Income and Body Mass Index in Europe*

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Abstract

The problem of obesity is alarming public health authorities around the world. Therefore, it is important to study its determinants. In this paper we explore the empirical relationship between household income and body mass index (BMI) in nine European Union countries. Our findings suggest that the association is negative for women, but we find no statistically significant relationship for men. However, we show that the different relationship for men and women appears to be driven by the negative relationship for women between BMI and individual income from work. We tentatively conclude that the negative relationship between household income and BMI for women may simply be capturing the wage penalty that obese women suffer in the labor market.

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1. Introduction

Obesity poses one of the greatest public health challenges for the twenty-first century. We see particularly alarming trends in several parts of the world, including the World Health Organization's European region (WHO, 2005)[1]. According to the WHO (2003), the prevalence of obesity has increased by 10-40% in most European countries over the last decade. Furthermore, obesity among children is growing fast, especially in Southern Europe, with rates ranging from 20% to more than 35% (International Obesity Task Force, 2002, 2003, 2005).

As highlighted by Philipson (2001), obesity is not only a health risk factor but also a major issue for health economics and public finance, accounting for 2 to 3.5% of the overall health care budgets in France and Portugal, respectively (Thompson and Wolf, 2001). Further, given the current fast-growing trends in obesity, and the fact that these estimates are outdated, they are considered lower bounds for the actual costs. In Spain, for example, nearly 7% of health care costs are associated with obesity (WHO, 2005). Hence, it is a priority to understand the determinants of body mass index (BMI), and of overweight and obesity, in particular.

In this paper we estimate the association between BMI and household income for several European countries. Previous research has found that the prevalence of obesity declines with household income for women but not for men (Sanz-de-Galdeano, 2005). If the association between BMI and household income was negative for both

[1] "Obesity" and "overweight" are defined by an individual's body mass index (BMI), a measure of height-adjusted weight (defined as an individual's weight in kilograms, divided by her height in meters squared). BMI above 30 is considered to reflect obesity, while BMI above 25 is considered overweight. BMI below 18.5 is considered to reflect underweight.

men and women, it might be that poor individuals can cover caloric requirements more easily by purchasing high-calorie products (Drewnowski and Specter, 2004). However, this explanation cannot account for the different relationship between men and women. We show that the negative relationship between BMI and household income for women appears to be driven by the correlation between BMI and individual income from work.

The structure of our paper is as follows. Section 2 presents a brief review of the literature and highlights the contributions of our work. Section 3 describes the data and the variables used in our empirical analysis. Section 4 presents the results. Section 5 concludes.

2. Income and Body Mass Index

Perhaps the most well known papers on the economic determinants of obesity are by Philipson and Posner (1999), Lakdawalla and Philipson (2002), Cutler et al. (2003), Chou et al. (2004) and Komlos et al. (2004)[2]. There is also a recent paper by Lakdawalla and Philipson (2007) which looks at the effect of job-related exercise on BMI determination. For the purposes of our study —an empirical analysis using individual European data— we focus on the works by Michaud and van Soest (2005) and Sanz-de-Galdeano (2005).

Sanz-de-Galdeano (2005) provides an interesting descriptive analysis of the European obesity epidemic with comparable country results. Like us, she uses data from

[2] See Finkelstein et al. (2005) for an excellent review.

the European Community Household Panel (ECHP), thus avoiding one of the points emphasized by Sobal and Stunkard (1989): that the differences in the methodology, the measure of socioeconomic status, or the data collection procedure in each country-specific study can lead to misleading conclusions. Her results show that household income is negatively related to the probability of being obese for women, but her results for men are mixed.

Michaud and van Soest (2005) explore the EU-US differences in obesity for people above age 50 using data from the Health and Retirement Study (HRS) for the US and the Survey of Health, Aging and Retirement in Europe (SHARE) for European countries. Both surveys contain information on physical activity and food consumption, which allows them to estimate a well-defined BMI equation as a function of proxy variables for caloric intakes and outtakes. Their results show that current income is barely related to BMI, conditional on employment status and wealth.

This paper complements the previous two studies, exploring first the relationship between BMI, obesity status, and weight classification and household income, and second offering an explanation for why the relationship is negative for women, but that no relationship emerges for men.

3. Data

The data used in this paper come from the European Community Household Panel (ECHP), Eurostat, 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. The ECHP covers a wide range of topics on living conditions, and its standardized methodology and procedures yield comparable information across countries. Peracchi (2002) and the Europanel Users Network (http://epunet.essex.ac.uk) provide more detailed information on the ECHP.

We use the data for nine countries with a full ECHP data format (all except Sweden) and the available data on BMI (all but France, Germany, Luxembourg, Netherlands, and United Kingdom). Hence, we focus our final analysis on Austria, Belgium, Denmark, Finland, Greece, Ireland, Italy, Portugal, and Spain.

The main dependent variables in the present analysis are BMI, obesity status, and weight classification. BMI is constructed using self-reported height and weight measures, which means that our anthropometric indicators suffer from measurement error. Moreover, we must be aware that this kind of measurement error is not classical (see for example, Boström and Diderichsen, 1997). The obesity status indicator is a dummy that takes a value of 1 if the individual has a BMI above 30, and 0 otherwise. The weight classification takes four different values: 1 if the individual's BMI is below 18.5 (underweight), 2 if the individual's BMI is between 18.5 and 25 (normal weight), 3 if the individual's BMI is above 25 but below 30 (overweight), and 4 if the individual's BMI is above 30 (obese).

The relevant explanatory variable in the present analysis is household income, defined as total net annual household income, adjusted by the number of adult equivalents (1 + 0.7*[(number of individuals 14 and above) - 1] + 0.5*[(household size) - number of individuals 14 and above)]) and the country's annual consumer price index for all items (OECD, 2006). This adjustment is done to obtain an annual measure of available real income per household member.

Turning now to the empirical specifications, we run two kinds of regressions: naïve, in which we simply control for age, age squared, and year dummies, and thus have only raw (unadjusted) estimates; and augmented, in which we try to control for individual heterogeneity, yielding adjusted estimates. Individual heterogeneity is accounted for somewhat by adding these covariates: completed education dummies, marital status dummies, smoking behavior dummies, and the number of children below 14. Adding education helps us to explain differences in discount rates across individuals, which may affect income and BMI. Marital status and the number of children below 14 are included to account for pregnancy in the case of women (information that is not available in the ECHP) and for dietary habits depending on the family structure that will affect both men and women. Finally, smoking dummies reflect smoking behavior, which can capture other life-style factors associated with BMI and income.

We estimate different models for each country, allowing for a purely flexible econometric specification, in the sense that none of the coefficients are restricted to be the same across countries. Moreover, the models are estimated for men and women separately, because previous empirical work has documented different signed relationships between BMI and income for men and women. ECHP personal weights are used in all estimations described in this paper.

4. Results

Table 1 describes the BMI distribution in each country separately for men and women aged 15-75 in 2001. The sample are larger for Southern (Greece, Italy, Portugal, and Spain) than Northern (Austria, Belgium, Denmark, Ireland, and Finland) countries (see Peracchi, 2002). The median BMI for men ranges from 24.82 in Ireland to 25.82 in Greece, while for women it ranges from 23.06 in Italy to 24.22 in Greece[3].

[Insert Table 1 about here]

The prevalence of obesity among men ranges from 8.1% and 8.8% in Ireland and Italy, respectively, to 13.6% and 13.9% in Finland and Spain. Qualitatively similar results arise for women: 8.2% in Italy, 8.6% in Ireland, 13.2% in Spain, and 14.7% in Finland.

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[3] We report the same descriptive statistics for the BMI distribution in 2001 as in Sanz-de-Galdeano (2005). However, we use the personal (cross-sectional) weights available in the ECHP. Of course, we have checked that our unweighed estimates are the same as those in Sanz-de-Galdeano. We noted three differences from a total of 126 reported numbers, perhaps due to spelling typos: (1) the unweighed average BMI for men in Spain is reported to be 25.00 in Sanz-de-Galdeano, while it is 26.00 in our case; (2) the number of male observations is 1,918 in Sanz-de-Galdeano, while this number is 1,818 in our case; (3) the third quartile of the male BMI distribution in Belgium is 27.95 in Sanz-de-Galdeano, while it is 27.76 in our case.

4.1. The relationship between BMI and household income

Tables 2 and 3 report unadjusted and adjusted estimates, respectively, of the relationship between contemporaneous BMI and contemporaneous household income for women. Both types of estimates indicate that contemporaneous BMI and contemporaneous household income are negatively related for women. In Table 2 we can see that eight out of nine unadjusted estimates are negative and statistically significant. Moreover, Table 3 shows that this qualitative result is robust to the addition of several covariates (educational dummies, marital status dummies, smoking behavior dummies, number of children below 14): six out of nine adjusted estimates are negative and statistically significant. Similar results (not reported here) are obtained after we discard outliers, which we define as those observations with BMI values out of the range [15, 55)[4].

[Table 2 about here]

[Table 3 about here]

Tables 4 and 5 report unadjusted and adjusted estimates, respectively, for men. These estimates suggest that, if anything, there is no clear pattern of association between BMI and household income for men. We find statistically significant positive relationships in two countries, Ireland and Spain. The relationship is statistically negative in Italy, but this is not statistically significant once we drop the extreme values

[4] The number of outliers in the female BMI distribution is: 6 (Austria), 11 (Belgium), 7 (Denmark), 4 (Finland), 20 (Greece), 10 (Ireland), 26 (Italy), 14 (Portugal), 11 (Spain).

of the BMI distribution, as previously defined. For the rest of the coefficients, similar results (not reported here) are obtained after dealing with these observations[5].

[Table 4 about here]

[Table 5 about here]

Overall, our preliminary findings suggest the existence of a negative relationship between BMI and household income for women, and no relationship for men. Reassuringly, these results are robust to the addition of covariates and to the presence of extreme values in the BMI distribution. Moreover, replacing current household income with lagged household income does not affect our qualitative results (see Table A1). Nonetheless, OLS estimates can be misleading because of a non-linear or non-monotonic relationship between BMI and household income.

A non-linear relationship between BMI and household income may emerge if income only has an effect on BMI for high BMI levels. In this case, household income only will affect the probability of being obese. A non-monotonic relationship can exist if household income has similar effects on BMI across the tails of the BMI distribution (underweight and obesity) but a differential effect across the mid-range of the BMI distribution.

