

d'Hombres, Beatrice; Brunello, Giorgio

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Does obesity hurt your wages more in Dublin than in Madrid? Evidence from ECHP

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Béatrice d'Hombres
Giorgio Brunello

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Béatrice d'Hombres

University of Padova

Giorgio Brunello

*University of Padova, CESifo
and IZA Bonn*

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0

Fax: +49-228-3894-180

Email: iza@iza.org

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ABSTRACT

Does Obesity Hurt Your Wages More in Dublin than in Madrid? Evidence from ECHP*

We use data from the European Community Household Panel to investigate the impact of obesity on wages in 9 European countries, ranging from Ireland to Spain. We find that the common impact of obesity on wages is negative and statistically significant, independently of gender. Given the nature of European labor markets, however, we believe that a common impact is overly restrictive. When we allow this impact to vary across countries, we find a negative relationship between the BMI and wages in the countries of the European "olive belt" and a positive relationship in the countries of the "beer belt". We speculate that such difference could be driven by the interaction between the weather, BMI and individual (unobserved) productivity.

JEL Classification: I12, J3

Keywords: wages, body mass index, Europe

Corresponding author:

Giorgio Brunello
Università di Padova
Dipartimento di Scienze Economiche
Via del Santo 33
35100 Padova
Italy
Email: giorgio.brunello@unipd.it

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1 Introduction

There is a growing literature that documents the relationship between physical appearance and labour market outcomes in developed countries (Cawley, 2004, Cawley and Danziger, 2000, Hamermesh and Biddle, 1994, Averett and Korenman, 1996, Register and Williams, 1990). Some of these studies show that obesity is an handicap to social advancement, especially for women. Most of the evidence of the negative correlation between obesity and wages is for the US, but there are a few recent studies which address the economic impact of obesity in Europe (see Fahr, 2003, and Sousa, 2005¹).

The consequences of obesity are numerous, both in terms of an increase in health problems (diabetes, cardiovascular diseases, hypertension, etc) and in terms of the adverse impact on the quality of life. On the one hand, obesity may hamper productivity. On the other hand, when labour markets are imperfect and there is asymmetric information about individual productivity, obese individuals may be statistically discriminated if employers believe that they are less productive than the rest of the population (Aigner and Cain, 1977).

Taste discrimination by employers and /or customers, and cultural factors may also result in differentiated treatment based on physical attributes (Becker, 1957). In spite of monetary unification, Europe differs broadly in culture, values and social customs. Suppose that, *ceteris paribus*, obesity attracts a negative premium in Madrid and a positive premium in Dublin. In a perfectly mobile labor market, we would expect mobility flows from Madrid to Dublin to arbitrage away these differences. If mobility costs are substantial, however, either because of language or because of social networks, these differences will persist over time.

¹Both studies use the European Community Household Panel. Fahr, 2003 ignores the potential endogeneity of the body mass index in wage regressions. Sousa, 2005, use matching techniques and focuses on the impact of the body mass index on labor force participation. Cawley *et al*, 2005, investigate the relationship between obesity and earnings in the US and Germany.

In this paper, we explore the impact of the body mass index (henceforth *BMI*) - measured as weight over the square of height - on wages in nine European countries, using information from the European Community Household Panel, a dataset explicitly designed to favour international comparisons. Any such exploration must confront the fact that a positive (or negative) correlation between *BMI* and wages need not imply a causal relationship running from the former to the latter. The uncovered correlation could in fact reflect both that obesity affects wages and that wages affect obesity. Most of the existing empirical literature has tried to deal with the identification of the causal relationship between obesity and wages, and our comparative exercise is no exception to this pattern.

We start by reporting for the pooled sample ordinary least squares estimates, which show that the correlation of obesity and earnings varies with gender - positive for males, negative for females. However, OLS estimates are likely to be biased by the endogeneity of *BMI*. Following Cawley, 2000, 2004 and Cawley *et al*, 2005, we use information on the *BMI* of parents, siblings, and children to construct an instrument of individual *BMI*. Our estimates based on instrumental variables show that obesity hurts wages, independently of gender.

We also find that the impact of obesity on wages varies across the countries of Europe, and that this variation exhibits interesting patterns. For instance, obesity affects wages negatively in the countries with lower GDP per capita and positively in the countries with higher GDP. Perhaps more interestingly, we find that the impact of obesity on wages is negative in the warmer countries of the "olive belt" of Europe - Spain, Greece, Italy and Portugal - and positive in the colder countries of the "beer belt" (Austria, Ireland, Denmark, Belgium and Finland). We speculate that the impact of being overweight or obese on productivity might depend on the weather: negative in warmer climates and positive in colder environments.

