Consumer Knowledge, Perception and Acceptance of GMOs

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Selected Paper prepared for presentation at the Southern Agricultural Economics Association 2017 Annual Meeting
Mobile, Alabama, February 4-7, 2016

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In the United States, only a few states have voted to label foods containing genetically modified organisms (GMO): Connecticut, Maine and Vermont. Only Vermont has implemented their mandate, with the other states waiting for participation by larger agriculture producing states. This summer, however, President Obama signed into law a federal mandate requiring all GM foods to be labeled. Importantly, companies can choose to use a text label, a toll-free phone number or a digital label such as a QR code. As a result, within 2 years all foods will be required to identify if they contain GMOs.

While food producers have been largely against the provision of GMO labels, citing the potential for misleading consumers and additional costs, moving forward with the federal mandate it is important for them to understand more about consumer preferences for GMO labels. Noussair et al (2002) found that consumers in France were not aware of GMO labels on products they observed in an experimental auction. When they were made aware of the labels, however, their willingness to pay declined by 30%. In a meta-analysis, Lusk et al (2004) found that consumer had a higher valuation for non-GM foods. At the same time, a large share of the variation of the estimated willingness to pay for GM foods, they found, is explained by consumer characteristics, the characteristics of the food being valued and methodology used. The primary objective of this paper is to further analyze what types of consumers are in favor of GMO labels and how might these characteristics be relevant to food producers.

To this end, we collect data of 1200 consumers in the state of Connecticut, where GMO labeling has already been approved. We then examine what types of consumers are more likely to be in favor, against or indifferent to GMO labels. To add to this analysis, we examine differences across 3 product categories food, plants and turfgrass. Importantly, we expect different preferences for products that are consumed directly versus those that are used for other purposes (Bovay and Alston 2016). We also assess consumer trust in different sources of information regarding GMOs, their perception and knowledge of GMOs as well as a variety of demographic differences.

Our results indicate that a large majority of respondents want GMO labeling, but there is a sizeable segment that is indifferent to labeling. Concerns for health issues related to GMOs and interest in technological advancement significantly influence consumer preferences. In addition, trust in sources of information on GMOs play an important role in consumer preferences for GMO labels. It may be important for industry marketing to invest in informational efforts regarding GMOs and health safety as well as technological advancement. As the federal mandate allows for providing more information than just a simple logo, there could be some potential advantages to providing consumers with more information regarding GMO products.

Data and Methods

During the summer and fall of 2016 we implemented an online survey to better understand consumer preferences for GMO labeling. Utilizing a sample from Global

Market Insite, Inc. (GMI), panelists within the GMI sample were randomly invited to participate in the survey. They were then asked whether they thought 3 different product categories (food, plants, turfgrass) should be labeled as GMO. Labeling of food is important given consumer concerns for GMOs and their health. Plants provide food (e.g. garden vegetables) or are used to decorate (e.g. ornamentals) and are indirectly consumed. Turfgrass provides a different type of household utility than food or plants. Further, there is the expectation of GMO turfgrass introduction into the market in the near future.

Panelists were then asked to rank their perceived GMO knowledge level on a 0-100 point scale (0="not at all knowledgeable" and 100="extremely knowledgeable"). After rating their own knowledge, respondents were asked to rate the knowledge level of other entities, including scientists and the federal government. Respondents were then asked to rate their trust in environmental information provided by various sources on a 0-100 point scale (0="not accurate at all" and 100="extremely accurate"). Finally, respondents were asked to rate on a 0-100 point scale (0="strongly disagree" and 100="strongly agree") whether they agreed/disagreed that a listed statement (e.g., contains DNA from another organism, increased chance of long term health issues, step forward for agricultural technology) was characteristics of a GMO in general. We collected demographic data of the respondents as well.

For a variety of reasons only respondents from the state of Connecticut (CT) were included in the sample. Notably, the sample was limited to CT based on funding agency requirements. However, CT offers an interesting market to examine GMO labeling given CT was the first state to pass a GMO labeling law (CT General

Assembly, 2013). Even though the law has since been nullified by a federal labeling requirement passed in 2016 (Radelat, 2016), CT is still at the forefront of GMO labeling.

