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by

Joan Costa-Font^{*}

Mireia Jofre-Bonet^{}**

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^{*} European Institute & LSE Health, London School of Economics, London UK; CESifo, Munich Germany; FEDEA-Health Spain.

^{**} Economics Department, City University, and LSE-Health, London, UK and FEDEA Health and CRES, Spain.

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Jorge Juan, 46
28001 Madrid -España
Tel.: +34 914 359 020
Fax: +34 915 779 575
infpub@fedea.es

N.I.F. G-78044393

Body image and food disorders: Evidence from a sample of European women*

Joan Costa-Font[†]

Mireia Jofre-Bonet[‡]

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Abstract

Excessive preoccupation for self-image has been pointed out as an essential factor explaining food disorders. This paper draws upon Akerlof and Kranton (2000) to model how 'self-image' and others' appearances influence health related behaviours. We estimate the influence of 'peers' image' on the likelihood of anorexia and self-image using data from a cross sectional European representative survey for 2004. We follow a two-step empirical strategy. First, we estimate the probability that a woman is extremely thin and, at the same time, she sees herself as too fat. Our findings reveal that peers' average Body Mass Index decreases the likelihood of being anorexic. Second, we take apart the two processes and estimate a recursive probit model of being very thin and perceiving one self as being too fat. Although peers' Body Mass Index decreases the likelihood of being very thin but increases that of seeing one self as too fat, the unobservables explaining both processes are significantly correlated.

Keywords: self-image, identity, body image, eating disorders, anorexia
JEL codes: I12, Q18

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[†]European Institute & LSE Health, London School of Economics, London UK; CESifo, Munich Germany; FEDEA-Health Spain

[‡]Economics Department, City University, and LSE-Health, London, UK and FEDEA-Health and CRES, Spain

1 Introduction

Anorexia nervosa and bulimia nervosa are the two most common types of eating disorders among women. The two disorders can be difficult to distinguish from each other because they have similar characteristics: Those suffering from either anorexia or bulimia will have a distorted image of their body and will be obsessed with what they eat. The incidence of new cases of anorexia nervosa in the UK has been estimated to up to 11 new cases per 100,000 persons per year and that of bulimia nervosa to up to 18 new cases. As these disorders tend to be long-standing, the prevalence rates for bulimia nervosa among young adult women have risen and are now at 1%-3%. The effects of eating disorders can be damaging, if not downright devastating and life threatening. People who weigh at least 15% less than the normal weight for their height may not have enough body fat to keep their organs and other body parts healthy. Persons with anorexia have their hearts, liver and kidneys damaged by the lack of nutrients. Starvation makes the body slow down causing a drop in blood pressure, pulse, and breathing rate and for girls the starvation mode may mean they stop getting their periods.¹ Disordered eating is a condition that can cause long-term physical and social consequences (Hill, 1993).

The reasons behind the increasing trend of food disorders are yet to be completely well understood but ‘socially transmitted’ standard of ‘ideal’ body image has been pointed out as an important determinant for individual’s health production function in terms of food intake and exercise.² Social psychologists regard social image as continually constructed and essential in determining physical, psychological and social equilibrium (Schilder, 1958), all of which affect self-perception and may lead to a form of extreme weight aversion. Recent contributions to the economics literature allow modeling some of these ideas even if from a different perspective. Akerlof and Kranton (2000) along with Bodenhorn, and Ruebeck (2003) have modeled the influence of identity in explaining gender attitudes and ethnic preferences, respectively. More recently, Etile (2007) examines the role of social norms on obesity and concludes social norms have little effect on behaviors leading to obesity.³ Gardner (1996) discusses that body image might enhance behavioral reactions when individuals perceive a large gap between their desired image and the one they find themselves with,⁴ and that

¹Lack of energy can lead people with anorexia to feel light-headed and unable to concentrate. Anemia and swollen joints are common in people with anorexia, as are brittle bones and osteoporosis. Anorexia can cause a person’s hair to fall out, fingernails to break off, and a soft hair called ‘lanugo’ to grow all over the skin. In severe cases, eating disorders can lead to severe malnutrition and to death. Besides the health effects associated with anorexia, there are enormous costs to society, not only in terms of quality of life years lost but also productivity losses, forgone earnings and health expenditures resulting from the increase of the prevalence of these conditions.

²Fairburn and Cooper (1984) report on an experiment proving the clear aspiration of women to be thinner, even more exaggerated in women with bulimia nervosa.

³According to Gardner (1996), body image includes two components: one perceptual, which refers to estimation of size and appearance, and another attitudinal, which relates to feelings and attitudes towards one’s own body.

⁴Slade (1988) defines body image as “the picture we have in our mind of the size, outline

this gap gives rise to permanent distorted body self-perceptions. Altogether, the power exerted by media stereotypes of beauty and the social norms individuals are immersed in -particularly the association between thinness, aesthetic ideal and success (Hill, 1993) - is widely accepted. Further, it has been suggested that the consequent fear of rejection based on physical appearance has driven the increase in the number of persons suffering eating disorders. Hence, eating disorders are ‘socially formed’ rather than a personal pathology (Bordo, 2003). Hutchinson (1982) points out that the ‘body image’ refers not only to the description of the body but ‘where body, mind and culture meet’. Accordingly, different cultural backgrounds are likely to exert idiosyncratic influences in the prevalence of food disorders, which need to be controlled for.