For all of these reasons, it is informative to explore the relationship between BMI and income in a non-linear setting, looking at the relationship between obesity status and household income using a probit model.

[5] The number of outliers in the male BMI distribution is: 3 (Austria), 6 (Belgium), 0 (Denmark), 3 (Finland), 11 (Greece), 1 (Ireland), 16 (Italy), 13 (Portugal), 9 (Spain).

The probit estimates for women, with and without covariates, are reported in Tables 6 and 7, and in Tables 8 and 9 for men.

[Table 6 about here]

[Table 7 about here]

[Table 8 about here]

[Table 9 about here]

Tables 6 and 7 show that female obesity is negatively associated with household income. For men, the results in Tables 8 and 9 suggest no clear relationship. Figures 1 and 2 allow us to compare OLS with probit estimates. For women, 17 out of 18 estimates are negative, independent of using BMI (OLS) or an obesity indicator (probit). In the case of men, 13 out of 18 estimates have the same sign, no matter what dependent variable is used.

[Figure 1 about here]

[Figure 2 about here]

In the Appendix, we report multinomial logit estimates (Tables A2, A3, A4, and A5). These new results again suggest that the relationship between weight classification obesity and household income is negative for women. For men, there is no such evidence of statistically significant associations.

To sum up, the empirical evidence suggests that BMI and income are negatively related for women, but no relationship is found for men. In the next subsection we try to understand why this is so.

4.2. Why a different relationship between men and women?

To understand the relationship between BMI and household income, we must acknowledge that our reported estimates likely suffer from several kinds of biases. First, measurement error in both self-reported income and BMI constructed from self-reported height and weight can lead to unreliable estimates (e.g. Boström and Diderichsen, 1997). Second, relevant omitted variables related to both income and BMI, such as the rate of time preference (see Komlos et al. 2004, on the role of the rate of time preference as an obesity determinant), can bias our estimates. Third, reverse causality from BMI to income cannot be overlooked. This is because household income includes individual income from work, and the later can be affected by BMI: obese women may suffer a wage penalty in the labor market (Cawley 2000, 2004; Brunello and D'Hombres 2007; Garcia and Quintana-Domeque 2007, Lundborg et al. 2007).

Unfortunately, we cannot assess the implications of measurement error issues for our estimates because we do not have independent measures of income and BMI, nor do we have any available valid instrument. The omitted variable bias is explained somewhat in the adjusted regressions, where we control for several covariates: completed education dummies, marital status dummies, number of children below 14, and smoking behavior dummies. These covariates can be thought to control for lifestyles (factors) related to both BMI and income. However, we cannot account for other factors, either because these are unobservable or because are not available in the ECHP data. Using individual fixed effects may explain both observed and unobserved individual differences that remain constant over time. However, given the small variability in household income across time, such an approach is ineffective[6]. Of course, without instrumental variables, even if we used individual fixed effects, we could not account for reverse causality.

We have already mentioned that previous studies indicate that obese women may suffer from a wage penalty in the labor market. So, we should look at reverse causality as a potential explanation for the different BMI-income relationship between men and women. In this subsection, we explore the relationship between obesity and income, but only after decomposing household income into two main components: “household income minus individual income from work”, and “individual income from work”. If the negative association between household income and BMI is driven by the negative relationship between “individual income from work” and BMI, then we should expect to find no association between “household income minus individual income from work” and BMI once we control for “individual income from work” and a negative association between “individual income from work” and BMI.

To perform this analysis, we focus on a demographic group attached to the labor market, people between 30 and 60 years of age. If reverse causality from BMI to individual labor income lies behind the BMI-household income relationship, it must be

[6] For example, for men, the correlations between individual's log (adjusted household income + 1) in 2001 and 1996 are .40 in Denmark, .48 in Belgium, .65 in Ireland, .54 in Italy and Greece, .43 in Spain, ,59 in Portugal, .52 in Austria and .56 in Finland.

more easily observable for this demographic group. Moreover, focusing on this group has another advantage: there is some evidence that this age group could be more robust to measurement error in self-reported anthropometric measures. Recently, Ezzati et al. (2006), comparing self-reported and objectively measured weight and height measures for the United States, find that the average measurement error for people between 25 and their late fifties is more or less constant.

Tables 10 and 11 show the relationships between obesity and household income for men and women, respectively. As we discussed previously, obesity is negatively associated with household income for women, but no clear relationship is found for men. Table 12 suggests that decomposing household income into two components — “household income minus individual income from work” and “individual income from work”— makes no difference for men. As we can see in the table, none of the coefficients on the income components are statistically different from zero, except for the barely significant coefficient on “household income minus income from work” in the case of Italy. However, our findings are completely different for women. Interestingly, we find that the negative relationship between obesity and household income for women appears to be driven by the negative relationship between obesity and individual income from work (see Table 13). In other words, it seems that there is a correspondence between negative obesity-income associations for women in Austria, Belgium, Finland, Italy, and Spain (presented in Table 11) and statistically negative associations between obesity and individual income from work in those same countries (reported in Table 13). Moreover, the most striking result is that for women “household income minus individual income from work” is not related to obesity. This indeed suggests that the negative relationship between household income and obesity is driven by the relationship between obesity and "individual income from work".

These findings are thus consistent with obese women suffering from a wage penalty in the labor market. Whether this penalty is due to labor market discrimination against obese workers, productivity differences between obese and non-obese female workers, or unobservable factors related to both obesity and wages is a different issue; several papers have been written about it.

Our findings are also consistent with an alternative explanation, completely unlike the wage penalty story: "individual income from work" may reflect on-the-job exercise. If higher individual income from work is positively related to on-the-job exercise, then it will reflect the negative effect of exercise on BMI. Using the National Longitudinal Survey of Youth (NLSY), Lakdawalla and Philipson (2007) show that job-related exercise had causal effects on weight for male workers, but for female workers the effect primarily seems selective. A man who spends 18 years in the most physically-demanding occupation is about 14 percent lighter than his peer in the least physically-demanding occupation. Female workers, however, seem to select into occupations according to their weight. Unfortunately, our data does not allow us investigate the role of on-the-job-exercise on weight determination. Nevertheless, given the empirical evidence from the NLSY about selectivity of women into different occupations depending on weight, it is tempting to argue that the direction is from weight to "individual income from work" rather than the other way around. Hence, we tentatively conclude that the wage penalty suffered by obese women in the labor market lies behind the negative relationship between obesity and household income.

5. Discussion

In this paper, we have reexamined the relationship between household income and BMI, obesity status, and weight classification, for men and women in nine European Union countries.

Our empirical findings show that, for women, household income is negatively related to BMI and, particularly, to obesity. However, we find no relationship for men. Moreover, we offer an explanation for the different association between household income and BMI for men and women. The negative relationship for women appears to be driven by the negative association between obesity and individual income from work.

We tentatively conclude that, indeed, the negative relationship between household income and BMI may simply be capturing the wage penalty that obese women suffer in the labor market. However, much more research must be done to explore this issue further.

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TABLES

Table 1. Prevalence of Obesity and BMI distributions in 2001 by Gender and Country, people aged 15-75

	% Obese	BMI mean	BMI percentiles 10	25	50	75	90	# Obs.
A. Men								
Austria	10.90%	25.58	21.46	23.26	25.25	27.68	30.12	2,533
Belgium	12.49%	25.46	20.57	22.65	25.01	27.78	30.46	1,818
Denmark	10.45%	25.41	21.16	22.92	24.93	27.40	30.19	1,719
Finland	13.64%	26.01	21.63	23.37	25.36	28.09	30.93	2,479
Greece	9.91%	26.07	22.21	23.88	25.82	27.70	29.98	4,025
Ireland	8.1%	25.25	21.05	22.86	24.82	27.14	29.41	1,783
Italy	8.82%	25.29	21.22	22.86	24.82	27.34	29.41	6,139
Portugal	10.12%	25.61	21.63	23.31	25.28	27.55	30.07	4,766
Spain	13.87%	25.93	21.45	23.26	25.59	28.08	30.86	5,231
B. Women								
Austria	10.53%	24.27	19.49	21.16	23.59	26.77	30.10	2,626
Belgium	11.03%	24.24	19.49	21.08	23.24	26.44	30.46	2,052
Denmark	10.86%	24.41	19.71	21.34	23.51	26.77	30.12	1,747
Finland	14.63%	25.10	20.18	21.80	24.17	27.68	31.22	2,505
Greece	10.77%	24.83	20.06	21.77	24.22	27.34	30.30	4,320
Ireland	8.58%	24.13	19.20	20.94	23.39	26.35	29.62	1,886
Italy	8.18%	23.68	19.10	20.76	23.06	25.86	29.14	6,295
Portugal	11.64%	24.91	20.06	21.79	24.09	27.34	30.47	5,174
Spain	13.65%	24.63	19.36	21.01	23.83	27.34	31.24	5,437

Note: Observations have been weighed using the ECHP personal (cross-sectional) weights.

Table 2. Unadjusted OLS Estimates. Dependent Variable: BMI
Women aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	−.695***	−1.07***	−.104	−.870***	−.298***	−.375**	−.748***	−.670***	−.640***
	(.148)	(.165)	(.232)	(.187)	(.002)	(.178)	(.076)	(.135)	(.096)
R^2	.20	.14	.05	.14	.18	.10	.20	.15	.25
N	7,998	6,478	5,043	8,138	12,693	6,331	19,535	15,087	15,409

Note: All regressions include age, age squared and year dummies. Robust standard errors clustered at the household level in parentheses. Observations are weighed using the appropriate ECHP weights. log (Adj. HH Inc) is the logarithm of the total net household income, adjusted by the number of equivalent adults and the country's consumer price index, plus 1.
*** (**) [*] Statistically significant at the 1% (5%) [10%]

Table 3. Adjusted OLS Estimates. Dependent Variable: BMI
Women aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	−.389***	−.885***	.005	−.655***	.027	−.259	−.472***	−.200*	−.294***
	(.151)	(.172)	(.225)	(.186)	(.098)	(.189)	(.077)	(.086)	(.092)
R^2	.23	.16	.07	.15	.19	.12	.22	.19	.28
N	7,778	6,367	5,013	8,126	12,689	6,176	19,339	15,085	15,327

Note: All regressions include age, age squared, year dummies, educational level dummies, marital status dummies, smoking behavior dummies, and number of children below 14. Robust standard errors clustered at the household level in parentheses. Observations are weighed using the appropriate ECHP weights. log (Adj. HH Inc) is the logarithm of the total net household income, adjusted by the number of equivalent adults and the country's consumer price index, plus 1.
*** (**) [*] Statistically significant at the 1% (5%) [10%]

Table 4. Unadjusted OLS Estimates. Dependent Variable: BMI
Men aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	.031	−.110	.018	.235	.039	.071	−.285***	.244**	−.150***
	(.152)	(.160)	(.018)	(.160)	(.075)	(.170)	(.071)	(.122)	(.070)
R^2	.18	.12	.07	.10	.09	.15	.14	.11	.13
N	7,751	5,726	4,999	8,080	11,727	6,110	19,050	13,874	14,902

Note: See Table 2.