Optimally, we would compare our sample to census estimates at the state level to statistically assess representativeness, but standard errors are not provided for the census estimates. Simply looking at the sample data provide some insight into the representativeness of our sample (Table 1). The median household income in CT is $70,000 (U.S. Census Bureau, 2011), which is comparable to our sample median income of $73,129. With respect to age, the CT population median age is 40 years (U.S. Census Bureau, 2015), which is slightly younger than our sample's median age of 45. Eighty-one percent of our sample was Caucasian which is similar to the CT population make-up of 80.8% (U.S. Census Bureau, 2011). Our sample oversamples women relative to CT. However, women are shown to be the majority shopping group (Zepeda, 2009; Flagg et al., 2013; Wolfe, 2013) thus providing us more detail on household purchasing habits.

We analyzed our survey response data using a multinomial logit (MNL) model to identify the drivers that potentially lead to a respondent supporting/not supporting GMO labeling. Following Greene (2003, p. 721), the MNL model probability is specified as:

$$Prob(S_i = j) = \frac{e^{\beta_j' X_i}}{\sum_{k=1}^{3} e^{\beta_j' X_i}} \quad \text{where j = 1, 2, 3} \qquad (1)$$

where $Prob(S_i=j)$ represents participant i's probability of being in category j, k_i are demographic, knowledge, informational trust, and perceived characteristic variables, and β_j is a vector of model parameters. We evaluated correlation between the

explanatory variables but found it was not statistically important. We calculated marginal effects from the estimated model parameters. Marginal effects of continuous variables are interpreted as the percent change in category membership given a one-unit change from the mean variable of interest. The marginal effects for categorical variables are interpreted as the percent change category membership given a move from the base category.

Results and Discussion

When respondents were asked how knowledgeable they were about GMOs, on average they viewed themselves as moderately knowledgeable (Table 2). However, respondents viewed the federal government significantly more knowledgeable and scientists the most knowledgeable.

With respect to trusting sources of environmental information, a university was considered the most accurate followed by non-profits and environmental activists (Table 2). The federal government was perceived as being moderately accurate in providing information, whereas, industry associations and mass merchandisers were perceived as the least accurate. Of interest, environmental activists were viewed as providing more accurate environmental information than industry associations.

Respondents were split on whether GMOs are a step forward for agricultural technology (Table 3). On average, respondents neither agreed nor disagreed that GMOs were an agricultural technological advancement (rating 49.6). Delving more into this variable provided some interesting results. First, the median rating was 51

implying a major split between respondents' views. Furthermore, approximately 25% of respondents were below 30 (disagree spectrum of scale) while 25% were above 67 (agree spectrum of scale). Based on these results there is quite a degree of heterogeneity within consumers. As for long term health issues, respondents leaned more toward believing GMOs would increase long term health issues (average rating 61.7). The median for health issues was 60. Finally, respondents by and large agreed (average rating of 65.1) with the statement that GMOs contain DNA from another organism. The median rating was 64.

In general, we find that respondents have varied knowledge of GMOs, perceive information sources differently, and perceive GMOs differently. However, when it comes to labeling, respondents were overwhelmingly in favor of GMO labeling regardless of product type. Specifically, 82%, 80%, and 76% of respondents were in favor of GMO labeling for food, plants, and turfgrass, respectively (Table 4). Only a small percentage were not in favor with 10-20% indifferent.

Multinomial Logit Marginal Effects: Food

Based on our analysis we find that demographics play a role in driving the labeling decision (Table 5). Older consumers were more likely to want GMO labeling for food, although this effect was small: a10 year increase in the mean age (45 to 55) would result in a 1% increase in the likelihood a respondent would want GMO labeling. Respondents identifying themselves as republicans and independent were 8.4% and 5.2% less likely than democrats to want GMO food labeled.

For each rating point above the mean perception that GMOs are a step forward for agricultural technology, the respondent was 0.2% less likely to want GMO food labeled. However, as respondents' increasingly perceived GMOs as increasing long term health risks they were more likely to want GMO labeling. Furthermore, as respondents perceived the federal government as providing accurate environmental information they were less likely to want GMO food labeling.

In contrast, an increasing belief that the federal government provides accurate information resulted in an increased likelihood that a respondent would want no GMO food labeling (Table 5). For every one-unit increase in the mean rating for accuracy of information provided by the federal government, a respondent was 0.1% more likely to want no GMO food labeling. Furthermore, an increased perception that GMOs cause increased long-term health issues resulted in a respondent being less likely to be in the no label group.

