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Consumers' willingness to pay for non-GM food labeling in Thailand

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Abstract

Despite the fact that Thailand does not allow the commercialization of GM crops, the imports of GM soybeans, GM maize, and processed GM food are allowed under the current regulations. While the existence of GM food is unavoidable in Thailand's market, food processors have more information on the presence of GM than the consumers. GM food labeling is a means to provide consumers with GM information. However, the current GM food labeling in Thailand only imposes a mandatory "GM labeling" for the food products containing GM ingredients while "non-GM labeling" providing information on the absence of GM ingredient is prohibited. This study uses willingness-to-pay for non-GM labeling to evaluate characteristics of consumers who are willing to pay a premium for non-GM information. The results suggest that non-GM labeling is an appropriate policy for Thailand when the majority of consumers are averse to GM food and willing to pay less for GM contaminated products or if they consider negative health impacts a serious problem.

Introduction

Thailand is one of the countries that do not approve the commercialization of GM crop production, and open-field trials remain highly regulated. In addition, the import regulations of GM products are rather stringent. A list of 85 GM products is prohibited for imports (Ministry of Agriculture and Cooperatives, 2010). GM soybeans, GM maize and processed GM food products, however, are exempt from import prohibition. Evidently the existence of GM food is unavoidable in Thailand's market. Food producers unquestionably have more information about the use of GM ingredients in their products than the consumers. Because GM food is almost impossible to be distinguished from normal food in the market, GM food labeling is a vital means to eliminate asymmetric information between producers and consumers regarding the existence of GM ingredients. As a result, Thailand's Ministry of Health declared GM food labeling regulation in 2002, and it became into forced on May 10, 2003.

Compared to GM food labeling regulations in other countries, Thailand's regulation may be considered as moderately stringent (Gruère and Rao, 2007). Like Indonesia, Russia and Saudi Arabia, the GM food labeling regulation in Thailand is mandatory for the presence of GM ingredients. Unlike the mandatory GM labeling regulations in the EU, Brazil and China that cover the use of GM ingredients in the process of production, mandatory GM food labeling in Thailand is limited to the presence of GM components in the final products. In other words, it applies to "substantial equivalent"[3] GM food products only. Canada, Hong Kong, South Africa and the U.S., on the contrary, impose a voluntary labeling by defining what food can be called GM or non–GM, and let the producers decide whether they want to provide such information on their products. Australia, New Zealand, Japan, South Korea and Taiwan enforce a mandatory labeling for the presence of GM ingredients, and allow a voluntary labeling for the absence of GM ingredients.

The differences in GM labeling policies across countries could reflect the differences in consumers' preferences towards GM food, and the benefits of GM labels accordingly. The current mandatory GM food labeling regulation in Thailand requires that 22 food products, containing ingredients derived from GM soybeans and GM maize, such as popcorn, corn

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snacks, tofu and soybean milk are subject to GM labeling. The GM ingredients must be in the top three major ingredients by weight representing more than five percent of the total weight, and must contain more than five percent of GM in each ingredient (Ministry of Health, 2002). This regulation imposes a "GM labeling" that provides consumers information about the presence of GM ingredients. Food products containing GM materials must be labeled "Genetically Modified". Unlike voluntary "non-GM labeling" that provides information about the absence of GM ingredients in several countries, the use of "GMO-free", "non-GM", "does not contain GM", or other statements alike is prohibited in Thailand. This raises one important question whether the alternative negative labeling could be more appropriate for Thailand's consumers.

In general, GM labeling regulation involves significant costs of segregation, testing, certification and labeling to the food industry that should be weighed against the benefits to consumers such labeling could generate. Studies have shown that GM label is perceived by consumers as a negative signal (Tegene *et al*., 2002); however, it would help steering opposing consumers away from GM products (Runge and Jackson, 2000). Unless consumers who are adverse to GM products are willing to pay a premium to avoid GM foods, the cost of GM labeling could surpass the benefit from the information of GM presence. The drawback with mandatory GM labeling is that all consumers, including those who do not care of GM, bear the cost of testing, certification, and labeling (Caswell, 2000).

