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Consumer and Producer Influences in Agricultural Policy Formulation: Some Empirical Evidence

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Abstract
The political economy of agricultural protection (PEAP) literature has progressed along two distinct paradigms of the interactions among economic agents: the self-will government (SWG) models and the clearing house government (CHG) models. This study treats the two approaches as complementary, as it investigates the primary determinants of agricultural protection across industrialized and developing countries.

Disciplines
Agricultural and Resource Economics | Agricultural Economics | Economic Policy | Public Economics

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Working Paper 97-WP 175
January 1997

Center for Agricultural and Rural Development
Iowa State University

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Introduction

The political economy of agricultural protection (*PEAP*) literature has progressed along two distinct paradigms of the interactions among economic agents: the *self-willed government* (*SWG*) models and the *clearing house government* (*CHG*) models. The first approach assumes that the government is an autonomous unit maximizing a social welfare function. The *CHG* approach treats the political process as a clearing house where a relatively passive government redistributes resources among different interest groups. The earlier *PEAP* studies have viewed the protectionistic policies as being the outcomes of either altruistic motives or the self-interest motives. This study treats the two approaches as complementary. This study investigates the primary determinants of agricultural protection across industrialized and developing countries. Our hypotheses are that consumers' concerns regarding stable consumption patterns as well as producers' pressure group characteristics play a prominent role in the determination of political market equilibrium in the agricultural sector. This methodology integrates development of theoretical and empirical analyses. Davidson and MacKinnon's (1981) pair-wise non-nested *J* tests are used to analyze the relative influence of consumers and producers in policy formulation across countries.

Theoretical Framework

Consumer Model

It is postulated that the perceived benefits from consistent consumption patterns through stabilization of food prices translates into consumer preferences. These perceived benefits constitute the demand for intervention from the consumers. Since incomes and the size of risk in relation to income vary from society to society, this generates varying degrees of political demand from consumers across countries. This section proposes an alternative hypothesis to explain this phenomenon as an extension of Foster and Rausser's (1992, p. 17) and Gardner's (1990, p. 20) suggestions. Consumers accept government intervention in the agricultural sector because of the consumption benefits accruing to them.[1] The argument relates to the paradigm of the social concerns approach that groups seeking risk insurance are protected by the government. This motive has largely been ignored in the *PEAP* literature so far. This section stresses the need for an analysis that quantifies the linkages among food security, price stabilization and *PEAP* policies.

Assume the consumer derives utility from the consumption of two commodities, q_1 and q_2 , whose prices are p_1 and p_2. Let q_1 be the staple food commodity in question (wheat) and q_2 be a composite bundle of other commodities. The consumer prefers a smooth consumption pattern over an erratic one. In a stochastic environment where production and prices are fluctuating, the consumer is interested in meeting a target level of consumption. Let the income of the consumer be y; and $\hat{q}_1$ and $\hat{q}_2$ be the minimum target consumption levels of q_1 and q_2. It can also be assumed that both goods are substitutes to a certain extent only after the minimum requirements of both have been met. If the consumption of q_1 falls below the target level, then extreme discomfort occurs. In terms of indirect utility function, $\tilde{v}(p_1 , p_2 , y)$, which is twice differentiable within the feasible region with $(\partial\tilde{v}/\partial p_i) < 0$, $(\partial\tilde{v}/\partial y) > 0$, and $(\partial^2\tilde{v}/\partial y^2) < 0$, where $i = 1,2$:

$$\tilde{v} = \begin{bmatrix} v(p_1, p_2, y) & if & p_1 \leq \frac{y}{\hat{q}_1} \\ v_o & if & p_1 > \frac{y}{\hat{q}_1} \end{bmatrix}.$$

The consumer may be interested in a price stabilization policy that would alter the distribution of prices such that the probability of prices being higher than the critical level is reduced. In this case, then, the expression for the indirect utility function becomes

$$E\,[\tilde{v}] = \int_0^{y/\hat{q}_1} v(\cdot)\, g(p_1)\, dp_1 + v_o \left\{1 - G\left(\frac{y}{\hat{q}_1}\right)\right\} = \int_0^{y/\hat{q}_1} v_o\,(p_1,\ p_2,\ y - b)\, g\,(p_1)\, dp_1$$

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11 This argument is postulated to transcend across developing as well as industrialized countries, albeit with varying degrees.