The objective of this paper is to build an economic model of eating disorders, anorexia in particular, that relates social environmental factors, ‘self-image’ and objective weight. We take some of the implications of the model to the data using a European representative data set and estimate the influence of ‘peers’ image’ on the likelihood of anorexia and that of self-image on one own weight. We estimate the determinants of the probability that a woman is extremely thin and, at the same time, she sees her self as too fat. We also take apart the two processes and estimate a recursive probit model of being extremely thin and perceiving one self as being too fat. We find that the unobserved factors explaining both processes are correlated. This paper confirms that social pressure through peer’s shape is determinant in explaining anorexia nervosa and distorted body self perception. To our knowledge, there is no previous work examining anorexia using an economic decision model perspective that combines self-image/identity formation and individual health production. This work also adds to recent findings that suggest that mean peer weight is correlated with adolescent weight (Trogdon et al, 2008), given that we find that peer effects are the most important and robust determinant of food disorders.

The structure of the paper is the following: First, we provide some background on the issue of self-image and anorexia among women. Second, we propose an economic model of eating disorders. Third, we set out our empirical strategy by describing the dataset and estimating a probit model of anorexia implied by our model and also a bi-variate recursive probit model of being very thin and seeing one self as too fat . The following section presents the estimation results and the last section discusses and concludes.

2 Eating Disorders and Body image: a summary

Different factors have been suggested as possible determinants of anorexia nervosa: Some of those are related to ‘nature’, i.e. gender, genes and predisposition. Other factors are related to ‘nurture’ – i.e., parental values’ and sociocultural

and shape of our body and the feelings we have about these characteristics and parts that make them up.”

influences. But, as mentioned above, those determinants seem to mainly make the individual more - or less - susceptible of having his/her food intake and exercise routine shaped after the strong socio-environmental pressures that define what an ideal body image looks like.

Gender and anorexia: Girls who achieve sexual maturity ahead of peers, with the associated development of breasts, hips, and other physical signs of womanhood, are at increased risk of becoming eating disordered (Bordo, 2003). These girls often wrongly interpret their new curves as becoming fat and feel uncomfortable because they no longer look like peers who still have childish bodies. Wanting to take control and 'fix' their insecurities, and under the influence of a culture that equates success and happiness with thinness, a young woman in this group may 'tackle' her/his body. For this group of young women, dieting, bingeing, purging, exercising, and other strange behaviors are not random but the result of a conscious decision process.

Genes, family and anorexia: There is also evidence that eating disorders may run in families. Parents influence their off-springs' values and priorities, including those towards food. Additionally, it has been suggested that there may be a genetic component to certain traits such as obsessive behaviors, which include eating disorders. According to recent research (Archives of General Psychiatry 2006; 63:305-312) Genetic factors account for more than half (56%) of the risk of developing anorexia nervosa. Work on the genetics of bulimia and binge eating continues. Studies reported in the New England Journal of Medicine (3/03) indicate that for some, but not all, people heredity is an important factor in the development of obesity and binge eating. There are suggestions that women who develop anorexia nervosa have excess activity in the brain's dopamine receptors, which regulate pleasure. This may lead to an explanation of why they feel driven to lose weight but receive no pleasure from shedding pounds. (Journal of Biological Psychiatry; July 2005. Guido Frank, et al.)

Some of those with eating disorders report having felt smothered in overprotective families. Others have felt abandoned, misunderstood, and alone. Parents who overvalue physical appearance can unwittingly contribute to an eating disorder. So can those who make critical comments, even in jest, about their children's bodies. Further, families that include a person with an eating disorder tend to be rigid, and ineffective at resolving conflict. Sometimes mothers are emotionally cool while fathers are physically and/or emotionally absent. At the same time, there are high expectations of achievement and success. Children learn not to disclose doubts, fears, anxieties, and imperfections. Instead they try to solve their problems by manipulating weight and food, trying to achieve the appearance of success even if they do not feel successful. (Bordo, 1993)

People vulnerable to eating disorders, in most cases, are experiencing relationship problems, loneliness in particular. Even those who appear to have normal relationships reveal great fear of criticism and rejection if their perceived flaws and shortcomings become known. (Bachar et al., 2001).

Socio-environmental factors: The Media. Many people believe media stereotyping helps explain why about ninety percent of people with eating disorders are women and only ten percent are men. In Westernized countries charac-

terized by competitive striving for success, women often experience unrealistic cultural demands for thinness. According to Health magazine, April 2002, 32% of female TV network characters are underweight, while only 5% of females in the U.S. audience are underweight. According to Health magazine, only 3% of female TV network characters are obese, while 25% of U.S. women fall into that category. The differences between media images of happy, successful men and women are interesting. While women appear young, beautiful, and thin, men are young or old, but strong and powerful in all the areas that matter - physically, in business, and socially. Thin is not desirable; power, strength and firmness are.

The media-portrayed ideal body image influences social interactions, and at the same time, social interactions might amplify the dominance of the 'ideal' body image propagated by the media. This circularity only makes the power of social interactions in shaping people's self identities more extreme.

In sum, females of similar generation, education and background are likely to have been exposed to similar media and social environments and, accordingly, they are likely to have similar ideal self-identities. Thus, to measure the strength of such socially transmitted influences on individual behavior the concept of peer or social multiplier effect as applied in Glaeser et al. (1996) and in Sacerdote (2000) may be adequate.

3 An economic decision model of eating disorders

In the light of current empirical evidence, modelling eating disorders might be problematic. From what was discussed above, food disorders seem the result of socially influenced biased self-perceptions which cause the 'utility' associated to an essential good such as food to become negative after a certain net caloric intake threshold.

In order to model eating disorders, anorexia in our case, we find the self-identity model of Akerlof and Kranton (2000) particularly useful: We assume that an individual chooses food and exercise related 'actions' in order to maximize an implicit utility function that depends not only on his/her net caloric intake (food consumption minus what is consumed by exercise), but also on his/her self-image (identity) and health. Besides these individual factors, one individual's utility function is conditioned by his/her peers' net caloric intake; his/her characteristics and sociocultural environmental factors. Thus, we can model the utility function as:

$$U_j = U_j(a_j, a_{-j}, c_j, SI_j, H_j; z_j, Z_j), \quad (1)$$

where a_j is j 's net caloric intake; a_{-j} represents the net caloric intake of others 'around' j ; c_j reflects j 's all other non-food related actions; SI_j is j 's self-image; H_j is j 's health production function, z_j are his/her characteristics; and, Z_j the environmental factors in which j is immersed.

