Comparing Consumer Attitudes towards Genetically Modified Food in Europe

A. Springer
K. Mattas
G. Papastefanou
A. Tsioumanis

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A. Springer[1], K. Mattas[2], G. Papastefanou[3], A. Tsioumanis[4]

E-mail notification: mattas@agro.auth.gr

papastefanou@zuma-mannheim.de

[1] Dipl.Soz., University of Giessen and Center for Survey Research and Methodology, Mannheim
[2] Professor, Dept. of Agricultural Economics, Aristotle University, Thessaloniki, Greece
[3] Dr., Center for Survey Research and Methodology, Mannheim, Germany
[4] MSc, Dept. of Agricultural Economics, Aristotle University, Thessaloniki, Greece.

ABSTRACT

As biotechnology evolves new methods of genetic engineering are now being applied to the production and processing of foods. This paper is trying to explore the attitudes of the European consumers towards genetic modification of food. Using survey data of the EU member countries the proposed research paper is planned to have a threefold output: 1) providing a comparative ranking of the EU member countries in relation to the prevalence of rejection of genetically modified food, 2) uncovering intra-european differences in genetic food engineering rejection as being based on socio-demographic and informational resp. knowledge based differentials between EU countries and 3) specifying the importance of socio-economic and informational determinants of a potential defender of genetically modified food by estimating the partial effects of age, gender, education, income, family status, size of household, knowledge on genetical food engineering and information use behavior in a multivariate model of the attitudes towards genetically modified food. This causal approach will be followed in selected EU countries representing extreme positions in the EU attitude ranking.

By these empirical results the paper is trying to reveal intra-EU differentials of consumer attitudes towards genetically modified food, which is a necessary baseline for adequate and efficient policies in order to satisfy consumer needs for quality and security. The results will also prove helpful to the food industry providing differential information for marketing decisions and focusing adjustments in different EU food markets.

Key words: genetic modification, attitudes towards genetic modification, biotechnology, food

Introduction

The uses and applications of biotechnology have increased rapidly over the last 20 years. More than 100 million acres of the world's most fertile farmland were planted with genetically modified crops in 2000, about 25 times as much as just four years earlier. Wind-blown pollen, commingled seeds and black-market plantings have further extended these products.

Genetic modification and selection have been used over the centuries in order to increase agricultural productivity. In this paper the term "biotechnology" refers to those techniques used by scientists that enable them to modify genes within an organism or transfer genes between organisms in a way that would be impossible to happen in nature. In other words, modern biotechnology does not include traditional breeding techniques, in-vitro fertilisation or hybrids.

During the last few years the public has become in general more ambivalent towards new technologies and while expecting technological innovation to make their life better, they still hold concerns about possible adverse effects deriving from the use of these technologies. Modern biotechnology is a central issue in the public debate. Scientific claims about benefits for society are not accepted without criticism.

Examples of these are health concerns as demonstrated in Pusztai rat experiments (Ewen and Pusztai, 1999); environmental concerns like in the case of the Monarch Butterfly (Losey et al., 1999); socio-economic concerns focusing on corporate biopatenting (Greenpeace, 2000; Anderson, 1999) and ethical concerns ("playing God" (Barbagello and Trench, 1999, p. 25)), or trying to "displace the first Creator" (Krimskey, 1982, p. 266).

Today, it is more realistic to see the development of a new technology as a result of a complex social system of interactions and decisions. This system does not only involve scientists, but also other parties in society, one of which is the general public. The public (and groups in the public) influence decisions around new biotechnology, not only politically through democratic channels or interest groups, but also as consumers via the market. Understanding the public's range of views on biotechnology is important for decision makers to be able to anticipate potential acceptance problems, or, one step further, to take consumer or public desires and concerns into account in the development of applications.

As observed by Stenholm and Waggoner (1992), consumers will be the ultimate judges of emerging technologies in agricultural biotechnologies. Previous research has shown that public attitudes towards genetic engineering are influenced by the general perception on the potential risks and benefits involved (Sparks and Shepherd, 1994; Fischoff et al., 1978, 1984). Different factors influence perception of risk associated with various related issues (Renn et al., 1992). Risks from biotechnology to society are perceived as significantly greater than those to one's self or other people (Frewer et al., 1994).