As noted in Table 4, almost 14% of respondents were indifferent to GMO food labeling. Respondents that considered themselves politically independent were 5% more likely to be indifferent on GMO food labeling (Table 5). Increasing health issues resulted in a respondent being less likely to be indifferent, while perceiving GMO as a step forward for agricultural technology increased a respondents' likelihood of being indifferent. Finally, perceiving the federal government as being accurate was a positive indicator of being indifferent to GMO food labeling.

Results from the MNL GMO food labeling model provided some interesting results. Notably, respondents that viewed the federal government as providing accurate information were more likely to be indifferent or prefer no labeling.

Further, whether the respondent perceived GMOs as a health issue in the long term (negative) or a scientific break-through for agriculture (positive) played a role in whether labeling was preferred or not.

Multinomial Logit Marginal Effects: Plants

Compared to the food model above, the MNL plants model had more significant demographics and a similar number of environmental source and GMO perception variables being significant. Similar to the food model, older consumers were more likely to want GMO plant labeling. However, Caucasians and males were less likely to prefer labeling. Caucasians and males were 5.1% and 5.1% less likely to want GMO plant labeling. Republicans and other political affiliations compared to democrats with republicans being 6.7% less likely to want GMO plant labeling. Furthermore, as household income increases, respondents would be less likely to want labeling.

In contrast to the foods model, the more a respondent viewed the federal government as having knowledge about GMOs, the more likely they were to want GMO plants labeled. However, as trust in information provided by the federal government increased, a respondent was likely to want plants labeled as GMO. Furthermore, respondents viewing GMOs as a potential health risk were apt to want plant GMO labeling, while respondents viewing it as a technological advancement were less likely.

With respect to respondents not wanting GMO plant labeling, younger consumers were more likely to not want labels. Respondents viewing GMOs as a

technological advancement were less likely to want labeling, while increased trust in industry associations and the federal government are predisposed to not want labeling.

Younger respondents, males, and Caucasians were more likely to be indifferent to GMO plant labeling. As a respondent's perception of the federal government's knowledge about GMOs increases, they were less likely to be indifferent on labeling. In contrast, as trust in environmental information by the federal government increases, they were more likely to be indifferent about labeling. For every unit increase in rating that GMOs cause long term health issues a respondent was 0.2% less likely to be indifferent. Yet a rating increase of one unit for technological advancement would result in a 0.2% increase in being indifferent.

Multinomial Logit Marginal Effects: Turfgrass

Similar to the foods model, demographics seemed to play only a small role in a respondent wanting GMO turfgrass labeling. Republicans were 10% less likely to want GMO turfgrass labeling compared to democrats. However, as household income increased, respondents were less likely to want labeling. The income result is different from the food model (no significance) but similar to that of the plants model. The most likely reason for income to be significant for the non-food models is that plants and turfgrass are luxury goods and higher incomes might see GMO labeling as meaning higher prices or increased burden to find non-GMO products.

In contrast to the other models, we find that GMO knowledge by the federal government variable is insignificant. However, respondents perceiving GMOs as

containing DNA from another organism (accurate definition) are more likely to want labeling as are respondents that perceive long term health issues. However, respondents perceiving GMOs as a technological advancement would be less likely. Increased trust in environmental information provided by the federal government would decrease the likelihood that a respondent would want GMO turfgrass labeling.

As with the food and plant models, long term health perceptions (negative) and trust in information provided by the federal government (positive) are significant indicators of not wanting GMO turfgrass labeling. However, trust in university information is significant as well. As trust in environmental information by universities increases, a respondent is less likely to be in the "no" GMO turfgrass labeling category.

With respect to indifference to labeling, our results match the food and plant models. Perceived health risk provides a negative impact on being indifferent, while perceiving GMO as a technological advancement and being more trusting of environmental information provided by the federal government are positive indicators of being indifferent to GMO turfgrass labeling.

Conclusions

The goal of this paper was to examine attitudes and drivers of GMO labeling for food and non-food (plants and turfgrass) products. Overall, we find that a large majority (75-82%) of respondents want GMO labeling. However, there is a sizeable segment that is indifferent to labeling. We also find that long-term health issues is a concern for many respondents, thereby, most likely driving up the number of

respondents wanting GMO labeling. As for knowledge, scientists are considered the most knowledgeable, followed by the federal government, and then the respondent themselves.