Similarly to Akerlof and Kranton (2000), self-image SI_j depends not only on j 's net caloric intake, a_j , but also on others' net caloric intake, a_{-j} ; and it is conditioned by j 's individual characteristics and environmental factors, z_j and Z_j , and on j 's status', s_j - as a person in a higher status may have a better self-image than an identical one in a lower status.⁵ Thus, we write the equation of self-image⁶ as:

$$SI_j = I_j(a_j, a_{-j}; s_j, z_j, Z_j) \quad (2)$$

Finally, we introduce a health production function H_j , which depends on j 's net caloric intake, a_j ; j 's non food related actions, c_j ; j 's status', s_j ; and, any other individual and environmental factors, z_j and Z_j . We write the health production equation as follows:

$$H_j = H_j(a_j, c_j; s_j, z_j, Z_j) \quad (3)$$

Standard utility maximization subject to a budget constraint under the usual regularity assumptions would lead to an associated first order condition as follows:

$$\frac{dU_j}{da_j} = \underbrace{\frac{dU_j}{da_j}}_u + \underbrace{\frac{dU_j}{dSI_j} \frac{dSI_j}{da_j}}_{si} + \underbrace{\frac{dU_j}{dH_j} \frac{dH_j}{da_j}}_h - \lambda p_a = 0, \quad (4)$$

where λ is the usual income multiplier and p_a the monetary price of net caloric intake or the combination of food price and exercise cost including the opportunity cost of the time invested in it.

By rearranging, equation (4) can be expressed as:

$$\frac{dU_j}{da_j} = \underbrace{\frac{dU_j}{da_j} + \frac{dU_j}{dH_j} \frac{dH_j}{da_j}}_{+} + \underbrace{\frac{dU_j}{dSI_j} \frac{dSI_j}{da_j}}_{-} - \lambda p_a = 0, \quad (4b)$$

Even if very simplistically, equation (4b) reflects the fact that net caloric intake related choices will not only obey to the (in principle positive) effect that eating and exercising has on individual's utility and health, but also to the effect that net caloric intake has on utility and health through its impact on self-image.

We would expect a person without any eating disorder to have: a positive marginal utility from net caloric intake as eating is normally enjoyable; a positive

⁵Here status can be interpreted loosely reflecting not only social status but also physical appearance, and other status' determining attributes.

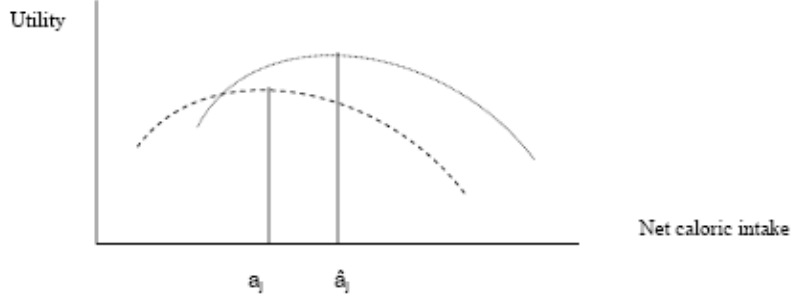
⁶Akerlof and Kranton (2000) include also j 's ideal identity and the prescribed norms associated to j 's status but, to avoid unnecessary modelling complications of our model, we only use her/his peers' image given her status, characteristics and socio-cultural environmental factors to capture what is socially normal for j given his environment.

marginal utility from health and also from an increased self-image. Also, we assume that a normal net caloric intake has a positive marginal impact on health since nutrition is necessary for survival. Thus, the first two summands in equation (4b) are expected to be positive.

Contrarily, we expect a possibly negative marginal impact of net caloric intake on self-image after a certain level of net caloric intake, which would make the sign of the second term in equation (4b) negative. Thus, the net caloric intake chosen to optimize overall utility will vary depending on the relative magnitude of the positive and negative signs in equation (4b) above.

Given the empirical evidence, a person with anorexia will have an extraordinarily large negative term associated to the effect of net caloric intake on self-image. Thus, in this special case the net utility of net caloric intake would achieve a maximum at a much lower level than for a non-anorexic person.

Figure 1. Optimal equilibrium with and without anorexia



Thus, an anorexic individual chooses a net caloric intake a_j that is under the healthy/optimal net caloric intake associated to his/her characteristics under, $\hat{a}_j$. We can think of this minimum necessary net caloric intake threshold as the one that would keep individual on a body mass index (BMI) considered “healthy”.

From equation (4b), it is easy to infer an implicit reduced form of net caloric intake that depends on the individual status, the individual characteristics and the social environment, which includes the net caloric intake (dieting and exercise) behavior of others. In particular, under some the standard normality and linearity assumptions, the likelihood of being anorexic, e.g. the probability that the net caloric intake of individual j is below his/her minimal healthy level $\hat{a}_j$ can be expressed as:

$$P(a_j < \hat{a}_j) = \Phi(s_j, z_j, Z_j, a_{-j}) \quad (5)$$

4 Data and Methods

4.1 Data

We use two types of variables: Individual level variables and socio-environmental variables. The former are taken directly from the answers to the Eurobarometer 59.0 questionnaire. The Eurobarometer 59.0 study number 3903 is part of the standard Eurobarometer Surveys have been conducted each Spring and Autumn since Autumn 1973 and European countries have been added as the European Union has expanded. The regular sample in standard Eurobarometer Surveys is 1,000 people per country with the exception of Luxembourg (600) and the United Kingdom (1,000 in Great Britain and 300 in Northern Ireland). In order to monitor the integration of the five new Länder into the unified Germany and the European Union, 2,000 people have been sampled in Germany since Eurobarometer 34: 1,000 in East Germany and 1,000 in West Germany. In each of the 15 member states, the survey is carried out by national institutes associated with the European Opinion Research Group.⁷

