas and Frankenberg (2000) and in Ezzati et

[1] The pounds/inches BMI formula is: Weight (in pounds) x 704.5 divided by Height (in inches) x Height (in inches).

al. (2006) with US data. 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.[2]

4.2 The ECHP

The European Community Household Panel, Eurostat, is a survey based on a standardized questionnaire that involves annual interviewing of a representative panel of households and individuals in member states of the European Union during 1994–2001. We use the ECHP users' database (UDB).[3]

The ECHP covers a wide range of topics on living conditions, and its standardized methodology and procedures yield comparable information across countries. As in the PSID, anthropometric data are self-reported in the EHCP. Our analysis is focused on 9 European countries: Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, Portugal, and Spain. France, Germany, Luxembourg, The Netherlands, and United Kingdom have no available anthropometric information in the ECHP. Moreover, Sweden is excluded from our analysis because it does not have a full ECHP data format in any of the waves.[4]

We estimate different models for each country, allowing for a purely flexible econometric

[2] It is not clear that the method used in Cawley (2000, 2004) can be applied in our context. While in the NHANES III and NLSY each individual only self-reports his/her own weight/height, in the PSID the household head is reporting his own and his wife's height and weight. However, Cawley et al. (2005) use the procedure using data from the PSID without discussing such an issue.

[3] Organizations can purchase a version of this users' database under strict contractual conditions, http://circa.europa.eu/irc/dsis/echpanel/info/data/information.html.

[4] Peracchi (2002) and the Europanel Users Network (http://epunet.essex.ac.uk) provide more detailed information on the ECHP.

specification, in the sense that none of the coefficients are restricted to be the same across countries. In other words, we estimate the sorting and compensation in different European countries. This can reveal interesting patterns in the sorting and the trade-offs between anthropometric and socioeconomic characteristics across different countries (cultures).

5 Empirical Analysis

5.1 A linear specification of the model

We now further specify the model by assuming specific functional forms. We take a linear approximation for F and G; i.e.,

$$\begin{aligned} F\left(X_i^1, ..., X_i^K\right) &= \sum_k f_k X_i^k \\ G\left(Y_j^1, ..., Y_j^L\right) &= \sum_l g_l Y_j^l \end{aligned}$$

Regressing a female (male) characteristic Y_j^l (X_i^k) over the set of male (female) characteristics for married couples:

$$Y_j^l = \sum_k f_k X_i^k + \varepsilon_i^k \tag{1}$$

$$X_j^k = \sum_l g_l Y_j^l + \eta_j^l \tag{2}$$

where ε_i^k capture unobserved heterogeneity that we allow to be correlated across k, and similarly for η_j^l. Hence, we can estimate (1) simultaneously for all characteristics l using Seemingly-Unrelated-Regression (SUR) and the same with (2). Then, we obtain the marginal rate of substitution between characteristics n and m for male i and female j:

$$
\begin{aligned}
MRS_i^{m,n} &= \frac{\partial Y_j^l / \partial X_i^n}{\partial Y_j^l / \partial X_i^m} = \frac{f_n}{f_m} \\
MRS_j^{m,n} &= \frac{\partial X_i^k / \partial Y_j^n}{\partial X_i^k / \partial Y_j^m} = \frac{g_n}{g_m}
\end{aligned}
$$

Note that the $MRS_i^{m,n}$ ($MRS_j^{m,n}$) do not vary across characteristics l (k).

5.2 Main Results

Table 2 shows the estimated coefficients of the characteristics that constitute the male's index with which women evaluate men's attractiveness, highlighting the existence of both sorting and compensation across anthropometric and socioeconomic characteristics of men and women. Specifically, the estimates show that men are willing and able to substitute their defects (e.g., having a higher BMI) with their qualities (e.g., having a higher log wage, being taller), and women are willing to accept this compensation across male characteristics (i.e, women see these characteristics as actual substitutes). Concerning assortative mating, column (1) shows that there is positive sorting in body size: wife's BMI is positively associated with husband's BMI, which is consistent with previous studies in the medical literature (e.g., Allison et al., 1996; Speakman et al., 2007) and in economics (e.g., Gunter et al., 2009; Oreffice and Quintana-Domeque, 2009). Furthermore, column (2) provides evidence of assortative mating in socioeconomic characteristics: wife's log (predicted wage) is positively associated with husband's log (wage), consistent with previous studies (e.g., Lam, 1988; Wong, 2003).

[Insert Table 2 about here]

The bottom panel of Table 2 shows the estimated marginal rates of substitution between husband's BMI and his log(wage), husband's height and his log (wage) and husband's height and his BMI. As predicted by our model, we cannot reject that the ratios are equal no matter which characteristic of the wife's index is considered. For example, given the wife's BMI, the ratio of the coefficients of the husband's BMI and log(wage) is -0.278, which indicates that men can actually compensate their higher BMI with a higher log(wage): an additional unit of husband's BMI (roughly an increase in weight of 3.2 kg for the average husband) can be compensated by a 0.3%-increase in husband's average wage. In other words, a 10kg-increase in weight for the average husband can be compensated by a 1%-increase in husband's average wage.