Perhaps the biggest contribution of this paper is that perceptions and trust in information source are seem to be larger drivers in the labeling decision with demographics only playing a small role. The federal government is seemingly a key indicator to whether a respondent wanted labeling or not. Even though scientists rated higher in terms of knowledge about GMOs and universities were the most trusted provider of environmental information, the trust in environmental information provided by the federal government was a key indicator in the labeling decision. Notably, increased trust in federal government environmental information resulted in a respondent being less likely to want GMO labeling for food and non-food products. This is an interesting insight as the federal government seems to have no true GMO stance other than the recent labeling law that was passed. The federal government stance on environmental issues is complex.

The findings of this study suggest that consumers want GMO labeling. Since mandatory labeling is impending, opponents of GMO labeling could make gains by focusing on the informational efforts that no evidence of health issues has been found. Further, messaging should focus on GMOs being a technological advancement. Other messaging should look to increase trust in environmental information provided by the federal government. Proponents of GMO labeling should focus on the health issue and by encouraging more research to examine the health aspects of GMOs. Proponents should also look to shape the federal

government's message on environmental issues as this perception is a key driver for respondents not wanting or being indifferent to labeling.

References

Bovay, J. and J.M. Alston. 2016. GM Labeling Regulation by Plebiscite: Analysis of Voting on Proposition 37 in California. Journal of Agricultural and Resource Economics, 41(2):161-188.

CT General Assembly. 2013. Committee Bill No. 6527. 10 Jan. 2017. <https://www.cga.ct.gov/2013/ACT/pa/pdf/2013PA-00183-R00HB-06527-PA.pdf>.

Flagg, L.A., B. Sen, M. Kilgore, and J.L. Locher. 2013. "The Influence of Gender, Age, Education, and Household Size on Meal Preparation and Food Shopping Responsibilities." *Public Health Nutrition* (August):1-10.

Greene, W.H. 2003. Econometric analysis. 5th Ed. Prentice Hall, Upper Saddle River, NJ.

Lusk, J. L., M. Jamal, L. Kurlander, M. Roucan, and L. Taulman. 2005. A meta-analysis of genetically modified food valuation studies. *Journal of Agricultural and Resource Economics*, 28-44.

Noussair, C., S. Robin and B. Ruffieux. 2002. Do consumers not care about biotech foods or do they just not read the labels? *Economics Letters* 75(1): 47-53.

Radelat, A. 2016. Senate Moves to Quash CT's GMO Food Labeling Law. The CT Mirror. 13 Jan. 2017. < http://ctmirror.org/2016/07/06/senate-poised-to-quash-connecticuts-gmo-food-labeling-law/>.

U.S. Census Bureau. 2011. State and county quickfacts: Connecticut. 24 06 Jan. 2017. <http://quickfacts.census.gov/qfd/states/09000.html>.

U.S. Census Bureau. 2015. Census Bureau Releases 2010 Census Demographic Profiles for Alaska, Arizona, California, Connecticut, Georgia, Idaho, Minnesota, Montana, New Hampshire, New York, Ohio, Puerto Rico and Wisconsin. 10 Jan. 2017. <https://www.census.gov/newsroom/releases/archives/2010_census/cb11-cn137.html>.

Wolfe, A. 2013. "Christine Lagarde: On Top of the World." *The Wall Street Journal*, Oct 5,6 pg.C17.

Zepeda, L. 2009. "Which Little Piggy Goes to Market? Characteristics of US Farmers' Market Shoppers." *International Journal of Consumer Studies* 33(3):250-257.

Tables

Table 1. Demographics of the survey sample.

	Mean	Std. Dev.
Age (median)	45.0	--
Ethnicity: Caucasian	81.1%	39.1%
Gender: Male	26.6%	44.2%
Political party		
Democrat	29.8%	45.7%
Republican	21.8%	41.3%
Independent	38.1%	48.6%
Other Political (not Democrat)	10.3%	30.4%
Urbanicity		
Rural	23.5%	42.4%
Suburban	63.8%	48.1%
Urban	12.7%	33.3%
# household adults	2.3	1.1
# household children	0.5	0.9
Household income (median)	$73,129	--
Education		
High school diploma or less	20.4%	40.3%
Some college/2 year	34.7%	47.6%
Bachelor's degree	26.8%	44.3%
Graduate degree	18.1%	38.6%

Table 2. Respondent perceived knowledge and information source trust.

