

# How External Political-Economic Forces Affect Firms' Attitudes Toward the Industrial Use of Genetically Modified Organisms: An Analysis in the South Korean Context

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Based on survey data, this article investigates the effects of external political-economic forces on firms' attitudes toward the industrial use of GMOs in the South Korean context by performing an ordered probit regression analysis. The survey, covering 240 firms, was conducted from November 15, 2005 through December 17, 2005. Results indicate that external political-economic pressures derived from government, consumers, industry, and markets were important for promoting firms' industrial use of GMOs. The most important variables (listed in order of decreasing importance) were market attractiveness, competitive intensity, consumer acceptance, and regulatory intensity in terms of the coefficient. Hence, in South Korea, to promote firms' industrial use of GMOs, the highest priority must be given to policy measures promoting market circumstances securing high profits. And these should be followed by policies that induce inter-firm competition, obtain consumer acceptance, and develop government regulations that are not a burden to firms. NGOs pressures (i.e., NGOs objection), firm's size, and dummies for firm types (i.e., food industry vs. others) were not significant factors affecting firms' attitudes towards the industrial use of GMOs.

**Key words:** Korea, industrial use of GMOs, political-economic forces, firms' attitudes.

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## Introduction

Genetically modified organisms (GMOs) resulting from modern biotechnology are the expanding industrial resources with various applications in industrial sectors as diverse as chemistry, food and feed, pulp, and paper or textile, etc. The industrial use of GMOs is currently positioned as a one of the most significant and contentious societal debates globally. Their significance arises from the perceived economic benefits to firms that can successfully capture competitive advantages in industrial use, counterposed by the possible threats to human health and the environment. In this context, the ability to use GMOs seems likely to become one of the key drivers of global economy in the future.

Most firms are fully aware of the strategic importance of issues relating to the industrial use of GMOs. However, many leaders of firms think it may not be easy to realize great potential benefits from the industrial use of GMOs. This stems from an inconsistency between societal needs and expectations of the potential benefits and risks relating to the industrial use of GMOs. Such inconsistency has been imposing society-specific endogenous political-economic pressures on firms. These pressures derive from the external stakeholders' needs and expectations that GMOs will assume impor-

tant roles in creating business opportunities for, and damaging social reputations of, firms. The external political-economic forces, hence, have significant effects on firms' attitudes towards the industrial use of GMOs.

This article investigates the effects of external political-economic forces on firms' attitudes toward the industrial use of GMOs and discusses its policy implication in the South Korean context. In particular, this article attempts, by performing an ordered probit regression analysis, to identify the country-specific importance and priority of the external political-economic forces that may influence firms' attitudes defined as a pattern based on two variables, managerial interpretations (Dutton & Duncan, 1987), and behavioral intentions (Cordano & Frieze, 2000; Flannery & May, 2000).

## External Political Forces and Firms' Attitudes

The external political environment includes pressures from external stakeholders demanding that firms secure social legitimacy in order to survive. As per stakeholder theory (Freeman, 1984), firms ought to respond to the objectives and concerns of all possible stakeholder

groups impacted by, and having an impact upon, the firm. Stakeholder theory, however, is largely prescriptive, and in practice, firms respond to the concerns and objectives only of those stakeholders whom they consider to be strategically important. Studies by Babinard and Josling (2001) and Brammer, Dixon, and Ambrose (2003) identify the main sources of external political pressures relating to the industrial use of GMOs as government, consumer, and non-governmental organizations (NGOs), which are strategically important to firms.

But Aerni and Bernauer (2006) seem to describe NGOs as the only external political actor to firms, insinuating that regulatory intensity and consumer acceptance may be the result of anti-GMO campaigns by NGOs that attracted public attention. This seems that NGOs, consumers, and government cannot be separate external political actors. In fact, NGOs are mounting anti-GMO campaigns based on their position papers (Aerni & Bernauer, 2006), fulfilling a watchdog role, acting as private enforcers, and seeking compensation or preventing harm (Gunningham & Grabosky, 1998). These roles contribute to why NGOs may put pressure directly on firms and industry (Gunningham, Phillipson, & Grabosky, 1999). As mentioned in Aerni and Bernauer (2006), numerous NGOs also stand out as the main distributors of information on GMOs to government and consumers. This means that NGOs play a role, not as the only conclusive source determining regulatory intensity and consumer acceptance on GMOs, but as one of several stakeholders that strengthen the regulatory intensity and reinforce negative consumer acceptance of GMOs.