The special issue of the Eurobarometer, 59.0, was carried out between 15th January and 19th February 2003, in all European Union countries, on behalf of the European Opinion Research Group. The questions from this special Eurobarometer focussed on attitudes towards life long learning; health issues; dietary habits and alcohol consumption; safety issues; partnership; household tasks; childcare and family planning. In particular, it addressed the incidence of chronic illness, long-term treatment, and dental health and, in more depth, health maintenance by discussing doctor's visits and various screening tests; women's health – and medical tests relating specifically to women's health; and general and children's safety.⁸

Given that the mechanisms leading towards anorexia and bulimia affect women particularly (Hall, 1993), we focus on studying women's behavior and thus select only women. This leaves us with a sample of 8,740 of valid observations.

We scrutinize a set of individual variables ranging from socio-demographic characteristics to biometric measures and behavioral attitudes. This set of variables are: weight, height, own body perception, healthiness of eating habits, age, gender, being married, educational level, professional category, political attitudes, and whether the individual lives in a city or rural area. Furthermore, to capture the freedom and the quality of the answers, in some of our specifications we have used the number of people present during the interview and the cooperation level.

We categorize a woman as anorexic if she is extremely thin but perceives herself as too being fat. To that purpose, we create an indicator variable called

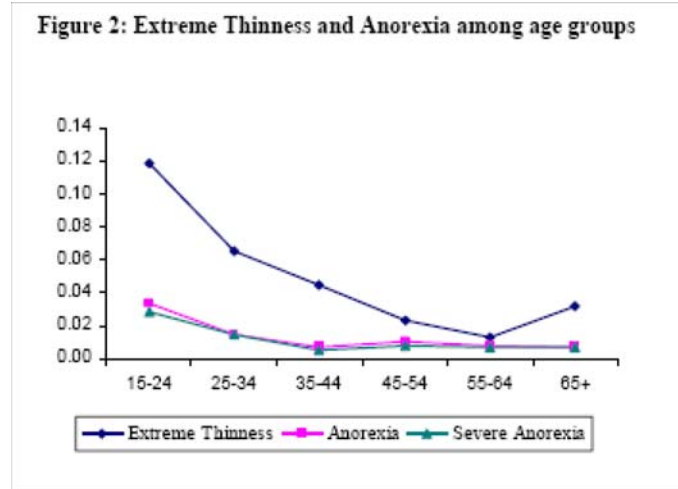
⁷From Standard Eurobarometer 59 / Spring 2003 - European Opinion Research Group EEIG: http://ec.europa.eu/public_opinion/archives/eb/eb59/eb59_rapport_final_en.pdf

⁸Special Barometer: Health, Food and Alcohol and Safety. Special Eurobarometer 186 / Wave 59.0 - European Opinion Research Group EEIG: http://ec.europa.eu/public_opinion/archives/ebs/ebs_186_en.pdf

‘anorexia’ which takes a value 1 if a woman has a BMI less than 17.5 and, at the same time, sees her self as being ‘too fat’. Complementarily, we create a second anorexia indicator variable labelled as ‘severe anorexia’ if, besides having a BMI of 17.5 and seeing herself as too fat, the woman also declares to be eating ‘healthily’ enough. To identify being very thin, we create an indicator variable called ‘underweight’, which takes value 1 if the individual has a BMI below 17.5. Finally, to identify seeing oneself too fat, we create a variable called ‘too fat’, which takes value 1 if the individual declares to see herself as too fat and 0 otherwise.

We also create a variable to measure health consciousness as the number of declared gynecological check-ups they had during the last six months, which ranges from 0 to 6.

Figure 2 reports the prevalence of extreme thinness and anorexia among women over three age groups. First, extreme thinness in terms of very low BMI is highest during the early youth (age groups 15 to 24) and its prevalence progressively decreases until the age 55- 64 years of age, to grow slowly again in the late years of life. Second, anorexia as we have defined has a prevalence of 3% prevalence for women between 15 and 24, just slightly higher than severe anorexia. Both follow a decreasing pattern till the age of 35, after which they remain relatively constant at about 1%. Indeed, we find that the prevalence of anorexia is close to just below 4% for younger age groups and just below 2% among women age 25-34. Therefore, a different pattern of analysis is expected between women below 34 and those older.



The first panel in Table 1 provides some summarizing statistics for our data: The average age of women in our sample is 45 years of age. Of those, 57% are married, 37.5% are the head of their household, and 27% live in a small town or rural area. Roughly 26% completed primary school, 41% secondary school, 24% studied up to 18 years of age, and 9.4% have a University degree. The

average value of the variable ‘being health conscious’ for the full sample is 1.25, indicating the average number of gynecological tests in the last 6 months.

