The Impact Of Socio-Demographic Factors And Political Perceptions On Consumer Attitudes Towards Genetically Modified Foods: An Econometric Investigation

Lila Antonopoulou, Christos T. Papadas, and Antonis Targoutzidis[*]

Abstract

This survey-based paper investigates the impact of socio-demographic factors, along with political perceptions, as expressed by attitudes towards globalization, on consumer attitudes towards GM foods, in Greece. Different aspects of consumer attitudes regarding GM foods are examined, such as general preference, banning, labeling, intention to purchase them at a sufficiently low price, the nutritional category of food product and the proximity of the genetic modification to the final product. Econometric analysis using Logit and Probit models was conducted. Estimates clearly show that in general, attitudes towards GM foods are not affected by socio-demographic characteristics. However, political perceptions are a significant influential factor.

Keywords: *Globalization, political, genetically modified food, econometric*

JEL Classification: D12, M31, R22

Introduction

After the 2004 settlement on the trade regulation of genetically modified (GM) food products in EU, the debate has largely turned to consumer behavior and attitudes towards these products, which is the topic of investigation in an expanding literature. Consumers do not accept a scientific development as necessarily beneficial to society (Bonny, 2003) and this belief may stem from different sources and backgrounds.

Subjective prior beliefs on attributes are held by consumers (Akerlof 1970, Stigler 1961, Molho 1997), and their opinions do not appear to be based on expert knowledge (Trewavas 1999, 2001). Alternative models have distinguished in the past between spontaneous and well thought out decisions of consumers (Fazio 1986, Triandis, 1980). In the case of GM products, the debate and the perception of risk or their rejection, do not appear to be based on scientific proof for risks particular to genetic modification

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[*]   Lila Antonopoulou: Assistant Professor Department of Economics, Aristotle University of Thessaloniki, University Campus, 54124 Thessaloniki, Greece
tel. +302310996454, fax. +302310996456, email: lanton@econ.auth.gr,
Christos T. Papadas: Assistant Professor, Department of Agricultural Economics and Rural Development, Agricultural University of Athens, Iera Odos 75, Botanikos 11855, Athens, Greece
tel. +302105294724, fax. +30210529 4764, email: cpap@aua.gr
Antonis Targoutzidis (corresponding author): Regional Director of the Hellenic Institute for Occupational Health and Safety, 26 Octovriou 90, 54628 Thessaloniki, Greece
tel. +302310501035, fax. +302310501055, email: targoutzidis@elinyae.gr

(Conner and Jacobs, 1999). Even though consumers obtain new information to update prior beliefs on products (DeGroot 1970, Molho 1997, Tirole 2003), there is evidence that for GM foods in particular, there is a refusal of consumers to adjust opinions on the basis of new evidence (Trewavas & Leaver 2001). This may be due to intuitive rather than rational thinking (Haidt 2001) especially when one considers the moral aspects of the debate as mentioned above (Magnusson and Koivisto Hursti 2002). Dual process theories recognize intuitive and rational thinking as the two orthogonal types of information processing (Epstein et al. 1996, Stanovich & West 2000, Loewenstein et al. 2001).

Despite the previous findings on the role and effectiveness of information on attitudes towards GM foods, more recent literature suggests that uninformed consumers are significantly more sensitive to new information from interested and third parties than consumers who had informed prior beliefs and seem largely unaffected (Huffman et al. 2004).

GM foods have been associated also with "magical thinking" which is the belief that "objectively unrelated objects and events can somehow affect one another solely because of their similarity or contiguity in time and space, in a manner not governed by any ordinary principle of transmission of energy or information" (Saher et al. 2006, Rozin & Nemeroff 1990, Vyse 1997).

Most studies investigating and dealing with explicit attitudes towards GM products are survey based on a questionnaire or interview format (Cook et al. 2002, etc). Despite the usefulness of knowledge and information on explicit attitudes, it has been found that implicit attitudes are very helpful in predicting consumer behavior (Fazio & Olson 2003a). Contrary to explicit attitudes which are derived and measured from responses consciously controlled, implicit attitudes are more spontaneous and automatic.

A literature review on implicit attitude measurements is found in Spence (2005). They are based on non verbal behavior, specially designed physiological examination, reaction time tests, etc. They are more stable than explicit attitudes (Hermans et al. 2003) for which, it has been argued that are easier to manipulate, change in a short period of time, and contrary to what other studies show, they are very susceptible to new information received (Fazio & Olson, 2003b). In general, a distinction and understanding of the relationships between implicit and explicit attitudes may well explain significant differences between stated consumer beliefs and actual consumer behavior.

It is inappropriate to make generalizations on consumer attitudes based on different surveys, because of different dates, places, context of analysis, questionnaire formulations, etc. (Bonny 2003). Different economic conditions and tradition or rapid change of market structure could affect perceptions on GM foods (Curtis et al. 2004). Studies show that explicit attitudes vary considerably between different countries. According to Eurobarometer (2001) survey, country appears to be the most important factor of differentiation and there is certainly a need to understand the components of this factor. It is supported that national culture, differences in public debate and government action, economic development and industrialization, tradition, etc, are major components of the country factor (Zechendorf 1998, De Cheveigné et al. 2002, Springer at al. 2002, Grimsrud et al. 2003, etc). However, it was also found that simply an area being urban and industrial is not an important factor for consumer attitudes (Eurobarometer 2001).