Note that now

$$G\left(\frac{y}{\hat{q}_1}\right) = \int_0^{y/\hat{q}_1} g(p_1)\, dp_1 = \Pr\left\{ p_1 \le \left(\frac{y}{\hat{q}_1}\right)\right\} = 1 \qquad \text{where,} \quad \int_{y/\hat{q}_1}^{\infty} g(p_1)\, dp_1 = 0.$$

Using Taylor series approximation on both sides of the expected utility function, $E[\, v(p_1 , p_2 , y)\,] = v\, (\bar{p}_1^*, p_2 , y - b)$, and taking expectations, an expression similar to Newberry and Stiglitz (1981) is obtained for the cash benefits to the consumers of price stabilization (or the gains that would accrue from partial stabilization of the domestic market around $\bar{p}_1^*$):[2] $b \cong (½)\, \beta_1\, y[\, \beta_1 (R_c - \eta) - \varepsilon_{11}]\, \sigma^2_{p1} / p_1^2 - \beta_1 (R_c - \eta)\, \rho_{p1,y} / p_1$. Using the implicit function theorem, the consumer benefits can be expressed in terms of price and income elasticities of demand (ε, η), Arrow-Pratt's coefficient of relative risk aversion (R_c), Engel coefficients (β), and the income of the consumer (y). Ignoring the subscripts, then,

$b^* = \tau\{\beta, \varepsilon, R_c , y, \eta, \omega\}$ where, ω is a vector of other exogenous variables.

Producer Model

A behavioral model of agricultural producers is developed following the *CHG* approach in the *PEAP* literature. The political power of the producer group depends upon attributes such as their membership size, their efficiency at overcoming the free-rider problem and their incomes. Farmers' investment in political influence for securing protection (k), their relative group size (n) and income level (w), have been modeled explicitly into the traditional theory of profit maximizing firms.[3]

The price of the output is hypothesized to be influenced by the farmers' lobbying activity, that is, $p = \bar{p} + \tau(\bullet)$, where $\bar{p}$ is the mean of free-market price without intervention,

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22 Analogous to food security, a case may also be made here for consumers' social preferences to pay to support farmers because of the perceived virtues of country life.

33 It is assumed that producers maximize their profits without taking into account the demand for protection coming from consumers such that the interaction term regarding the effects of level of expenditures of one group on that of the other can be ignored.

$\tau > 0$ is the increase in price (subsidy) due to lobbying and $\tau < 0$ implies taxation of producers.[4] The amount of political support supplied in response to a given expenditure of time and resources by the group, $K = \sum_{i=1}^{n} k_i,$ would depend upon a number of factors such as their number and wealth. The farmer's maximization problem can be written as:

$$\pi_i = [\bar{P} + \tau(k, w, n, \theta)]\, q_i - c(q_i) - k_i \, .$$

The first-order conditions would imply that producers spend on lobbying as long as the last dollar spent brings about an increase in income of one dollar, that is, $q_i(\partial\tau/\partial\kappa)=1$. Using the implicit function theorem, the producers' maximization problem yields the expression for the indirect profit function: $\pi^* = \pi(\bar{P}, w, n, q)$. Thus, the profits of agricultural producers are affected by the size (n) and wealth (w) of the group, the mean of the free-market price ($\bar{P}$), and some other exogenous variables (θ).

Politician's Model

Government is assumed to choose the level of policy instrument, τ, so as to maximize an objective function defined over the indirect utility function of consumers (v^*), the indirect profit function of producers (π^*) and the cost of the policy (m). A government/politician's optimization problem is defined as: $Max_\tau \; U = U(v^*, \pi^*, m)$, where U is the politician's utility function for the staple food policy-making assumed to be separable, additive and strictly concave in its arguments. It is further assumed that the politician's preferences in the staple commodity policy are separable from other concerns.

To illustrate the effect on domestic consumers and producers assume that the cost of the policy, m, is constant. Then, this equation implies that $\frac{-\partial U/\partial v^*}{\partial U/\partial \pi^*}\Big|_{m=const.} = \frac{\partial \pi^*/\partial\tau}{\partial v^*/\partial\tau}$.