### **Government Pressures**

The development, application, or commercialization of innovative products or technologies, including GMOs, prompts the creation of regulations. Regulations perform two functions: economic and social. The former improves the allocative efficiency of the market system, such as ensuring the productivity and competitiveness of commercial activity within a particular jurisdiction (Porter, 1990). The latter channels market activity to meet non-economic preferences and expectations, for example, food-safety measures (Spriggs & Isaac, 2001) and environmental-protection measures (Wheal & Williams, 1993). All regulations are, in fact, a blend of economic and social objectives (Isaac, 2002). According to Paarlberg (2001) and Foster, Berry, and Hogan (2003),

regulations on GMOs also are a mixture of the two functions.

Korea drafted the Act on Transboundary Movement of Living Modified Organisms (LMO Act) and its Presidential Decree and Ministerial Ordinance to implement the Cartagena Protocol on Biosafety (CPB) on March 28, 2001, and finalized the Protocol on September 30, 2005, which was then announced on December 27, 2007. Korea ratified the CPB on October 3, 2007 and on January 1, 2008, implemented the LMO Act, Korea's implementing legislation for the CPB. The Korean government is considering that the LMO Act needs to be revised to be consistent with the actual practice and the CPB. The CPB seeks to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling, and use of GMOs by taking into account risks to human health and the environment in accordance with the precautionary approach contained in Principle 15 of the Rio Declaration Environment and Development. This means that the CPB emphasizes social function to acquire the safety in the industrial use of GMOs.

Regulatory policies focused on social functions can result in increased costs to firms by requiring it to ensure the safety in the industrial use of GMOs at a high level. In many ways, such regulatory and institutional barriers comprise the largest obstacle to firms faced with the industrial use of GMOs, which discourages many firms from pursuing GMO usage.

### **Consumer Pressures**

Firms regard consumers as more strategically important reference points than other external stakeholders. According to Aerni (2001) and Curtis, McCluskey, and Wahl (2004), a consumer's perceived cost-benefit analysis influences his or her acceptance of GMOs and GM products. To consumers, the safety to GMOs and GM products is a matter of concern given the highest priority on the assumption that they can furnish potential benefits.

The introduction of innovative products, including GMOs, is mostly accompanied by uncertainty, such as the unknown risks to human health and the environment, which raises considerable concern among consumers in most countries. A 2007 poll of 1,508 consumers conducted by the Korea Biosafety Clearing House (KBCH) showed that 75% of the respondents were aware of biotechnology. Of the respondents, 72% and 70% expressed concern that GMOs would be harmful to human health and the environment, respectively. Additionally, 63% of the respondents thought GMOs are

greatly beneficial to humans, whereas 47% thought they are not beneficial. Only 5% of the respondents had a very positive outlook on GMOs in terms of acceptance (Ministry of Knowledge Economy [MKE], 2008).

Bredahl (2001), Moon (2001), and Grunert, Bredahl, and Scholderer (2003) have shown that consumers have positive attitudes toward GM products when such products satisfy consumers' expectations of safety. Consumers' positive attitudes can affect their purchase intentions and behaviors, which have a direct influence on firms' attitudes toward the industrial use of GMOs. Hence, when a firm perceives that consumers' acceptance of GMOs and GM products is high, it is active in the industrial use of GMOs.

### **NGOs Pressures**

NGOs engage in vigorous protests against the use of GM ingredients by firms (Heugens, 2003) and appear to be largely opposed to GMOs (Aerni & Bernauer, 2006; Paarlberg & Pray, 2007). NGOs' activities against GMOs and GM products lead to the GM-free declaration of firms (Brammer et al., 2003) and have an effect on the formation of public antipathy toward GMOs (Burke, 2004). There are about 20 NGOs in Korea that irregularly express their concerns about GMOs. The NGOs have presented their social and scientific claims in press releases, statements, and self-published reports, and have carried out their GM-free campaigns.