The paper is organized as follows. Section 1 introduces the empirical re-

relationship between obesity and wages. Section 2 describes the data. Results are presented and discussed in Section 3. Conclusions follow.

2 The Empirical Relationship between Obesity and Wages

We model individual hourly wages w as follows:

$$\begin{cases} w_{it} = \beta_0 + X_{it}\beta_1 + BMI_{it}\gamma_1 + \eta_{it}, & i = 1, \dots, N, \quad t = 1, \dots, T \\ \eta_{it} = f_i + \varepsilon_{it}, \end{cases} \quad (1)$$

where the subscript i is for the individual, t is for time, X_{it} is a $[NT \times K]$ vector of time-varying explanatory variables, BMI_{it} is the body mass index - defined as individual weight divided by the square of height, ε_{it} is the disturbance term and f_i the unobserved individual effect. Standard OLS estimates yield unbiased results if $E[BMI'_{it}\eta_{it}] = 0$ holds. However, as reviewed in detail by Cawley, 2004, there are at least three reasons why the orthogonality condition fails. First, there is potential reverse causality, because obesity is higher among those with low income, who have a higher intake of cheap food rich in fat and sugar. Second, unobservable individual effects associated to genetic and to non-genetic factors - such as ability and parental background - are correlated both with earnings and with the respondents's weight, i.e. $E[BMI'_{it}f_i] \neq 0$. Finally, the body mass index can be measured with error - as we rely on self-reported measures of weight and height.

Gortmarker *et al*, 1993, Sargent and Blanchflower, 1994, and Averett and Korenman, 1996, address reverse causality by replacing the contemporaneous body mass index with its seven years lagged value. Since our data cover a relatively short span of time, we cannot use the BMI lagged seven years, as done in the literature. Averett and Korenman, 1996, Behrman and Rosenzweig, 2001, Conley and Glauber, 2005, use information on siblings and twins to remove the common household effect - due to both genetic

and non - genetic factors. Baum and Ford, 2004, and Cawley, 2004 rely on fixed effect estimators to control for unobservable individuals effects. We also use the fixed effects estimator, but we do not find it very convincing in the current context: since the individual variation of the body mass index over a short time interval is likely to be dominated by measurement error, using such method is unlikely to pick up any significant relationship between obesity and wages.

Pagan and Davila, 1997, Cawley, 2000, 2004 and Cawley *et al*, 2005 use instrumental variables². Pagan and Davila select indicators of health problems, such as self-esteem and family poverty, as instruments. However, as argued by Cawley, 2004, these instruments are likely to be correlated with earnings, and do not satisfy the orthogonality condition. Behrman and Rosenzweig, 2001, use a twin estimator and select as instrument the lagged weight of *BMI* to simultaneously correct for reverse causality and endogeneity. Cawley, 2000, 2004 select as instrument the *BMI* of a biological family member³. Finally, Cawley *et al*, 2005, compare the relationship between obesity and earnings in the US and Germany, and use the weight of a child or of a parent as instruments⁴.

Does the BMI of a biological family member satisfies the two necessary conditions for instrument validity? As reviewed by Cawley, 2004, members of a biological family share part of their genes, which ensures a strong correlation between the endogenous variable and its instrument. In other words, the selected instrument is unlikely to be weak. Turning to orthogonality, the *BMI* of a biological family member fails to qualify as a valid instrument if it is correlated with the error term in the wage regression. This could happen if there are nongenetic unobserved effects which affect both

²Recently, Sousa (2005) studies the impact of weight on employment and labour market participation in Europe, using a matching estimator.

³Biological members include parents, siblings and children.

⁴Note also that Cawley, 2000, 2004, correct the self-reported measures of weight and height using the methodology outlined by Lee and Sepanski, 1995, and Bound *et al*, 2002.

the *BMI* of parents, siblings and children, and the wage residual in (1). Cawley, 2004, argues extensively that this is unlikely, quoting evidence from adoption studies, which suggest that the correlation of weight within families is due to genetic factors rather than to family environment. Moreover, Vogler *et al*, 1995, Grilo and Pogue-Geile, 1991, find no evidence that the common family environment influences the body mass index, which suggests that the *BMI* of a family member is unlikely to be correlated with wage residual via unobserved nongenetic effects. If we are prepared to assume that unobservable genetic factors affecting individual earnings are orthogonal to the transmitted genetic variation in weight, as Cawley does, the orthogonality condition holds and the *BMI* of a biological family member is a valid instrument of individual *BMI*.