Socio-demographic variables are usually among the first that come to mind as poten-

tial factors influencing consumer attitudes and intentions. It is not surprising that their role as such was commonly examined and measured in numerous studies (eg. Onyango & Nayga 2004, Hossain et al. 2002, etc). In several of them, variables such as gender, age, level of education etc., were found to exercise some influence (Jussanme & Judson 1992, Baker & Burnham 2001, Mc Cluskey et al. 2003, etc).

Other studies are less supportive of the significance of socio-demographic factors (Bonny 2003, Sprinder et al. 2002, etc.). Isaacs (2001) for example, found that such variables did not make any difference in willingness or unwillingness of consumers to purchase GM products.

There is clear evidence of the existence of a political component in consumer attitudes towards GM foods, even though this component may appear in more than one forms. Some consumers for example, reject GM foods because they believe it will disadvantage the economies of developing nations (Tenbült et al. 2005, Gamble et al. 2000) and shift the distribution of trade benefits against them, even though some studies (Paarlberg 2002) argue that on the contrary, a ban on GM production and trade may actually hurt these economies. Consumer perceptions and trust on government and also on biotechnology companies, together with trust in science, are influential factors too (Frewer et al. 1998, Hossain et al. 2002).

This study attempts to explore also the impact of political factors on consumer attitude against GM food, by quantitative analysis of a questionnaire-based survey in Greece, which is one of the most extreme countries in opposing GM foods in EU, according to Eurobarometer (2002) survey. This impact is compared to the one of socio-demographic factors. Several aspects of attitude against GM foods, such as effect of the price on GM food acceptance, labeling preferences, effect of the type of food and the extent of genetic modification to the final product are also investigated.

Methodology

For the purposes of the quantitative analysis of this paper, information and data on the employed variables were collected from the responses in questionnaires that were distributed to consumers in different areas of the Greek city of Thessaloniki. After excluding few questionnaires containing inconsistencies (double answers in the same question, etc), 333 valid questionnaires were considered. The distribution areas were selected to contribute to a representative consumer sample in terms of socio-demographic characteristics.

Logit and Probit regression models are used to obtain econometric estimates of the investigated relationships between various factors. Factors that potentially affect beliefs and attitudes are the independent variables. Four socio-demographic characteristics, including age, gender, education and income class, along with political perceptions, were considered as such. In order to test the hypothesis that there is a political component influencing consumer attitudes, this study uses as a proxy variable for this component, attitudes towards "globalization". There are many parameters that can describe political beliefs, whereas consumers' exact definition of globalization may vary. However, globalization as a general and sometimes abstract notion represents a wide and concise spectrum of components of political orientation that is becoming the core of the political debate, gradually replacing traditional political segmentation. Witkowski

(2005) has already discussed the relation between anti-globalization and rejection of genetic modification, whereas Bonny (2003) argues that GM foods are seen as a scapegoat for anti-globalization, while some of the most opposing forces to GM products are anti-globalization organizations.

The first five questions of the questionnaire relate to consumer characteristics resulting to the exogenous, independent variables. Consumer characteristics (sociodemographic and view on globalization) of every observation, fall into certain categories (eg, age of less than 30 years old). Based on these categories for each characteristic, dummy variables are defined as the independent variables of the logit and probit regressions. For every characteristic there are as many dummies as the number of categories for the characteristic, minus one (for a category only, no dummy is specified). Each dummy corresponding to a certain category of a characteristic, takes the value 1 if the observation's characteristic falls indeed into this category, and the value 0 if otherwise. Therefore, whenever a consumer's characteristic falls into the category to which no dummy is assigned, all defined dummies for this characteristic take the value 0.

Table 1 shows the consumer characteristics considered, the categories to which these are distinguished, the number of dummy variables corresponding to each characteristic, and the proportion of consumers falling into each category in our sample.

Two dependent variables considered in this study reflect and relate directly to consumers' explicit attitudes towards using GM foods. Respondents were requested to state whether they are generally in favor or not of GM foods and whether they believe that their production and trade should be banned. The third variable examines their intention to purchase a GM food product in the event of a sufficiently low price. The fourth endogenous variable describes consumers' attitudes towards mandatory labeling which is also related to the consumer information issue. There is a strong demand for labeling but strong objection towards GM products prevailing in Europe does not provide the whole picture, especially for northern countries (e.g. The Netherlands or the UK). The actual results of labeling policies are among the new areas of marketing research.

The fifth dependent variable describes consumers' attitudes towards GM foods and related products which are not usually considered as basic or "ordinary". Such products can be confectioneries, chips, drinks, tobacco, etc. There is evidence that this type of distinction between products affects consumer attitudes (Gaskell et al. 2003, Holmberg 2002, Food & Drink Weekly 2000, Grunert et al. 2001 etc.). Moreover, Teisl & Levy (1997) argue that "consumers may act as if they hold nutricient (or health risk) budget" between different food categories.

