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# **Effect of gender, nationality and attitudes on weight reduction strategies**

Carola Grebitus<sup>1</sup>, Monika Hartmann<sup>1</sup> and Nikolai Reynolds<sup>2</sup>

<sup>1</sup> University of Bonn  
Institute for Food and Resource Economics  
Nussallee 21, 53115 Bonn, Germany  
carola.grebitus@ilr.uni-bonn.de

<sup>2</sup> Synovate, MarketQuest, Western Europe  
Frankfurt, Germany



**Paper prepared for presentation at the EAAE 2011 Congress**

**Change and Uncertainty**  
Challenges for Agriculture,  
Food and Natural Resources

August 30 to September 2, 2011  
ETH Zurich, Zurich, Switzerland

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## **Effect of gender, nationality and attitudes on weight reduction strategies**

### **1. Introduction**

Malnutrition leads to high costs for the public health care system. For example, the share of health care budget that is spent for curing diseases resulting from obesity amounts to 7% in the European Community (Commission of the European Communities 2005). But the economic costs of obesity or other forms of malnutrition are not only reflected in an increased burden for the health system. Additional costs accrue to the individual and the society due to a loss of economic efficiency resulting from lower returns on education, decreased household wages and incomes, increased premature retirement and unemployment as well as higher dependence on welfare (Yach et al. 2006).

The economic consequences of diet-related health risks may induce responses by government, non-governmental institutions, media, industry, as well as by persons affected by those health risks. For example, to fight overweight and obesity, individuals may change their dietary patterns but also increase physical activity or start off by seeking advice from dietitians. In order to be able to develop theories about dietary behavior and communicating health messages related to food and diets, we have to understand which strategies consumers use to maintain and/or reduce their body weight.

Against this background, the question what influences people when fighting weight gain has to be considered. This contribution adds to the literature by analyzing whether this is dependent on gender, nationality and attitudes. We aim to analyze how the patterns people develop to maintain their weight, i.e. fight weight gain can be described. This paper deals with the overall research questions of what influences strategies 1) to reduce body weight once a certain threshold is exceeded and 2) to maintain or reduce body weight. As strategies we define (i) physical activity, (ii) change in dietary patterns and (iii) passive behavior. Determinants defined are body consciousness measured by frequency of weighing, gender, nationality to account for cultural differences and attitudes towards food, diets and food industry. Results are supposed to support designing of public health campaigns and programmes that aim to change community or national health behaviour trends taking into account national differences. To do so, a global survey on fitness, weight control and attitudes on food and health took place in 19 different countries around the globe. The remainder of the paper is as follows. Section 2 describes data and descriptive analysis. Section 3 presents empirical results and section 4 concludes.

### **2. Data and descriptive analysis**

#### **2.1 Data set**

In this study, a unique data set is used. Consumer data were collected from March to July 2010 by the market research company Synovate across 19 countries. The countries considered encompassed: Argentina, Brazil, Canada, Chile, China, Colombia, Denmark, Egypt, India, Indonesia, Korea, Netherlands, Romania, Russia, Saudi Arabia, Singapore, Turkey, UK and USA. For each country, sampling methods and survey modes were selected according to the requirements of the respective countries (e.g. CATI), whilst still allowing comparability across countries. The survey resulted in 13,155 responses. Data collected included questions on fitness, weight control and attitudes on food and health. As 471 respondents refused to answer the question “How often do you weigh yourself?” the number of observations in the empirical analyses is reduced to 12,684 respondents due to missing values.

## 2.2 Descriptive statistics

### *Dependent variables*

To analyze the effect of gender, nationality and attitudes towards weight reducing/ maintaining strategies we define two sets of dependent variables: 1) Steps taken when a person feels that the *body weight goes beyond a certain threshold* and 2) Steps taken by a person to *maintain or reduce body weight*. We use the two different sets to account for the fact that some people only react if necessary (1) while others constantly show interest in a 'healthy' weight (2).

First, to find out what consumers do to get themselves back on track when gaining weight, we stated the multiple response question "Do you take any of the following steps when you feel your weight goes beyond a certain threshold?". Possible answers were: increase physical activity, take herbs or supplements which promise weight loss, go to the doctor, Weightwatchers meetings, massage to lose weight, acupuncture to lose weight, reduce food intake, change types of foods that you eat, reduce Soda/ Softdrinks, has a bit in every 3 hours, increase water intake, watch what I eat, drink more water, leave some foods (bread, candies) and none of these. The top three responses overall were 'reduce food intake' accounting for 40% of the answers, 'increase physical activity' with 35% and 'change types of food that you eat' with 25%. To use this in the empirical analysis we categorized the answers into physical activity (36% of responses), passive behavior such as massage and acupuncture (6% of responses) and dietary change including e.g. reduction of food intake (52% of responses). The variables were coded as dummy variables equal to one if the respondent answered positively to at least one of the statements in the respective category.