3 Data and Descriptive Statistics

Our data are drawn from the European Community Household Panel (ECHP), a dataset designed and coordinated by Eurostat, the European Statistical Office. The ECHP is an harmonized cross-national longitudinal survey covering all countries in the European Union from 1994 to 2001, with a focus on household income and living conditions, and with information on individual health, education and employment status.

We only consider countries where information on weight and height is available - Denmark, Belgium, Ireland, Italy, Greece, Spain, Portugal, Austria and Finland - and focus on employees working at least 15 hours per week and aged between 18 and 65 years over the period 1998 – 2001⁵. Our key indicator is the Body Mass Index, defined as the weight (in kilograms) divided by squared height (in meters), which is highly correlated with direct measures of body fat and is widely used in epidemiology and medicine⁶. We

⁵We have no information about weight for the previous years of the panel.

⁶Several other measures have been used in the literature, such as the weight and height, or the percentage of obese individuals. Authors often use the three indicators - underweight, overweight and obese - for clinical weight specification. In addition, Harper, 2000

eliminate potential outliers by restricting our sample further to include only individuals with a *BMI* above 15 and lower than 35.

Table 1 provides summary statistics, separately for men and women. An individual is considered as underweight, overweight and obese if her *BMI* is below 18.5, between 25 and 30 and equal or higher than 30 respectively. Males are more likely to be overweight and obese than females: 43% and 7% of males are overweight and obese respectively, compared to 21% and 5% for females. The prevalence of obesity varies in a substantial way across countries. The table shows that 7% or more of female respondents are obese in Denmark and Finland, compared to 2% in Italy. Similarly, 28% of females are overweight in Finland, compared to 16% in Spain. Differences are marked also for males: 50% of Greek males are overweight, compared to 37% in Belgium. The highest percentage of obese males is found in Spain and Finland (9% and 10%), and the lowest in Italy (5%).

4 Results

Figures 1 and 2 report the semi-parametric estimates of the impact of the *BMI* on the log hourly wage, after having partialled out age, time and country effects. Both figures suggest that the relationship between wages and *BMI* is decreasing, independently of gender.

In the empirical estimates, we pool the available data over countries and years. Notice that the *BMI* has the potential of affecting individual earnings both directly, by influencing productivity or because of wage discrimination, and indirectly, via its impact on educational attainment and job allocation.

use indicators of the location of the respondent in the gender distribution of *BMI*. This is probably relevant when social norms determine how an individual is viewed by the society.

Figure 1: Semi-parametric estimate of the effect of BMI on log hourly wage, Males

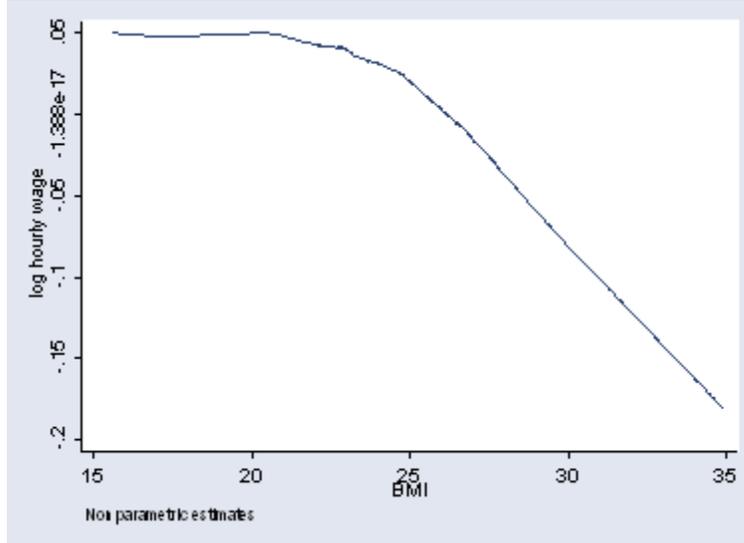


Figure 2: Semi-parametric estimate of the effect of BMI on log hourly wage, Females