The sixth dependent variable refers to consumer attitudes towards GM foods with reduced "extent of genetic modification". This variable refers to the stage of processing where genetic modification took place. For example this perceived extent is obviously different for meat from GM animals than from meat from animals fed with GM forage. There are detailed studies that examine consumer attitudes in such scenarios and for different products as well (Grunert et al. 2001).

Six questions of the questionnaire, following the five mentioned, relate to the qualitative dependent variables employed, as shown in Table 2. It appears that consumer responses on dependent variables of the sample are in accordance with the findings of Eurobarometer surveys for Greece.

Different quantitative methods have been used to examine the impact of certain fac-

tors on consumers' attitudes towards GM products. It is the qualitative nature of the dependent variables that led to the choice of logit and probit types of regression analysis, which is adopted in this study.

Table 1. Consumer characteristics and independent variables

Consumer Characteristic	Category of characteristic	Number of Dummy variables	Sample Proportion
Consumer age	less than 30 y.o.	2	35.43%
	between 30 & 50 y.o.		38.74%
	more than 50 y.o.		25.83%
Consumer gender	male	1	49.55%
	female		50.45%
Consumer education	no completed secondary	3	17.12%
	completed secondary		49.92%
	completed university		25.23%
	completed postgraduate		8.4%
Net monthly family Income	less than 1,000	2	34.53%
	1,000 – 2,500		48.9%
	more than 2,500		16.5%
Opinion on globalization	in favor	2	30.33%
	against		56.2%
	doesn't know		13.51%

Given the strong negative attitudes towards GM foods in Greece and our sample, in every question related to a dependent variable, a significantly high percentage rate of responses is similar, while the opposite choice of response and the "don't knows" attract much lower percentages of responses. This reduces substantially the variation of the dependent variable between the three alternative responses, which would be desired to conduct multinomial logit and probit analysis. For this reason the binomial type of logit and probit models are implemented. Responses expressing negative attitude towards GM foods were assigned the observed value 1. Responses "favoring" GM foods and the "don't knows" were both given the value 0 representing "non-negative" attitude. Table 2 shows also the detailed list of possible values for the dependent variables.

Results

Logit and probit results exhibit strong similarities with a slight only superiority of the logit specification. For this reason only the results of logit analysis are presented and discussed here. In addition, regressions are conducted with various combinations of independent variables, omitting and replacing some of them each time, because of the low levels of their estimated significance. This process is followed in regressions of all six dependent variables.

As a result, a considerable number of logit equation estimates is derived. In all estimated equations, views on globalization are statistically significant and add to the low goodness of fit. As a rule, socio-demographic variables display lack of significance

which persists even at high levels of statistical significance. There are only few exceptions discussed below. For this reason, only logit results with statistically significant coefficients (above 5% level of significance) are presented here.

Table 2. Dependent variables and values

Dependent Variable	*Observation*	*Values*	*Sample proportion*
NGM: General attitude towards GM foods	Favors the use of GM foods	0	10.5%
	Against the use of GM foods	1	81.4%
	Do not have an opinion	0	8.2%
BGMF: Attitude towards banning of GM foods	GM foods should be banned	1	73.9%
	GM foods should not be banned	0	19.2%
	Do not have an opinion	0	6.9%
NCGM: Would buy a GM food if sufficiently cheaper.	Yes	0	16.2%
	No	1	78.7%
	I don't know	0	5.1%
MLAB: Favoring mandatory labeling	Yes	1	93.39%
	No	0	3.6%
	I don't know	0	3.0%
NBGM: Would buy Non basic GM products (cigarettes, alcohol, snacks, etc)	Yes	0	16.52%
	No	1	78.1%
	I don't know	0	5.4%
NDGM: Would buy food with distant GM (buying milk from GM fed cow)	Yes	0	18.3%
	No	1	75.1%
	I don't know	0	6.6%

Tables 3 and 4 present six sets of maximum likelihood estimates. Each set of estimates corresponds to a logit regression, one for each dependent variable (and the significant independent variables). Table 3 shows the estimated coefficients, their standard errors and z values, estimated 95% confidence intervals for the coefficients, and the pseudo-R^2 estimate of each logit model. Table 4 shows for each regression the more important, estimated marginal probability effects of every independent variable.

A dummy's estimated coefficient associates the dummy's value of 1, with the probability of the dependent variable taking value 1. The marginal probability effect of a dummy variable shows the change in the probability of the dependent variable taking value 1 (observation falling into the category represented by the unit), as the dummy changes value from 0 to 1 (an observed independent variable changes and falls into the category represented by the unit). Standard errors, z values, and 95% confidence intervals, for the estimated marginal probability effects are also provided.

In this first regression, with NGM as a dependent variable, CONST is the usual constant that enters a logit regression too, and NGLOB is a dummy variable taking value 1 if the respondent is against globalization and 0 otherwise (he/she is in favor of globalization or doesn't have an opinion).