Arguments both for and against the technology can be found in literature (Beck, 1992; Straughan, 1991). However, some evidence suggests that even if the public's knowledge has increased in the field of biotechnology, people are less optimistic regarding the capacity of the genetic engineering to improve their living conditions (Eurobarometer, 1999). Particularly, the genetic engineering process applied to the food sector is considered less useful than in the other applications (Eurobarometer, 1999).

It is also likely that attitudes towards the technology are strongly influenced by the perception that consequences are not known, and perceptions of uncertainty about outcomes rather than beliefs about particular outcomes might provide the dominant influence on attitudes (Sparks et al., 1995). This leads us to the notion of the "precautionary principle". This principle is based on the premise that *when an activity arises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not yet fully established scientifically* (Barrett and Flora, 2000).

In the case of genetic engineering applied to food production, it is probable that the unknown consequences of development and application play an important role in defining the risk perceptions of the public (Sparks and Shepherd, 1994; Renn et al., 1992).

Attitudes towards GM food in Europe - an overview

This paper is trying to explore the attitudes of the European consumers towards genetic modification of food. In order to do that our first step is to provide a comparative ranking of the EU member countries in relation to the prevalence of rejection of genetically modified food (see table 1).

Table 1: Rejection rate towards GM food in different European countries[5] (%)

	agree	disagree	N
Netherlands	**57,2**	42,8	402
Great Britain	**58,3**	41,7	393
Finland	**66,7**	33,3	412
Germany (east)	**68,8**	31,2	397
Luxembourg	**69,0**	31,0	245
Italy	**69,1**	30,9	376
Northern Ireland	**71,7**	28,3	106
Belgium	**72,6**	27,4	402
Ireland	**74,0**	26,0	339
Germany (West)	**74,0**	26,0	423
Spain	**74,1**	25,9	340
Sweden	**74,7**	25,3	419
Portugal	**79,1**	20,9	320
Austria	**79,6**	20,4	402
Denmark	**79,7**	20,3	469
France	**82,5**	17,5	394
Greece	**85,0**	15,0	406
Total	**72,9**	27,1	6245

Source: own calculations, Eurobarometer 52.1

As it is obvious there are important differences among the countries. The European mean rejection rate is on average 73 %. This mean rate is represented by e.g. Sweden, West Germany and Spain. Above that average one may find countries like Denmark, France and Greece. Greece is taking the most rejective position in the scale (85 % rejection rate) while the lower rejection rate appears in Great Britain (58%) and the Netherlands (57%).
Our research tries to uncover the underlying reasons explaining the intra-european differences in genetic food engineering rejection based on socio-demographic and cognitive factors.

[5] Based on the degree of agreement to the statement: "I dread the idea of GM food".

The current analysis focuses on Greece and West Germany for two main reasons. The first one derives from the extreme position that Greece shows in table 1 and the second reason lies on the fact that the authors of this paper originate from these two countries. This provides the advantage of a better understanding and facilitates the analysis especially when beliefs or other cognitive factors are concerned.

Data and Methodology

For the following analysis secondary data from the Eurobarometer 52.1 (1999) have been used. The sample was pan-european (15 countries) consisting of about 16000 subjects in total. The sample population consists of randomly selected members over 15 years in each country.
A thousand people were asked in each country except Germany (this sample consisting of 2000 people: 1000 from the western parts and 1000 from the eastern parts of Germany), the United Kingdom (1000 people from Great Britain and 300 from Northern Ireland) and Luxembourg (sample of 600 people). The sample was split into half, one on biotechnology and the other one concerning genetics. This paper focuses on the biotechnology part.

The dependent variable used for the following analysis was associated with the statement "I dread the idea of GM food". Focusing on this statement enables us to measure an attitude towards GM food. Under the limitation that secondary data pose we had only few options on constructing a dependent variable, as most Eurobarometer questions are not directly dealing with attitudes. Moreover using this statement as the dependent variable we are only able to draw conclusions about the rejection of GM food, which is associated with a negative attitude. It is not possible out of a non-negative attitude to derive a positive one, so that poses a second limitation to our analysis.