NGOs achieve strength (power), present particularly pressing agendas (urgency), and possess strong reputations (legitimacy) as a consequence of resources that they acquire or use (Doh & Teegen, 2002), which allows them to summon wide social support. From this perspective, endorsement by NGOs can have a direct influence on firms' positive attitudes toward the industrial use of GMOs. Hence, a firm is active in the industrial use of GMOs when it perceives that NGOs' acceptance of GMOs and GM products is high.

### **External Economic Forces and Firms' Attitudes**

The external economic environment that, in general, implies present or prospective economic circumstances includes pressures demanding that firms improve economic performance. The economic benefit-seeking behaviors of firms are mainly due to industry structure and product market characteristics.

### **Industry Pressures**

The stakeholder literature posits that, in competitive environments, strategies and tactics that appear to have market value are quickly imitated or adopted (Jennings & Zandbergen, 1995). Competitor actions may be a source of mimetic isomorphism (Delmas & Toffel, 2004). The high degree of mimetic pressure suggests that competitors can take a more active and competitive posture in the industrial use of GMOs to stay ahead of the competition.

Korean companies have publicly declared to be GM-free in industrial sectors such as food, medicine, and wholesale, which is an example of competitive matching within the industry. However, competition among firms in the industrial use of GMOs becomes intense when firms perceive that GMOs and GM products provide them with sufficient economic benefits. Hence, a firm is active in the industrial use of GMOs when it perceives that competitive intensity among firms in the industrial use of GMOs and GM products is high.

### **Market Pressures**

Attractiveness of a product market is a function of the size and rate of market growth (Menon & Menon, 1997), which ensures higher profits (Eliashberg & Chatterjee, 1985). A firm will study various strategic tactics when it perceives the probability of creating market opportunity to be high. A positive evaluation of the potential profits of GMOs and the GM product market reduces the risks and the uncertainties relating to the industrial use of GMOs, which is likely to lead firms to carry out various activities aimed at capturing the profit potential. Hence, a firm is active in the industrial use of GMOs when it perceives that attractiveness of GMOs and GM product markets is high.

### **Measures**

The research instrument was a fixed-response questionnaire using a five-point Likert scale (*1=strongly disagree, 5=strongly agree*). The majority of this article's data flow from a survey carried out in South Korea from November 15, 2005, to December 17, 2005.

This article conducted purposive sampling of firms in the food/beverage, leather/bag/footwear, pulp/paper, fiber, cokes/refined petroleum products, compounds/chemicals, rubber/plastic, wholesale/commodity brokerage, and retail industries. The survey collected a total 240 usable firm responses through one-on-one interviews with the senior manager of each firm in the sample.

Table 1. Factor analysis: External political-economic forces.