In Table 3 we report the same set of coefficients as in Table 2, the difference being that the coefficients correspond to the characteristics that constitute the female's index with which men assess women's attractiveness. As above, we observe positive sorting in body size and socioeconomic characteristics. We also observe a similar pattern of substitutability between female qualities and defects. There is evidence of compensation of a higher female's BMI with a higher female's log predicted wage across husbands characteristics, namely, husband's BMI, height and log (wage). Furthermore, the marginal rates of substitution between wife's BMI and her log (predicted wage) are constant across husbands characteristics, as predicted by our model. An additional unit of wife's BMI can be compensated by a 0.15%-increase in wife's average (predicted) wage.

[Insert Table 3 about here]

Interestingly, the MRS between husband's BMI and husband's log(wage) is twice as high (in absolute value) than the MRS between wife's BMI and wife's log(predicted wage), suggesting that female physical attractiveness plays a larger role in men's assessment of a woman than male physical attractiveness does for women.

Similar results are found in tables 4 and 5, where we replace husband's log (wage) with husband's log (earnings).

[Insert Table 4 about here]

[Insert Table 5 about here]

Overall, our findings show the following patterns:

(1) Beautiful (or able) husbands marry beautiful (or able) wives, ceteris paribus.

(2) Ugly (or unable) husbands who marry beautiful (or able) wives are more able (or more beautiful), ceteris paribus.

This results show that preferences are one important cause of marital sorting, which can arise without search frictions. Moreover, the different MRS between men and women, suggest that they differ in their assessments of mates' physical attractiveness. However, these differences may be due to the higher degree of heterogeneity in male income than in the female income distribution.

5.3 Additional Results

The evidence presented so far points to a marriage market trade-off between BMI and actual earnings of husbands, which is absent for wives. We further explore the ability of married men to compensate their BMI by earning higher labor income, and the absence of this effect of wife's BMI on their disposable income. We focus on working couples, where wives as well are working, because we want to analyze compensation effects for body size in terms of earnings of both husbands and wives. Moreover, couples where the wife is also working should be the ones in which women would actually have the means to provide a compensation for their high BMI in terms of disposable income.

Table 6 presents regressions where the dependent variable is earnings, separately by gender and marital status, controlling for BMI and socioeconomic characteristics of the individual (and the spouse), such as age, completed education, number of children in the household, health status, household non-labor income, and state fixed effects. Interestingly, column (1) shows that the BMI of married men exhibits a positive significant correlation with their earnings, whereas column (2) shows that for unmarried men the relationship between BMI and earnings is not statistically significant. Men seem responsive to their BMI and willing to alter their labor supply behavior increasing their earnings only within marriage. There could be a compensation mechanism across own individual characteristics. Everything else being equal, if a male individual is heavier (has a higher BMI), he may work more hours and earn more to compensate for the poor physical characteristic and still match with a decent spouse. It seems that heavier husbands with higher labor supply can match to wives comparable to those of thinner husbands, ceteris paribus. Evidence on labor supply (available upon request) seems to confirm this interpretation.

[**Insert Table 6 about here**]

This significant correlation for husbands is remarkable, inasmuch married men's labor supply and earnings generally exhibit a low elasticity. Consistent with our previous findings, there is also a negative significant relationship between the wife's BMI and the husband's labor income

Columns (3) and (4) show the earnings regressions for women by marital status. If we compare the female estimates to those for men, the most striking finding is that now BMI is not related to earnings. This evidence would reinforce our interpretation of the index estimates, suggesting that male's preferences for thin women are much stronger than those of women for thin men. It does not seem to be the case that the absence of compensation for women is due to labor market constraints, as wives' labor supplies do not exhibit any significant correlation with their BMIs either and their actual wages do not exhibit a negative significant correlation with BMI (available upon request). The returns to education (in terms of earnings) are very similar for both married and unmarried women.

Overall, our findings support our approach of the potentially new channel through which BMI affects income, specifically for men. We show that heavier husbands earn more income than thinner ones, to compensate their spouse for their poor physical characteristic. No such positive relationship is found for unmarried individuals or for wives. This evidence may contribute to a better understanding of the relationship between BMI and income, which has been extensively analyzed in the literature for both men and women, without reaching a consensus on the actual effects for men (for women a negative relationship is found in most studies). Some studies have found a positive association between income (earnings) and BMI for men (e.g. Garcia Villar and Quintana-Domeque, 2009), and this may be explained by the interaction effects of BMI and marital status on earnings, through an increase in labor supply due to a compensation mechanism.