The independent variables can be divided into two main categories. The first one is consisted of a group of socio-demographic factors, which are listed below in table 2.

Table 2: Socio-demographic independent variables

Original variable EB 52.1	Target variable	Coding	Further explanations
d13r	Kids	1 = no kids 0 = Kids	0 summarizes the categories 1, 2, 3, more than 4 Kids
d7	Marital status	1 = married 0 = not married Missing values = others	Category 1 consists of people who are married, re-married, living together category 0 consists divorced, living separated, never stayed with another person, at the moment alone, widowed

d10	Gender	1 = female 0 = male	
d8r	Education	low = up to 15 years medium = 16-19 years high = more than 20 years Missing = Student	Takes into account the age a person quit fulltime education
d15ar1	Professional status	1 = working 0 = not working	
d29c1	Income position	-- = very low - = low + = good ++ = very good Missing values = don't know, no answer	
d11r1	Age	1 = 15-24 Years 2 = 25-34 Years 3 = 35-44 Years 4 = 45-54 Years 5 = 55-64 Years 6 = 65 +	
d1rb	Left-right scale	1 = Left 2 = Medium 3 = Right Missing values = don't know, no answer	

The second category of the independent variables is associated with cognitive factors (see table 3). These factors are associated with beliefs, risk perception and knowledge towards GM food. The reason this group of factors was taken into consideration is that many researchers focusing only on socio-demographic factors have failed in providing well-reasoned explanations for existing differences.

Table 3: Cognitive independent variables

Original variable EB 52.1	Target variable	Coding	Further explanations
q6b3 q6b5 q6b8 q6b9	Beliefs	1 = disagree, totally disagree 0 = agree, totally agree Missing = don't know, neither agree nor don't agree	Measures the extent of rejective beliefs on a 5-point scale. Agreement means high rejection
q6b1	Risk	1 = disagree, totally	Measures the extent of risk.

q6b4 q6b6 q6b7 q6b11 q6b12		disagree 0 = agree, totally agree Missing = don't know, neither agree nor don't agree	Agreement means high risk perception
q706	Subinfo[6]	1 = agree 0 = disagree Missing values = don't know	Measures the extent of feeling well informed. High agreement means feeling informed
q701 q702 q707 q708 q709	Acceptance[7]	1 = agree 0 = disagree Missing values = don't know	Measures the extent of acceptance towards GM food
q9a	Trust[8]		Several possible organisations/institutions. The one which most people trust in is named
q401, q402, q403, q404, q405, q406, q407, q408, q409, q410, q411, q412	Knowledge[9]	1 = low 2 = medium 3 = high Missing values = don't know	Measures the extent of knowledge by taking into account the number of correctly answered questions.