Items	Communality	CA (factor 1)	CI (factor 2)	NO (factor 3)	MA (factor 4)	IR (factor 5)
<b>IR1. Overall, the regulations related to GMOs and GM products are very strict.</b>	0.671	-0.078	-0.044	-0.210	-0.117	0.778
<b>IR2. The regulations related to GMOs and GM products can result in increased costs to the company.</b>	0.552	-0.140	-0.262	-0.174	0.014	0.664
<b>IR4. The regulations related to GMOs and GM products are reducing the firm's ability to operate efficiently and profitably.</b>	0.736	-0.099	0.003	-0.163	-0.120	0.828
<b>CA1. Consumers believe that GMOs and GM products are safe with respect to human health and the environment.</b>	0.725	0.835	0.138	-0.060	0.011	-0.074
<b>CA2. Consumers think that GMOs and GM products are necessary to human beings.</b>	0.653	0.705	0.263	-0.161	0.232	-0.089
<b>CA3. Consumers prefer GMOs and GM products.</b>	0.761	0.801	0.029	0.097	0.308	-0.121
<b>CA4. Consumers believe that GMOs and GM products offer great benefits, potentially, to human beings.</b>	0.758	0.834	0.078	0.004	0.221	-0.088
<b>CA5. Overall, consumers accept GMOs and GM products.</b>	0.634	0.770	0.169	0.072	0.079	-0.031
<b>NO1. NGOs have considerable antipathy to the industrial use of GMOs.</b>	0.824	0.037	-0.062	0.863	-0.089	0.256
<b>NO2. NGOs' demonstrations against the industrial use of GMOs are frequent occurrences.</b>	0.862	-0.017	-0.083	0.903	-0.043	0.195
<b>NO3. NGOs' activities directed at opposition to the industrial use of GMOs are highly systemtized.</b>	0.649	-0.013	-0.075	0.794	-0.023	0.115
<b>CI1. The competition for investing in the industrial use of GMOs among competitors in the industry served is fierce.</b>	0.753	0.173	0.816	-0.093	0.209	-0.071
<b>CI2. Competitors are very aggressive in using GMOs.</b>	0.774	0.194	0.797	-0.118	0.263	-0.138
<b>CI3. In the industry served, there is fierce competition for differentiation among competitors by using GMOs.</b>	0.776	0.158	0.842	-0.031	0.180	-0.090
<b>MA1. The current market size for GMOs and GM products is large.</b>	0.730	0.164	0.315	-0.177	0.754	-0.061
<b>MA2. The size of potential markets for GMOs and GM products in the future will grow rapidly.</b>	0.782	0.317	0.127	0.008	0.809	-0.100
<b>MA3. Putting GMOs and GM products on the market can lead to high profits for the firm.</b>	0.730	0.184	0.273	-0.023	0.782	-0.098
<b>Eigenvalue</b>		5.70	2.80	1.67	1.11	1.07
<b>Percent of total variance</b>		33.56	16.49	9.85	6.56	6.29
<b>Kaise-Meyer-Olkin</b>	0.843					
<b>Barlett Test of Sphericity</b>	2077.03 ( <i>P</i> =.000)					
<b>Scale reliability analysis Cronbach's alpha (emboldened variables)</b>		0.881	0.855	0.855	0.823	0.711

Table 2. Factor analysis: Attitudes of the firm.

Items	Communality	IU (factor 1)	MI (factor 2)
<b>MI1. Industrial use of GMOs represent an opportunity for the business.</b>	0.771	0.230	0.848
<b>MI2. Industrial use of GMOs is jeopardizing profits of the firm.</b>	0.802	0.234	0.862
<b>MI3. Investing in the industrial use of GMOs can lead to competitive benefits for the firm.</b>	0.797	0.225	0.864
<b>IU1. We are willing to use GMOs.</b>	0.884	0.899	0.274
<b>IU2. We have a plan to use GMOs.</b>	0.920	0.921	0.268
<b>IU3. We are willing to invest money for using GMOs.</b>	0.880	0.915	0.205
<b>Eigenvalue</b>		3.81	1.24
<b>Percent of total variance</b>		63.65	20.67
<b>Kaise-Meyer-Olkin</b>	0.804		
<b>Barlett Test of Sphericity</b>	1083.52 ( <i>P</i> =.000)		
<b>Scale reliability analysis: Cronbach's alpha (emboldened variables)</b>		0.867	0.940

### External Political-Economic Forces

This article defined government pressures in terms of the intensity of regulatory environment (IR) based on Delmas and Toffel (2004), the extent to which it restricts a firm's activities and assessed IR in terms of four items (see Table 1): overall stringency (Brammer et al., 2003), the number of regulatory inspections (Delmas & Toffel, 2004), cost-burden, and the reduction of operational effectiveness and profitability (Fineman & Clarke, 1996). Consumer pressures were defined as consumer acceptance (CA), based on Aerni (2001), Curtis et al. (2004), Moon (2001), Frewer, Hedderley, Howard, and Shepherd (1997), Gaskel (2000), and Hoban (2000), and assessed CA in terms of five items (see Table 1): overall acceptance, trust in safety, perception of benefit, perception of the need, and preference. NGO pressures were defined as NGO objection (NO), based on Aerni and Bernauer (2006), and measured NO using three items (see Table 1): the intensity, frequency, and organization of opposition activities (Burke, 2004). Industry pressures were conceptualized as competitive intensity (CI), which is related to the activities of competing firms based on Cui, Griffith, and Cavusgil (2005). This article used a three-item set (see Table 1) to assess the extent of competition in terms of the degrees of differentiation, competition, and activity in the industrial use of GMOs of competitors. Market pressures were defined as market attractiveness (MA), based on Menon and Menon (1997) and Eliashberg and Chatterjee (1985), and assessed MA in terms of three items (see Table 1): size,

growth, and profitability of GMOs and GM products market.