Second, to find out what consumers do to maintain/ reduce body weight constantly, we stated the multiple response question "Have you used or are you using any of the following to maintain or reduce weight?". Possible answers were: consume calorie control programs like Kalibrate, Herbalife or others, reductive massage, weight loss course/ membership like Weightwatchers, Marie France, Jenny Craig and others, medicine/ medication, visits to a dietician/ nutritionist/ doctor, diet plans such as the Atkins Diet, South Beach Diet and others, diet books and diet recipe books, meal replacements such as shakes, bars etc., herbs or supplements which promise weight loss, order smaller portions at restaurants/ share a meal in order to eat, home exercise equipment, low-carbohydrate food products, gym membership/ exercise classes/ personal trainer, low-fat food products and none of these. The top three strategies used or being used across all markets to maintain or reduce weight were low fat products (32%), low carbohydrate food products (16%) and gym membership/ exercise classes/ personal trainer (16%). Again, to use this in the empirical analysis we categorized the answers into physical activity (28% of responses), passive behavior/ advice such as diet books, visits to a dietician (18% of responses) and dietary change including e.g. order smaller portions at restaurants (45% of responses). The variables were coded as dummy variables equal to one if the respondent answered positively to at least one of the statements in the respective category. Table 1 depicts the variable description of dependent variables.

**Table 1: Dependent variable description**

Variable	Description	Mean	SD	Min	Max
Q1 physical activity	Dummy variable equal to 1 if weight increase is answered by physical activity, 0 if otherwise	0.36	0.48	0	1
Q1 passive behavior	Dummy variable equal to 1 if at least one of the following options is used, 0 if otherwise: take herbs or supplements which promise weight loss; goes to doctor; acupuncture to lose weight; Weightwatchers; Massage to lose weight	0.06	0.25	0	1
Q1 dietary change	Dummy variable equal to 1 if at least one of the following options is used, 0 if otherwise: reduce food intake; change types of foods that you eat; reduce softdrinks; has a bit in every 3 hours; increase water intake; watch what I eat; drink more water; leave some foods (bread, candies)	0.52	0.50	0	1
Q2 physical activity	Dummy variable equal to 1 if at least one of the following options is used, 0 if otherwise: gym membership/exercise classes/personal trainer; home exercise equipment	0.28	0.45	0	1
Q2 passive behavior/Advice	Dummy variable equal to 1 if at least one of the following options is used, 0 if otherwise: diet plans such as the Atkins Diet, South Beach Diet and others; diet books and diet recipe books; Weight loss course/member: Weightwatchers, Marie France, Jenny Craig and others; visits to a dietician / nutritionist / doctor Medicine / medication;	0.18	0.39	0	1
Q2 dietary change	Dummy variable equal to 1 if at least one of the following options is used, 0 if otherwise: herbs or supplements which promise weight loss; low-fat food products; meal replacements such as shakes, bars etc.; low-carbohydrate food products; order smaller portions at restaurants/ share a meal in order to eat; consume calories control programs like Kalibrate, Herbalife or others	0.45	0.50	0	1

### *Independent variables*

To analyze determinants of the respective strategies we started off by asking participants *how often they weigh themselves*. This gives a first impression on consumers' health consciousness. Results show for example that only 5% of respondents weigh themselves daily and 15% once a week. 35% weigh themselves whenever they remember and one quarter of the sample claims not to weigh themselves at all.

Additionally, we account for *consumer attitudes* towards eating habits, because food is not simply a functional transaction which we undertake to keep ourselves going. It tastes good, we enjoy it, and it has cultural and social meaning. Eating the 'wrong' things can be comforting. In this regard, 26% of respondents globally tend to eat junk food when feeling down. Conversely, 84% of respondents agree that eating healthy food makes them feel better. About one third of respondents (29%) surveyed across the 19 markets admitted to liking the taste of fast food too much to give it up. Contrary to this, 69% of respondents across all markets watch their food intake carefully and strive to be healthy. Over a third (32%) of all respondents agree that they are worried about the issue of childhood obesity, in their own home. 58% of respondents agree that they are worried about the issue of childhood obesity in their country. Overall, 61% of respondents agree that food companies can help prevent childhood obesity. Because data were collected simply by answering with yes or no (1/0 coding) we could not apply factor analysis to combine correlated items into uncorrelated factors. Instead we built indicators summing up statements that fit into the categories food lover (e.g. I like the taste of fast food too much to give it up), healthy eater (e.g. Healthy food makes me feel better), worry obesity (e.g. I am worried about the

issue of childhood obesity, in my country) and pro food industry (e.g. food companies can help prevent childhood obesity). These indices were included in the empirical analysis to measure the influence of consumer attitudes on weight reducing/maintaining strategies (see Table 2 for variable description). Furthermore, *gender* (equally distributed among the sample) and *nationality* were included as independent variables.