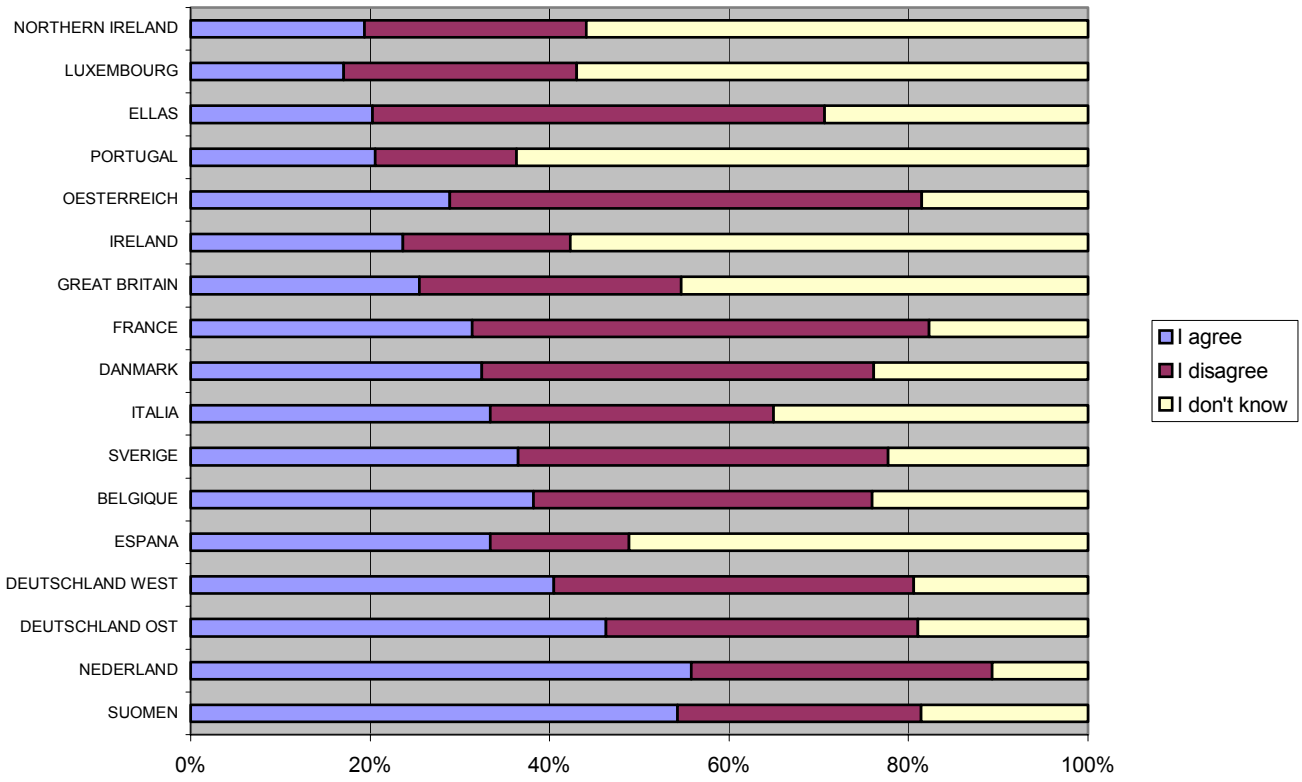
One of the main objectives of this research is to find out which of the two groups of factors is more important for explaining existing country differences.

Results and discussion

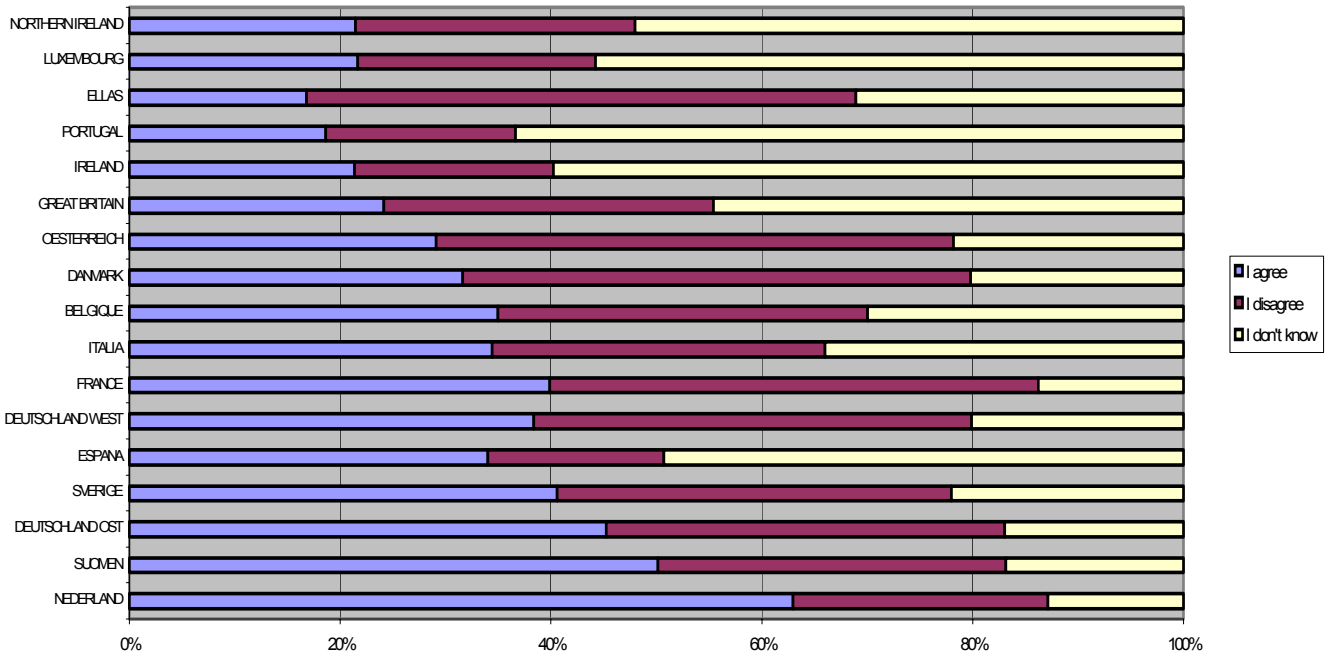
In order to conduct the analysis logistic regression has been used. This method offers the possibility to include only those respondents with a clear attitude towards GM food because of its binary system.
To give an impression of the situation of GM foods in Europe see the histograms below.