Perceived knowledge of GMO		
	Mean	Significance
Respondent	46.5	C
Scientists	74.6	A
Federal Government	53.9	B
Trust of environmental information source		
	Mean	Significance
University	68.2	A
Industry associations	44.5	D
Federal government	46.2	C
Non-profit	61.9	B
Mass merchandiser	43.0	D
Environmental activist group	63.1	B

Note: categories with the same letter are not significantly different at the 0.1 level.
Note: responses were on a 0-100 point line scale. For knowledge 0 = not at all knowledgeable and 100 = extremely knowledgeable. For information source, 0 = not accurate at all and 100 = extremely accurate.

Table 3. Perceptions of GMO.

	Mean	Std. Dev.
Contains DNA from another organism	65.1	25.5
Increased chance of long term health issues	61.7	30.2
Step forward for agricultural technology	49.6	27.3

Note: scale used was a 0-100 point line scale where 0 = strongly disagree and 100 = strongly agree.

Table 4. Should GMO products be labeled?

	Food	Plants	Turfgrass
Yes	82.2%	80.3%	75.9%
No	4.1%	4.4%	6.0%
Indifferent	13.7%	15.3%	18.1%
Observations	1,243	1,240	1,244

Table 5. Marginal effects for GMO food labeling model.

	Yes		No		Indifferent	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Age	**0.001**	**0.062**	-0.000	0.280	-0.001	0.113
Ethnicity: Caucasian	0.024	0.459	-0.030	0.106	0.006	0.800
Gender: Male	-0.009	0.661	0.006	0.418	0.003	0.880
Political party						
Republican	**-0.084**	**0.036**	0.036	0.107	0.049	0.155
Independent	**-0.052**	**0.065**	0.002	0.833	**0.050**	**0.056**
Other Political (not Democrat)	-0.049	0.343	0.007	0.644	0.042	0.395
Urbanicity						
Suburban	-0.029	0.215	0.003	0.758	0.026	0.221
Urban	0.002	0.962	-0.002	0.890	-0.000	0.997
# household adults	0.006	0.567	**0.006**	**0.080**	-0.012	0.247
# household children	0.013	0.276	-0.001	0.824	-0.012	0.275
Household income	-0.000	0.355	-0.000	0.710	0.000	0.265
Education						
Some college/2 year	0.026	0.317	-0.011	0.195	-0.014	0.544
Bachelor's degree	0.038	0.122	-0.002	0.839	-0.037	0.104
Graduate degree	0.028	0.302	0.000	0.990	-0.028	0.240
GMO knowledge perception						
Respondent	0.000	0.694	0.000	0.141	-0.000	0.304
Scientists	0.000	0.408	-0.000	0.872	-0.000	0.398
Federal Government	0.001	0.205	-0.000	0.337	-0.000	0.320
GMO perception						
Contains DNA from another organism	**0.001**	**0.092**	-0.000	0.314	-0.000	0.161
Increased chance of long term health issues	**0.003**	**0.000**	**-0.001**	**0.000**	**-0.002**	**0.000**
Step forward for agricultural technology	**-0.002**	**0.000**	0.000	0.598	**0.002**	**0.000**
Environmental information provider trust						
University	0.001	0.156	-0.000	0.110	-0.000	0.363
Industry associations	-0.001	0.146	0.000	0.110	0.000	0.367
Federal government	**-0.001**	**0.003**	**0.001**	**0.029**	**0.001**	**0.013**
Non-profit	-0.000	0.593	0.000	0.340	0.000	0.892
Mass merchandiser	0.000	0.268	-0.000	0.246	-0.000	0.469
Environmental activist group	0.001	0.127	-0.000	0.872	-0.000	0.110
Log pseudolikelihood			-378.23			
Prob>Chi2			0.000			
Pseudo R2			19.99%			

Table 6. Marginal effects for GMO plants labeling model.