**Table 2: Independent variable description**

Variable	Description	Mean	SD	Min	Max
Gender	Dummy variable equal to 1 if female, 0 if otherwise.	0.50	0.50	0	1
Times of weighing	1=More than once a day, 2=Daily, 3=Once every few days, 4=Weekly, 5=Monthly, 6=Whenever remember/ clothes are getting tight, 7=don't weigh myself	5.40	1.59	1	7
Argentina	Dummy variable equal to 1 if respondent comes from the respective country, 0 if otherwise	0.02	0.15	0	1
Brazil		0.05	0.21	0	1
Canada		0.08	0.27	0	1
Columbia		0.04	0.19	0	1
Denmark		0.04	0.19	0	1
Egypt		0.02	0.15	0	1
UK		0.04	0.19	0	1
USA		0.04	0.19	0	1
Netherlands		0.09	0.28	0	1
Turkey		0.04	0.19	0	1
China		0.08	0.27	0	1
India		0.04	0.19	0	1
Indonesia		0.08	0.27	0	1
Korea		0.04	0.19	0	1
Saudi Arabia		0.04	0.20	0	1
Singapore		0.04	0.19	0	1
Chile		0.04	0.19	0	1
Romania		0.11	0.32	0	1
Russia		0.09	0.29	0	1
Food lover	Sum of responses equal to 1 with one or more of these items: eat whatever I want, whenever I want; life is too short to deny yourself whatever you want, even though it may be unhealthy; like the taste of fast food too much to give it up	1.24	1.01	0	3
Healthy eater	Sum of responses equal to 1 with one or more of these items: watch my food intake carefully and strive to be healthy; healthy food makes me feel better	1.53	0.66	0	2
Worry obesity	Sum of responses equal to 1 with one or more of these items: worried about issue of childhood obesity, in my own home; worried about issue of childhood obesity, in my country	0.88	0.79	0	2
Pro food industry	Sum of responses equal to 1 with one or more of these items: food companies offer enough healthy food options; food companies can help prevent childhood obesity	1.06	0.77	0	2

### 2.3 Bivariate Probit Model

Because the dependent variables are binary variables we employ binomial probit models to analyze determinants of weight reducing/ maintaining strategies. We compare different strategies applied when a person feels that the *body weight goes beyond a certain threshold* and we contrast different steps taken by a person to *maintain/ reduce body weight*. The binomial probit allows us to always estimate two strategies simultaneously (Greene, 2000). We do so because the different strategies might not be independent from each other. This estimation approach gives us the opportunity to answer the research

question of whether e.g. changing dietary patterns and increase of physical activity to reduce body weight are complements or substitutes. A significant positive or negative correlation coefficient would be evidence of the cross equation effects and that the strategy choices are not independent. The estimated correlation coefficient  $\rho$  provides a measure to evaluate whether two single univariate probit models or one bivariate probit model is sufficient. This correlation coefficient is also known as the ‘polychoric correlation coefficient’ in the psychometric and statistical literature (Olsson, 1979). If  $\rho$  is significant, the bivariate probit model is preferred. If not, then two single univariate probit models are preferred. In sum, we use a bivariate probit model to estimate the determinants for different steps to reduce/ maintain body weight jointly and test whether the respective two equations are independent or not. The bivariate probit model is estimated using maximum likelihood methods. As the bivariate probit model is a standard procedure we would like to refer the interested reader to Greene (2000) for more information.

### **3. Econometric analysis**

#### **3.1 Determinants of strategies to reduce body weight**

To answer our first research question of what determines which different weight reduction strategies are applied if a certain weight threshold is passed tables 3 to 5 present results of different bivariate probit models. In all three models the correlation coefficient  $\rho$  is highly significant but with rather weak, positive correlations. The significance points towards the fact that the bivariate probit models are more appropriate than single probit models. The positive sign indicates that the different strategies are rather supplements than complements, but with a weak correlation. This means that, e.g. citizens increasing their physical activity to loose weight are less likely to get acupuncture to reduce their weight.

The first model compares results for passive versus active behavior (table 3). Significant results for gender indicate that women are more likely to be passive and visit for example a dietician while males are more likely to work out to reduce a weight gain. The more often someone weights him/herself the lower the probability to apply either strategy. Nationality proves to be significant for several countries. For example citizens from Brazil are more likely to show a passive behavior than being physical active while US Americans and citizens from the UK are more likely to become physically active. With regard to consumer attitudes food lovers are less likely to become physically active while the opposite is true for healthy eaters, worried consumers and those who hold trust in the food industry.