### Attitudes of Firms

This article defined the attitude of a firm as a pattern based on two variables, managerial interpretations (Dutton & Duncan, 1987) and behavioral intentions (Cordano & Frieze, 2000; Flannery & May, 2000).

One dimension of managerial interpretations along which managers have been found to make sense of, or interpret, strategic issues is whether an issue is perceived as a threat or as an opportunity (Jackson & Dutton, 1988; Sharma & Nguan, 1999). This article used a three-item set (see Table 2) based on Sharma and Nguan (1999) to measure managerial interpretation (MI).

Studies using Ajzen's theory of planned behavior define behavioral intention in terms of the intention and plan to perform specific activities (Cordano & Frieze, 2000). This article assessed intention of industrial use (IU) with three items (see Table 2) in line with the work of Ajzen (1991).

### Research Methodology

#### Construct Validation and Scale Purification

A rotated (varimax) principal component factor analysis reduced all 18 items of external political-economic forces to a five-factor solution, accounting for 72.75% of the variance (see Table 1).

**Table 3. Cluster profile of the attitudes of the firm.**

Variable	1. Reactive (n=78)	2. Defensive (n=64)	3. Active (n=98)	ANOVA		Duncan's multiple range test		
				F ratio	F prob.	1-2	1-3	2-3
MI <sup>a</sup>	-1.023 (2.16)	-0.982 (3.59)	0.275 (3.49)	232.058	0.000	*	*	*
IU <sup>a</sup>	-0.370 (1.53)	0.825 (1.62)	0.936 (3.57)	147.620	0.000	*	*	*

<sup>a</sup> Variables are standardized factor scores.

\* Significant differences between cluster are calculated using the Duncan's multiple range test ( $p < 0.000$ ). Parentheses denote the descriptive statistics means for each attitude cluster.

Only 1 of the 18 items, the number of regulatory inspections (IR3), did not load on any factor. All five factor solutions produced an eigenvalue greater than 1. The associated item factor loadings ( $> 0.6$  for all 17 remaining items) and reliability alphas satisfied the criteria established by Nunnally (1978).

A rotated (varimax) principal component factor analysis reduced all 6 items of the attitudes of the firm to a two-factor solution, accounting for 84.32% of the variance (see Table 2). The associated item factor loading and reliability alphas were satisfactory.

**Ordered Probit Regression**

This study conducted a cluster analysis to classify a firm's attitude defined as a pattern in accordance with the recommendation of Punj and Stewart (1983) and Harrigan (1985). And then this study used F-ratio comparisons of variances among the standardized factor scores of criterion variables from a one-way ANOVA analysis and Duncan's multiple range test to see the inter-cluster differences attributable to each variable. Table 3 shows the results of the cluster analysis.

As shown in Table 3, all ANOVA F-statistics are highly significant. The first cluster (reactive) accounts for 78 firms, 32.5% of the sample. Cluster members scored low on both opportunity interpretation and intention of industrial use. The second cluster (defensive) accounts for 64 firms, 26.7% of the sample. Cluster members scored *high* on opportunity interpretation and *low* on the intention of industrial use. The third cluster (active) accounts for 98 firms, 40.8% of the sample. Cluster members scored high on the both dimensions. Duncan's multiple range test indicates that the yield standardized factor scores are statistically different among the three cluster profiles.

Firms' attitudes (reactive, defensive, and active) are ordered or ranked according to two criteria: managerial interpretations and behavioral intentions. For that rea-

**Table 4. Ordered probit regression analysis (N=240).**

Variable	Coefficient (std.err)	Wald
IR	-0.396 (0.139)	8.105**
NO	-0.245 (0.138)	3.158
CA	0.578 (0.140)	16.967**
CI	0.744 (0.145)	26.432**
MA	0.913 (0.149)	37.518**
SIZE	-0.005 (0.000)	0.109
INDUSTRY=1	0.515 (0.413)	1.561
INDUSTRY=0	0 <sup>a</sup>	
Pseudo-(Nagelkerke)		0.351
Pearson goodness-of-fit, chi-square (471)		464.322
Model fitting, chi-square (7)		89.300

Note. Dependent variable is firms' attitudes. Link function probit.