While consumers are more likely to judge non-GM labeling as having provided an adequate amount of information to make an informed decision than GM labeling (Roe and Tiesl, 2007), there are several reasons against non-GM labeling. First, it may have less cost advantage than GM labeling. The major cost of non-GM labeling arises from identity preservation and segregation system that non-GM food producers would unavoidably bear so as to gain credibility from consumers. Second, evidences have shown that non-GM labeling is generally viewed as less credible than GM labeling (Teisl *et al*., 2003; Roe and Teisl, 2007) though it (non-GM labeling) probably makes sense if the part of the market that cares about GM is small (Caswell, 1998). Third, and probably the key rationale for the prohibition of negative GM labeling in Thailand, is because it would be misleading to imply that food products are "GM-free" when genetic modification had never been conducted on that product class.

Food producers who avoid the use of GM ingredients to preserve non-GM identity would bear more production cost from segregation and testing, but ironically they are not allowed to promote their products as non-GM under the current regulation. Unsurprisingly despite the prohibition of non-GM labeling, several food products such as tofu and mixed-cereal drink found in Thailand's market are labeled non-GM.

Crespi and Marette (2003) show that GM labeling should be used if the ratio of GM-adverse consumers to indifferent consumers is high, while the non-GM labeling should be used if this ratio is low. Thus, non-GM labeling could be more appropriate in Thailand if consumers who demand non-GM products are willing to pay a premium for non-GM information, and the GM labeling regulation may have to be reconsidered. The objective of this study is specifically to investigate the extent to what non-GM information on soybean milk has on consumer's willingness-to-pay (WTP), relatively to without non-GM information. Soybean milk is chosen for this study because it is a popular product among Thai consumers, and the main ingredient (soybeans) has high potential to be genetically modified.

Materials and Methods

Methodology

In the context of GM food market, willingness-to-pay (WTP) has been used to estimate the maximum premium a consumer is willing to pay extra to avoid GM products while willingness-to-accept (WTA) has been used to estimate the minimum discount he is willing to accept GM products (Moon *et al*., 2007). Regarding consumers' demand for different GM food labeling, the willingness-to-pay (WTP) has been used in several studies (Crespi and Marette, 2003; Huffman *et al*., 2003; Kaye-Blake *et al*., 2004; Loureiro and Hine, 2004; Rousu *et al*., 2007; Scatsasta *et al*., 2007; Gruère *et al*., 2008;Dannenberg *et al*., 2011). In this study, WTP is the price a consumer is willing to pay for a product, and can be considered as consumer's perceived utility from consuming such product and the GM information contained on its label.

Provided that the interested soybean milk product does not contain any GM ingredients, consumer *n*'s WTP for non-GM soybean milk without any GM information (no label) is his perceived utility, $U_n^{\text{no label}}$, which is unobservable. However, the information from a set of observable variables can be utilized to calculate the probability that consumers with certain characteristics will have different perceived utilities. Consumer n's representative utility, denoted

$V_n^{\text{no label}} = V_n^{\text{no label}}(X_n, S_n)$ depends on his observable characteristics, X_n, and perceptions of GM technology, Sn. The unobserved perceived utility is decomposed as where $U_n = V_n + \varepsilon_n$, ε_n is assumed to be random. Thus,

$$WTP_n^{no\ label} = U_n^{no\ label} = f^{no\ label}(X_n, S_n) + \varepsilon_n^{no\ label} \quad (1)$$

Similarly consumer *n*'s WTP for the same product with "non-GM label" is given as U_n^{nonGM} label, and can be written in the same manner.

$$WTP_n^{nonGM\ label} = U_n^{nonGM\ label} = f^{nonGM\ label}(X_n, S_n) + \varepsilon_n^{nonGM\ label} \quad (2)$$

The difference between consumer *n*'s WTP for no labeled soybean milk and WTP for non-GM labeled soybean milk implies the price he is willing to pay extra for non-GM information for the same non-GM product.

$$\Delta WTP_n = WTP_n^{no\ label} - WTP_n^{nonGM\ label}$$

$$= f^{no\ label}(X_n, S_n) - f^{nonGM\ label}(X_n, S_n) + \varepsilon_n^{no\ label} - \varepsilon_n^{nonGM\ label} \quad (3)$$

The value of ΔWTP_n is transformed into three categories:

$$Y_n = \begin{cases} 1 & < 0 \\ 2\ if\ \Delta WTP_n = 0 \\ 3 & > 0 \end{cases} \quad (4)$$

Let $Y_n = 1$ when $\Delta WTP_n < 0$ indicating that a consumer is willing to pay extra for "non-GM label", compared to "no label", and non-GM labeling will satisfy his demand for the non-GM information; $Y_n = 2$ when $\Delta WTP_n = 0$ implying he is indifferent between receiving and not receiving non-GM information; $Y_n = 3$ when $\Delta WTP_n > 0$ meaning a consumer has a higher perceived utility from "no label" than "non-GM label", implying that he prefers not to receive information regarding the absence of GM than to receive such information.