The second model compares results for changing dietary patterns versus active behavior (table 4). Significant results for gender indicate that women are more likely to change their diet and reduce for example their meal size while males are more likely to work out to reverse the weight gain. The more often someone weights him/herself the lower the probability to apply either strategy. Nationality proves to be significant for several countries. For example citizens from Brazil, Columbia, Egypt, The Netherlands and Turkey are less likely to change their diet to loose weight. Again US Americans and citizens from the UK are more likely to get physically active. The same holds for Chinese and Danish citizens. Regarding consumer attitudes food lovers are less likely to change their diet while the opposite is true for healthy eaters and concerned citizens.

The third model compares results for changing dietary patterns versus passive behavior (table 5). Significant results for gender indicate that women are more likely to do

both change their diet and at the same time seek for support going to doctors and the like. Again, the more often someone steps on the scales the lower the probability to apply either strategy. Nationality proves to be significant for several countries. For instance Koreans and Danes are less likely to show a passive behavior. Analyzing consumer attitudes food lovers are less likely to change their diet while the contrary is true for healthy eaters and concerned citizens. Worried people are more likely to show a passive behavior though.

**Table 3: Choosing “passive behavior” or “activity” if gaining weight**

	Q1 passive behavior				Q1 physical activity			
	Coef.	Std. err.	z-value		Coef.	Std. err.	z-value	
Gender	0.33	0.04	8.97 ***		-0.15	0.02	-6.15 ***	
Times of weighing	-0.12	0.01	-10.6 ***		-0.1	0.01	-13.08 ***	
Brazil	0.41	0.17	2.4 **		-0.16	0.1	-1.66 *	
Canada	0.13	0.17	0.77		0.4	0.09	4.53 ***	
Columbia	0.26	0.19	1.35		-0.33	0.11	-2.91 ***	
Denmark	-0.46	0.21	-2.17 **		0.18	0.1	1.83 *	
Egypt	0.36	0.18	1.98 *		0.06	0.11	0.58	
UK	0.09	0.18	0.48		0.3	0.1	3.09 ***	
USA	0.2	0.18	1.14		0.47	0.1	4.77 ***	
Netherlands	-0.24	0.18	-1.35		0.09	0.09	0.97	
Turkey	0.06	0.18	0.35		-0.46	0.1	-4.58 ***	
China	0.89	0.16	5.62 ***		0.54	0.09	5.95 ***	
India	0.13	0.18	0.68		-0.27	0.1	-2.72 ***	
Indonesia	0.26	0.17	1.56		-0.15	0.09	-1.69 *	
Korea	-0.59	0.22	-2.69 **		0.13	0.1	1.34	
Saudi Arabia	0.69	0.17	4.07 ***		0.01	0.1	0.14	
Singapore	-0.04	0.19	-0.21		0.06	0.1	0.55	
Chile	0.34	0.18	1.94 *		-0.21	0.1	-2.08 **	
Romania	0.18	0.16	1.12		-0.31	0.09	-3.5 ***	
Russia	0.02	0.17	0.13		-0.37	0.09	-4.13 ***	
Food lover	0.03	0.02	1.43		-0.05	0.01	-4.24 ***	
Healthy eater	0.04	0.03	1.26		0.22	0.02	10.86 ***	
Worry obesity	0.13	0.03	4.81 ***		0.07	0.02	4.16 ***	
Pro food industry	0.03	0.03	1.31		0.06	0.02	3.68 ***	
Constant	-1.57	0.17	-9.26 ***		-0.14	0.1	-1.44	
Rho	0.16	0.02	6.81 ***					

Wald  $\chi^2$  (48) = 1828.49, Log pseudolikelihood = -10404.48, Prob> $\chi^2$  = 0.00.

Asterisks indicate the level of significance at 1% for \*\*\*, 5% for \*\*, and 10% for \*.

**Table 4: Choosing “diet change” or “activity” if gaining weight**

	Q1 dietary change				Q1 physical activity			
	Coef.	Std. err.	z-value		Coef.	Std. err.	z-value	
Gender	0.37	0.02	15.66 ***		-0.15	0.02	-6.14 ***	
Times of weighing	-0.17	0.01	-21.04 ***		-0.1	0.01	-13.18 ***	
Brazil	-0.31	0.1	-3.08 ***		-0.16	0.1	-1.63 *	
Canada	0.06	0.09	0.61		0.41	0.09	4.55 ***	
Columbia	-0.6	0.11	-5.45 ***		-0.32	0.11	-2.79 ***	
Denmark	-0.03	0.1	-0.28		0.19	0.1	1.86 *	
Egypt	-0.3	0.11	-2.75 ***		0.06	0.11	0.55	
UK	0	0.1	-0.05		0.31	0.1	3.1 ***	
USA	0.13	0.1	1.23		0.47	0.1	4.78 ***	
Netherlands	-0.32	0.09	-3.59 ***		0.09	0.09	1.02	
Turkey	-0.59	0.1	-6 ***		-0.44	0.1	-4.38 ***	