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44 The theory developed here focuses on a homogeneous commodity (q) with no substitution, and a small country case - in which the world price of the commodity is considered as given. In this case, the border price can be substituted for the free-market price. Moreover, it is consistent with the empirical analysis since the calculations of the dependent variable are also based upon these assumptions.

In other words, the politician will set the policy instrument level where the marginal rate of substitution of consumer's interests for producer's interests is equal to the trade-off between the producer's and consumer's interests due to a change in the policy instrument.

Determinants of International Agricultural Protection

In this section, an attempt is made to empirically validate the results of the consumer, producer and policy-makers' models using the data from 30 industrialized and developing countries for the period 1982-87 (USDA, 1990 and 1993). The next subsection tests the significance of consumers' food security concerns in the determination of protectionistic policies. The *OLS*, *GLS* and pooled cross-section time-series (*PCSTS*) estimation techniques are used to fit the regression models with producer subsidy equivalents for wheat (PSE_{wheat}) as the dependent variable. In the *PCSTS* models, the data were corrected for both the cross-sectional heteroscedasticity and the time-series autocorrelation.

Consumer Preferences

Model specification tests as well as graphical disposition (neither reported) suggest a non-linear relationship between the Engel coefficients and protection levels. The Engel coefficients (in all forms) are found to be negatively correlated with the protection levels (Table 1). The coefficient estimates are mostly statistically significant at one percent level. As the share of food in household budget increases, as is the case in developing countries, the subsidies to the agricultural producers decline.

Another important variable identified in the theoretical model of consumers, the income elasticity of demand (η), also had the expected negative sign and was statistically significant in all the regression models. High income elasticity may also be expected to increase the marginal gains to consumers from food security. The price elasticity of demand for wheat is also found to be negatively related to the protection level awarded to wheat farmers indicating that the higher the price elasticity of demand, the higher the consumers' marginal gains from reduced prices. As the per capita incomes of the nonfarm population increase, consumer welfare becomes less

Table 1. Results for consumer interest models

Independent Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Estimation Technique:	*PCSTS*	*PCSTS*	*GLS*	*OLS*	*OLS*	*OLS*	*PCSTS*	*PCSTS*
Engel Coefficient	7.248*	-	5.937*	-	6.247*	5.742*	-0.968*	5.063*
	(4.70)		(4.27)		(4.52)	(3.83)	(-3.51)	(2.98)
(Engel Coefficient)^{2}	-0.072*	-	-0.072*	-	-0.062*	-0.059*	-	-0.044**
	(-4.54)		(-4.26)		(4.25)	(-3.58)		(-2.35)
ln Engel	-	-27.817*	-	-	-	-	-	-
		(-3.77)						
Income Elasticity- Wheat	-	-60.478*	-75.303*	-29.787**	-22.775**	-25.817**	-56.558*	-51.388*
		(-4.18)	(-5.20)	(-2.43)	(-1.98)	(-2.17)	(-3.60)	(-2.68)
Income Elasticity- Food	-34.175	-	-	-	-	-	-	-
	(-0.95)							
Price Elasticity- Wheat	-	-	-	-	-	-	-	-19.250
								(-1.05)
Relative Risk- Aversion	-108.430*	-	-	-49.311*	-78.638*	-76.878*	-	-121.69*
	(-3.93)			(-5.70)	(-3.70)	(-3.47)		(-4.03)
Per Capita Income (*GNPC*)	-	-	0.006*	-	-	-	-	-
			(5.76)					
GNPC - Non-Farm	0.002*	-	-	-	0.004*	0.004*	-	-
	(4.14)				(4.32)	(4.38)		
Self-Sufficiency Rate		-0.079*	-0.061**	-	-	-	-0.067*	-
	-	(-3.754)	(-2.53)				(-3.34)	
Import Dependence	-	-	-	0.221*	-	0.142**	-	-
				(3.18)		(2.04)		
Dummy: Japan (D_J)	-	-	-	-	46.610*	-	-	-
					(3.84)			
Intercept	53.851*	140.52*	-83.838*	93.069*	-1.400	1.632	76.473*	106*
	(2.55)	(6.108)	(-2.785)	(8.64)	(-0.05)	(0.06)	(9.93)	(5.53)
Adjusted R^2	0.42	0.36	0.51	0.42	0.51	0.48	0.34	0.37
DF	174	176	174	176	173	173	176	174