[6] This is enabled with the variable: "I feel sufficiently informed about biotechnology".
[7] The following items were used to construct an additive scale:
q701 (I would buy genetically modified fruits if they tasted better)
q702 (I would pay more for non GM food)
q707 (I would be willing to buy cooking oil that contained a small amount of GM soy)
q708 (If they got rid of all traces of genetic modification from GM sugar cane, I would be happy to eat the sugar)
q709 (I would be willing to eat the eggs of chickens fed on GM corn)
[8] "Now I would like to ask you which of the following source of information , if any, you trust to tell you the truth about modern biotechnology. Please choose the source of information you trust most, if any, from the following list."
[9] See URBAN/PFENNIG (1996: 132)
low knowlegde (less than 50% correct answered questions)
medium knowlegde (50-75% correct answered questions)
high knowlegde (more than 75% correct answered questions)

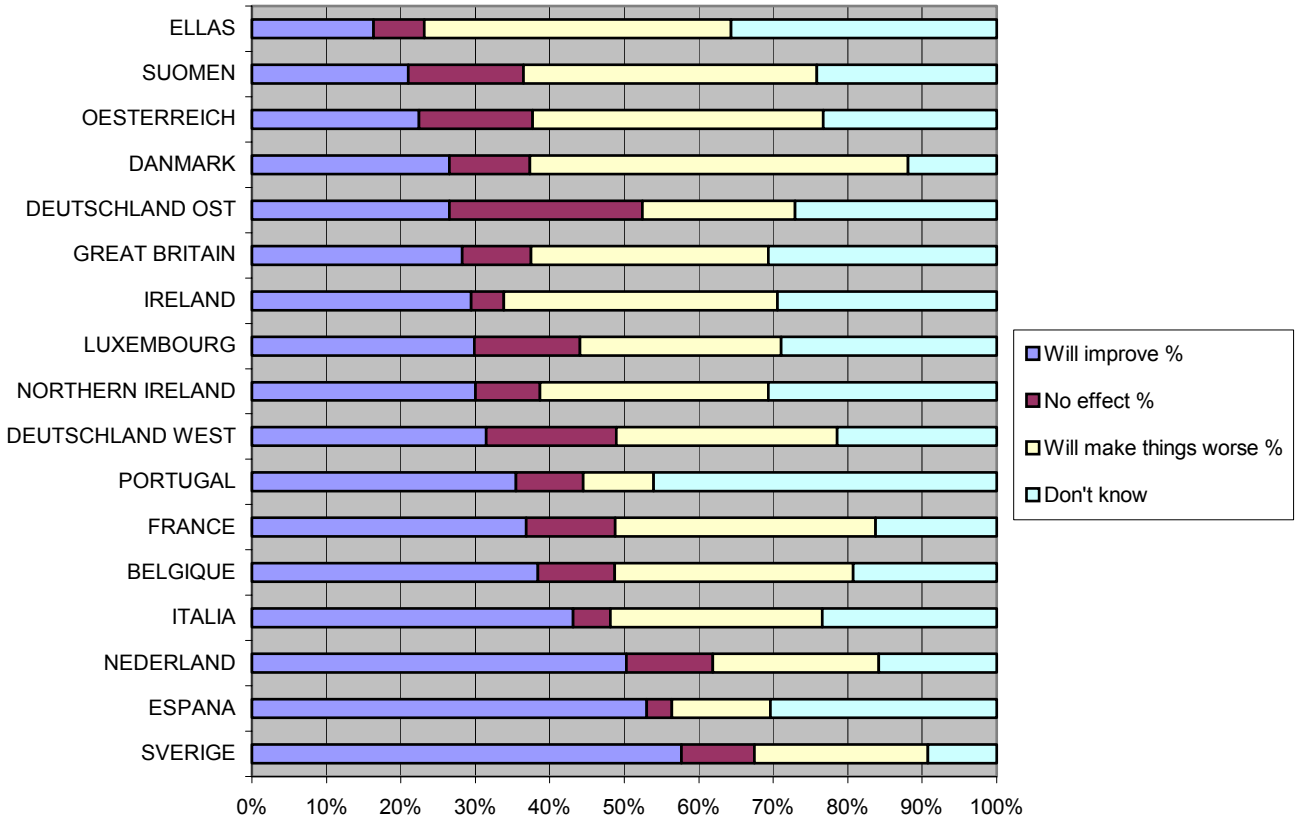
Biotechnology for food production should be promoted