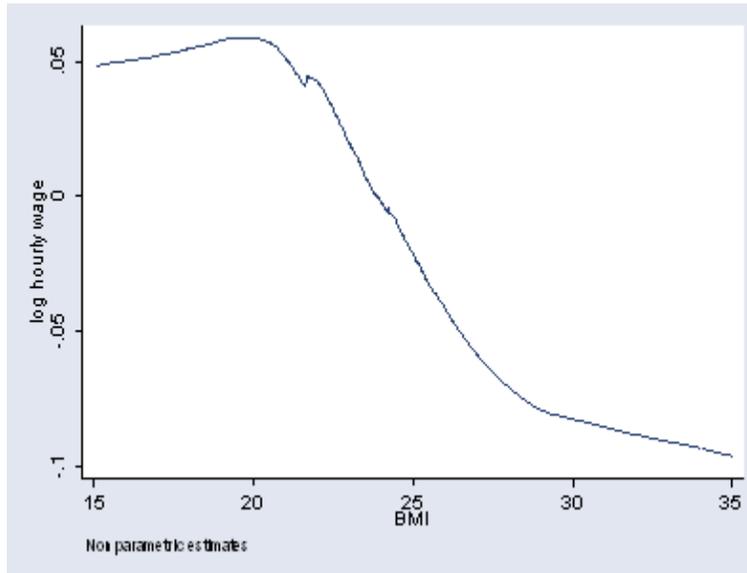


Table 1: Summary statistics, ECHP, 1998-2001

	FEMALES			MALES		
	BMI	overw	obese	BMI	overw	obese
Full sample	23.31	0.21	0.05	25.36	0.43	0.07
Denmark	23.98	0.25	0.07	25.32	0.43	0.08
Belgium	22.80	0.16	0.04	24.98	0.37	0.08
Ireland	23.41	0.22	0.05	25.09	0.42	0.06
Italy	22.56	0.17	0.02	25.05	0.40	0.05
Greece	23.32	0.22	0.04	25.71	0.50	0.06
Spain	22.79	0.16	0.04	25.74	0.45	0.10
Portugal	23.80	0.24	0.06	25.39	0.43	0.07
Austria	23.17	0.21	0.04	25.17	0.40	0.07
Finland	24.20	0.28	0.08	25.49	0.42	0.09

Note: Overw: BMI between 25 and 30. Obese: BMI equal or higher than 30.
Source : ECHP, 1998-2001.

In order to distinguish between direct and indirect effects, we follow Persico *et al*, 2004, and estimate first wage equations which include among the regressors individual BMI and variables not affected by the BMI, such as age and time and country dummies. We then add additional controls - education, household composition, health and current smoking habits. In the richest specification, we also include regional, occupation and industry dummies.

4.1 OLS estimates

The OLS estimates - weighted with the longitudinal ECHP weights - are reported in the first part of Table 2, separately for males and females⁷. The specification in the first and fourth columns includes the *BMI*, age and age squared, and country and time dummies. The coefficient associated with BMI turns out to be precisely estimated, negative and equal to -0.016

⁷The full results are in Table 6 of the Appendix.

for females and not statistically significant for males. According to these estimates, a 10% increase in the *BMI* of females from its mean value reduces their log hourly wages by 3.72%. Since the specification is very parsimonious - we do not control, for instance, for the negative effect of obesity on health - this effect can be considered as an upper bound on the wage penalty suffered by heavier females.

In columns (2) and (5) of the table, we add variables related to human capital investment and household characteristics, such as education, marital status and the presence of children younger than 12. Childbearing is usually associated with an increase in weight and with specific labour market outcomes. At least for women, education is negatively correlated with weight, this inverse relationship being due in part to the higher frequency of weight monitoring and to different behavioral patterns among more educated people (see Wardle and Griffith, 2001).

We also include three health variables, a dummy equal to 1 if the individual is in poor or bad health, a dummy equal to 1 if the individual is hampered in her daily activity by illness, and the number of cigarettes smoked. Studies have shown that the prevalence of health problems is higher for the obese than for the rest of the population (Michaud and Van Soest, 2005) and that obesity may limit labour supply. Smoking habits can affect current productivity - for instance because of the breaks from work required by the act of smoking- and are negatively correlated with weight (Molarius *et al*, 1997).⁸

When we add this set of explanatory variables, the estimated impact of *BMI* on the log hourly wage remains negative and statistically significant for females and becomes positive and statistically significant for males⁹. Finally,

⁸Smoking also controls for unobservable heterogeneity in the individual discount rate.