The second panel in Table 1 shows the descriptive statistics for young women, which have a higher incidence of food disorders. This group is of women between 15 and 34 years of age, with an average age of 25 years. Only 47% are married, 28% are the head of their household, 30% live in a small town or rural area. Of those, 8% have primary education, 41% secondary, 23% received education until the age of 18, and, finally, 27% obtained a University degree. For this younger group, the average number of gynecological check-ups during the last year is 1.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.
All Women			
Age	8,740	45.07	17.91
Married	8,740	56.8%	49.5%
Being Head of Household	8,740	37.5%	48.4%
Living in Rural Area	8,740	26.8%	44.3%
Having Primary Education	8,740	26.0%	43.9%
Having Secondary Education	8,740	40.7%	49.1%
Having Education up to 18 years	8,740	23.9%	42.6%
Having been in University	8,740	9.4%	29.2%
Being health conscious	8,740	1.3	1.5
Women between 15 and 34 years of age			
Age	2,871	25.40	5.59
Married	2,871	46.9%	49.9%
Being Head of Household	2,871	27.6%	44.7%
Living in Rural Area	2,871	30.1%	45.9%
Having Primary Education	2,871	8.3%	27.6%
Having Secondary Education	2,871	41.1%	49.2%
Having Education up to 18 years	2,871	23.4%	42.3%
Having been in University	2,871	27.3%	44.5%
Being health conscious	2,871	1.0	1.3

Source: our own using data from Eurobarometer 59.0 study number 3903

In order to capture the peer effect pressure felt by a woman in terms of acceptable body shape around her, we create a variable containing the BMI of women in her age group and in her region of residence,⁹ with which we want

⁹Source: World Magazine Trends FIPP/ ZenithOptimedia World Magazine Trends

to proxy the BMI of her reference group. Trying to capture social norms and image patrons, we include a variable called ‘women’s magazines per capita’ in the country, which corresponds to the per capita number of magazines categorized as for women.¹⁰

Table 2 provides a breakdown by country and age groups the percentages of anorexia, extreme thinness, of those believing they have weight problems and need to diet, and the average BMI. It can be seen that the country with a higher prevalence of female anorexia as defined by this paper (in column 3) is Austria, France, Spain and Northern Ireland. The lowest is in Germany, Luxembourg and Italy. Almost all countries seem to have a population generally worried about their weight ranging from 36% in France to 56% in Northern Ireland, and among the younger group, Luxembourg and Ireland have the highest percentage, 49%, while Italy has only 22%. Consistently, the lowest percentages of people declaring to eat adequately are found in West Germany (64%), Austria (79%) and the highest in Finland (91%) and Luxembourg (90%), Denmark (93%).

¹⁰Source: World Magazine Trends FIPP/ ZenithOptimedia World Magazine Trends

Table 2: Country specific BMI average and other measures of thinness and distorted self-image

countries	Country Average BMI		BMI<17.5		BMI<19.1		BMI<17.5 & Seeing One Self Too Fat or Normal		BMI<17.5, Seeing OneSelf Normal or Too Fat and Eating Adequately		Seeing OneSelf Too Fat		Eating Adequately		Circulation of Women's Magazines per 1000 persons
	All Women	Younger Women 15-34	All Women	Younger Women 15-34	All Women	Younger Women 15-34	All Women	Younger Women 15-34	All Women	Younger Women 15-34	All Women	Younger Women 15-34	All Women	Younger Women 15-34	All Women
Belgium	24.1	24.0	1.3%	1.7%	7.8%	11.2%	0.4%	0.6%	0.4%	0.6%	48%	47%	85%	78%	0.053
Denmark	23.3	23.4	1.2%	2.2%	6.3%	15.1%	0.8%	1.5%	0.6%	0.7%	44%	40%	93%	82%	0.0418
Germany East	23.2	23.1	0.6%	1.6%	6.4%	11.9%	0.2%	0.0%	0.0%	0.0%	42%	37%	83%	76%	0.0369
Germany West	24.7	25.3	0.4%	1.2%	5.2%	12.1%	0.2%	0.6%	0.0%	0.0%	51%	38%	64%	55%	0.2137
Greece	25.3	22.7	1.8%	3.9%	10.4%	21.2%	0.8%	2.6%	0.8%	2.6%	41%	34%	80%	75%	0.0223
Italy	22.7	23.8	0.6%	0.5%	5.4%	10.9%	0.2%	0.5%	0.2%	0.5%	38%	22%	89%	90%	0.0253
Spain	23.9	22.3	3.7%	5.1%	14.4%	23.4%	1.4%	1.1%	1.0%	0.0%	48%	40%	80%	76%	0.0443
France	22.5	23.1	1.8%	3.2%	5.7%	8.1%	1.3%	2.7%	1.3%	2.7%	36%	30%	88%	88%	0.0374
Ireland	23.2	24.5	1.0%	3.0%	4.8%	11.1%	0.4%	1.2%	0.4%	1.1%	56%	49%	82%	76%	0.0266
Northern Ireland	24.5	23.3	3.6%	4.7%	10.4%	15.9%	1.3%	2.3%	1.3%	2.3%	48%	40%	84%	75%	1.3202
Luxembourg	23.1	24.6	0.6%	0.0%	3.7%	8.1%	0.0%	0.0%	0.0%	0.0%	52%	49%	90%	87%	1.1593
The Netherlands	24.6	24.9	1.2%	2.8%	5.1%	9.5%	0.6%	1.1%	0.6%	1.1%	42%	29%	84%	86%	0.0691
Portugal	25.0	24.8	1.2%	2.4%	4.4%	7.0%	0.5%	1.0%	0.3%	0.5%	55%	49%	83%	76%	0.0187
United Kingdom	24.8	24.6	1.0%	2.9%	2.9%	8.4%	0.4%	1.4%	0.4%	1.4%	46%	34%	83%	83%	0.0373
Finland	24.7	24.7	1.1%	1.6%	5.7%	11.8%	0.5%	0.5%	0.5%	0.5%	50%	38%	91%	86%	0.0975
Sweden	23.5	23.4	1.6%	2.5%	5.0%	9.7%	0.6%	1.3%	0.4%	0.6%	50%	38%	85%	83%	0.0429
Austria	23.2	23.0	1.7%	5.2%	7.1%	16.9%	1.5%	4.6%	1.4%	4.0%	38%	30%	79%	77%	0.0525

4.2 Empirical Strategy

We split our empirical exercises in two complementary steps. We first estimate the impact of several variables on the likelihood of being anorexic. Second, we estimate a bi-variate recursive probit that breaks apart the two processes involved in anorexia: Extreme thinness and seeing one self as too fat.