Table 3. Statistically significant independent variables

Dependent Variable	Significant independent variable	Estimated Coefficient	Standard Errors	Z values	95% C. I.	Pseudo-R^2
NGM	CONST	0.808	0.180	4.51	0.457 1.160	0.09
	NGLOB	1.494	0.311	4.80	0.884 2.104	
BGMF	CONST	0.474	0.170	2.79	0.141 0.808	0.06
	NGLOB	1.103	0.258	4.27	0.597 1.609	
NCGM	CONST	1.062	0.202	5.24	0.665 1.458	0.08
	NGLOB	0.974	0.282	3.45	0.421 1.528	
	NSED	-1.150	0.320	-3.60	-1.777 -0.523	
MLAB	CONST	2.654	0.347	7.66	1.974 3.333	0.07
	NGLOB	0.960	0.466	2.06	0.466 1.874	
	UED	-1.262	0.453	-2.78	-2.15 -0.372	
NBGM	CONST	0.895	0.196	4.56	0.51 1.28	0.09
	NGLOB	1.253	0.287	4.36	0.691 1.816	
	NSED	-1.011	0.325	-3.11	-1.648 -0.375	
NDGM	CONST	0.871	0.211	4.12	0.457 1.285	0.06
	NGLOB	0.838	0.259	3.23	0.33 1.347	
	AGE	-0.577	0.261	-2.21	-1.089 -0.643	

Apart from the constant, only negative attitudes towards globalization present strong significance as the z value shows. In fact NGLOB is significant even at levels of significance almost identical to zero (P>|z|=0) and subsequently the confidence interval does not contain zero. The low value of pseudo-R^2, not uncommon in such cross section analysis, reflects the inadequacy of most independent variables to capture the variation of the dependent variable.

The significance of NGLOB is demonstrated by its marginal probability effect as well, which is also non-negligible and substantially different than zero as the z value shows, and maintains its statistical significance at all levels its statistical significance.

For BGMF, the only statistically significant independent variable is NGLOB. And it is so, at all levels of significance. The positive coefficient of this variable shows that opposition to globalization relates significantly and positively to the probability of being also in favor of a ban on GM foods. This result is confirmed by the significant - at all levels - marginal probability effect, including its confidence interval. The constant term of the regression, also significant as in all cases in picking up a large part of the dependent variable's variation, gains its statistical significance at a 0.5% level only.

For NCM the significant independent variables found in the regression are NGLOB again, and a dummy (NSED) related to education. The dummy takes value 1 if the respondent did not complete secondary education and 0 otherwise. Rejection of globalization is positively and significantly related to the probability of refusing to purchase GM food even at a lower price. On the other hand, non-completed secondary education is significant with a negative sign. It reduces therefore the probability of refusing purchase if the GM food is sufficiently cheap (and increases the chances of buying a GM food if it is sufficiently cheap, or at least not be certain about that).

Table 4. Marginal effects after Logit

		Marginal Probability Effect	*Standard Error*	*Z value*	*95% C. I.*
Pr(NGM) = 0.839 (prediction)	NGLOB	0.217	0.0436	4.98	0.132 0.303
Pr(BGMF) = 0.749 (prediction)	NGLOB	0.212	0.049	4.36	0.117 0.308
Pr(NCGM) = 0.804 (prediction)	NGLOB	0.159	0.046	3.46	0.069 0.249
	NSED	-0.220	0.069	-3.17	-0.357 -0.084
Pr(MLAB) = 0.947 (prediction)	NGLOB	0.053	0.026	2.0	0.001 0.104
	UED	-0.0871	0.0381	-2.28	-0.162 -0.012
Pr(NBGM) = 0.806 (prediction)	NGLOB	0.205	0.046	4.44	0.115 0.296
	NSED	-0.189	0.069	-2.75	-0.324 -0.054
Pr(NDGM) = 0.757	NGLOB	0.158	0.049	3.24	0.063 0.253
	AGE	-0.11	0.051	-2.15	-0.211 -0.01

The significance of NSED holds at almost all levels of significance while NGLOB is significant, at the 1% level as well. The constant term is also significant at all levels. Low educational levels are positively related with low incomes and this may partially explain the negative sign of NSED, even though low income itself was not found significant (this however may be due to not accounting for concentration of the least edu-

cated belonging in the low income class).

Similar arguments hold for the probability marginal effects of each dummy variable. Again, these effects exhibit strong significance (and even though the absolute marginal effect of NSED is larger than that of NGLOB, the latter becomes significant at 0.1% level of significance and the former at 0.2%, due to its larger standard error).

For MLAB, two significant variables were found, NGLOB and UED which is a dummy for education taking value 1 if the respondent has completed university education (not postgraduate) and 0 if otherwise. Again, as one would expect the significant coefficient of NGLOB has a negative sign, showing that the respondent's opposition to globalization increases his/hers probabilities of favoring mandatory labeling. It is interesting to note also that the significance of NGLOB coefficient begins at the 3.9% level which is certainly not high but higher than in the other regressions where the significance was stronger. This reduction in significance compared to other regressions is attributed to the fact that an important proportion of respondents who are not opposing globalization and GM foods, are still favoring mandatory labeling.