Table 5. Adjusted OLS Estimates. Dependent Variable: BMI
Men aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	.157	.167	.197	.242	.112	.358**	−.139***	.422***	.006
	(.152)	(.165)	(.189)	(.161)	(.080)	(.182)	(.076)	(.119)	(.086)
R^2	.20	.15	.09	.12	.11	.18	.16	.14	.15
N	7,550	5,663	4,962	8,069	11,723	5,965	18,903	13,872	14,846

Note: See Table 3.

Table 6. Unadjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise) Women aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	–.031***	–.056***	.000	–.055***	–.010***	–.028***	–.022***	–.022***	–.025***
	(.008)	(.010)	(.017)	(.014)	(.006)	(.010)	(.004)	(.007)	(.005)
Pseudo-R^2	.10	.06	.02	.06	.07	.05	.10	.06	.10
N	7,998	6,478	5,043	8,138	12,693	6,331	19,535	15,087	15,409

Note: See Table 2.

Table 7. Adjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise) Women aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	–.020**	–.051***	.002	–.035**	.003	–.019*	–.015***	–.004	–.013**
	(.008)	(.010)	(.016)	(.015)	(.006)	(.011)	(.004)	(.007)	(.005)
Pseudo-R^2	.11	.08	.05	.07	.08	.06	.11	.09	.12
N	7,778	6,367	5,013	8,126	12,689	6,176	19,339	15,085	15,327

Note: See Table 3.

Table 8. Unadjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise) Men aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	.005	–.012	–.020	.000	–.008	.010	–.020***	.013**	–.014***
	(.011)	(.012)	(.015)	(.014)	(.006)	(.015)	(.005)	(.007)	(.005)
Pseudo-R^2	.07	.03	.03	.03	.04	.04	.07	.04	.05
N	7,751	5,726	4,999	8,080	11,727	6,110	19,050	13,874	14,902

Note: See Table 2.

Table 9. Adjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise) Men aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	.006	.003	–.010	–.002	–.007	.015	–.013**	.022***	–.005
	(.012)	(.013)	(.016)	(.015)	(.007)	(.016)	(.006)	(.009)	(.006)
Pseudo-R^2	.08	.05	.05	.04	.05	.07	.08	.05	.06
N	7,550	5,663	4,962	8,069	11,723	5,965	18,903	13,872	14,846

Note: See Table 3.

Table 10. Adjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise)
Women aged 30-60, BMI>=15 & BMI<55

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	–.043***	–.055***	–.003	–.052***	–.003	–.041***	–.019***	–.007	–.016**
	(.011)	(.012)	(.019)	(.018)	(.009)	(.016)	(.005)	(.011)	(.007)
Pseudo-R^2	.07	.10	.07	.06	.05	.05	.07	.05	.08
N	4,404	3,899	3,144	4,952	6,592	3,352	10,837	7,604	7,804

Note: See Table 3.

Table 11. Adjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise)
Men aged 30-60, BMI>=15 & BMI<55

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc + 1)	.002	.002	.008	–.011	–.013	.005	–.018**	.035**	–.006
	(.016)	(.019)	(.021)	(.019)	(.010)	(.016)	(.008)	(.015)	(.010)
Pseudo-R^2	.06	.03	.05	.03	.03	.05	.05	.03	.02
N	4,242	3,549	3,171	4,850	6,347	3,209	10,640	6,844	7,591

Note: See Table 3.

Table 12. Adjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise)
Women aged 30-60, BMI>=15 & BMI<55

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc – Individual Inc. from work + 1)	–.004	–.007	.005	–.005	.001	–.009	–.005	–.003	–.002
	(.005)	(.005)	(.007)	(.009)	(.004)	(.009)	(.003)	(.006)	(.005)
log (Adj. Individual Inc. from work + 1)	–.008***	–.008***	–.006	–.015***	–.001	–.007	–.005***	–.003	–.004**
	(.002)	(.002)	(.004)	(.004)	(.001)	(.006)	(.002)	(.002)	(.002)
Pseudo-R^2	.07	.09	.07	.07	.05	.05	.07	.06	.08
N	4,404	3,899	3,144	4,363	6,592	3,352	10,837	7,604	7,804

Note: See Table 3.
Adj. HH Inc – Individual Inc. from work: Adjusted "total net household income" minus "total net individual income from work"
Adj. Individual Inc. from work: Adjusted "total net individual income from work"

Table 13. Adjusted Probit Estimates. Dependent Variable: Obesity indicator (1 if BMI >= 30, 0 otherwise)
Men aged 30-60, BMI>=15 & BMI<55

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
log (Adj. HH Inc – Individual Inc. from work + 1)	.004	–.001	–.006	.028	–.002	.012	–.004*	.003	.002
	(.007)	(.004)	(.005)	(.010)	(.001)	(.007)	(.002)	(.005)	(.003)
log (Adj. Individual Inc. from work + 1)	–.003	–.004	–.004	–.004	.002	–.001	–.004	.001	–.001
	(.004)	(.003)	(.005)	(.005)	(.002)	(.006)	(.003)	(.003)	(.002)
Pseudo-R^2	.06	.03	.05	.04	.03	.05	.04	.02	.02
N	4,242	3,549	3,171	3,778	6,347	3,209	10,640	6,844	7,591

Note: See Table 12.

FIGURES

Figure 1. Comparison of Estimates for Women

	BMI		Obese	
	Table – 2	Table – 3	Table – 6	Table – 7
Austria	–***	–***	–***	–**
Belgium	–***	–***	–***	–***
Denmark	–	+	+	+
Finland	–***	–***	–***	–**
Greece	–***	+	–***	+
Ireland	–**	–	–***	–*
Italy	–***	–***	–***	–***
Portugal	–***	–*	–***	–
Spain	–***	–***	–***	–**

Note:
+ : sign of the association is positive
– : sign of the association is negative
*** (**) [*] Statistically significant at the 1% (5%) [10%]

Figure 2. Comparison of Estimates for Men

	BMI		Obese	
	Table – 4	Table – 5	Table – 8	Table – 9
Austria	+	+	+	+
Belgium	–	+	–	+
Denmark	+	+	–	–
Finland	+	+	+	–
Greece	+	+	–	–
Ireland	+	+**	+	+
Italy	–***	–***	–***	–**
Portugal	+**	+***	+**	+***
Spain	–***	+	–***	–

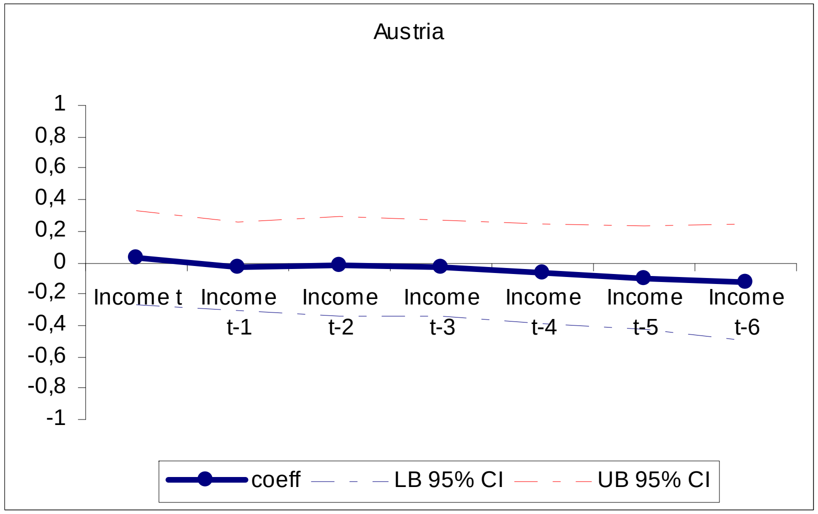
Note: See figure 1.

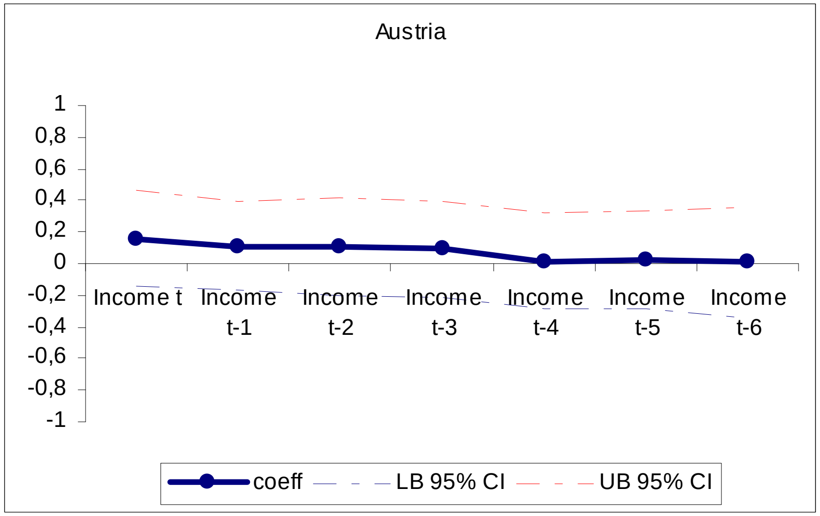
APPENDIX. Table A1. OLS Estimates of the Coefficient on log (Adj. HH Inc + 1) depending on the lag used, from (t) to (t – 6)

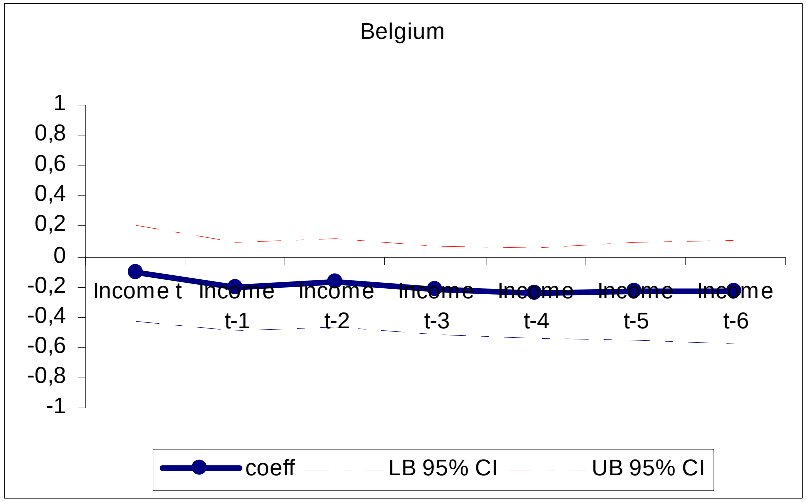
Controlling for age, age squared, and year dummies.