Assume that $\Delta\varepsilon_j$ is independent and identically distributed around zero mean, and its cumulative distribution follows a logistic distribution. The WTP function is assumed to be a linear form; the multinomial logit model (Train, 2003) is used to estimate the choice probability of nominal dependent variable. The logit choice probabilities of individual *n*'s Y_{nj} is expressed as

$$P(Y_n = j) = \frac{e^{\beta_j X_j}}{\sum_{i=1}^{3} e^{\beta_i X_i}} \quad \text{for } j = 1, 2, 3. \quad (5)$$

$$\frac{P(Y_n = j)}{P(base)} = e^{\beta_j X_j}$$

$$\ln \frac{P(Y_n = j)}{P(base)} = \beta_j X_j \quad \text{for all } j \neq base \quad (6)$$

Coefficient estimates from the multinomial logit model calculated from the odd ratio in (6) are interpreted as a pair-wise comparison between the effect of changes in independent variables on the probability of alternative j and the base alternative. A more useful interpretation of the estimates is the marginal effect of variable X_k on the probability of the predicted alternative j, calculated as .

$$\partial P(Y=j)/\partial X_k = \beta_j P_j(1-P_j).$$

Data and estimation

Soybean milk in Thailand is generally sold at two main outlets: a brand name tetra box packaging (with label) at modern trade markets and no-brand plastic bag packaging (without label) at street markets. The former is subject to GM labeling regulation while the latter is not. Bangkok consumers are chosen as a target because they are more reachable to labeled soybean milk, and more aware of GM issues. A survey of soybean milk consumers in Bangkok was conducted via a two-stage stratified sampling method. A supermarket where consumers purchase soybean milk is a proxy to locate consumers with different characteristics. In the first stage, a list of all 137 supermarkets in Bangkok is divided into two groups: high- and low-income, based on store chains. Forty-one of them are considered as high-income shops, and 96 are considered as low-income shops. In the second stage, a store location, urban and suburban, is used as a proxy to categorize consumers into high and low levels of GM knowledge. Urban consumers are assumed to have higher GM knowledge than suburban consumers. In total, 30 supermarkets are high-income high-GM knowledge, 11 are high-income low-GM knowledge, 41 are low-income high-GM knowledge, and 55 are in low-income low-GM knowledge.

Due to unknown population of soybean milk consumers in Bangkok, the sample size is calculated using prior information of soybean consumers who have GM information (Pusdavo , 2006). Presume that the estimated proportion of GM consumers = 0.33, the sample size determined at 0.05 significant level

is 340 (Zikmund, 2000). The samples are equally distributed and randomly selected from four groups of supermarkets.

A consumer is given the information of the reference soybean milk product (250 ml carton) as non-GM (0% contamination), he is shown two hypothetical soybean milk labels: one without any GM information (no label. see Figure 1A) and the other with non-GM information (non-GM label, see Figure 1B). The price of reference soybean milk without GM labeling is given at the average market value of 10 baht/250 ml carton. In an open-ended question, a consumer is requested to elicit this WTP for non-GM labeling of the same product. The difference in WTP is calculated and converted into variable Y_{nj}.

The attitudes toward GM technology are asked on various aspects including the importance of food labeling regarding non-GM information (*sig_nonGM_info*), lower price of GM products (*low_price*), negative health effect (*neg_health*), and positive environmental effect (*postv_env*). The answers are provided on a five-point Likert scale, and converted into points. The WTP for GM labeling (*WTP_GM_label*) is asked to compare consumer's WTP for soybean milk that has less than 5% contamination with GM labeling (GM label, see Figure 1C) and the other without GM information (Figure 1A). The difference in prices reflects his preference towards GM labeling even when GM component is less than 5%.

A maximum likelihood estimation is used to estimate parameters in (6). $Y_n = 2$ ($\Delta WTP_n = 0$) is chosen as a base model. Because occupation and education are qualitative variables, the identification problem is avoided by excluding one category of each variable: student ($Occpn_1$) and bachelor degree (Edu_2), respectively. Income is asked in ranges because many respondents are reluctant to specify his exact income. The income ranges are converted into median value of the range except for the lowest and highest that are translated into the upper and lower values.