A somewhat surprising result is that university graduates are more likely to oppose mandatory labeling, since a significant part of those against it are concentrated in this educational category. More information, such as the kind of education, could have helped perhaps to understand this result. However, the same result does not extend to holders of postgraduate degrees.

The marginal probability effects of the two variables are as expected significant. However, following our discussion on the impact of both variables, it is to be expected that these effects are not very large. In fact they are the smallest marginal effects in all logit models estimated. The two 95% confidence intervals do not contain zero but their lower and upper limit respectively are close to 0.

For NBGM, the two significant independent variables found are NGLOB again and NSED as in the third logit model presented. The results on NSED are in fact compatible with the findings of the third regression.

Opposition to globalization, is a significant factor of increasing the probability of refusing to purchase a GM food product, even if it is not basic. On the other hand, a respondent's lack of completed secondary education is significant in reducing the probability of refusal to buy and therefore increases the chances of purchasing such a product or at least the respondent's not being certain about that. NGLOB is significant at almost all levels and NSED above 2%.

The marginal probability effects are exhibiting similar characteristics as expected with that of NGLOB being significant at all levels of significance and the one of NSED above the relatively high 6% level.

Finally, for NDGM, the two significant independent variables are NGLOB (at levels 1% and above) and a dummy AGE which takes values 1 if the respondent is 30 years old or less, and 0 otherwise. This variable is significant above the 2.7% level.

The results show that opposition to globalization is positively related to the probability of refusing to purchase the milk of an animal fed with GM products despite the "distance" of the occurred modification. On the contrary, a younger age of 30 or less is negatively related to the probability of refusal to purchase (and therefore positive relationship to the probability of purchase or at least not be certain about that). Young people's lower sense of potential danger combined with the distance of the genetic modifi-

cation may be the cause that reduces the negativity of attitudes observed towards such products.

The marginal probability effects are also significant even though their size and significance, especially those for AGE are relatively small compared to most of the other estimates. The 95% confidence interval for AGE's effect in particular, is very close to containing zero, even though it does maintain its significance above the 3.2% level (1% for the effect of NGLOB).

Discussion

Socio-demographic factors with regard to their impact on consumer preferences for GM foods have been studied in many papers. Young people (especially students), higher income classes, and males, appear to be less hostile to GM foods (Bonny 2003, Eurobarometer 2002). However, it has also been reported that very poor people are also less hostile to GM foods, as in Pachico and Wolf (2002) where GM acceptance was high among respondents in the study that felt they did not have adequate food for their families. Level of income did not appear to be a significant influencing factor in the present survey. Age appeared to have an impact only in foods with "distant" modification, with young people being more positive for them.

In Canada where socio-demographic factors were found to have some influence on acceptance of GM foods, gender had a moderate effect with females being more negative about this type of foods (Lockie et al. 2005). The suggestion that females are less likely to accept GM products is supported by several other studies (Hall & Moran 2006, Subrahmanyan & Cheng 2000, Moon & Balasubramanian 2001, Norton 1999). No such trend, however, appeared in this study.

The level of education is another factor found to affect perceptions, with holders of postgraduate degrees valuing risks due to genetic modification significantly lower than those with less education (Hall & Moran 2006, Moon & Balasubramanian 2001, Gaskell et al. 2003). The subject of education may be important too. For example, there were findings that students of natural sciences were less negative about GM foods (NSF 2000, Priest 2000). Similar findings for graduates of natural science programs support the view that this type of education may be related with more positive or less negative attitudes towards GM food (Bredahl 2001, Grunert et al. 2001). Perhaps then, the finding that acquiring new information enhances negative attitudes rather than acceptance of GM foods (see discussion in Lawrence et al. 2001, Grice & Lawrence 2003), simply raises again the issue of the source of information, the accuracy or partiality of information and the process of transferring it.

In this study, in addition to consumer views on globalization, only a variable on education and another on age, appeared to have an effect on some attitudes.

In general, socio-demographic factors do not appear to have a concise and clear impact on attitude against GMs in this survey, which is also the case for most studies in literature. Political influence, which is the main subject of this topic, appeared to have a more significant impact.

The main sources of information are institutions actively involved and aligned with certain sides of the debate on genetic modification. Generally speaking, the fact there is no conclusive research on the impact of genetic modification leaves a lot of room avail-

able to information generated by interested parties (Huffman et al. 2004). The Council for Biotechnology Information (2001) for example, promotes the views of leading companies in the biotechnology sector, while Greenpeace and other GM opposing groups disseminate their own information (Greenpeace International 2001a, b, Friends of the Earth 2001, 2003). According to Eurobarometer (2003), 75% of Europeans believe that the US have too much influence on the globalization process. At the state level US is seen as the main supporter of GM foods, and opposition to US is probably related to the adverse relationship between globalization and these types of food. In any case in Eurobarometer (2001, 2004) surveys, a strong statistical correlation between GM rejection and opposition to globalization can be found.

Protection of local cultures and traditions has been discussed in literature as a driving force behind opposition to globalization. According to Watson (1997) GM food is inevitably seen within a globalization frame, becoming a threat to these cultures which are affected by food attitudes and issues anyway. Newburry (2004) argues that the subject of genetic engineering becomes a key democracy issue about the freedom of choice of people on what "they can eat and grow". In any case the GM dispute has been considered as a threat that may seriously affect trade which is the only glue between Europe and the USA after the Iraq war fractiousness (Reason 2004).