4.2.1 Being anorexic:

Given the empirical evidence described earlier and the model specification in section 2, we assume that an individual's propensity to be anorexic can be modelled as a latent variable which depends on individual and socio-environmental characteristics:

$$A_j^* = \gamma Z_j + \beta z_j + \varepsilon_j, \quad (6)$$

where Z_j refers to the socio-environmental factors that individual j faces - including importance of certain types of media, peer's behavior (Manski, 1993), country access to the internet as well as trust in the press, etc.; z_j are individual specific controls such as gender, age, professional status, political affiliation and education; and as usual j represents j 's unobserved idiosyncratic characteristics. Peer effects are important because they affect peoples health related preferences regarding what an acceptable weight is (Crawford and Campbell, 1999) as well as information updating and access to social networks (Etile, 2007).

As usual, in our survey we only observe the value that a dichotomous variable takes. This variable is 1 if the person can be considered anorexic and 0 otherwise:

$$A_j = 1_{(A_j^* > 0)} = \begin{cases} 1 & \text{if } A_j^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

Assuming normality of the error term in equation (6), we can estimate the likelihood of being anorexic as the probit model:

$$P(A_j = 1 | z_j, Z_j) = \Phi(\varepsilon_j \leq \gamma Z_j + \beta z_j),$$

,where Φ is the normal distribution cumulative probability function.

4.2.2 Joint estimation of body self image and health production function

In this second empirical exercise, we investigate how different factors affect the two different processes involved in developing anorexia: being very thin, and having a self-image of being 'too fat'.

We assume that one own body image as 'too fat' reflects one's latent (body) 'self-identity' à la Akerlof and Kranton (2000) . Nevertheless, again, what the

econometrician observes is only a dichotomous variable taking a value 1 if the individual declares that to have a perception of him/herself of being too fat and 0 otherwise. In order to simplify the analysis, we assume that depends linearly on social and individual characteristics.

$$SI_j = G(z_j, Z_j) + e_j \quad (7)$$

Similarly, the process of being extremely thin or underweight may be thought of as a partial approximation to the individual's latent health production function. As before, we assume that what we observe is the dichotomous variable, associated with this process. The variable takes value 1 when the individual is extremely thin and 0 otherwise.

We again assume that depends linearly on social and individual characteristics and also, and very importantly, that the likelihood of being very thin depends on the individual's own body perception or self-image, .

$$UW_j = F(z_j', Z_j', SI_j) + \mu_j \quad (8)$$

We estimate the system formed by equations (7) and (8) above as a recursive probit model by assuming that $F(.)$ and $G(.)$ are linear and that the idiosyncratic terms μ_j and ε_j are jointly normally distributed. We use a different notation for the social (Z_j and Z_j') and individual (z_j and z_j') characteristics in each equation so that the necessary identification restrictions are satisfied.

By estimating the recursive probit model above, we are able to investigate how individual and environmental factors influence on these two processes while allowing that the unobserved factors affecting self-image and extreme thinness are correlated, and at the same time consider the effect of self image on health production. The latter is done along the lines of Green (1998).

4.3 Results

4.3.1 Probability of anorexia

Table 3 displays the results of our preliminary strategy of estimating a probit model to determine which observable factors might explain the propensity of a woman to see herself as too fat whilst being extremely underweight ($BMI < 17.5$) – displayed in column 1; and in column 2, that she moreover thinks she is eating adequately despite of a very low weight. We estimate one probit model for our full sample and one for those women that are between 15 and 34 years of age. As explanatory variables we include several potential determinants of such behaviors: marital status; living in an rural setting; being the head of the household; age; education; revealed - rather than declared - evidence of health consciousness - measured through the number of gynecological screens taken in the last 6 months; and some socio-environmental potential factors: the

peer's BMI - measured through group of reference BMI,¹¹ and, the circulation of women's magazine per capita in the country of residence.

For the full sample of women, the estimated marginal effects reported in Table 3 suggest that the BMI of the group of reference in terms of age, gender and location is very significant and negative (-0.00147 for the full sample, -0.00262 for the sample of younger women). Thus, the higher the BMI one's peers, the lower the probability of suffering from anorexia. We find for that for the younger women, the effect of the BMI of the peers is even stronger in terms of decreasing the probability of being anorexic. Being married (only significant for the full sample and equal to -0.00381), aging and having more education decrease the likelihood of being anorexic or severely anorexic as defined above. Whilst the signs of being married, age and education are understandable, the peer effect result is in line with the literature on social multiplier effects (Glaeser et al., 1996; Sacerdote, 2000). Nevertheless, this should be taken with a grain of salt as our measure of peer effects is measured crudely.

Living in a rural setting, being the head of the family do not seem to exert an effect somehow surprisingly. Lastly, the variable reflecting the circulation of women's magazine per capita does not have an effect either, although that could be due to the crudeness of this measure.

With respect to the effects of these variables on the probability of being severely anorexic, note that they are qualitatively very similar but just a big smaller in magnitude than the ones commented above.

¹¹The group of reference is defined of those women in the same age bracket, in the same region of residence.