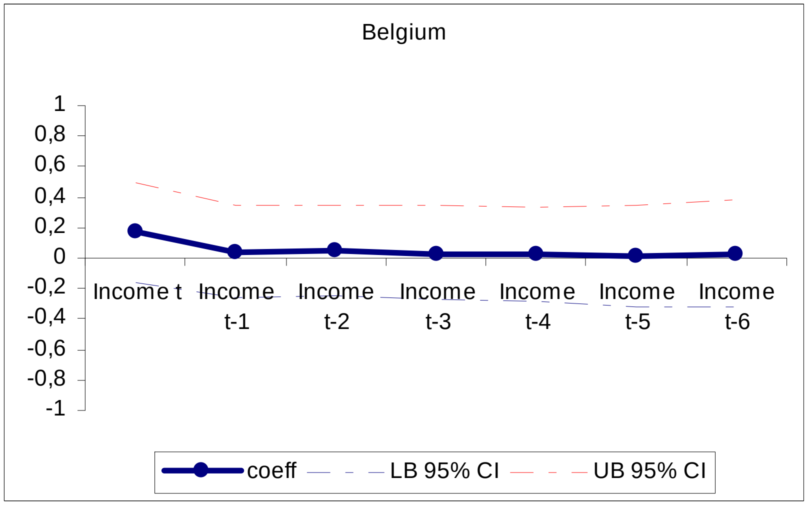
Controlling for age, age squared, year dummies, educational dummies, marital status dummies, number of children below 14, and smoking behavior dummies.

I. MEN









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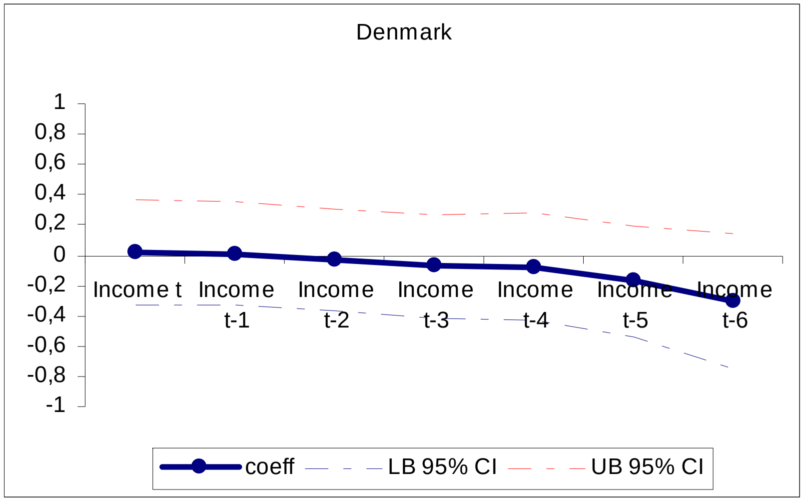

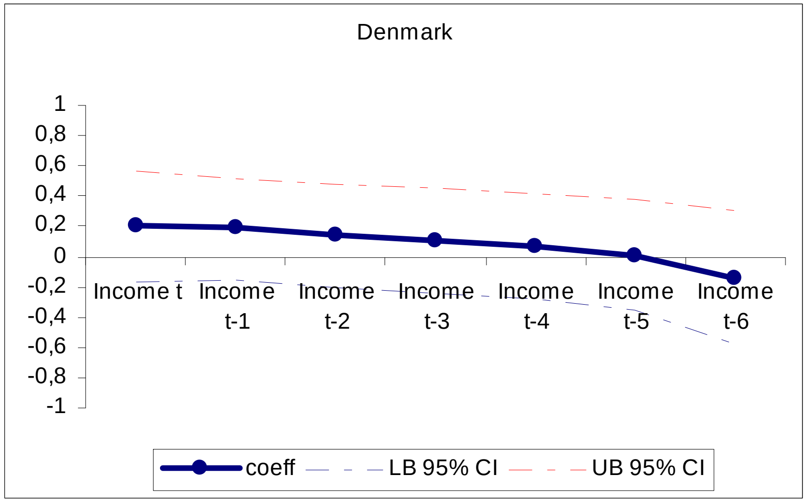

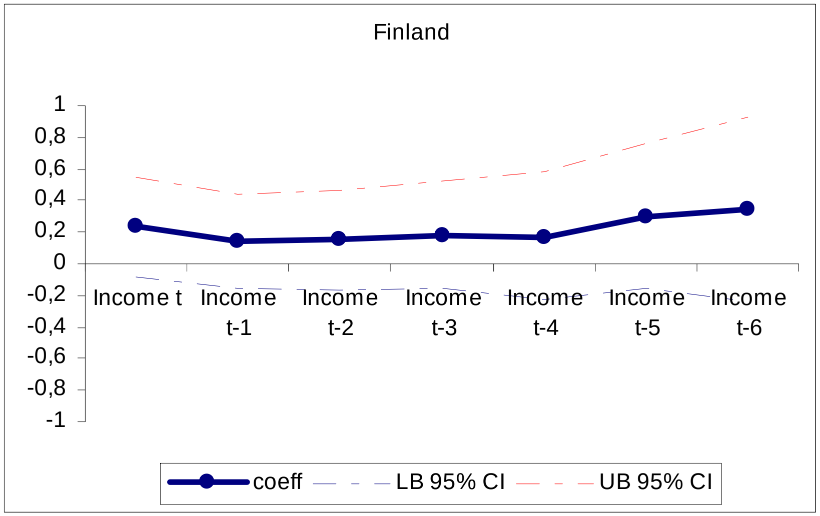

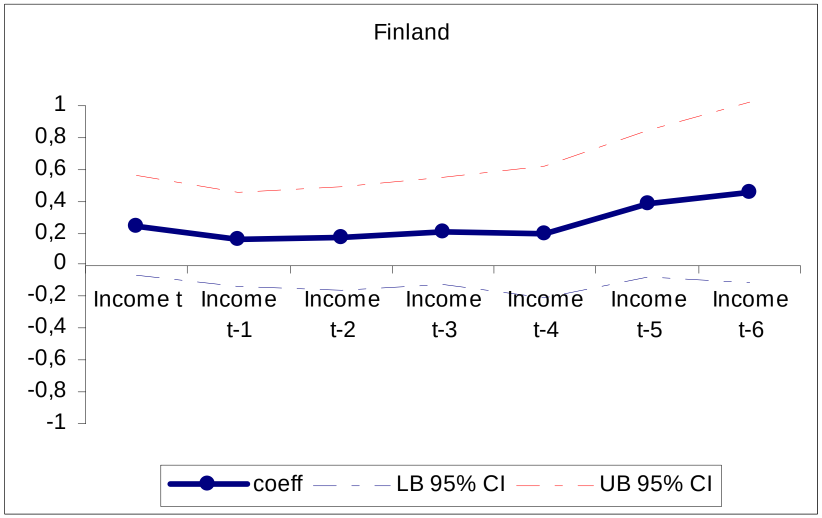

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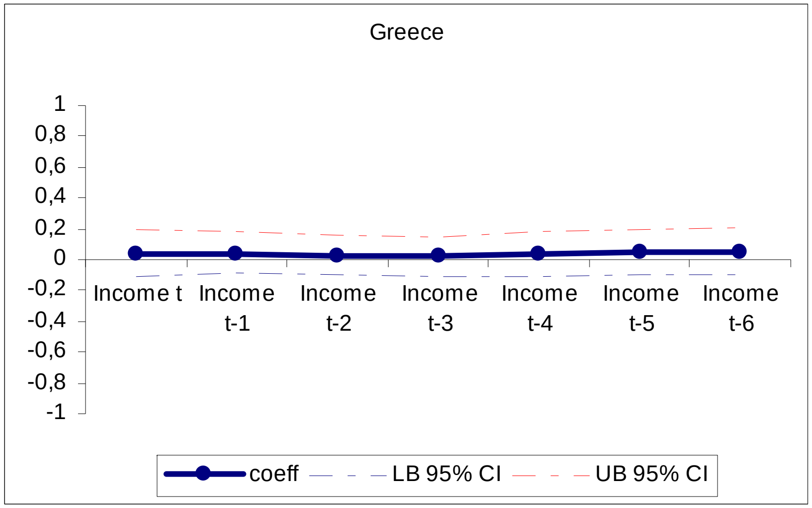