This paper found a strong relationship between political views (expressed by opposition to globalization) and opposition to GM foods. This relation was present in all aspects of GM opposition expressed by the six dependent variables used (general preference, banning, labeling, food category, price effect and "extent" of genetic modification), unlike socio-demographic factors that appeared to impact only occasionally. Although generalizations have to be avoided, this survey adds to the growing literature supporting this relation between a category of products and an indicator of political orientation, such as attitude against globalization. Such a relation indicates a growing scope of political beliefs that is expanded to cover a number of issues-components of the global attitude (and potentially behavior too) of an individual and raises a number of issues for discussion that exceed the scope of this paper.

Nevertheless, it has to be emphasized that this is only an indication and not a global proof of the relation between globalization opposition and GM opposition, whereas the relation between attitudes and actual behavior of consumers is not clear. Likewise, Gaskell et al (2003) argue that observed behaviors differ from stated ones when responding to surveys, because people think like voters rather than consumers. However, in any case, responses do have their significance for policy making even if they are the result of voter-like behavior.

Summary and Conclusions

The subject of consumer attitudes towards genetically modified food products has been examined theoretically from several different points of view, specifying and examining different factors of influence depending on the adopted approach. Methods of quantitative analyses also vary as a result of choice, data availability, and the concepts and theory involved. In Greece, a country that ranks among the top in terms of explicit consumer rejection of GM foods, factors affecting such attitudes and their role have not yet been properly investigated.

This paper examines the potential impact of socio-demographic factors such as age, gender, education, and family income as well as of certain political perceptions on consumer attitudes. These perceptions were approximated and quantified using consumer views on globalization. Regardless of how respondents perceive or define globalization, according to published statistics and the sampling of this paper the majority of consumers are against it.

Given the qualitative nature of the dependent variables logit and probit models were estimated, associating the examined factors with the probability of occurrence of the dependent variable (its taking value 1). Logit estimates of coefficients, marginal probability effects, confidence intervals, etc were provided. They show consistently and confirm the significance of the political factor.

Rejection of globalization is strongly associated with increased probability of being against GM foods, supporting a ban on them, favoring mandatory labeling if these foods are allowed, and refusal to purchase them even in the case of lower prices. The majority of the respondents is skeptical on GM foods, but it appears that opponents of globalization are significantly more likely to be against GM foods. In other words, the opponents of globalization appear to be more concentrated against GM foods. In fact, the minority of consumers that does not oppose GM foods, belongs overwhelmingly to those who do not oppose globalization.

This is the most certain and perhaps the most interesting result even though on some occasions educational levels and age did play a role too, as discussed. These results add to the existing literature that supports the relation between globalization opposition and GM opposition, which gives rise to a wide discussion about the scope and meaning of political beliefs in a changing world.

References

Akerlof, GA 1970, 'The market for "lemons": quality uncertainty and the market mechanism', *The Quarterly Journal of Economics*, vol. 84, pp. 488-500.

Baker, GA, & Burnham, TA 2001, 'Consumer response to genetically modified foods: Market segment analysis and implications for producers and policy makers'. *Journal of Agricultural and Resource Economics*, vol. 26, no 2, pp. 387-403.

Bonny, S 2003, 'Why are most Europeans opposed to GMO's? Factors explaining rejection in France and Europe.' *Electronic Journal of Biotechnology*: 6/10. Viewed 8 May 2007, <http://www.ejbiotechnology.info/content/vol6/issue1/full4/#27>

Bredahl, L 1999. 'Consumers' cognitions with regard to genetically modified food. Results of a qualitative study in four countries.' *Appetite*, vol. 3, pp. 343-360.

Cook, AJ, Kerr, GN & Moore, K. 2002, 'Attitudes and intentions towards purchasing GM food'. *Journal of Economic Psychology*, vol. 23, pp. 557-572.

Council for Biotechnology Information 2001, 'Frequently Asked Questions'. Viewed 8 May 2007, <http://my.webmd.com/en/faq/default.asp?MID=10>

DeGroot, MH 1970, *Optimal Statistical Decision*. McGraw Hill, New York, NY.

Conner, AJ & Jacobs, JME 1999. 'Genetic engineering of crops as potential source of genetic hazard in the human diet', *Mutation Research*, vol. 443, pp. 223-234.

Curtis, KR, McCluskey, JJ & Wahl, TI 2004, 'Consumer acceptance of genetically modified food products in the developing world'' *AgBioforum*, vol. 7, no 1-2, pp. 70-75.

De Cheveigné, S, Boy, D & Galloux, JC 2002, '*Les biotechnologies en débat : Pour une Démocratie Scientifique.*' Balland, Paris.

Epstein, S, Paccini, R, Denes-Ray, V & Heier, H 1996, 'Individual differences in intuitive-experiential and analytical-rational thinking styles'. *Journal of Personality and Social Psychology*, vol. 71, pp. 390-405.