Biotechnology is acceptable for food production



Biotechnology will improve our lifes in the next 20 years



It is obvious that the Greek population takes a negative position towards biotechnology compared with other countries (e.g. West Germany), which underlines our decision to choose these countries for the following multivariate analysis.

Table 4: Results from logistic regression

Nagelkerkes R^2	,029	,060	,072	,073	,093	,096	,099	,121	,317
N	829	829	766	766	766	766	766	531	531
Model Chi-Square	15,44***	32,32***	35,87***	36,09***	46,36***	48,10***	49,74***	43,10***	121,0***
Goodness-of-FitTest	-	2,82	8,01	6,39	10,41	10,23	6,84	7,93	9,24
Land: BRD (W)	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	
Greece	1,98***	2,20***	2,21***	2,22***	2,26***	2,21***	2,26***	2,18***	
Alter: 15-24		*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*
25-34									
35-44		2,36***	2,93***	2,92***	2,99***	2,55***	2,84***	3,12*	
45-54							2,21*	3,52***	2,02*
55-64		2,29***	2,49***	2,36*	2,56***	2,66***	3,11***	4,28***	4,23***
65+		2,72***	2,75***	2,53*	2,93***	3,07***	3,45***	5,44***	6,68***
education: low			*1,0*	*1,0*	*1,0*	*1,0*	*1,0*		
medium									
High			,52***	,53*	,55*	,56*	,54*		
Job: working.									
Not working									
Gender: Female					*1,0*	*1,0*	*1,0*	*1,0*	*1,0*
Male					,54***	,54***	,54***	,53***	,53***
Kids: no Kids									
Kids									
Status: married									
Not married									
knowledge: low								*1,0*	*1,0*
Medium									
High								,42*	,36***
Beliefs: disagree									*1,0*
agree									3,53***

Source: own calculations, Eurobarometer 52.1, *** significant 1%-Niveau, * 5%-Niveau

The table above shows that the probability for a Greek person to reject GM food is 98% higher than for a German person. This difference is increasing when we include in the analysis socio-demographic factors with age being the single most important factor. However the socio-demographic factors on their own can not explain the differences.

As mentioned before cognitive variables seem to be the most important factors for explaining the differences. When including the knowledge variable in the regression analysis the gap between the two countries diminishes and is no longer significant when we take into account the beliefs variable as well. Because of this we draw the conclusion that "beliefs" are the main reason for explaining the difference between Greece and West Germany.