⁹The impact of *BMI* on earnings could vary by occupation. To check this, we re-estimate the wage equation separately for manual occupations and non-manual occupations. The results are not reported, but the coefficient associated with *BMI* is always positive, albeit statistically significant only for the case of manual workers. The coefficient associated with *BMI* is equal to 0.0030 for manual labour and to 0.0013 for non-manual

we add in the third and sixth columns of the table occupation, industry and regional dummies. Physical activity is inversely associated with *BMI*, in particular for men (Martinez-Gonzales *et al*, 1999, Stam-Moraga, 1999), and occupations that are demanding in terms of physical strength are less remunerated in the labor market. The inclusion of these dummies affects the coefficient associated with *BMI* for both males and females. More precisely, a 10% increase in mean *BMI* reduces wages by a much smaller 0.23% for females, and raises male wages by 1%. As suggested by McLean and Moon, 1980, the widespread positive effect for males could be due to the presence of a "portly banker effect", as larger size may generate a "non verbal signal" of power, strength, or capability, which commands respect from co-workers and employers.

Our results are consistent with previous literature. Cawley *et al*, 2005, also identify a positive and statistically significant association between wages and weight among US males and a negative relationship among US females. However, the magnitude of the coefficients associated to *BMI* is smaller in our case, both for males and females. For the reasons discussed above, the uncovered correlations are plagued by the presence of unobservables and by reverse causality running from wages to *BMI*¹⁰. In the next two subsections we try to deal with these issues, starting briefly with the fixed effects estimator and turning next to instrumental variables.

4.2 Fixed effects estimates

Since OLS estimates are biased because of the correlation between the *BMI* and unobservables, one option is to remove time invariant individual effects

occupations.

¹⁰Note that our results are potentially subject to a sample selection bias since labour market participation depend on unobservable individual characteristics. We use the classic Heckman's method (1979) to correct for sample selection bias, but find no sensible difference in the results. Results are available from the authors upon request.

Table 2: OLS estimates, by gender

	FEMALES			MALES		
	- OLS -			- OLS -		
	1	2	3	4	5	6
BMI	-0.014 12.69	-0.005 6.73	-0.001 2.30	-0.001 1.17	0.003 4.06	0.004 5.26
Obs.	35505			47743		

Note: Source: ECHP 1998 – 2001. Estimates weighted with the longitudinal individual weights provided by ECHP. White heteroskedasticity-consistent absolute value of t-statistic below coefficients. Columns 1 and 4: Other regressors include age, age squared, country dummies and time dummies. Columns 2 and 5: 1 and 4+educational level attainment dummies (secondary and tertiary), indicators for the presence of children under 12, marital status, part-time, health situation, current smoking habits. Columns 3 and 6: 2 and 5+ regional, occupation and activity dummies.

by using a fixed effects estimator¹¹. If we do so for the richest specification, the estimated coefficient associated to *BMI* is not statistically significant both for females (−0.001 with a *t*-value of 0.19) and for males (0.000 with *t*-value of 0.03). A word of caution is needed on the use of fixed effects estimates in the current context. The "within" transformation operated by the fixed effect estimator results in a substantial reduction in the variance of the BMI, which goes from $\sigma_h^2 = 3.37$ in levels to $\sigma_h^2 = 1.35$ in deviations with respect to individuals-specific means. Basing identification on individual variation over time results in a substantial loss in variance, and in the insignificant coefficients associated to the *BMI* variable. In addition, as mentioned earlier, we face a measurement error problem which attenuates the estimate of the coefficient associated with *BMI*. Attenuation is more

¹¹The individual fixed effect estimator has been used by Baum and Ford, 2004 and Cawley, 2004. In addition, Conley and Glauber, 2005, Averett and Korenman, 1996 rely on differences between siblings while Behrman and Rosensweig, 2001 use MZ twins fixed effects.

important when the true variance of the variable is low. In summary, we fear that the estimates of the impact of *BMI* on wages based on the fixed effects estimator is largely driven by noisy variations in the body mass index. Therefore, we turn to IV estimates.

4.3 IV estimates

We instrument individual *BMI* with the *BMI* of a biological family member, defined as a parent, child or sibling. For individuals with several available family members, we average out all available *BMI*s. For example, when an individual has two parents and three siblings, we take the unweighted average of the average *BMI* of the parents and the average *BMI* of the siblings. Since the European Community Household Panel does not explicitly report parental and sibling information for each interviewed individual, we need to reconstruct this information by linking records of individuals belonging to the same household. This exercise is not possible, for instance, for one person households with deceased parents, or for couples with no children and no living parents, or for households without parents or siblings currently alive. Therefore, our instrument can only be computed for a sub-sample of individuals. As detailed in the Data Appendix, the percentage of missing values is highest in Denmark, Finland and Belgium.