Eurobarometer 2001, *Europeans, Science and Technology*. Eurobarometer 55.2, EC, Brussels.

Eurobarometer 2004, *Globalisation*. Flash Eurobarometer 151b, EC, Brussels.

Fazio, RH 1986, 'How do attitudes guide behaviour'. In RM, Sorrento & ET, Higgins (Eds.), *The handbook of motivation and cognition: Foundations of social behaviour*, The Guilford Press, New York.

Fazio, RH & Olson, MA 2003a, 'Implicit measures in social cognition research: Their meaning and use.' *Annual Review of Psychology*,vol. 54, pp. 297-327.

Fazio, RH & Olson, MA 2003b, 'Attitudes: Foundations, functions, and consequences'. In MA, Hogg, & J, Cooper (Eds.), *The handbook of social psychology*, Sage, London.

Food & Drink Weekly. 2000, 'Consumer views on biotechnology differ according to pollster'. *Food & Drink Weekly*. June 26

Friends of the Earth. 2001, 'The need for labeling genetically engineered foods'. Viewed 8 May 2007, <http://www.foe.org/safefood/factshtgelabel.htm>

Friends of the Earth. 2003, 'Environmental hazards of genetically engineered plants.' Viewed 8 May 2007, <http://www.foe.org/camps/comm/safefood/gefood/factsheets/envirohazfacts.html>

Frewer, L, Howard, C & Shepherd, R 1998, 'The influence of initial attitudes on responses to communication about genetic engineering in food production'. *Agriculture and Human Values*, vol. 15, pp. 15-30.

Gamble, J, Muggleston, S, Hedderly, D, Parminter, T & Richardson-Harman, N 2000, '*Genetic engineering – the public's point of view'*, Mount Albert Research Centre, Horticulture and Food Research Institute of New Zealand Limited.

Gaskell, G, Allum, N & Stares, S 2003,. *Europeans and biotechnology in 2002: Eurobarometer 58.0*, EC, Brussels.

Greenpeace International. 2001a, 'Public concern'. Viewed 8 May 2007, <http://www.greenpeace.org/%7Egeneng/reports/food/intrfo07.htm>

Greenpeace International. 2001b, 'The potential for allergic reactions.' Viewed 8 May 2007, <http://www.greenpeace.org/%7Egeneng/reports/food/intrfo11.htm>

Grice, J & Lawrence, G 2003, Consumer surveys of biotechnology: asking the questions until we get the answers we want OR Empowering the public to express their opinion. Paper presented at the Agrifood Research Network Conference, Akaroa, New Zealand, April.

Grimsurd, K, McCluskey, JJ, Loureiro, M & Wahl, TI 2003, 'Consumer attitudes towards genetically modified food in Norway'. IMPACT Center, Technical Working Paper. Viewed 8 May 2007, < http://www.agbioforum.org/v7n12/v7n12a13-mccluskey.htm>

Grunert, KG, Lähteenmäki, L, Nielsen, NA, Poulsen, JB, Ueland, O & Åström, A 2001, 'Consumer Perceptions of food products involving genetic modification – results from a qualitative study in four Nordic countries', *Food Quality and Preference*, vol. 12, pp. 527-542.

Haidt, J 2001, 'The emotional dog and its rational tail: A social intuitionist approach to moral judgment', *Psychological Review*, vol. 108, pp. 814-834.

Hall, C & Moran, D 2006, 'Investigating GM perceptions: A survey of anti-GM and environmental campaign group members', *Journal of Rural Studies*, vol. 22, pp. 29-37.

Hermans, D, Baeyens, F & Eelen, P 2003, 'On the acquisition and activation of evaluative in-

formation in memory: The study of evaluative learning and affective priming combined'. In: J, Musch & DC, Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion*. Laurence Erlbaum, New Jersey.

Holmberg, M 2002, 'Going Slow with GMO', *Successful Farming*, June 15.

Hossain, F, Onyango, B, Adelaja, A, Schilling, B & Hallman, W, 2002. 'Consumer acceptance of food biotechnology: Willingness to buy genetically modified food products'. *Agricultural and Resource Economics Review*, vol. 31, p. 260

Huffman, WE, Roussu, M, Shogren, JF & Tegene, A 2004, 'The effects of prior beliefs and learning on consumers' acceptance of genetically modified foods', *Journal of Economic Behavior and Organization*, vol. 63, no 1, pp 193-206.

Isaacs, JC 2001, '*Acceptance of genetically modified foods, and environmental attitude'*. Louisiana Department of Wildlife and Fisheries, Louisiana.

Jussaume, RA Jr & Judson, DH 1992, Public perception about food safety in the United States and Japan, *Rural Sociology*, vol. 67, pp. 235-49.

Lawrence, G, Norton, J & Vanclay, F 2001, 'Gene technology, agri-food industries and consumers'. In Hindmarsh, R., and Lawrence, G. (Eds.), *Altered genes II: the future?,* Scribe, Melbourne.

Lockie, S, Lawrence, G, Lyons, K & Grice, J 2005, 'Factors underlying support or opposition to biotechnology among Australian food consumers and implications for retailer-led food regulation'. *Food Policy*, vol. 30, pp. 399-418.