sensitive to changes in the wheat price. The results presented here represent a first such attempt to explicitly include the income and price elasticities of demand in a cross-country analysis. The relative risk aversion of consumers (R_c) is also found to be negatively correlated with wheat protection levels. The coefficient estimates are highly significant in all the models. Low income consumers in developing countries are more risk averse relative to their well-to-do counterparts in developed countries. This supports the public interest interpretation (the *SWG* approach in the political economy literature) of the motives for government intervention in the agricultural sector. Both variants of consumers' income (*GNPC* and *GNPC*- Nonfarm) have the expected positive sign and are statistically significant at the one percent level. The results support the view that society has an income elastic demand for assisting farmers.

Among other measures of consumers' food security concerns, the self-sufficiency rate had the correct negative sign and was significant at the one or five percent level, while import dependence, as expected, is observed to be positively correlated with the producer protection levels. The binary variable used for Japan was also statistically significant. The overall results of the analysis are very robust in that up to 51 percent variation in producer support is explained by consumers' concerns *alone*. All the variables suggested by the theoretical model (except the price elasticity of wheat demand) are highly statistically significant in explaining the protection levels.

Producer Preferences

The empirical analysis in this subsection uses the pooled cross-section time-series (*PCSTS*) estimation to test the comparative static results of the theoretical model of producers. As expected, the coefficients on group-size variables had a negative and statistically significant sign (Table 2). The results support the group-size theories proposed by Olson (1965) and Becker (1983) that small groups tend to be more successful relative to large ones in obtaining political favors.

The share of agriculture in the gross domestic product (GDP_{Ag}) provides a close approximation of the relative wealth of farmers identified in the theoretical model. The coefficients have the hypothesized negative sign and are significant. Factor ratio (*FACTOR*) is used in the analysis as an index of the comparative advantage in agriculture. It is defined as the ratio of arable land per farm worker to the average capital endowment per worker in the society. The significant negative coefficients obtained in the regressions corroborate the findings reported in Honma and Hayami (1986a and 1986b) that, as the comparative advantage shifts away from agriculture, farmers are able to garner increased protection from imports. The lagged world price of wheat ($P_{w,t-1}$) also has the expected negative sign.

Table 2. Results for producer interest models

Independent Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Share of Agriculture in Labor Force	-0.971* (-6.99)	-0.021 (-1.20)	-	-1.01* (-6.26)	-	-	-1.259* (-10.0)
Relative Share of Agriculture to Industry in Labor Force	-	-	-	-	-11.304* (-3.77)	-	-
Share of Agriculture in *GDP* (log)	-	-	-11.850** (-2.52)	-	-	-22.423* (-5.92)	-
Factor Ratio	-7.909* (-4.11)	-7.525* (-3.93)	-5.898** (-2.25)	-7.836* (-3.58)	-6.177* (-2.87)	-7.692* (-3.48)	-11.122* (-6.05)
World Price (Lagged)	-0.028 (-1.34)	-0.029 (-1.37)	-	-	-	-0.038*** (-1.72)	-
Japan Dummy (D_J)	52.233* (7.17)	48.077* (5.58)	61.322* (5.928)	56.246* (6.87)	59.068* (6.52)	-	43.083* (6.71)
EFTA Dummy (D_E)	20.468** (2.60)	20.163** (2.30)	26.823** (2.32)	21.563** (2.45)	27.499* (3.03)	21.624* (2.62)	-
Industrial Dummy (D_I) x E_{sp}	-	-	19.170*** (1.67)	-	-	-	-
Income Dummy (D_Y)	-	23.306* (5.03)	-	-	5.631 (0.86)	-	-
Intercept	59.306* (7.98)	-16.847*** (-1.72)	42.491* (2.92)	55.930* (6.67)	28.108*** (1.79)	84.288* (7.66)	71.951* (12.67)
R^2	0.72	0.68	0.61	0.67	0.67	0.38	0.66
DF	174	173	174	175	174	175	176

Gardner (1987) hypothesizes a negative correlation between supply elasticity (E_{sp}) and the producer gains from farm programs in the United States. However, this contention could not be supported by the cross-country empirical evidence.[5] The dummy variable used to identify the *EFTA* countries was significant and so was the dummy used for Japan. The income dummy, used to capture the income differential across industrialized, middle income and low income countries, was also found to be positively correlated with the level of protection awarded to wheat farmers.