**Table 4 continued**

	Q1 dietary change				Q1 physical activity			
	Coef.	Std. err.	z-value		Coef.	Std. err.	z-value	
China	-0.01	0.09	-0.12		0.54	0.09	5.99	***
India	-0.85	0.1	-8.52	***	-0.26	0.1	-2.63	***
Indonesia	-0.74	0.09	-8.14	***	-0.15	0.09	-1.6	
Korea	-0.71	0.1	-7.31	***	0.15	0.1	1.5	
Saudi Arabia	-0.01	0.1	-0.13		0.02	0.1	0.17	
Singapore	-0.64	0.1	-6.42	***	0.06	0.1	0.62	
Chile	-0.21	0.1	-2.07	**	-0.2	0.1	-1.98	**
Romania	-0.47	0.09	-5.4	***	-0.3	0.09	-3.35	***
Russia	-0.77	0.09	-8.85	***	-0.35	0.09	-3.95	***
Food lover	-0.13	0.01	-10.33	***	-0.05	0.01	-4.21	***
Healthy eater	0.14	0.02	7.02	***	0.22	0.02	10.89	***
Worry obesity	0.1	0.02	6.27	***	0.07	0.02	4.22	***
Pro food industry	0.03	0.02	1.59		0.06	0.02	3.67	***
Constant	1.02	0.1	10.43	***	-0.14	0.1	-1.47	
Rho	0.27	0.02	17.19	***				

Wald  $\chi^2$  (48) = 2786.77, Log pseudolikelihood = -15235.07, Prob> $\chi^2$  = 0.00.

Asterisks indicate the level of significance at 1% for \*\*\*, 5% for \*\*, and 10% for \*.

**Table 5: Choosing “passive behavior” or “diet change” if gaining weight**

	Q1 passive behavior			Q1 dietary change		
	Coef.	Std. err.	z-value	Coef.	Std. err.	z-value
Gender	0.34	0.04	9.15 ***	0.37	0.02	15.6 ***
Times of weighing	-0.12	0.01	-10.52 ***	-0.17	0.01	-21 ***
Brazil	0.4	0.17	2.32 **	-0.3	0.1	-3 ***
Canada	0.12	0.17	0.75	0.06	0.09	0.62
Columbia	0.25	0.19	1.27	-0.59	0.11	-5.4 ***
Denmark	-0.48	0.21	-2.27 **	-0.02	0.1	-0.2
Egypt	0.35	0.18	1.92 *	-0.29	0.11	-2.7 ***
UK	0.07	0.18	0.37	0	0.1	-0
USA	0.19	0.17	1.08	0.12	0.1	1.24
Netherlands	-0.25	0.18	-1.4	-0.32	0.09	-3.5 ***
Turkey	0.06	0.18	0.35	-0.58	0.1	-5.9 ***
China	0.87	0.16	5.5 ***	0	0.09	0
India	0.12	0.18	0.64	-0.84	0.1	-8.5 ***
Indonesia	0.24	0.17	1.42	-0.73	0.09	-8.1 ***
Korea	-0.62	0.22	-2.84 ***	-0.71	0.1	-7.3 ***
Saudi Arabia	0.67	0.17	3.95 ***	-0.01	0.1	-0.1
Singapore	-0.05	0.19	-0.28	-0.63	0.1	-6.4 ***
Chile	0.32	0.18	1.82 *	-0.2	0.1	-2 **
Romania	0.17	0.16	1.05	-0.46	0.09	-5.3 ***
Russia	0.01	0.17	0.06	-0.77	0.09	-8.8 ***
Food lover	0.03	0.02	1.43	-0.13	0.01	-10 ***
Healthy eater	0.04	0.03	1.31	0.14	0.02	6.98 ***
Worry obesity	0.13	0.03	4.99 ***	0.1	0.02	6.24 ***
Pro food industry	0.03	0.03	1.27	0.03	0.02	1.52
Constant	-1.57	0.17	-9.21 ***	1.02	0.1	10.4 ***
Rho	0.2	0.03	8.01 ***			

Wald  $\chi^2$  (48) = 2483.51, Log pseudolikelihood = -10408.01, Prob> $\chi^2$  = 0.00.

Asterisks indicate the level of significance at 1% for \*\*\*, 5% for \*\*, and 10% for \*.