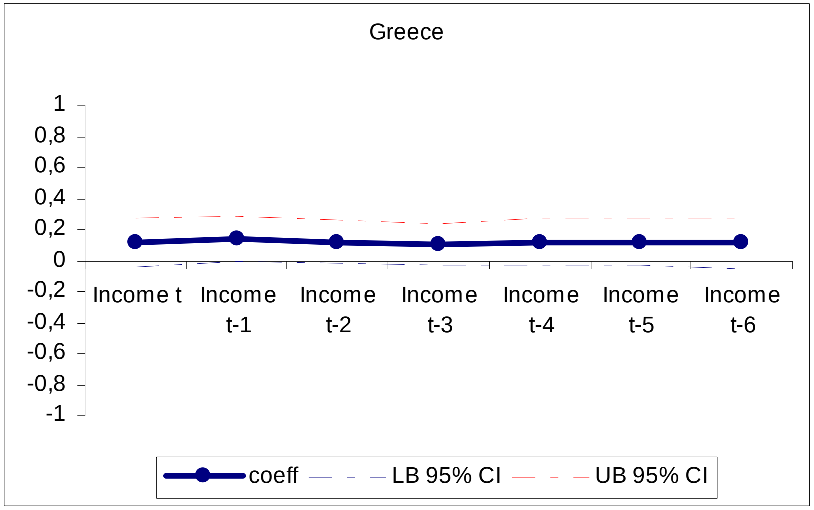

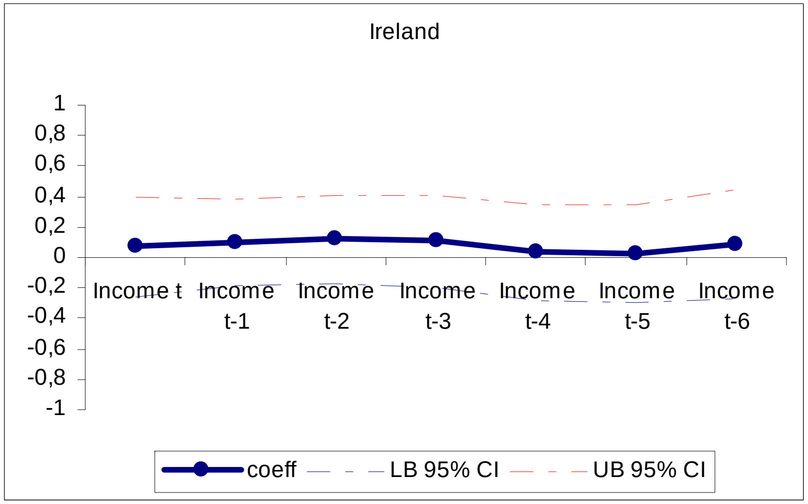

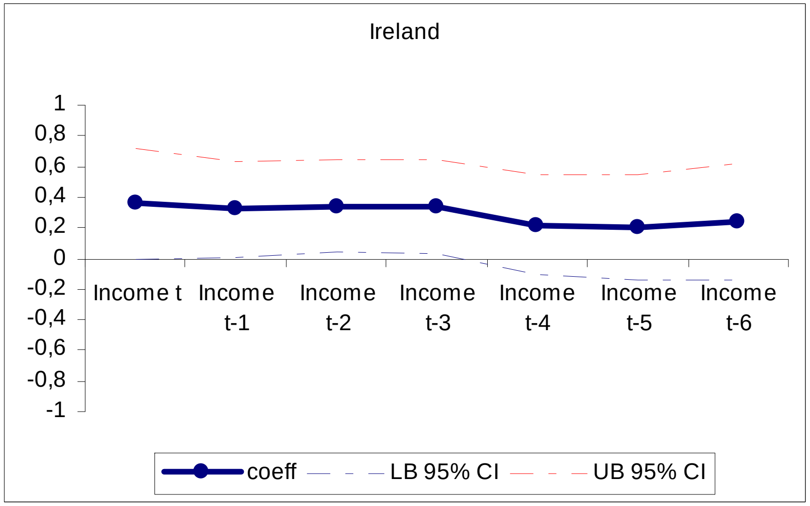

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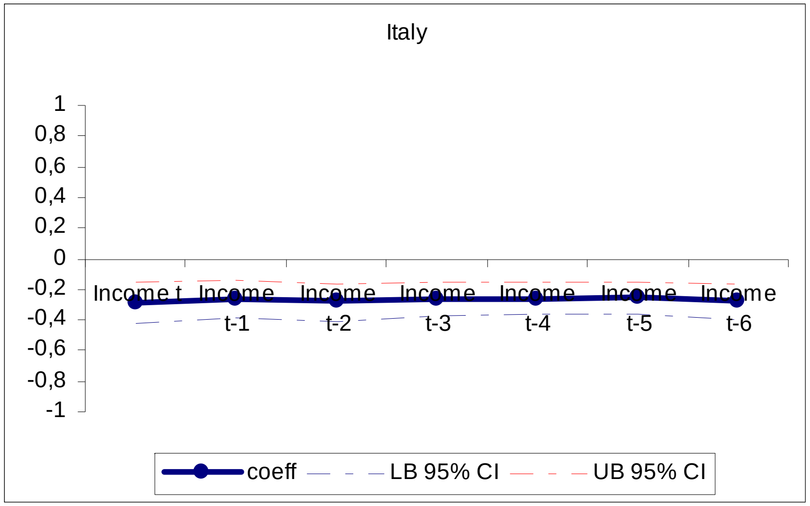

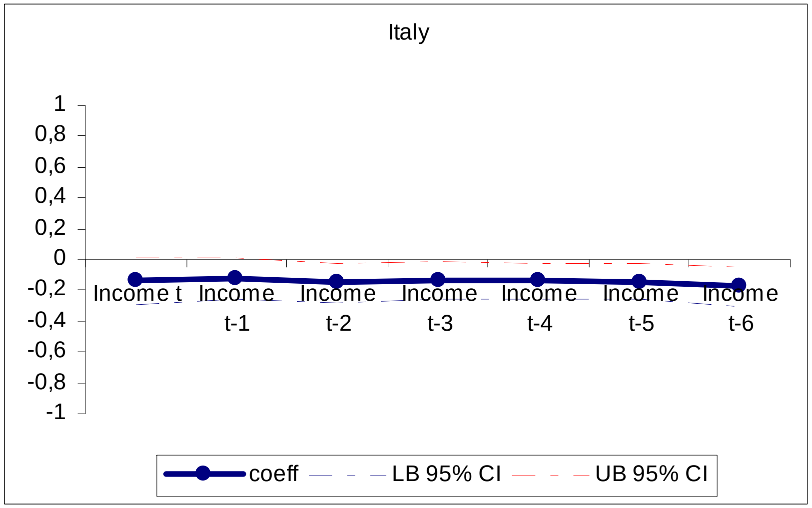

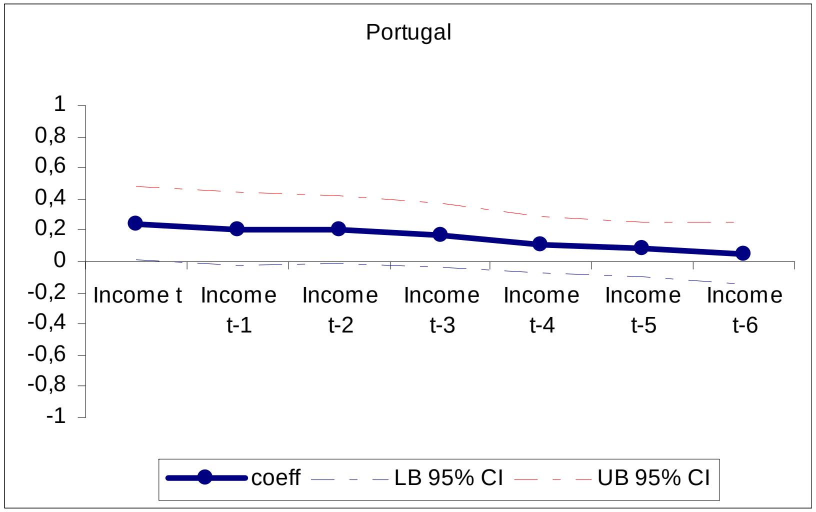

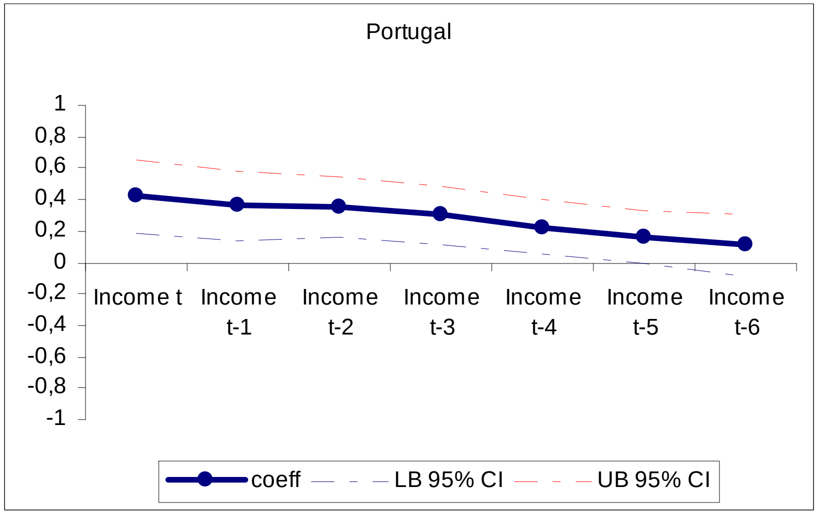

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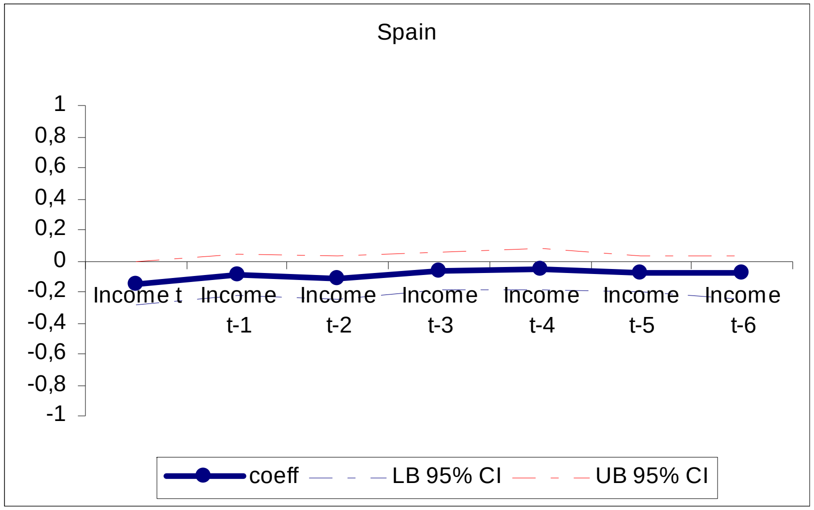