Determinants of the Political Welfare Function

The results reported in Table 3 indicate that including variables from both the interest groups increases the explanatory power of the models. For example, model (5) is able to explain up to 82 percent of the variation in protection levels across selected countries. In contrast, earlier studies using the variables from both consumer *and* producer groups reported R^2 values between

55 It may be due to the *EFTA* countries where supply elasticity is high (around 0.9) and average protection levels are considerably higher than in other industrialized countries.

Table 3. The results of integrated producer, consumer and politician models

Independent Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Estimation Technique	*OLS*	*OLS*	*OLS*	*PCSTS*	*PCSTS*
Engel Coefficient	4.655*	-	3.546*	2.649*	2.265*
	(3.52)		(2.80)	(3.16)	(2.25)
(Engel Coefficient)^2	-0.046*	-	-0.034**	-0.033*	-0.013
	(-3.30)		(2.54)	(-2.76)	(-1.02)
Income Elasticity- Wheat	-56.648*	-49.850*	-49.953*	-63.833*	-38.846*
	(4.94)	(-4.54)	(-4.58)	(-5.33)	(-2.82)
Relative Risk- Aversion	-47.348**	-36.487*	-32.709***	-	-
	(2.34)	(-4.93)	(-1.69)		
Per Capita Income (GNPC)	0.004*	-	0.005*	0.004*	-
	(4.47)		(5.51)	(7.42)	
ln (GNPC)	-	-	-	-	27.855*
					(5.585)
Factor Ratio	-11.121*	-13.551*	-13.334*	12.093*	-10.702*
	(-5.72)	(-7.21)	(-7.33)	(-7.74)	(-5.86)
World Price (Lagged)	-	-0.104*	-0.148*	-0.029	-0.029
		(-3.74)	(5.67)	(-1.63)	(-1.40)
Government Finance	0.00007	-	0.0001**	0.00001	0.00005
	(1.13)		(2.03)	(1.17)	(0.63)
Trend	-	3.948*	-	-	-
		(3.51)			
Dummy: Japan	35.637*	25.009**	-	29.567*	31.753*
	(3.11)	(2.12)		(4.95)	(5.58)
Intercept	3.384	-7724.1*	20.862	-8.854	-225.58*
	(0.13)	(-3.46)	(0.87)	(-0.55)	(-3.95)
Adjusted R^2	0.61	0.64	0.65	0.75	0.82
DF	171	173	171	171	171

Note: In case of the pooled cross-section time-series estimation, the coefficient of determination is the Buse R^2.

20 and 35 percent only with many variables showing insignificant contribution in explaining the protection levels (see for example, Herrmann, 1989; Miller, 1991; Gardner, 1987). Results obtained for variables associated with producer and consumer groups are similar to our results. An important variable associated with the political leadership’s decision-making process – *government finance*, which states the surplus or deficit position of the treasury – had the expected positive sign and was statistically significant in model (3). The time trend variable was also positive and significant indicating the increasing protectionist policies across the selected 30 industrialized and developing countries. The per capita income appeared to be highly statistically significant in both the linear as well as log linear specifications. Overall, the results of this subsection are very encouraging. This analysis overcomes the problem of excluded variables, which is prevalent in most of the earlier studies, by making a systematic

and comprehensive attempt that provides a broader coverage of the determinants of the political economy of agricultural protection across countries.

Non-Nested Tests for Model Specification

It is often pointed out that a positive producer subsidy equivalent or an *NPC* greater than one does not necessarily suggest that the producer group has more political power, as is generally inferred in the *PEAP* literature (Miller, 1991). Providing subsidies to farmers to produce more may be in the general interest of the people (Rausser and Foster, 1992). Davidson and MacKinnon's (1981) pair-wise non-nested *J* tests in this section are, therefore, performed to determine which group's concerns overweigh in the policy formulation since it cannot be ascertained just by observing the sign of the protection level.