Results and Discussions

The definitions and statistics of demographic variables are summarized in Table 1, and those of GM attitude variables are listed in Table 2. Over half of respondents are willing to pay the same price for non-GM labeling as without GM labeling, and nearly 40% are willing to pay higher for non-GM labeling than without any GM information. Over 90% of consumers find information about non-GM important when making purchasing decision, and over 90% of them believe or strongly believe that food labeling regulation should include the information about GM ingredients. About half of consumers have positive attitudes that GM technology will make food products cheaper than conventional food, and that it can reduce the use of chemicals and make a better environment. At the same time, nearly 60% of them still believe that GM food can create a long-term health risk. Sixty percent of respondents are willing to pay less for the same soybean milk with GM labeling than without GM labeling. This is not surprising as the majority of them (66%) are not willing to buy GM food at all.

Table 3 represents coefficient estimates of the logit model. Three coefficients are statistically significant; *WTP_GM_label*, *neg_health* and *postv_env*. Consumers who perceive higher long-term health risks have lower probability to pay the same for negative labeling as no labeling. An increase in attitudes towards negative health effect will increase the probability of paying either more or less for non-GM labeling, compared to no labeling. Similarly, consumers who are willing to pay lower price for GM contaminated soybean milk (GM labeling, Figure 1C) than one without GM information (Figure 1A) are also willing to pay different price, either higher or lower, for non-GM labeling compared to no labeling.

The negative sign of positive environmental attitude variable implies that consumers who have a stronger perception that GM technology uses less chemicals and creates positive environmental impacts are less likely to pay more for no labeling than non-GM labeling. The estimates provide only basic information of the directions of changes in probability of alternatives compared with the base model.

A more useful interpretation is the marginal effects demonstrated in Table 4. The results show that consumers who have stronger attitudes toward negative health impacts have higher a probability of paying more for non-GM labeling than no labeling (Y=1). This implies that when a consumer perceives negative impacts of GM technology, he values non-GM food information on food labels. Similarly, those who are willing to pay less for soybean milk with GM labeling than no labeling (*WTP_GM_label*) are those who are averse to GM products; his probability of paying more for non-GM labeling increases by about 6%. However, the results show that consumers who have stronger attitudes toward positive environmental impact have higher probability of paying more for non-GM labeling than no labeling. This is probably because environmental impact is less associated with this type of consumers than health or GM

Table 1. Demographic variables and summary statistics

Variable	Value	Definition/Unit	Freq/Avg	%
Y	1	if WTP for no labeling < WTP for negative labeling	25	8
	2	if WTP for no labeling = WTP for negative labeling	184	53
	3	if WTP for no labeling > WTP for negative labeling	131	39
Gender	1	= female	213	63
	0	= male	127	37
Age		years	31	
Student	1	= student	66	19
	0	= others	274	81
Public	1	= government officials/state enterprise	52	15
	0	= others	288	85
Business	1	= business owner	33	9
	0	= others	307	91
Private	1	= private sector employee	154	45
	0	= others	186	55
Hired	1	= hired labor, housewife, retiree	35	10
	0	= others	305	90
High_sch	1	= below bachelor degree	72	22
	0	= others	268	78
Undergrad	1	= bachelor degree	198	58
	0	= others	142	42
Grad	1	= above bachelor degree	70	20
	0	= others	270	80
Income		baht/month		
	10,000	=< 10,000	100	29
	15,000	10,001-20,000	120	36
	25,000	20,001-30,000	58	17
	35,000	30,001-40,000	39	11
	45,000	40,001-50,000	10	3
	50,000	> 50,000	13	4