### 3.2 Determinants of strategies to maintain body weight

To answer our second research question of what determines that different strategies are applied to maintain/ reduce weight continuously tables 6 to 8 present results of different bivariate probit models. In all three models the correlation coefficient rho is highly significant but with rather weak, positive correlations. Nevertheless, the correlation is stronger than in the first three models presented. Again, the significance points towards the fact that the bivariate probit models are more appropriate than single probit models. The positive sign indicates that the different strategies are rather supplements than complements, but with a weak correlation. The dependent variables included in the different models are the same as in the models presented in section 3.1. All variables prove to be significant.

The first model compares results for passive versus active behavior (table 6). Significant results for gender indicate that women are more likely to be passive and men are more likely to become physically active. Similar to the models in the previous section, the more often someone weights him/herself the lower the probability to apply any of the strategies. Nationality proves to be significant for all researched countries. Interestingly the results differ from those to the first research question. Almost all signs are negative. Results for consumer attitudes lead to the assumption that food lovers are less likely to become physically active which does not hold for healthy eaters, concerned citizens and those who hold trust in the food industry. This again is similar to the results under section 3.1.

The second model compares results for changing dietary patterns versus active behavior (table 4). Similar to the results under section 3.1 significant results for gender indicate that women are more likely to change their diet and reduce for example their meal size while men are more likely to work out to maintain their weight. Nationality proves to be significant for all surveyed countries. But in contrast to the models from the previous section almost all signs are negative. Looking at consumer attitudes food lovers are less likely to either get active or change their diet while the opposite is true for healthy eaters and worried consumers.

The third model compares results for passive behavior/ advice versus dietary behavior (table 8). Significant results for gender indicate that women are more likely to be passive and at the same time change their dietary patterns. Nationality again proves to be significant for all sampled countries. For example citizens from Brazil are more likely to show a passive behavior than being physical active while US Americans and citizens from the UK are more likely to get physically active. With regard to consumer attitudes again food lovers are less likely to get physically active to maintain their weight while results indicate that the opposite is true for healthy eaters, concerned and trustful citizens.

**Table 6: Choosing “advice” or “activity” to maintain or reduce weight**

	Q2 passive behavior/ Advice			Q2 physical activity		
	Coef.	Std. err.	z-value	Coef.	Std. err.	z-value
Gender	0.40	0.03	13.88 ***	-0.07	0.03	-2.61 ***
Times of weighing	-0.16	0.01	-18.45 ***	-0.13	0.01	-16.17 ***
Brazil	-0.35	0.10	-3.41 ***	-0.75	0.10	-7.63 ***
Canada	-0.59	0.09	-6.29 ***	-0.53	0.09	-6.06 ***
Columbia	-1.10	0.14	-8.04 ***	-0.56	0.11	-5.21 ***
Denmark	-0.79	0.11	-7.35 ***	-0.8	0.10	-7.98 ***
Egypt	-0.78	0.12	-6.55 ***	-0.81	0.11	-7.41 ***

**Table 6 continued**

	Q2 passive behavior/ Advice			Q2 physical activity		
	Coef.	Std. err.	z-value	Coef.	Std. err.	z-value
UK	-0.45	0.10	-4.43 ***	-0.6	0.10	-6.11 ***
USA	-0.54	0.10	-5.24 ***	-0.46	0.10	-4.81 ***
Netherlands	-0.69	0.09	-7.33 ***	-0.96	0.09	-10.74 ***
Turkey	-0.99	0.11	-9.02 ***	-1.05	0.10	-10.64 ***
China	0.17	0.09	1.89 *	-0.57	0.09	-6.49 ***
India	-0.68	0.11	-6.30 ***	-1.13	0.10	-11.06 ***
Indonesia	-1.42	0.11	-12.78 ***	-1.66	0.10	-16.98 ***
Korea	-1.41	0.12	-11.54 ***	-0.81	0.10	-8.37 ***
Saudi Arabia	-0.39	0.10	-3.81 ***	-1.23	0.10	-12.23 ***
Singapore	-1.25	0.12	-10.40 ***	-1.13	0.10	-11.08 ***
Chile	-0.58	0.11	-5.43 ***	-0.96	0.10	-9.38 ***
Romania	-1.02	0.09	-10.88 ***	-1.54	0.09	-17.13 ***
Russia	-1.07	0.10	-11.25 ***	-1.17	0.09	-13.38 ***
Food lover	-0.05	0.01	-3.12 ***	-0.02	0.01	-1.93 *
Healthy eater	0.05	0.02	2.19 **	0.13	0.02	6.37 ***
Worry obesity	0.17	0.02	8.04 ***	0.1	0.02	5.74 ***
Pro food industry	0.05	0.02	2.56 ***	0.04	0.02	2.50 ***
Constant	0.16	0.10	1.62	0.75	0.10	7.77 ***
Rho	0.26	0.02	13.90 ***			

Wald  $\chi^2$  (48) = 2876.03, Log pseudolikelihood=-11821.37, Prob> $\chi^2$ =0.00.