Do these compensations really matter in a couple? We try to address this question by looking at whether in the absence of earnings compensation, higher BMI leads to higher probability of divorce in recently married couples (less than 5 years of marriage). Table 7 shows that an increase in husband's weight between 2005 and 2007 is associated with a higher probability of marital dissolution between 2005 and 2007, ceteris paribus. At the same time, an increase in husband's earnings is associated with a lower probability of divorce. An increase in husband's weight of 10 kilograms translates into an increase of 2% in the probability of divorce, while an increase in husband's earnings of 2% translates into a decrease of 7% in the probability of divorce.

[Insert Table 7 about here]

Since height does not change, a change in BMI translates into a proportional change in weight. Hence, the results in Table 7 show that couples where husbands increase their BMI and do not compensate their spouse with more income are more likely to end up divorced.

6 Conclusions

TBC

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Table 1: Descriptive statistics. PSID 2005.

Means (SD)	Married		Unmarried	
	Husbands	Wives	Males	Females
Hours of work (annual)	2,265 (667,7)	1,631 (754,5)	1,927 (844,1)	1,865 (629,6)
Earnings (annual)	51,107 (32,316)	31,753 (29,653)	36,428 (36,165)	31,430 (21,727)
BMI	25,71 (2,47)	24,45 (4,92)	25,15 (2,66)	23,43 (2,83)
Age	34,24 (6,15)	32,11 (4,46)	32,19 (9,70)	31,64 (7,06)
Education	13,98 (2,39)	14,20 (2,11)	13,94 (2,19)	14,07 (2,65)
Children	1,37 (1,06)		0,03 (0,20)	0,56 (1,20)
Good Health	0,96 (0,19)	0,96 (0,20)	0,94 (0,24)	0,95 (0,32)
Hourly wage	23,56 (16,16)	19,19 (14,77)	19,53 (19,34)	16,29 (9,87)

Table 2: Regressions of wife's characteristics on husband's characteristics. SUR Estimates.

	(1) Wife's BMI	(2) Wife's log(predicted wage)
A. Coefficients of the Male's Index		
Husband's log (wage)	-0.661***	0.094***
	(0.181)	(0.017)
Husband's height	-0.082**	0.017***
	(0.041)	(0.004)
Husband's BMI	0.183***	-0.011**
	(0.048)	(0.005)
Husband's Age	0.004	0.004*
	(0.021)	(0.002)
Number of children	0.218**	-0.355***
	(0.108)	(0.010)
Sample size	507	
Correlation of residuals	-0.057 (BP Test $Chi^2(1) = 1.67$)	
B. MRS = ratios of coefficients		
Husband's BMI / Husband's log (wage)	-0.277***	-0.121**
	(0.107)	(0.053)
Test of equality	$Chi^2(1) = 1.76$	
Husband's height / Husband's log (wage)	0.125*	0.181**
	(0.075)	(0.056)
Test of equality	$Chi^2(1) = 0.39$	
Husband's height / Husband's BMI	-0.450*	-0.149**
	(0.253)	(0.677)
Test of equality	$Chi^2(1) = 0.14$	

Note: All regressions include state fixed effects. Observations have been weighed using the PSID family weights.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 3: Regressions of husband's characteristics on wife's characteristics.
SUR Estimates.

	(1) Husband's BMI	(2) Husband's Height	(3) Husband's log (wage)
A. Coefficients of the Female's Index			
Wife's log (predicted wage)	-0.913**	2.38***	0.588***
	(0.414)	(0.49)	(0.107)
Wife's BMI	0.141***	-0.089*	-0.035***
	(0.040)	(0.046)	(0.011)
Wife's Age	0.015	-0.050	0.017**
	(0.026)	(0.031)	(0.007)
Number of children	-0.325*	0.713***	0.182***
	(0.180)	(0.212)	(0.047)
Sample size		507	
Corr. of residuals (1) and (2)		0.031	
Corr. of residuals (1) and (3)		0.015	
Corr. of residuals (2) and (3)		0.085	
		BP Test $Chi^2(3) = 4.29$	
B. MRS = ratios of coefficients			
Wife's BMI / Wife's log (predicted wage)	-0.154*	-0.037*	-0.060*
	(0.087)	(0.022)	(0.022)
Test of equality ratios (1) and (2)		$Chi^2(1) = 1.68$	
Test of equality ratios (1) and (3)		$Chi^2(1) = 0.61$	
Test of equality ratios (2) and (3)		$Chi^2(1) = 0.30$	

Note: All regressions include state fixed effects. Observations have been weighed using the PSID family weights.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 4: Regressions of wife's characteristics on husband's characteristics. SUR Estimates.