Table 2. GM attitude variables and summary statistics

Variable	Definition	Value	Freq	%
sig_nonGM_info	attitudes whether non-GM information is important	1 = yes	308	91
		2 = no	32	6
GM label	attitudes that GM food labeling regulation should cover imported processed food	1 = strongly disagree	1	1
		2 = disagree	5	2
		3 = neutral	17	5
		4 = agree	166	48
		5 = strongly agree	151	44
low_price	attitudes that GM food is cheaper than conventional food	1 = strongly disagree	19	6
		2 = disagree	59	17
		3 = neutral	77	23
		4 = agree	155	46
		5 = strongly agree	30	8
neg_health	attitudes that GM food consumption can cause long-term health hazard	1 = strongly disagree	11	3
		2 = disagree	37	11
		3 = neutral	96	28
		4 = agree	136	40
		5 = strongly agree	60	18
postv_env	attitudes that GM crop production can reduce chemical use and make better environment	1 = strongly disagree	6	2
		2 = disagree	54	16
		3 = neutral	100	30
		4 = agree	150	44
		5 = strongly agree	30	8
WTB	Are you willing to buy GM food?	1 = yes	114	34
		0 = no	226	66
WTP_GM_label	given reference product (< 5% contamination) with no labeling, a consumer is asked his WTP for the same product with positive labeling	= 1 if WTP for positive labeling < WTP no labeling	208	60
		= 0 if WTP for positive labeling >= WTP nolabeling	132	40

information, and even if they have a better attitude for environmental impact of GM, they make irrational decision for non-GM information.

Consumers who are willing to pay the same for non-GM labeling as no labeling (Y=2) are those whom we hypothesized to be indifferent between non-GM labeling and no labeling, and do not give value to non-GM information. Those who have graduate degrees are more likely to pay the same for non-GM labeling as no labeling, compared to undergraduates by about 12.6%. This implies that more educated consumers are not necessarily willing to pay more for soybean milk with non-GM labeling, and perhaps because they do not perceive certain benefits or risks of GM food. The probability of paying the same for non-GM labeling as no labeling decreases among consumers who have stronger attitudes toward negative health impacts, and those who give less value for the products containing GM information (*WTP_GM_label*), but increases as consumers have stronger attitudes toward positive environmental impacts.

Consumers who perceive GM technology contributing to better environment should have a higher tendency to accept GM products, and also a lower acceptance for non-GM soybean milk products. As expected, the stronger their attitudes toward better a environment from GM technology, the lower is the probability they are willing to pay less for non-GM labeling than no labeling (Y=3).

A negative attitude towards health impact is hypothesized to increase the probability of paying no value to non-GM information (Y=2) or probability of paying more value to non-GM information (Y=3), but increase the probability of paying higher value for non-GM information (Y=1). The findings show that most (57%) of consumers believe that GM foods consumption can cause long-term health hazards. Unexpectedly, the stronger their attitudes toward long-term health hazard, the lower is the probability of paying the same for soybean milk with non-GM labeling, and the higher is the probability of paying less for soybean milk with no labeling. One plausible explanation is that the existing knowledge of Thai consumers on health impacts of GM food is still limited. Their perception of negative health impact undervalues tangible benefits of non-GM labeling.

Consumers who have positive attitudes for the impact of GM crop production on environment are hypothesized to accept GM foods and reject food with non-GM labeling. As expected, the result suggests the more consumers believe that GM crop production reduces chemical use and make a better environment, the lower the probability of paying higher for soybean

Figure 1. 250 ml soybean milk (A) no labeling: containing less than 0% of GM soybeans, (B) non-GM labeling: containing less than 0% of GM soybeans and (C) GM labeling: containing less than 5% of GM soybeans

Table 3. Parameter estimates of logit model (Y=2 is a base model)

	WTP for no label - WTP for non-GM label < 0		WTP for no label -WTP for non-GM label > 0	
	Coeff	Std Err	Coeff	Std Err
Constant	-4.662	2.354	-0.252	1.176
Gender	-0.429	0.472	0.061	0.258
Age	-0.015	0.036	-0.014	0.019
Income	0.000	0.000	0.000	0.000
Public	0.500	0.963	0.618	0.486
Business	0.299	0.810	-0.427	0.538
Private	0.230	0.662	-0.181	0.369
Hired	1.271	0.949	0.339	0.510
High_sch	0.301	0.539	-0.234	0.328
Grad	-1.190	0.825	-0.460	0.318
sig_ nonGM_ info	0.100	0.815	0.544	0.455
GM_label	-0.337	0.335	-0.177	0.189
low_price	0.116	0.253	0.157	0.131
neg_health	0.540**	0.258	0.224*	0.130
postv_env	373.000	0.316	-0.352**	0.149
WTP_GM_ label	1.586***	0.596	0.439*	0.252
Log-likelihood = -269.1735		N = 340		

Note: *, **, *** = statistically significant at 10%, 5% and 1% level, respectively