\*\* and \* denote statistical significance at the 1% and 5% levels, respectively.

Parameter, <sup>a</sup>, is set to 0 because it is redundant. Summary and goodness-of-fit statistics report degrees of freedom values in the parenthesis.

son, an ordered probit regression model with two control variables—firm size, measured using annual sales, and dummies for firm types, where INDUSTRY=1 is 1 for a firm engaging in food industry and INDUSTRY=2 is 0 for a firm not engaging in food industry—was used to analyze the effects of external political-economic forces on firms' attitudes toward the industrial use of GMOs.

The results obtained with our data are shown in Table 4. The explanatory variables IR, CA, CI, and MA seem to be significant at 1% level. The results of this analysis show that regulatory intensity has a *negative* effect on firms' attitudes toward the industrial use of GMOs, and consumer acceptance, competitive intensity,

and market attractiveness have a *positive* effect on firms' attitudes toward the industrial use of GMOs.

However, NGOs' objections do not have an influence on firms' attitudes toward the industrial use of GMOs, which seems to be explained in terms of a political resource like money or political power, based on Aerni and Bernauer (2006). About 20 NGOs in Korea do not depend on foreign donors and do not get enough funds from the Korean government. The NGOs can decide independently on setting their priorities in activities due to the strong independence from foreign and domestic funding, but the NGO's actions can be restricted by lack of money. Therefore, it is not surprising that NGOs in Korea have organized a coalition and tend to only irregularly express their concern about GMOs and carry out their GM-Free campaign. As a result, NGOs in Korea seem to be unable to achieve public trust, a trait that is considered a political resource like money or power. This lack of power prohibits the NGOs from playing a key role in the formation of firms' attitudes toward the industrial use of GMOs.

### Implications and Limitations

This article proposed an ordered probit regression model of the effects of external political-economic forces on firms' attitudes toward the industrial use of GMOs and tested it in the South Korean context.

According to studies by Carter and Gruère (2003) and Kalaitzandonakes and Bijman (2003), firms' attitudes are main factors in determining the industrial use of GMOs. From this perspective, the results of this study have two key implications for policymakers. One significant implication is that policymakers need to identify and grasp the external political-economic forces. The results show that external political-economic pressures derived from government, consumer, industry, and markets are important for promoting firms' industrial use of GMOs, which suggests that governments should expend a great deal of effort trying to consider such pressures in developing and implementing national policy on the industrial use of GMOs. In this context, the results of the ordered probit regression model contain the country-specific importance of external political-economic forces that may affect implementation of effective policies and strategies. On the basis of the coefficients, the most important variables—listed in order of decreasing importance—are MA, CI, CA, and IR. Hence, in South Korea, to promote firms' industrial use of GMOs, policy measures directed toward promoting market circumstances that ensure high profits should

get the highest priority. These should be followed by policies that induce inter-firm competition, obtain consumer acceptance, and develop regulations that are not a burden to firms. The second implication is that policymakers need to examine firms' attitudes toward the industrial use of GMOs. The results of this study show that regulatory intensity, consumer acceptance, competitive intensity, and market attractiveness have significant influence on firms' attitudes, which means firms' attitudes are a significant criterion for developing and implementing national policy. In order to create effective policy, policymakers should fully take into account key stakeholders' needs and expectations within the social system. However, it is not easy for governments to grasp the needs and expectations of all stakeholders involved. In this case, firms' attitudes can be the proxy for strategically important stakeholders' needs and expectations that policymakers should consider.

This study has three limitations. The first limitation is that, because the research design was cross-sectional, the study does not shed light on changes in firms' attitudes toward the external political-economic forces over time. Future research, hence, should conduct yearly follow-up surveys over a long period in order to be able to capture whether or not these firms moved to more active positions. The second limitation is the sample size of 240 firms, which limits our ability to draw implications for each industry. The third limitation is that, because the study is South-Korea specific, the study may not generalize to other countries. Future research, hence, should conduct an empirical test to confirm the effects of political-economic forces on firms' attitudes in other countries toward the industrial use of GMOs.

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