We have argued at length above about the validity of the selected instrument. We check weakness by regressing *BMI* on the full set of explanatory variables plus our instrument and test whether the inclusion of the latter can be rejected by an F test. It turns out that the value of the F statistic is well above the threshold value of 10, indicated by Stock and Staiger, 1997, as the rule of thumb criterion to establish instrument weakness. We conclude that our instrument is not weak in a statistical sense¹².

Our IV estimates are reported in the first part of Table 3. To ease comparison, we also report OLS estimates computed on the same sub-sample.

¹²The results of the first step regression are in Table 7 of the Appendix.

Table 3: IV estimates, by gender

	FEMALES			MALES		
	- OLS -			- OLS -		
	1	2	3	4	5	6
BMI	-0.007 4.97	-0.006 5.22	-0.003 2.76	0.004 3.73	0.004 3.54	0.004 3.58
	- IV -			- IV -		
	1	2	3	4	5	6
BMI	-0.026 4.97	-0.017 3.93	-0.010 2.47	-0.059 8.83	-0.018 3.60	-0.013 2.64
Obs.	17,202			24,550		

Note: see Table 2.

Independently of gender, the estimated relationship between *BMI* and earnings is negative and statistically significant both for males and for females. IV estimates generate also larger coefficients - in absolute value - than OLS estimates, because they eliminate the attenuation bias associated to measurement error. Our results for females are consistent with those by Cawley *et al*, 2005 for the US and Germany: they find that the *IV* coefficient associated with *BMI* is negative for females and of higher magnitude than the *OLS* coefficient¹³. Conversely, the results for males contrast with those by Cawley and associates, who find that the impact of *BMI* on male wages is no longer statistically significant after controlling for endogeneity.

One possible reading of our findings is that *OLS* estimates are biased upwards by the positive correlation between unobservables - such as motivation or perseverance - and the *BMI*: heavier individuals compensate their weight with unobservable characteristics (for the econometrician) that are

¹³Cawley, 2000 obtains similar results for white females in US. In contrast, the coefficient associated with *BMI* is no longer significant for Black females and Hispanic females, once he uses IV estimates.

rewarded on the labor market.

4.4 Heterogeneous responses

In summary, once we control for unobserved heterogeneity, heavier European workers experience a wage penalty in the labor market. Is the negative impact of *BMI* on earnings common across Europe, or does it vary along well defined patterns? *Ceteris paribus*, we might expect that being overweight or obese affects (unobserved) productivity differently in a warm than in a cold climate, possibly because weight can be debilitating in the former case and an asset in the latter case. To check this, we re-estimate our IV regressions after augmenting them with the interaction of *BMI* with the average annual temperature in the capital city of each country in our sample, expressed as deviation from the baseline city, Madrid¹⁴. The results are shown in the first part of columns (1) and (2) of Table 4. Independently of gender, the interaction effect is negative and statistically significant, which confirms our hypothesis: being overweight in Madrid carries a penalty, but is an asset in Dublin, where the average annual temperature is 9.4 Farenheit degrees below Madrid¹⁵.

Naturally, the weather is not the only candidate to account for the heterogeneity in the relationship between obesity and wages in Europe. An alternative is *GDP* per capita. When we re-estimate our wage regressions after augmenting them with the interaction between individual *BMI* and *GDP* per capita in PPP - 1998 values - we find the results in the second part of columns (1) and (2) of Table 4 : the interaction is positive and statistically significant, suggesting that higher *GDP* per capita is associated with a lower wage penalty and even a premium for overweight and obese workers. This parallelism with the findings based on the weather should not

¹⁴The instruments are the average BMI of family members and the interaction of this variable with the weather.

¹⁵Average temperature in Madrid is 57.6F, compared to 48.2F in Dublin. Data on average 24 hour temperatures in the capital cities are from <http://worldweather.com>.

surprise, as the classification of countries into the "GDP per capita higher than or lower than Spain" groups contains the same countries classified into the "warmer or colder climate than in Spain" groups, with the single exception of Italy: Rome is on average slightly warmer than Madrid but Italy has a higher GDP per capita than Spain.

Table 4: IV estimates, by gender - with interactions

	FEMALES (1)	MALES (2)	FEMALES (3)	MALES (4)
BMI	-0.024 3.29	-0.029 3.86	-0.018 3.21	-0.023 3.65
BMI*WEATHER	-0.005 3.78	-0.007 3.92	-0.007 4.25	-0.008 2.03
BMI	-0.036 3.54	-0.063 3.57	-0.036 4.26	-0.051 3.00
BMI*GDP	0.210 3.82	0.388 3.44	0.270 4.60	0.348 2.22
OBS.	17, 202	24, 550	15, 465	22, 788

Note: see Table 2

A potential concern with the estimates in Table 4 is that we are including data from countries - Denmark, Belgium and Finland - where the selected instrument can be computed only for a minority of the available observations. However, as shown in columns (3) and (4) of Table 4, our results are robust to the exclusion of these countries from the sample.