Table 4. Estimates of marginal effects of logit model

Variables	Y = 1 WTP for no label -WTP for non-GM label < 0	Y=2 = 0	Y=3 > 0
Gender	-0.022	-0.001	0.023
	(0.023)	-	(0.060)
Age	0.000	0.003	-0.003
	(0.001)	(0.004)	(0.004)
Income	-1.360	-2.960	4.320
	(0.000)	(0.000)	(0.000)
Public	0.010	-0.150	0.140
	(0.048)	(0.116)	(0.116)
Business	0.025	0.078	-0.102
	(0.055)	(0.117)	(0.112)
Private	0.014	0.033	-0.047
	(0.030)	(0.086)	(0.085)
Hired	0.077	-0.120	0.042
	(0.089)	(0.121)	(0.121)
High_sch	0.020	0.041	-0.061
	(0.029)	(0.075)	(0.073)
Grad	-0.036	0.126*	-0.090
	(0.022)	(0.071)	(0.070)
sig_nonGM _info	-0.004	-0.115	0.120
	(0.039)	(0.095)	(0.093)
GM_label	-0.012	0.048	-0.036
	(0.015)	(0.045)	(0.044)
low_price	0.002	-0.038	0.035
	(0.011)	(0.031)	(0.031)
neg_health	0.020*	-0.064**	0.043
	(0.011)	(0.031)	(0.030)
postv_env	0.023*	0.067*	-0.091***
	(0.014)	(0.035)	(0.035)
WTP_GM_ label	0.059***	-0.135**	0.076
	(0.022)	(0.058)	(0.057)

Note: *, **, *** = statistically significant at 10%, 5% and 1% level, respectively.
Numbers in parentheses represent standard errors.

milk with non-GM labeling. On the contrary, they have higher probability of WTP less or at least the same for soybean milk with non-GM labeling.

Consumers who are willing to pay less for the information that soybean milk is GM than without GM information (*WTP_GM_label*) implies that he is unfavorable to GM foods. It is hypothesized that they prefer soybean milk with non-GM information and are willing to pay more for it. The results also suggest that they have a higher probability of paying more for soybean milk with non-GM labeling than no labeling by about 5.9%, and a lower probability of paying the same for soybean milk with non-GM labeling than no labeling by about 13.5%, compared to those who are willing to pay the same or more for GM contaminated products.

Other demographic variables including gender, age, income level and occupation are insignificantly correlated to the probability choice of paying for non-GM labeling. This implies that characteristics of consumers are not as important as their attitudes for GM food in determining their price of non-GM labeling. The result is consistent with the study by Baker and Burnham (2001) where attitude variables performed better as explanatory variables than socio-demographic variables. Despite the fact that a large proportion of consumers strongly believe or believe that GM technology could lower the price of food

products due to lower cost of production, the attitudes toward lower price of GM products are insignificant. Likewise, attitudes toward the importance of non-GM labeling and GM labeling regulation for imported products are insignificant. The reason could be the inadequate understanding of GM food labeling regulations and confusion that makes choice of paying for non-GM labeling irrelevant.

Conclusions

There has been no evidences that current GM food labeling regulation in Thailand that only allows for GM labeling (presence of GM ingredients) is more appropriate than non-GM labeling (absence of GM ingredients) for Thai consumers. This study attempts to provide information on the alternative non-GM labeling. The difference in consumer's willingness to pay for non-GM labeling and no labeling reflects the value he is giving to non-GM information. Consumers' characteristics and various aspects of attitudes toward GM food are hypothesized to reflect their preference for non-GM information, thus influence their willingness to pay for different labels of soybean milk. The results reveal that consumers who have negative attitudes toward long-term health impact, and those who are averse to GM food and willing to pay less for GM contaminated product give value to non-GM information and more likely to pay for non-GM labeling. Perhaps because the attitude towards positive environment impacts of GM technology is more remote to consumer's purchasing decision, it gives a contradictory result that non-GM labeling signals better product. Attitudes toward benefit of GM technology to lower the cost of production and the price of product, however, do not influence consumers' value for non-GM labeling.

The prominent limitation of this study is the hypothetical questions of WTP for non-existence label. To elicit the market value of non-GM information on food labels, experimental auction, where consumers use real money for real products, could be used for future studies though targeted sample size might have to be compromised.

This study suggests that Thai consumers probably do not have enough understanding of GM food labeling regulations to influence the price they are willing to pay for non-GM information. The non-GM labeling would not necessarily benefit Thai consumers unless the majority of them are averse to GM food and willing to pay less for GM contaminated products or if they consider negative health impacts a serious problem.

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