Two pair-wise non-nested tests were performed. The first estimation uses the ordinary least squares estimation while the pooled cross-section time-series estimation technique was used for the second test. The *OLS* and *PCSTS* estimations of these models yielded the results provided in Table 4:

To perform the pair-wise *J* tests, the consumer and producer models were then reestimated with alternating null hypotheses about the relative influence of consumer and producer models (Table 5). No general conclusion could be reached from the pair-wise *J* tests since the null hypotheses are rejected in both cases under the *OLS* estimation. The pooled estimation, however, does provide conclusive results.

Table 4: Preliminary estimation results for non-nested tests

Estimation	Group	Results
OLS	*Consumer*	τ^*_c = 105.97+ 3.138 *ENGEL* - 0.026 *(ENGEL)*^{2} - 98.864 R_c - 33.573 η ,
		(7.10) (2.38) (-1.90) (-4.28) (-2.64)
	Producer	τ^*_p = 82.216 - 15.6 *ln GDPAG* - 11.913 *FACTOR* - 0.19 $P_{w,\,t-1}$ + 30.894 D_I x E_{sp}
		(7.29) (-4.01) (-5.88) (-6.39) (3.88)
PCSTS	*Consumer*	τ^*_c = 103.63 + 5.169 *ENGEL* - 0.046 *(ENGEL)*^{2}- 115.57 R_c - 46.375 η ,
		(5.43) (3.04) (-2.58) (-3.89) (-2.74)
	Producer	τ^*_p = 71.093 - 17.542 *ln GDPAG* - 11.021 *FACTOR* - 0.042 $P_{w,\,t-1}$ + 30.017 D_I x E_{sp}
		(5.73) (-4.05) (-7.11) (-1.84) (3.32)

Note: Figures in parenthesis represent *t*-statistics.

Table 5: Results of the pair-wise non-nested *J* tests

Regressor	*OLS*	*Pool*	*Regressors*	*OLS*	*Pool*
Consumer Model			*Producer Model*		
ENGEL	2.876**	5.215*	*ln GDPAG*	-2.211	-18.468*
	(2.51)	(3.38)		(-0.528)	(-4.54)
$(ENGEL)^2$	-0.021***	-0.048*	*FACTOR*	-12.575*	-11.067*
	(1.79)	(-2.89)		(-6.80)	(-8.40)
R_c	-48.775**	-111.34*	$P_{w,\, t-1}$	-0.139*	-0.069*
	(2.31)	(-4.09)		(-4.88)	(-2.98)
η	-42.018*	-48.780*	D_I x E_{sp}	10.434	21.774**
	(-3.79)	(-3.26)		(1.30)	(2.53)
τ^*_p	0.824*	4.623	τ^*_c	0.805	9.904*
	(7.66)	**(1.17)**		**(6.02)**	**(3.09)**
Intercept	22.156	95.091*	Intercept	36.85*	77.875*
	(1.31)	(5.28)		(2.89)	(6.66)

Note: Figures in parentheses represent the t-statistics. The parenthesized bold t-statistics are for the respective null hypotheses. Under the null hypotheses, the test statistics is distributed as standard normal. The critical value at the 0.01 level is 2.60 at 174 degrees of freedom.
*, **, *** represent statistically significant at 1%, 5% and 10%.

While the test statistic reported for the mixing parameter in case of consumer model was statistically insignificant, it was significant at one percent level in case of the producer model. The pooled results, therefore, imply that variables identified in the consumer model carry relatively more influence in the determination of agricultural protection levels.

Summary

The earlier *PEAP* studies have viewed the protectionistic policies as being the outcomes of either altruistic motives (*SWG* literature) or the self-interest motives (*CHG* literature). This study shows that the two approaches are, in fact, complementary. Consumers' food security concerns and producers' pressure group tactics both influence the agricultural policy outcome across industrialized as well as developing countries.

Results our pair-wise *J* tests suggest that the pressure-group studies in the *PEAP* literature should not ignore consumer risk concerns. This result is contrary to the conclusions reached by Variyam et al. (1990) and Carter et al. (1990) who argue that self-interest is the primary motivational force that explains political preferences.

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