	Yes		No		Indifferent	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Age	**0.002**	**0.008**	**-0.001**	**0.073**	**-0.001**	**0.024**
Ethnicity: Caucasian	**-0.051**	**0.037**	-0.000	0.946	**0.051**	**0.025**
Gender: Male	**-0.051**	**0.053**	0.007	0.290	**0.043**	**0.079**
Political party						
Republican	**-0.067**	**0.085**	0.020	0.156	0.048	0.186
Independent	-0.047	0.107	0.002	0.754	0.045	0.108
Other Political (not Democrat)	**-0.135**	**0.038**	0.034	0.236	**0.101**	**0.090**
Urbanicity						
Suburban	-0.040	0.106	**0.016**	**0.023**	0.024	0.306
Urban	0.015	0.659	-0.002	0.858	-0.014	0.682
# household adults	0.009	0.385	0.002	0.434	-0.011	0.286
# household children	0.011	0.315	-0.003	0.422	-0.009	0.410
Household income	**-0.001**	**0.012**	0.000	0.846	**0.001**	**0.011**
Education						
Some college/2 year	0.031	0.245	-0.005	0.534	-0.026	0.291
Bachelor's degree	0.040	0.141	0.011	0.341	**-0.051**	**0.033**
Graduate degree	0.021	0.483	0.005	0.674	-0.027	0.326
GMO knowledge perception						
Respondent	0.000	0.801	0.000	0.116	-0.000	0.450
Scientists	0.001	0.185	-0.000	0.346	-0.000	0.259
Federal Government	**0.001**	**0.039**	-0.000	0.387	**-0.001**	**0.056**
GMO perception						
Contains DNA from another organism	0.001	0.048	-0.000	0.223	-0.001	0.081
Increased chance of long term health issues	**0.002**	**0.000**	**-0.001**	**0.000**	**-0.002**	**0.000**
Step forward for agricultural technology	**-0.002**	**0.000**	0.000	0.666	**0.002**	**0.000**
Environmental information provider trust						
University	0.000	0.298	-0.000	0.120	-0.000	0.537
Industry associations	-0.000	0.757	**0.001**	**0.067**	-0.000	0.740
Federal government	**-0.002**	**0.000**	**0.001**	**0.004**	**0.001**	**0.001**
Non-profit	0.000	0.768	0.000	0.808	-0.000	0.695
Mass merchandiser	0.001	0.124	-0.000	0.679	-0.001	0.127
Environmental activist group	0.000	0.775	-0.000	0.872	-0.000	0.799
Log pseudolikelihood			-396.73			
Prob>Chi2			0.000			
Pseudo R2			21.11%			

Table 7. Marginal effects for GMO turfgrass labeling model.

	Yes		No		Indifferent	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Age	0.001	0.122	-0.000	0.312	-0.001	0.199
Ethnicity: Caucasian	-0.033	0.359	-0.006	0.689	0.039	0.229
Gender: Male	-0.046	0.141	0.006	0.606	0.040	0.166
Political party						
Republican	**-0.100**	**0.034**	**0.038**	**0.092**	0.062	0.145
Independent	-0.058	0.104	0.003	0.831	**0.055**	**0.098**
Other Political (not Democrat)	-0.071	0.265	0.008	0.729	0.063	0.295
Urbanicity						
Suburban	-0.028	0.400	0.018	0.142	0.009	0.759
Urban	0.001	0.988	0.032	0.311	-0.032	0.402
# household adults	0.003	0.821	0.007	0.137	-0.010	0.440
# household children	0.014	0.331	-0.004	0.543	-0.011	0.422
Household income	**-0.001**	**0.080**	0.000	0.136	0.000	0.192
Education						
Some college/2 year	0.006	0.880	-0.017	0.161	0.011	0.752
Bachelor's degree	0.040	0.288	-0.010	0.398	-0.031	0.392
Graduate degree	0.029	0.494	-0.014	0.232	-0.016	0.700
GMO knowledge perception						
Respondent	0.000	0.438	0.000	0.198	-0.001	0.160
Scientists	0.000	0.483	0.000	0.910	-0.000	0.408
Federal Government	0.001	0.248	-0.000	0.836	-0.001	0.240
GMO perception						
Contains DNA from another organism	**0.001**	**0.044**	-0.000	0.114	-0.001	0.128
Increased chance of long term health issues	**0.003**	**0.000**	**-0.001**	**0.000**	**-0.002**	**0.000**
Step forward for agricultural technology	**-0.002**	**0.000**	0.000	0.437	**0.002**	**0.000**
Environmental information provider trust						
University	0.000	0.455	**-0.001**	**0.071**	-0.000	0.910
Industry associations	-0.000	0.751	0.000	0.108	-0.000	0.673
Federal government	**-0.002**	**0.000**	**0.001**	**0.017**	**0.001**	**0.003**
Non-profit	0.000	0.623	0.000	0.957	-0.000	0.581
Mass merchandiser	0.001	0.298	0.000	0.795	-0.001	0.211
Environmental activist group	0.000	0.569	-0.000	0.381	-0.000	0.780
Log pseudolikelihood			-492.18			
Prob>Chi2			0.000			
Pseudo R2			15.37%			