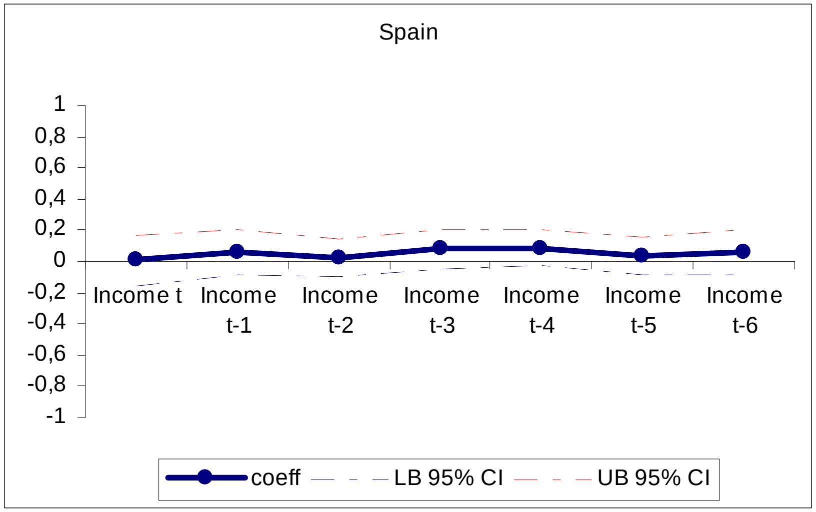
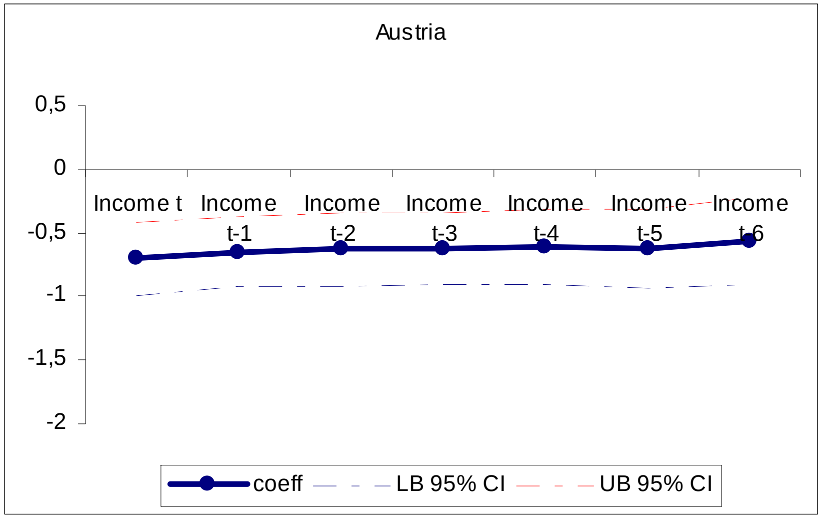
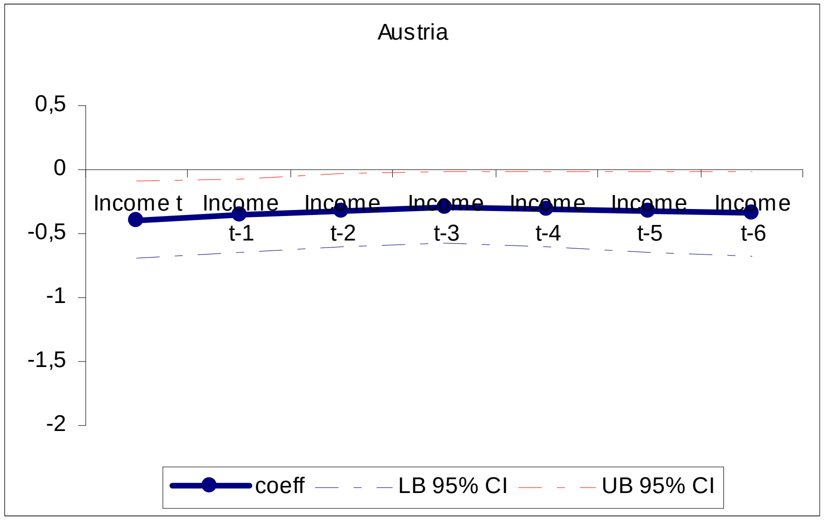
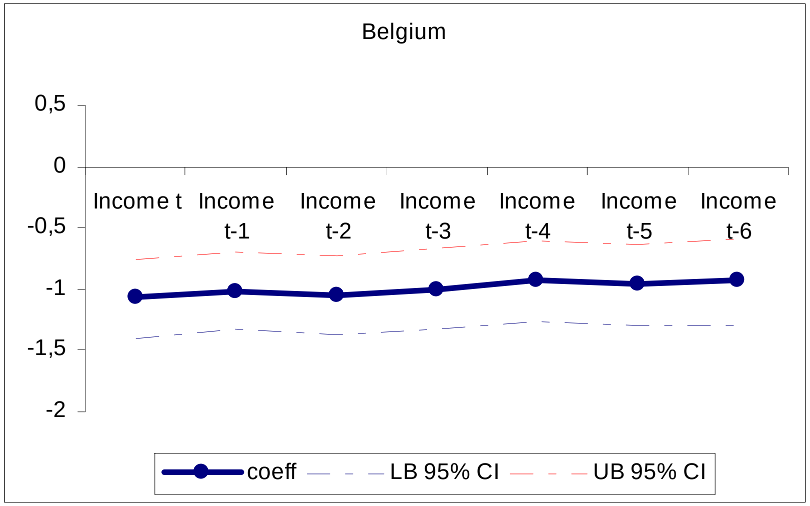


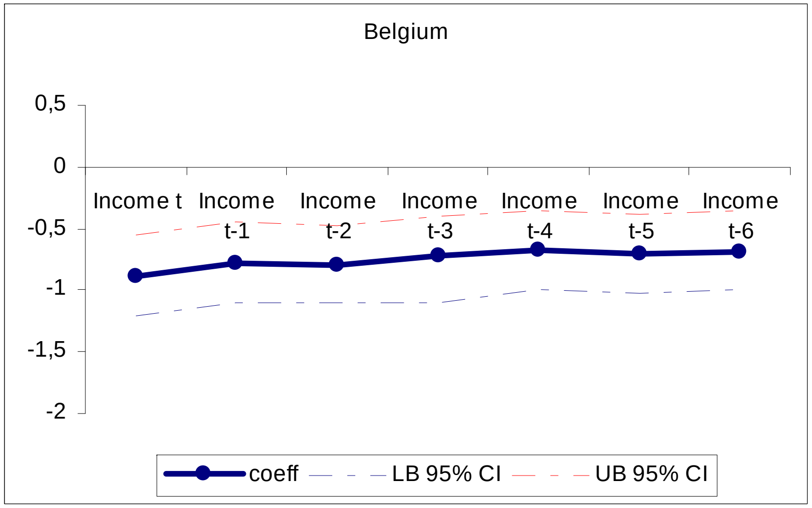
Table A1. (Continued)

II. WOMEN









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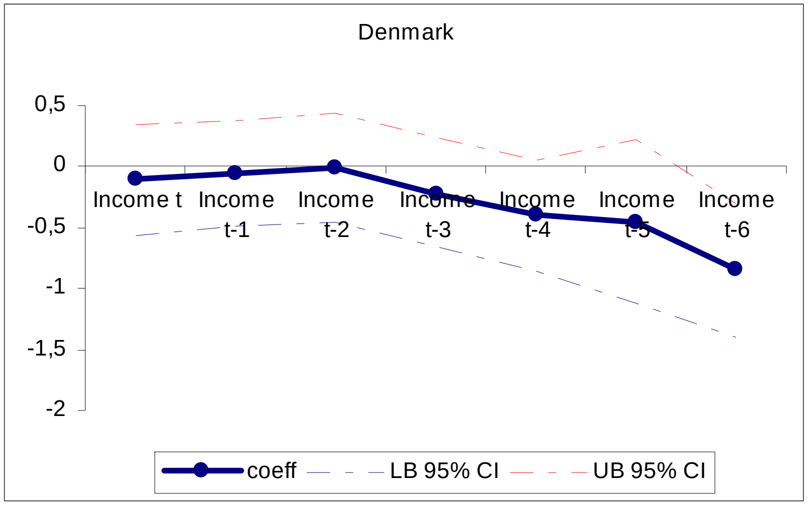