The next step is to run the regression for each country separately. This should give us a good idea of the relative importance of each factor for the country in question (see table 5). In this table only significant results are presented.

Table 5: logistic regression estimated for each country separately

	Greece	West Germany

Nagelkerkes R^2	,267	,441
Age:15-24		*1,0*
25-34		
35-44		
45-54		6,45*
55-64		11,35***
65+		
Education: low		
Medium		
High		
Job: working		
Not working		
Gender: Female		*1,0*
Male		,28***
Kids: no Kids		*1,0*
Kids		3,93*
Status: married		
Not married		
Knowledge: low		*1,0*
Medium		
High		,19***
Beliefs: disagree	*1,0*	*1,0*
Agree	20,18***	2,52***

Source: own calculations, Eurobarometer 52.1, *** significant 1%-Niveau, * 5%-Niveau

There are obvious differences in the relative importance of the factors affecting the attitude towards GM food between the two countries. In Greece only cognitive factors seem to be important, while in Germany other factors have to be taken into consideration as well. The most important factor here is age followed by gender and knowledge.

In table 6 we included beside the main effects discussed before some interactions that offer further possibilities for explaining the differences. It is quite interesting to focus on the interaction between Greece*Gender because this effect seems to play an important role in forming the differences. In this case the subgroup of Greek men shows an increased rejection rate compared with the German men. Moreover there is a similar rate of rejection between Greek men and women.
Another important effect can be found in the interaction Greece*Knowledge, which also shows a significant influence. Middle knowlegded subgroups in Greece are relatively more rejective than the same group in Germany.

Table 6: logistic regression + interactions

Nagelkerkes R^2	32,9	,336	,338	,347	,365	,378
Model chi^2	126,43***	129,40***	130,33***	134,15***	141,95***	148,09***
Goodness-of-Fit	7,99	14,26	6,94	10,69	6,88	9,98
Constant						
Land: BRD (W)					*1,0*	*1,0*
Greece					15,39***	19,36***
Age: 15-24	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*
25-34						
35-44	5,84*	6,21*	6,10*	3,98*		
45-54	5,88*	6,04*	6,04*	5,64*	5,66*	6,54*
55-64	12,94***	13,63***	13,14***	14,03***	13,07***	14,88***
65+	13,50***	13,13***	12,59***	13,75***	12,05***	12,96***
Education: low						
Medium						
High						
Job: working						
Not working						
Gender: Female	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*
Male	,54*	,53*	,53*	,52*	,28***	,27***
Kids: no Kids				*1,0*	*1,0*	*1,0*
Kids				3,81*	3,57*	3,79*
Status: married						
Not married						
Knowledge: low	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*
Medium						
High	,35***	,37***	,37***	,36***	,36***	,19***
Beliefs: disagree	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*	*1,0*
Agree	3,53***	3,69***	3,27***	3,42***	3,46***	3,66***
*Gr*Age: 15-24*	*1,0*				*1,0*	
25-34						
35-44						
45-54						
55-64	,11*				,11*	
65+						
*Gr*Education: low*						
Medium						
High						
*Gr*Beliefs: disagree*						
Agree						
*Gr*Kids: no Kids*				*1,0*		
Kids				,27*		
*Gr*Gender: Female*					*1,0*	
Male					,22***	
*Gr*Knowledge: low*						*1,0*
Medium						4,91*
High						

Source: own calculations, Eurobarometer 52.1, *** significant 1%-Niveau, * 5%-Niveau

Conclusion

Differences between countries can emerge from two possible reasons. They may have to do with the composition of the population within one country or they consist of differences in behavior resp. attitudes. While many researchers are only taking the first possibility into account we stress that it is not sufficient.

As we have seen so far, socio-demographic variables are not sufficient to explain differences between countries. For further explanations it is necessary to include other cognitive factors. Using these factors enables us to figure out further possibilities for explaining the difference between Greece and West Germany.

It is self evident that further research focusing on these cognitive factors is necessary in order to achieve a better understanding of the nature of the decision-making process. This may prove essential in the near future, as all EU members will have to adopt similar policies concerning both biotechnology in general and more specifically the genetic modification of food products.

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