Asterisks indicate the level of significance at 1% for \*\*\*, 5% for \*\*, and 10% for \*.

**Table 7: Choosing “activity” or “diet” to maintain or reduce weight**

	Q2 physical activity			Q2 dietary change		
	Coef.	Std. err.	z-value	Coef.	Std. err.	z-value
Gender	-0.06	0.03	-2.49 ***	0.33	0.02	13.77 ***
Times of weighing	-0.13	0.01	-16.35 ***	-0.16	0.01	-20.35 ***
Brazil	-0.75	0.1	-7.57 ***	-1.24	0.1	-11.84 ***
Canada	-0.53	0.09	-6.03 ***	-0.78	0.1	-8.09 ***
Columbia	-0.56	0.11	-5.14 ***	-1.09	0.12	-9.47 ***
Denmark	-0.8	0.1	-7.93 ***	-0.64	0.11	-5.99 ***
Egypt	-0.82	0.11	-7.41 ***	-1.11	0.12	-9.58 ***
UK	-0.6	0.1	-6.1 ***	-0.94	0.11	-8.94 ***
USA	-0.46	0.1	-4.77 ***	-0.86	0.11	-8.09 ***
Netherlands	-0.96	0.09	-10.66 ***	-1.36	0.1	-14.09 ***
Turkey	-1.05	0.1	-10.55 ***	-1.57	0.11	-14.91 ***
China	-0.58	0.09	-6.44 ***	-0.56	0.1	-5.73 ***
India	-1.13	0.1	-11 ***	-1.07	0.1	-10.29 ***
Indonesia	-1.67	0.1	-17 ***	-1.52	0.1	-15.52 ***
Korea	-0.81	0.1	-8.32 ***	-1.9	0.11	-17.62 ***
Saudi Arabia	-1.23	0.1	-12.09 ***	-0.73	0.1	-7.14 ***
Singapore	-1.12	0.1	-10.98 ***	-1.38	0.11	-13.08 ***
Chile	-0.96	0.1	-9.31 ***	-1.14	0.11	-10.63 ***
Romania	-1.53	0.09	-16.91 ***	-1.03	0.09	-11.07 ***
Russia	-1.16	0.09	-13.18 ***	-1.64	0.09	-17.34 ***
Food lover	-0.02	0.01	-1.89 *	-0.14	0.01	-10.98 ***
Healthy eater	0.13	0.02	6.25 ***	0.16	0.02	8.02 ***
Worry obesity	0.1	0.02	5.8 ***	0.15	0.02	8.58 ***
Pro food industry	0.04	0.02	2.47 ***	0.05	0.02	3.04 ***
Constant	0.76	0.1	7.82 ***	1.47	0.1	14.01 ***
Rho	0.31	0.02	18.21 ***			

Wald  $\chi^2$  (48) = 3191.69, Log pseudolikelihood = -14153.60, Prob> $\chi^2$  = 0.00.

Asterisks indicate the level of significance at 1% for \*\*\*, 5% for \*\*, and 10% for \*.

**Table 8: Choosing “advice” or “diet” to maintain or reduce weight**

	Q2 passive behavior/ Advice			Q2 dietary change			
	Coef.	Std. err.	z-value	Coef.	Std. err.	z-value	
Gender	0.4	0.03	13.96 ***	0.33	0.02	13.81 ***	
Times of weighing	-0.16	0.01	-18.59 ***	-0.16	0.01	-20.35 ***	
Brazil	-0.34	0.1	-3.36 ***	-1.24	0.1	-11.92 ***	
Canada	-0.57	0.09	-6.16 ***	-0.78	0.1	-8.21 ***	
Columbia	-1.08	0.14	-7.97 ***	-1.09	0.11	-9.53 ***	
Denmark	-0.78	0.11	-7.29 ***	-0.64	0.11	-5.98 ***	
Egypt	-0.79	0.12	-6.61 ***	-1.11	0.11	-9.63 ***	
UK	-0.45	0.1	-4.39 ***	-0.94	0.1	-8.95 ***	
USA	-0.53	0.1	-5.16 ***	-0.86	0.1	-8.23 ***	
Netherlands	-0.67	0.09	-7.18 ***	-1.36	0.1	-14.18 ***	
Turkey	-0.96	0.11	-8.78 ***	-1.58	0.1	-15.1 ***	
China	0.18	0.09	1.94 *	-0.56	0.1	-5.76 ***	
India	-0.68	0.11	-6.28 ***	-1.07	0.1	-10.37 ***	
Indonesia	-1.42	0.11	-12.96 ***	-1.52	0.1	-15.64 ***	
Korea	-1.41	0.12	-11.49 ***	-1.91	0.11	-17.73 ***	
Saudi Arabia	-0.38	0.1	-3.74 ***	-0.73	0.1	-7.13 ***	
Singapore	-1.25	0.12	-10.41 ***	-1.39	0.11	-13.16 ***	
Chile	-0.57	0.11	-5.35 ***	-1.14	0.11	-10.66 ***	
Romania	-1	0.09	-10.71 ***	-1.03	0.09	-11.14 ***	
Russia	-1.06	0.1	-11.09 ***	-1.64	0.09	-17.51 ***	
Food lover	-0.05	0.01	-3.15 ***	-0.14	0.01	-11.02 ***	
Healthy eater	0.05	0.02	2.26 **	0.16	0.02	8.01 ***	
Worry obesity	0.16	0.02	8.11 ***	0.15	0.02	8.58 ***	
Pro food industry	0.05	0.02	2.33 **	0.05	0.02	3.01 ***	
Constant	0.17	0.1	1.63	1.46	0.1	14.09 ***	
Rho	0.44	0.02	22.64 ***				