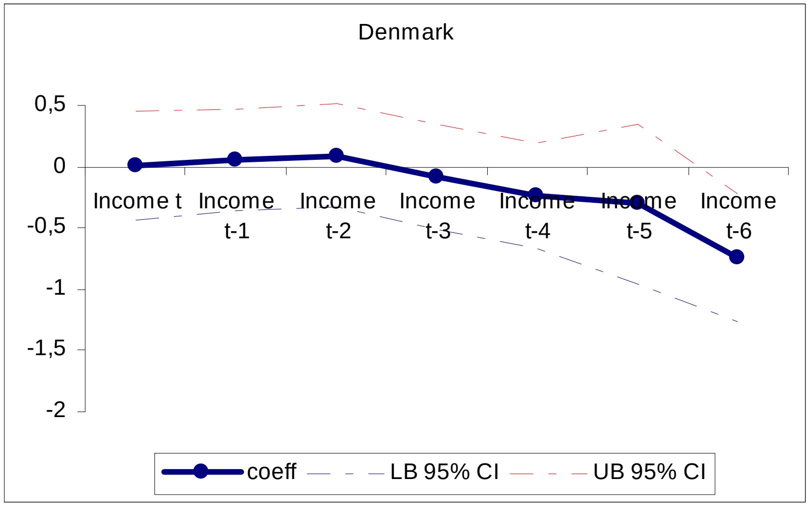

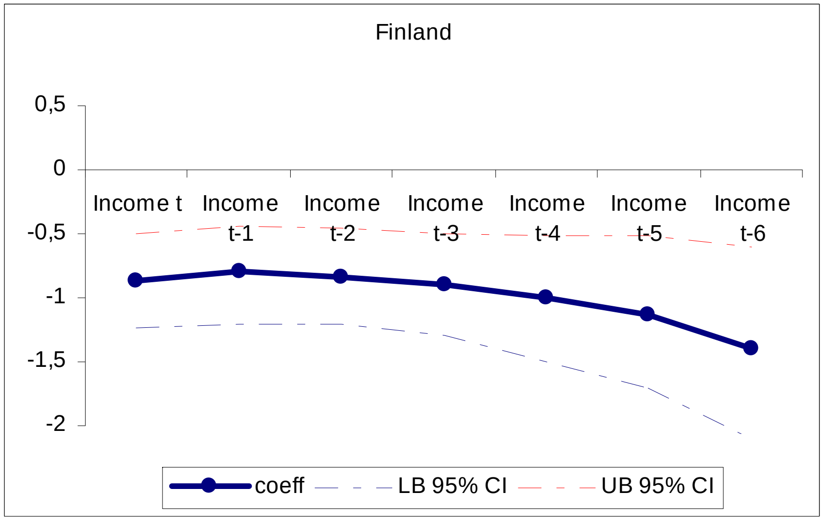

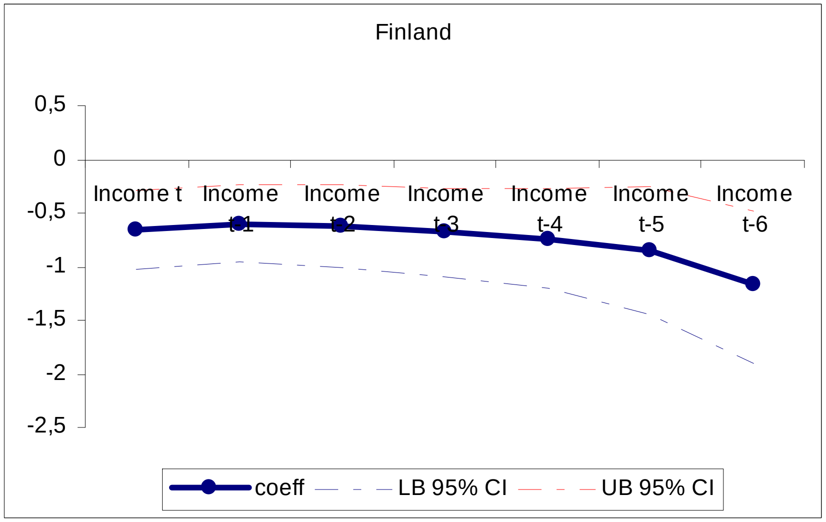

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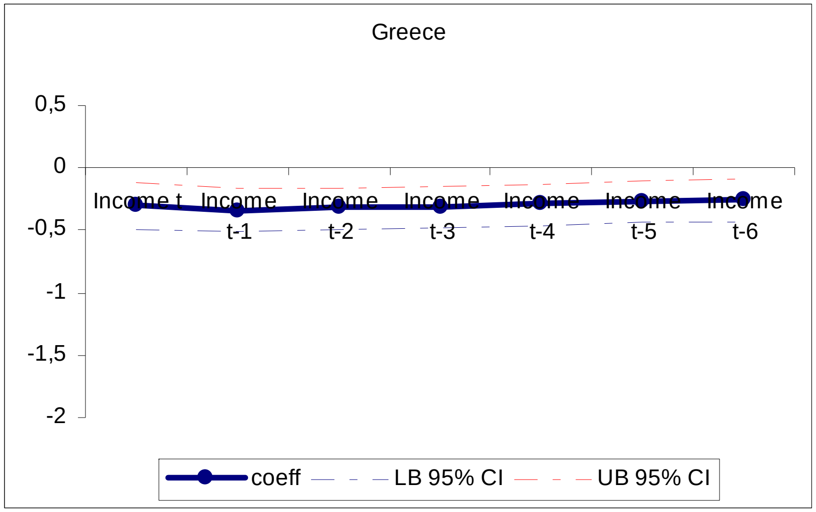

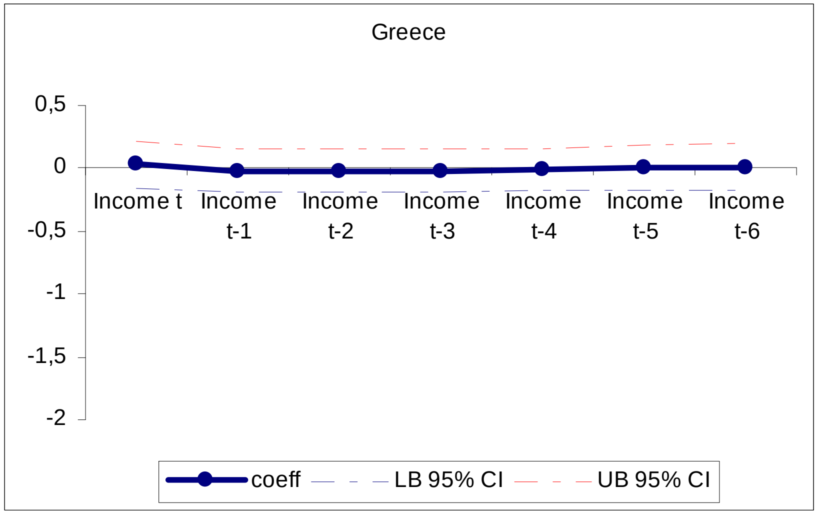

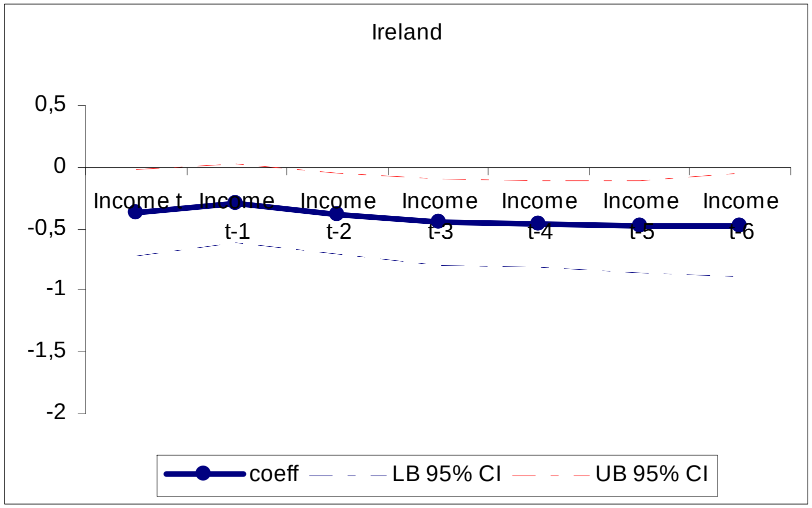

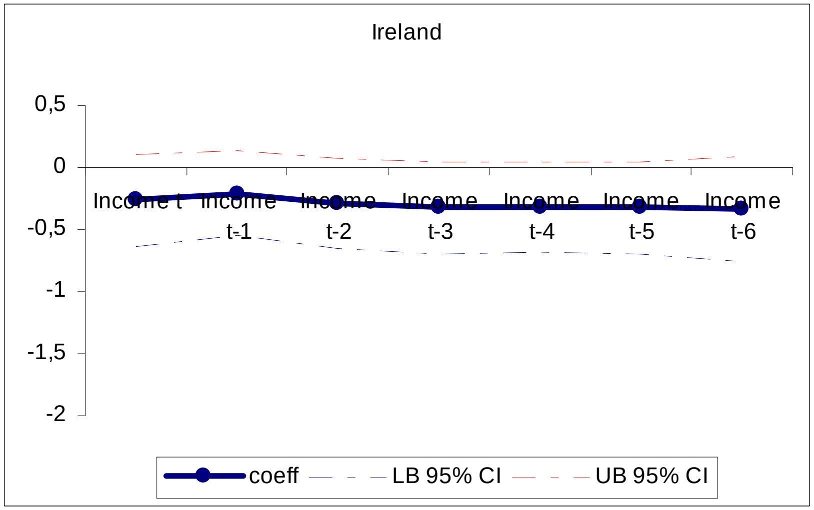

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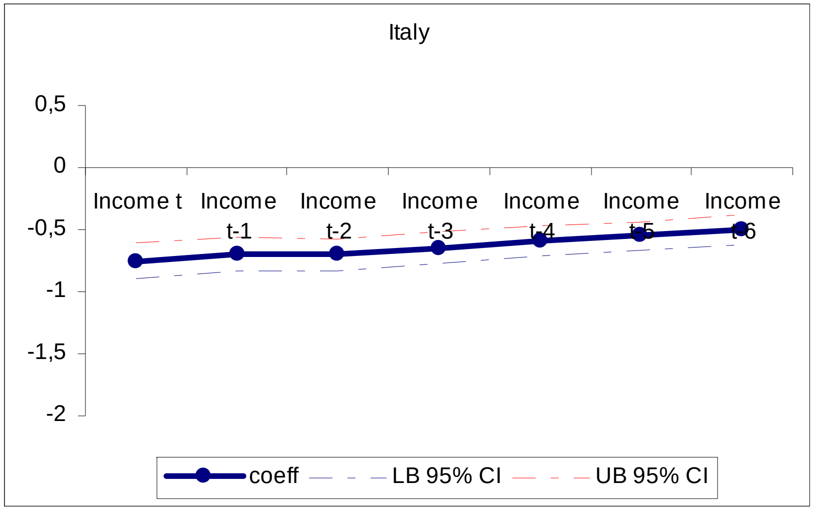