	(1) Wife's BMI	(2) Wife's log(predicted wage)
A. Coefficients of the Male's Index		
Husband's log (earnings)	-0.203	0.047***
	(0.131)	(0.012)
Husband's height	-0.094**	0.018***
	(0.041)	(0.004)
Husband's BMI	0.192***	-0.013**
	(0.049)	(0.005)
Husband's Age	0.001	0.004*
	(0.022)	(0.002)
Number of children	0.235**	-0.358***
	(0.109)	(0.010)
Sample size	507	
Correlation of residuals	-0.083** (BP Test $Chi^2(1) = 3.50$)	
B. MRS = ratios of coefficients		
Husband's BMI / Husband's log (earnings)	-0.946	-0.278**
	(0.648)	(0.118)
Test of equality	$Chi^2(1) = 1.07$	
Husband's height / Husband's log (earnings)	0.466	0.378***
	(0.388)	(0.138)
Test of equality	$Chi^2(1) = 0.05$	
Husband's height / Husband's BMI	-0.491**	-1.37**
	(0.250)	(0.566)
Test of equality	$Chi^2(1) = 2.13$	

Note: All regressions include state fixed effects. Observations have been weighed using the PSID family weights.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 5: Regressions of husband's characteristics on wife's characteristics. SUR Estimates.

	(1) Husband's BMI	(2) Husband's Height	(3) Husband's log (earnings)
A. Coefficients of the Female's Index			
Wife's log (predicted wage)	-0.913**	2.39***	0.599***
	(0.414)	(0.487)	(0.155)
Wife's BMI	0.141***	-0.089*	-0.019***
	(0.039)	(0.046)	(0.015)
Wife's Age	0.015	-0.050	0.025**
	(0.026)	(0.031)	(0.010)
Number of children	-0.325*	0.713***	0.206***
	(0.180)	(0.212)	(0.067)
Sample size		507	
Corr. of residuals (1) and (2)		0.031	
Corr. of residuals (1) and (3)		0.071	
Corr. of residuals (2) and (3)		0.114	
		BP Test $Chi^2(3) = 9.59$**	
B. MRS = ratios of coefficients			
Wife's BMI / Wife's log (predicted wage)	-0.154*	-0.037*	-0.031
	(0.087)	(0.022)	(0.027)
Test of equality ratios (1) and (2)		Chi2(1) = 1.68	
Test of equality ratios (1) and (3)		Chi2(1) = 0.04	
Test of equality ratios (2) and (3)		Chi2(1) = 1.78	

Note: All regressions include state fixed effects. Observations have been weighed using the PSID family weights.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 6: Regressions of log (earnings).

	Men		Women	
	Married	Unmarried	Married	Unmarried
BMI	0.011**	-0.000	0.001	0.000
	(0.005)	(0.008)	(0.007)	(0.005)
Age	0.010	0.003	0.029**	0.004
	(0.007)	(0.003)	(0.011)	(0.003)
Education	0.055***	0.048**	0.041	0.044***
	(0.014)	(0.023)	(0.030)	(0.014)
Number of children	0.020	0.199***	-0.209***	0.030
	(0.020)	(0.066)	(0.033)	(0.035)
Good Health	0.182	0.082	0.192	0.014
	(0.167)	(0.116)	(0.270)	(0.091)
Log (non-labor income)	-0.021***	-0.013	-0.013	-0.034***
	(0.006)	(0.010)	(0.010)	(0.008)
Spouse BMI	-0.014***	--	0.001	--
	(0.004)		(0.009)	
Spouse Age	0.021**	--	-0.006	--
	(0.009)		(0.009)	
Spouse Education	-0.001	--	0.006	--
	(0.014)		(0.024)	
Spouse Good Health	0.083	--	0.674***	--
	(0.106)		(0.199)	
R2	0.29	0.26	0.30	0.37
N	670	471	670	651

Note: Heteroskedastic robust standard errors are reported in parenthesis. All regressions include state fixed effects and occupational dummies for both spouses. Family weights are used.

*** p – value < 0.01, ** p – value < 0.05, * p – value < 0.01.

Table 7: Regressions of change in marital status between 2005 and 2007 for married individuals in 2005 (both spouses working)
(1 = if divorced in 2007, 0 = still married in 2005)

	Duration of marriage ≤ 5 years in 2005	Duration of marriage > 5 years in 2005
Δ Husband's log (earnings)	-0.035**	-0.005
	(0.017)	(0.004)
Δ Husband's weight	0.002*	-0.000
	(0.041)	(0.004)
Δ Wife's log (earnings)	0.003	-0.008
	(0.008)	(0.010)
Δ Wife's weight	-0.000	0.000
	(0.000)	(0.000)
Sample size	139	602

Note: All regressions include the change in the number of children. Observations have been weighed using the PSID family weights.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1