Table 3. Probit Model of the Likelihood of Suffering from Anorexia

COEFFICIENT	Anorexia (A) §		Severe Anorexia (B) §§	
	All Women	Younger Women 15-34	Anorexia	Younger Women 15-34
Peer Effects : Group BMI	-0.00147*** (-0.000457)	-0.00262* (-0.001)	-0.00140*** (-0.00042)	-0.0022 (-0.001)
Women's Magazine Circulation per capita	0.145 (1.659)	-4.236 (-5.069)	0.917 (1.532)	-0.92 (-4.644)
Being Married	-0.00381* (-0.002)	-0.00370 (-0.006)	-0.00459* (-0.002)	-0.0068 (-0.004)
Living in a Rural Environment	0.000814 (0.00143)	0.00321 (-0.00399)	0.000903 (0.00143)	0.0043 (0.004)
Being Head of the Household	-0.000681 (-0.001)	-0.00595 (-0.004)	-0.000774 (-0.001)	-0.0042 (-0.004)
Being health conscious†	0.000761** (0.000)	0.00265 (-0.00214)	0.000493 (0.000)	0.0016 (0.002)
between 25 and 34 years old	-0.00327*** (-0.001)	-0.0134*** (-0.005)	-0.00221** (-0.001)	-0.00752 (-0.004)
between 35 and 44 years old	-0.00487*** (-0.001)		-0.00368** (-0.002)	
More than 45 years of age	-0.0101*** (-0.003)		-0.00682*** (-0.002)	
Having Secondary Education	-0.00256** (-0.001)	-0.00539 (-0.004)	-0.00182** (-0.001)	-0.0027 (-0.004)
Having Education up to 18 years	-0.000686 (-0.001)	-0.000342 (-0.005)	-0.000726 (-0.001)	0.00043 (0.005)
Having been in University	-0.00247** (-0.001)	-0.00535 (-0.006)	-0.00210* (-0.001)	-0.0040 (-0.005)
Controlled by country of origin	Yes	Yes	Yes	Yes
Number of Observations	8012	2654	8012	265
Pseudo R squared	0.0859	0.0484	0.0788	0.021
LogLikelihood	-275.1	-180.8	-242.5	-14
Number of Clusters (countries)	17	17	17	1

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

§ Anorexia A is defined if the person is below 17.5 BMI and sees herself as a fat person.

§§ Anorexia B is defined if the person is below a BMI of 17.5, considers herself fat and thinks she is eating appropriately.

† Being health conscious is defined as the sum of all gynecological screens had in the last 6 months.

4.3.2 Robustness checks for the probability of being anorexic

To test the robustness of the specification in table 3, we estimate the impact on the peer marginal effect coefficient of adding the controls incrementally. Those are presented in Table 4 below. The results obtained suggest that the peer marginal effect is robust to these changes but the introduction of additional covariates progressive decreases this coefficient from -0.02 to -0.014 for the less restrictive definition of anorexia and from -0.016 to -0.014 for the strictest definition. However, for the younger sample, this coefficient seems slightly more stable even when introducing additional controls, it decreases from -0.014 to -0.010 for both definitions of anorexia.

Table 4: Robustness checks using alternative Probit model specifications

	Anorexia (A) §					Severe Anorexia (B) § §				
Anorexia (All Women)										
Peer Effects : Group BMI	-0.02 (0.001)	-0.017 (0.001)	-0.017 (0.001)	-0.015 (0.003)	-0.014 (0.000)	-0.018 (0.001)	-0.0158 (0.000)	-0.0147 (0.000)	-0.0146 (0.000)	-0.0139 (0.000)
Personal Characteristics	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Age variables	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Education	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Health Consciousness	No	No	No	No	Yes	No	No	No	No	Yes
Controlled by country of origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Anorexia (Young Women)										
Peer Effects : Group BMI	-0.014 (0.001)	-0.011 (0.001)	-0.011 (0.001)	-0.010 (0.003)	-0.010 (0.001)	-0.014 (0.001)	-0.011 (0.001)	-0.011 (0.001)	-0.011 (0.001)	-0.010 (0.001)
Personal Characteristics	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Health Consciousness	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Age variables	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Education	No	No	No	No	Yes	No	No	No	No	Yes
Controlled by country of origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

4.3.3 Joint estimation of fat self-image and low weight

In Table 5, we report the marginal effects of a bivariate recursive probit model (Greene, 1997) of being extremely thin and seeing one self as too fat separately, but allowing the unexplained variation in both facts to be related. Again, we estimate the bivariate model for full sample of women first, and then for those in the 15-24 year age range. The identification restrictions are that peers' BMI and women's magazine circulation are presumably related on body's self perception but not own weight, while seeing one self as too fat (self identity) may indeed influence the probability of being extremely thin.

From the estimates of the recursive bivariate probit we see that when we disaggregate the two processes involved in our simplistic definition of anorexia some interesting findings arise:

First of all, the peers' BMI has a positive effect on the probability of seeing one self as too fat (0.0714 for the full sample, 0.113 for the younger sample) although again, women's magazine circulation is not significant. Being married has a positive effect on the probability of being extremely thin (0.133) and seeing one self as too fat (0.189) only for the young sample. For the full sample, the effect of being extremely thin on seeing one self as too fat is significant (0.167). The effect of age on the probability of seeing oneself as too fat is positive for both groups and has a curvilinear effect on the probability of being extremely thin for the full sample. Living in a rural area has a positive effect on the likelihood of seeing one self as too fat (0.056) but this is not significant for the younger sample. Having been in university has a significant negative effect on being likely to see one self as too fat for both samples (-0.345 and -0.214) but it affects negatively the probability of being extremely thin only for the full sample (-0.169). Surprisingly, being head of the household or being health conscious

are not significant.

Finally, note that seeing one self as too fat (self image) has a very negative effect on the probability of being extremely thin. Thus, for the full sample (not those anorexic) seeing one self as too fat may respond to being not thin, as expected.

The coefficient γ , which captures the correlation of both processes, is positive and highly significant for both samples corroborating that there exist some unobserved factors influencing both women's body identity and extreme thinness that are positively correlated.