Loewenstein, GF, Weber, EU, Hsee, CK & Welch, N, 2001,'Risk as feelings', *Psychological Bulletin,* vol. 127, pp. 267-286.

Magnusson, MK & Koivisto Hursti, U-K 2002, 'Consumer attitudes towards genetically modified foods', *Appetite*, vol.39, pp. 9-24.

McCluskey, JJ, Grimsurd, KM, Ouchi, H & Wahl, TI 2003, 'Consumer response to genetically modified food products in Japan'. *Agricultural and Resource Economics Review*, vol. 32, no 2, pp. 222-231.

Molho, I 1997, *The Economics of Information*. Blackwell Publishing Inc, Malden.

Moon, W & Balasubramanian, SK 2001, 'A multi-attribute model of public acceptance of genetically modified organisms.' Paper presented at the Annual Meeting of American Agricultural Economics Association, Chicago, August.

National Science Foundation 2000, *Science and engineering indicators*. Arlington: NSB.

Newburry, U 2004. 'Anti-Frankefood movement grows'. *Mother Earth News*, August-September.

Norton, J 1999. Science, Technology and the Risk Society: Australian Consumers' Attitudes to Genetically-Engineered Foods.' PhD Thesis, Central Queensland University, Rockhampton.

Onyango, B & Nayga, Jr RM 2004, 'Consumer acceptance of nutritionally enhanced genetically modified food', *Journal of Agricultural and Resource Economics*, vol. 29, pp. 567-583.

Paarlberg, RL 2002, 'The real threat to GM crops in poor countries: consumer and policy resistance to GM foods in rich countries', *Food Policy*, vol. 27, pp. 247-50.

Pachico, D & Wolf, M 2002, 'Attitudes toward genetically modified food in Colombia'. Paper presented at the 6th International ICABR conference, Ravello, Italy.

Priest, SH 2000, 'US public opinion divided over biotechnology?' *Nature Biotechnology*, vol. 18, pp. 939-942.

Reason, T 2004, 'Euro clash: removing tarrifs is easy. Breaking down social barriers to trade is hard', *Magazine for Senior Financial Executives*, May 2004.

Rozin, P & Nemeroff, C 1990, 'The laws of sympathetic magic'. In J, Stigler, R, Shweder & G, Herdt (Eds.) *Cultural Psychology: Essays on comparative human development*, Cambridge University Press, Cambridge.

Saher, M, Lindeman, M & Koivisto Hursti, U-K 2006, 'Attitudes towards genetically modified and organic foods'. *Appetite*, vol. 46, no 3, pp. 324-331.

Spence, A 2005, 'Using implicit tasks in attitude research: A review and a guide.' *Social Psychological Review*, pp. 2-17.

Springer, A, Mattas, K, Papastefanou, G & Tsioumanis, A, 2002, Comparing consumer attitudes towards genetically modified food in Europe. *Proceedings of the Xth European Congress of Agricultural Economists*. Zaragoza, Spain.

Stanovich, KE & West, RF 2000, 'Individual differences in reasoning: Implications for the rationality debate?' *Behavioral and Brain Sciences*, vol. 23, pp. 645-726.

Stigler, GJ 1961, 'The economics of information', *Journal of Political Economy*, vol. 69, pp. 213-225.

Subrahmanyan, S & Cheng, PS 2000, 'Perceptions and attitudes of Singaporeans towards genetically modified food.' *The Journal of Consumer Affairs*, vol. 34, no 2, pp. 269-290.

Teisl, MF & Levy, AS 1997, 'Does nutrition labeling lead to healthier eating?' *Journal of Food Distribution Research*, vol. 3, p. 28.

Tenbült, P, de Vries, NK, Dreezens, E & Martijn, C 2005, 'Perceived naturalness and acceptance of genetically modified food.' *Appetite*, vol. 45, pp. 47-50.

Tirole, J, 2003, *The theory of industrial organization*. The MIT Press, Cambridge.

Trewavas, A 1999, 'Much food many problems.' *Nature*, vol. 402, pp. 231-232.

Trewavas, A 2001, Urban myths of organic farming.' *Nature*, vol. 410, pp. 409-410.

Trewavas, AJ & Leaver, CJ 2001, 'Is opposition to GM crops science or politics?' *EMBO Reports*, vol. 2, pp. 455-59.

Triandis, H 1980, 'Values, attitudes, and interpersonal behavior'. In HE, Howe & MM Page (Eds.), *Nebraska Symposium on motivation*, University of Nebraska Press, Lincoln, NE.

Vyse, SA 1997, *Believing in magic: The psychology of superstition*, Oxford University Press, New York.

Watson, JL 1997, *Golden Arches East: McDonald's in East Asia*. Stanford University Press, Stanford CA.

Witkowski, TH 2005, 'Global challenges to marketing in developing countries: Exploring the ideological divide.' *Journal of Public Policy and Marketing*, vol. 24, no 1, pp. 7-23.

Zechendorf, B. 1998, 'Agricultural biotechnology: why do Europeans have difficulty accepting it?' *Agriforum*, vol. 1, p. 1.