These patterns suggest that - for the purposes of this study - a meaningful grouping of countries is between the countries of the "olive belt" - Greece, Italy, Portugal and Spain - and the countries of the "beer belt" in Central and Northern Europe. The estimates presented in Table 5 allow the coefficient associated to the *BMI* to vary across the two groups of countries. For

the latter group, we also present estimates which exclude Denmark, Belgium and Finland. A clear pattern emerges: independently of gender, the impact of obesity on wages is negative and statistically significant in the countries of the "olive belt", positive and almost always statistically significant in the countries of the "beer belt".

Table 5: IV estimates, by gender

	FEMALES			MALES		
	- IV -					
	1	2	3	4	5	6
BMI - OLIVE BELT	-0.056	-0.041	-0.035	-0.093	-0.056	-0.060
	5.15	4.81	4.40	5.47	4.26	4.32
BMI - BEER BELT	0.017	0.018	0.027	0.024	0.054	0.076
	1.87	2.04	3.22	0.11	2.58	3.19
BMI - IRELAND & AUSTRIA	0.028	0.032	0.039	0.024	0.057	0.065
	2.05	2.51	3.22	0.76	1.79	1.83
Obs.	17, 202			24, 550		

Note: see Table 2.

5 Conclusion

The purpose of the paper was to investigate to what extent European overweight workers experience a wage penalty in the labor market. Some studies have shown that obesity is an handicap to social advancement, especially for women. Existing research, however, focuses mainly on the US and the UK.

We have used data from the European Community Household Panel - a comparative dataset covering most European countries - to investigate the impact of obesity on wages in 9 European countries, ranging from Finland to Spain. We have used ordinary least squares estimates as well as fixed effects and instrumental variables estimates. The bottom line is that - when we pool all countries and years to estimate a common effect - the impact of obesity on wages is negative and statistically significant, independently of

gender.

Given the nature of European labor markets, however, we suspect that a common impact of obesity on wages is overly restrictive. We have suggested two dimensions of cross-country variation in such impact, one related to a measure of average annual temperature in the country, and the other related to GDP per person. We have found that the negative relationship between *BMI* and wages is typical of the countries belonging to the "olive belt" of Europe. In Northern and Central Europe, a higher *BMI* favors individual wages.

We have speculated that the interaction between the weather and the *BMI* can help explain the contrast in results between Northern and Southern Europe. A deeper understanding of such contrast, however, is beyond the range of the current exploration, and must be left to future research.

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6 Appendix

- Data

The European Community Household Panel (ECHP) is a survey - running from 1994 to 2001– based on annual interviewees of a representative panel of households and adult individuals – aged 16 years and over - in each country. Fifteen European Countries are included: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. The information is stored in the “Production data base” that consists of 6 files : household file, personal file, register file, longitudinal link file, country file, and relationship file. Members of the same family are matched by using the relationship file. There is a record in the file for each pair of individuals in the same household, with information about the type of relationship they have (ie, partner, child, parents, siblings, grandchild, grandparent)¹⁶.

Information on individual weight and height are available since 1998 and for 9 countries only. Importantly, the use of the BMI of a biological family member as instrument for individual BMI reduces the available sample rather drastically. This is because respondents living (i) alone, (ii) in a couple or (iii) in couple with children aged less than 16, are excluded from our analysis. We report in the following table the sample size for OLS and IV estimates, by country.

¹⁶See Locatelli M., Moscato V., Pasqua S., 2001, for further details

- Tables

Table 6: Sample size, ECHP, 1998-2001

	FEMALES		MALES	
	OLS	<i>IV</i>	OLS	<i>IV</i>
Full sample	35503	17202	47743	24550
Denmark	2919	467	3095	467
Belgium	1867	544	2165	651
Ireland	2972	1724	3863	2277
Finland	3027	726	2768	644
Italy	5999	3307	8960	5074
Greece	3267	1845	4930	2904
Spain	5142	3013	8537	4878
Portugal	6518	3797	8311	4928
Austria	3792	1779	5114	2727