Table 5. Recursive -Probit Models for Being Very Thin and Seeing One self as 'Too Fat'

COEFFICIENT	All Women		Younger Women 15-34	
	Thinness ‡	Seeing oneself too fat	Thinness ‡	Seeing oneself too fat
Peer Effects: Group BMI		0.113*** (0.0158)		0.0714*** (0.015)
Women's Magazines Circulation per capita		24.20 (61.630)		-40.58 (-25.900)
Being Married	-0.00243 (-0.053)	0.167*** (0.047)	0.133** (0.066)	0.189*** (0.073)
Being Household Head	-0.0209 (-0.048)	0.0621 (0.038)	0.0411 (0.069)	0.0947 (0.068)
Being health conscious†	0.00177 (0.014)	0.00945 (0.009)	0.0159 (0.021)	-0.00895 (-0.011)
between 25 and 34 years old		0.180*** (0.036)		0.132*** (0.039)
between 35 and 44 years old		0.309*** (0.045)		
More than 45 years of age		0.338*** (0.051)		0.0196*** (0.007)
Age	-0.0173* (-0.009)		0.00456 (0.032)	
Age Squared	0.000137* (0.000)		- (-0.001)	
Living in a Rural Area	0.0441 (0.035)	0.0560** (0.023)	0.0390 (0.052)	0.00927 (0.036)
Having Secondary Education	0.0685 (0.059)	0.0368 (0.046)	0.0572 (0.072)	0.0706 (0.059)
Having Education up to 18 years	0.0968 (0.078)	-0.0254 (-0.055)	0.0695 (0.080)	0.00356 (0.077)
Having been in University	-0.169* (-0.095)	-0.345*** (-0.089)	-0.162 (-0.110)	-0.214** (-0.098)
Seeing oneself too fat	-2.793*** (-0.162)		- (-0.112)	
Constant	0.242* (0.146)	-3.205*** (-0.402)	-0.0281 (-0.424)	-2.180*** (-0.343)
Atrho		1.583*** (0.431)		7.564 (19.280)
Controlled by country of origin		Yes		Yes
Number of Observations		8740		2871
Chi-Square for rho=0		13.48		0.154
Reject Null rho=0		Yes		No
Degrees of Freedom		14		14
LogLikelihood		-0.845		-0.296
Number of Clusters (countries)		17		17

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

† Being health conscious is defined as the sum of all gynecological screens had in the last 6 months.

‡ Thinness is defined as having a BMI below 19.1

4.4 Robustness checks for the joint estimation of fat self image and low weight

As observed in Table 6 we find that the coefficient of peer effect on fat self image remain almost constant when additional controls are introduced both among all women examined and when a sample of only those younger women is examined. This confirms the important of peer effects as influencing perception of a fat weight perception. Similarly in Table 6, we have the recursive effect of fat self image on extreme thinness. Interestingly, the coefficient is negative and robust revealing that women that see themselves fine are about 44-46% less likely to be too thin.

Table 6: Robustness Checks (Alternative Recursive Probit Specifications)								
Anorexia (All Women)	Thinness				Seeing one self as too fat			
Peer Effects : Group BMI	-	-	-	-	0.043 (0.005)	0.044 (0.005)	0.043 (0.005)	0.044 (0.006)
Seeing one self as too fat	-0.42 (0.014)	-0.44 (0.130)	-0.44 (0.129)	-0.44 (0.130)	-	-	-	-
Personal Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age variables	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Education	No	No	Yes	Yes	No	No	Yes	Yes
Health Consciousness	No	No	No	Yes	No	No	No	Yes
Controlled by country of origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Anorexia (Young Women)	Thinness				Seeing one self as too fat			
Peer Effects : Group BMI					0.045 (0.060)	0.045 (0.060)	0.03 (0.013)	0.046 (0.060)
Seeing one self as too fat	-0.45 (0.200)	-0.44 (0.210)	-0.44 (0.210)	-0.44 (0.210)				
Personal Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age variables	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Education	No	No	Yes	Yes	No	No	Yes	Yes
Health Consciousness	No	No	No	Yes	No	No	No	Yes
Controlled by country of origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

5 Conclusion

This paper attempts to examine the influence of peers' body shapes on individual's health drawing from the example of anorexia. We present a simple theoretical framework for female's net caloric intake that depends not only on others' shapes but also on body self-image or perception motivated by Akerlof and Kranton (2000).

Our empirical exercise stemmed from that modelisation suggests that anorexia affects primarily non-married women aged between 15-34, and that the effect of peers' shape is very strong. These findings are somehow consistent with the hypothesis that individuals trade off health against self-image, yet this phe-

nomenon happens mostly at younger ages. Our crude measure of peers' shapes - average BMI of one's reference group - is significant and robust through samples, which points towards the importance of socio-environmental factors in health production, and particularly on food disorders. We find that the results are robust to different specifications that introduce sequentially relevant controls. The estimation of a recursive bi-variate probit model specification of extreme thinness and seeing one self as too fat confirms that self-image matters for health production after controlling for peer effects and other covariates. Again these results proved to be robust to different specifications.

On a general scale, these results speak to the debate on the formation of health preferences. Namely, they suggest that it is important to understand how individual utility is formed (Bowles, 1998), particularly for eating unhealthy food, and arguably a similar model could be applied to strenuous physical activity, whose costs in terms of health and wellbeing could be incorporated in one's utility maximization. The idea that formation of preferences, and particularly the effect of meta- preferences, is crucial in determining identity and health behaviors underlies this debate. This hypothesis has important consequences for health policy evaluation given that preference for health related activities is likely to be both influenced and to influence health outcomes.

Probably one of the implications is that there is a case for acting upon individual's identity, most likely when the latter is being formed, so as to prevent extreme health damage through anorexia so that women's wellbeing and that of their families are improved. However, our results should be taken with caution due to the absence of a longitudinal dataset in Europe.

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