Wald  $\chi^2$  (48) = 3257.55, Log pseudolikelihood = -12425.89, Prob> $\chi^2$  = 0.00.

Asterisks indicate the level of significance at 1% for \*\*\*, 5% for \*\*, and 10% for \*.

#### 4. Conclusions and Outlook

This paper deals with the questions of what influences strategies 1) to reduce body weight once a certain threshold is exceeded and 2) to maintain/ reduce body weight to keep a certain body weight continuously. As strategies we defined physical activity, change in dietary patterns and passive behavior, i.e. advice seeking. Determinants defined are body consciousness measured by means of average times of weighing, gender, nationality to account for cultural differences and attitudes towards food, diets and the food industry. Our findings show that different strategies are chosen by different segments. For example results for gender indicate that women are more likely to be passive and at the same time change their dietary patterns once their weight exceeds a certain threshold. This result is similar to the findings under the research question regarding continuous reduction of weight, i.e. maintaining a certain weight. This outcome leads to the conclusion that women prefer to change dietary patterns but rather seek support from others in doing so. This might in the end lead to a more successful result regarding weight loss. The differences in nationality regarding weight loss strategies could be helpful to create communication policies in the different countries. For example, if results indicate that a rather passive behavior is preferred; strategies could be developed to promote physical activity which might lead to better outcomes when it comes to weight reduction. The more often someone weighs him/herself the lower the probability to apply any of the strategies.

This could be explained with the fact that these people generally might have a lower weight and will not encounter such a situation, considering that some consumers weigh themselves multiple times a day. Attitudes show that consumers act according to their opinion in that food lovers have a low probability to change their eating habits to loose weight. Hence, those consumers need other strategies and advice to maintain a healthy weight. The opposite is true for consumers that are already concerned and believe in healthy eating habits. They could be supported by the promotional and educational strategies using rather cognitive and rational communication methods to assure that they maintain a healthy weight.

Limitations to the results stem from the fact that we were not able to include all three dependent variables in one model and therefore had to model all pairings of the strategies, leading to a great number of tables. A different approach would have been three single probit models, but with the correlation coefficient rho being significant the bivariate probit still seems to be the better choice. We will work on this to be able to present results still in comparison but more comprised. Furthermore, conducting a consumer survey around the world leads to limitations in that only a limited number of questions can be asked. For that reason we focused on attitudes, gender and nationality as determinants of health conscious behavior, being aware that several other constructs such as preferences, perception and socio-demographics other than gender determine choice of strategy.

Future research will be conducted by means of interaction effects to be able to account for differences in particular behavior and nationality. One might think of culture influencing attitudes, this could be depicted including interaction effects of nationality and attitude in the regression. Also, segmentation approaches or pattern analyses used in data mining might be useful to better account for regional effects.

## References

- COMMISSION OF THE EUROPEAN COMMUNITIES (2005): *Promoting healthy diets and physical activity: a European dimension for the prevention of overweight, obesity and chronic diseases*. Green Paper, Brussels, 08.12.2005, COM 637 final.
- DAVIS, S. (2001): Food choice in Europe - the consumer perspective. FREWER, L.; E. RISVIK & H. SCHIFFERSTEIN (eds.): *Food, people and society: a European perspective of consumers' food choices*, Berlin: 365-380.
- GREENE, W.H. (2000): *Econometric Analysis*. Prentice Hall, New Jersey, USA, 4th edition.
- OLSSON, U. (1979): Maximum likelihood estimation of the polychoric correlation coefficient. *Psychometrika*, 44 (4), 443-460.
- YACH, D., STUCKLER, D., & K.D. BROWNELL (2006): Epidemiologic and economic consequences of the global epidemics of obesity and diabetes. *Nature medicine*, 12(1):62-6.