Table 7: Summary statistics, ECHP, 1998-2001

	MALES	FEMALES
Net Hourly wage	8.45	7.45
Age	38.49	37.88
Hours	41.46	36.48
Secondary level of education %	35.52	38.14
Tertiary level of education %	15.83	22.17
BMI	25.36	23.31
Weight	77.56	62.46
Height	174.84	163.72
Overweight	0.43	0.21
Obesity	0.07	0.05
Obs.	35,503	47,743

Table 8: OLS estimates, by gender

	FEMALES			MALES		
	1	2	3	4	5	6
<i>BMI</i>	-0.0147 12.69	-0.0054 6.73	-0.0016 2.30	-0.0011 1.17	0.003 4.06	0.004 5.36
Age	0.043 17.83	0.048 23.41	0.039 20.70	0.062 32.77	0.041 23.52	0.033 21.19
Age, squared	-0.0003 11.43	-0.0004 15.98	-0.0003 14.21	-0.0006 24.97	-0.0006 16.95	-0.0002 14.98
Parttime		0.058 6.48	0.019 2.35		0.090 3.87	0.066 2.97
Living in a couple		0.012 1.80	0.023 3.65		0.100 13.65	0.093 13.23
Children under 12		0.016 2.46	0.017 2.89		-0.008 1.86	0.0230 3.96
Secondary level education		0.327 48.24	0.166 23.94		0.233 36.39	0.138 22.75
Third level education		0.703 78.33	0.328 31.74		0.581 62.96	0.308 32.13
Bad Health		-0.057 3.03	-0.043 2.48		-0.139 8.03	-0.115 7.44
Hampered in daily activity		-0.059 5.51	-0.042 4.16		-0.078 7.92	-0.055 6.01
Current smoker		0.001 5.58	0.001 5.91		-0.0012 5.99	-0.0007 3.45
Observations		35,503			47,743	

Table 9: First-Stage estimate of BMI

	FEMALES				MALES	
	1	2	3	4	5	6
<i>BMI</i> family members	0.296 22.20	0.302 22.26	0.294 22.25	0.198 22.40	0.021 24.49	0.214 24.15
Age	0.261 12.17	0.211 9.26	0.219 9.96	0.293 20.80	0.265 17.83	0.259 17.57
Age, squared	-0.001 5.80	-0.001 4.46	-0.001 4.90	-0.002 13.33	-0.002 12.99	-0.002 12.79
Parttime		0.085 0.90	0.086 0.91		0.308 2.22	0.314 2.24
Living in a couple		0.670 7.06	0.621 6.57		0.889 9.24	0.845 8.77
Children under 12		0.184 1.88	0.157 1.61		0.100 1.49	0.086 1.26
Secondary level education		-0.763 9.75	-0.521 6.09		-0.090 1.59	-0.093 1.61
Third level education		-1.081 1.37	-0.630 5.54		-0.331 4.32	-0.311 3.20
Bad Health		-0.141 0.55	-0.130 0.51		-0.156 0.85	-0.0158 0.87
Hampered in daily activity		0.589 3.17	0.528 2.94		-0.080 0.67	-0.061 0.52
Current smoker		-0.011 2.93	-0.010 2.61		-0.012 5.59	-0.012 5.75
Observations		17, 202			24, 550	

Table 10: IV estimates, Full specification

	FEMALES				MALES	
	1	2	3	4	5	6
<i>BMI</i>	-0.026 4.97	-0.017 3.93	-0.010 2.47	-0.059 8.83	-0.018 3.60	-0.013 2.64
Age	0.049 14.40	0.042 14.44	0.034 13.09	0.058 17.82	0.037 13.98	0.032 13.47
Age, squared	-0.000 10.00	-0.000 8.88	-0.000 8.24	-0.000 12.10	-0.000 9.55	-0.000 9.23
Parttime		0.077 5.22	0.034 2.66		0.036 1.28	0.003 0.14
Living in a couple		0.011 0.91	0.032 2.87		0.148 11.98	0.123 10.88
Children under 12		-0.021 1.79	-0.014 1.31		-0.036 3.93	-0.012 1.51
Secondary level education		0.287 28.56	0.131 13.34		0.192 21.30	0.114 13.19
Third level education		0.692 46.86	0.318 20.07		0.544 40.10	0.284 20.98
Bad Health		-0.026 0.92	-0.008 0.34		-0.112 4.85	-0.099 4.88
Hampered in daily activity		-0.074 4.20	-0.053 3.28		-0.115 8.45	-0.092 7.25
Current smoker		0.003 5.75	0.002 5.48		-0.001 4.33	-0.000 2.94
Observations		17, 202			24, 550	