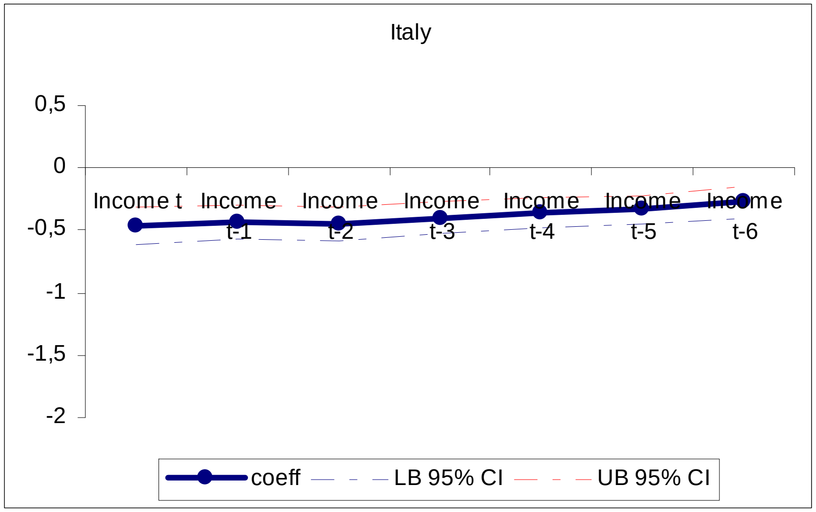

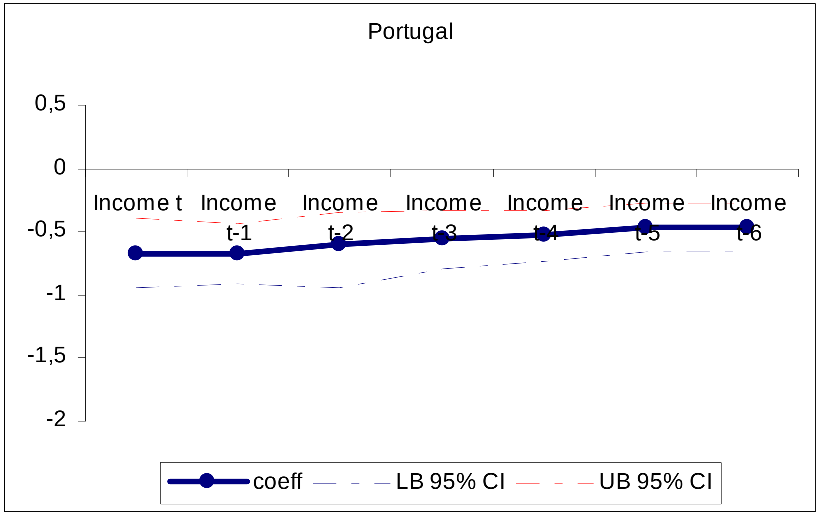

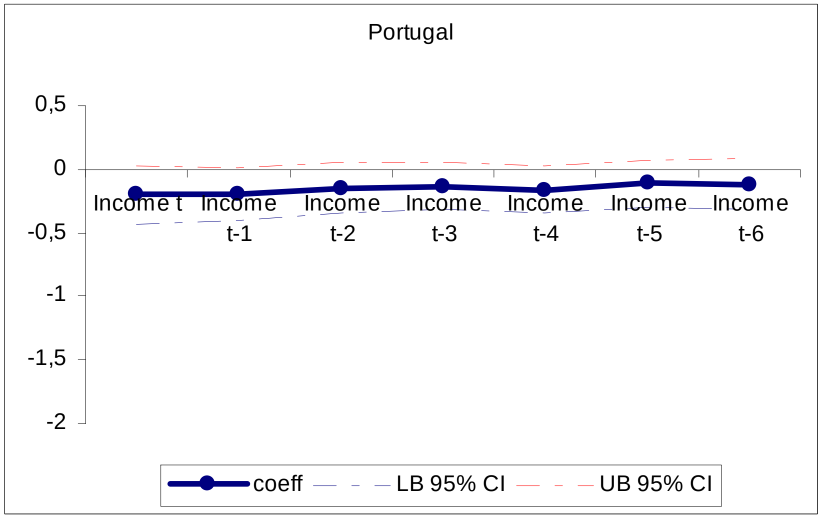

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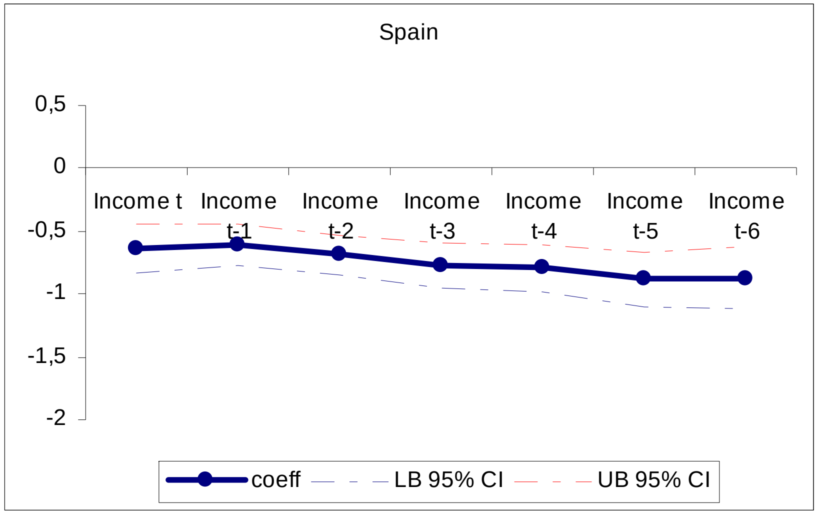

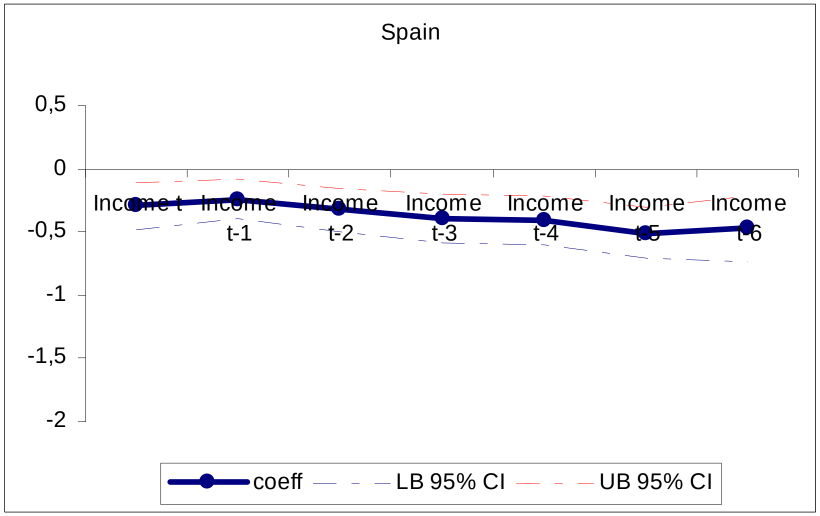

Table A2. Unadjusted Logit Multinomial Estimates of the Income Coefficient. Dependent Variable: Weight Classification
Reported values: Relative Risk Ratio for the log (Adjusted Household Income + 1)
Men aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
Underweight	.528***	.719	1.66	.844	.635**	1.07	.916	.791	.856
	(.093)	(.193)	(.564)	(.288)	(.117)	(.352)	(.169)	(.196)	(.120)
Overweight	.869*	1.04	.869	1.17*	1.05	1.00	.924*	1.12	.940
	(.074)	(.102)	(.106)	(.111)	(.056)	(.983)	(.040)	(.086)	(.043)
Obese	.964	.896	.763	1.09	.933	1.15	.723**	1.23**	.842***
	(.135)	(.133)	(.128)	(.162)	(.077)	(.264)	(.056)	(.125)	(.046)
Pseudo-R^2	.09	.06	.04	.05	.06	.06	.08	.06	.08
N	7,751	5,726	4,999	8,080	11,727	6,110	19,050	13,874	14,902

Note: See Table 2.

Table A3. Adjusted Logit Multinomial Estimates. Dependent Variable: Weight Classification
Reported values: Relative Risk Ratio for the log (Adjusted Household Income + 1)
Men aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
Underweight	.457***	.769	1.80	.850	.672**	.869	.913	.916	.928
	(.086)	(.228)	(.706)	(.299)	(.128)	(.209)	(.163)	(.215)	(.147)
Overweight	.989	1.21*	.964	1.19*	.999***	1.22**	1.02	1.24***	.988
	(.093)	(.129)	(.124)	(.117)	(.000)	(.116)	(.047)	(.094)	(.044)
Obese	1.06	1.13	.885	1.06	.986	1.41	.832**	1.48***	.948
	(.154)	(.186)	(.164)	(.172)	(.091)	(.362)	(.074)	(.186)	(.066)
Pseudo-R^2	.11	.08	.05	.06	.07	.09	.09	.08	.09
N	7,550	5,663	4,962	8,069	11,723	5,965	18,903	13,872	14,846

Note: See Table 3.

Table A4. Unadjusted Logit Multinomial Estimates of the Income Coefficient. Dependent Variable: Weight Classification
Reported values: Relative Risk Ratio for the log (Adjusted Household Income + 1)
Women aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
Underweight	.897	1.06	1.17	.950	.984	.780	1.17	1.54	1.06
	(.196)	(.166)	(.297)	(.161)	(.127)	(.196)	(.130)	(.414)	(.010)
Overweight	.811**	.669***	.881	.708***	.850***	.964	.691***	.762***	.721***
	(.072)	(.063)	(.122)	(.075)	(.043)	(.083)	(.032)	(.049)	(.038)
Obese	.615***	.484***	.966	.520***	.819***	.691***	.582***	.718***	.666***
	(.067)	(.059)	(.193)	(.073)	(.063)	(.090)	(.046)	(.062)	(.042)
Pseudo-R^2	.09	.07	.03	.07	.10	.05	.10	.07	.12
N	7,998	6,478	5,043	8,138	12,693	6,331	19,535	15,087	15,409

Note: See Table 2.

Table A5. Adjusted Logit Multinomial Estimates of the Income Coefficient. Dependent Variable: Weight Classification
Reported values: Relative Risk Ratio for the log (Adjusted Household Income + 1)
Women aged 15-75

	Austria	Belgium	Denmark	Finland	Greece	Ireland	Italy	Portugal	Spain
Underweight	.846	1.13	1.17	.955	.889	.893	1.02	1.13	1.05
	(.180)	(.192)	(.333)	(.164)	(.113)	(.233)	(.105)	(.381)	(.092)
Overweight	.981	.777***	.952	.723***	.983	1.00	.783***	.905	.875***
	(.010)	(.074)	(.134)	(.081)	(.053)	(.092)	(.039)	(.063)	(.041)
Obese	.760**	.530***	1.04	.631***	1.03	.778*	.689***	.939	.820***
	(.087)	(.065)	(.216)	(.093)	(.088)	(.114)	(.060)	(.085)	(.055)
Pseudo-R^2	.11	.08	.04	.08	.11	.06	.11	.09	.14
N	7,778	6,367	5,013	8,126	12,689	6,176	19,339	15,085	15,327

Note: See Table 3.