

# Political Economy Determinants of Technical Barriers to U.S. Agricultural Exports

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**Abstract:** Political economy determinants of questionable technical barriers applied to U.S. agricultural exports are evaluated using PROBIT and Poisson regression techniques. Results indicate the incidence of such barriers can increase when domestic agriculture is large relative to consumption, when producers are less competitive in international markets, and when the anticipated future level of protection through other forms of government intervention decreases.

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Technical barriers are a type of non-tariff restriction on international trade that has emerged at the center of agricultural policy disputes with increasing frequency, particularly since completion of the Uruguay Round GATT negotiations. In this paper new econometric evidence is presented about the economic and political determinants of questionable technical barriers; those that appear to violate at least one of the principles of the GATT Agreements. The maintained hypotheses of the analysis is that technical barriers to agricultural trade arise from a combination of scientific, economic, and political forces. Whether or not the incidence of questionable technical barriers increases when economic incentives and political leverage favor protection of domestic agriculture is tested using two regression techniques.

Market mechanisms do not always result in socially desirable outcomes when negative externalities arise from trade. In these cases, regulatory intervention may provide protection from the adverse effects of market exchange and have the potential to increase national welfare, even without consideration of terms-of-trade effects. All nations employ a wide range of technical standards and regulations to govern the sale of agricultural products in national markets, the majority of which are considered justified commercial limitations. Governments may also impose technical barriers as a nontransparent means to protect domestic producers from international competition. In these cases, under the small-country assumptions, technical barriers are welfare-decreasing policies, just as tariffs and other forms of non-tariff barriers.

Political economy can explain the provision of economic-based protection through technical barriers in cases when net national welfare is reduced. The political economy paradigm incorporates political constraints with economic criteria in evaluating policy formation. Policy choice is endogenous given the neoclassical behavior of producers, consumers, and government decision-makers acting as rational maximizers. Equilibrium occurs when no agent

is able to improve their well-being given the market forces and political behavior of other agents.<sup>1</sup>

### ***USDA Survey of Questionable Technical Barriers to U.S. Agricultural Exports***

The empirical analysis of questionable technical barriers is made possible by primary data collected through a USDA survey on questionable technical barriers that faced 1996 U.S. agricultural exports. Although limited to observations for a single exporter, and while providing only a cross-sectional view of such barriers at one moment in time, the evidence collected offers the most comprehensive information yet available on the incidence and impact of questionable technical barriers to agricultural trade.<sup>2</sup> The USDA Survey identified \$4.9 billion in estimated trade impacts from 302 questionable technical barriers, approximately 7 percent of the total value of 1996 U.S. agricultural exports. The barriers were somewhat concentrated as 16 countries accounted for 64 percent of the barriers and 89 percent of the total estimated trade impacts. There was also evidence of wider proliferation of barriers: an additional 47 countries utilized questionable technical barriers with smaller estimated impacts, while no questionable technical barriers were reported for 71 countries.

The technical barriers identified in the Survey can be categorized according to the geographical region in which the country imposing the restriction is located (see Table 1). The largest number of barriers is found in the countries of the Americas (91) followed by East Asia (78) and Europe (67). Less than 20 questionable technical barriers were identified in Africa or the Middle East.

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<sup>1</sup> Such a theoretical model has been explicated in classic papers by Stigler (1971) and Becker (1983) among others. Swinnen and Van der Zee (1993) Rodrik (1995) and Potters and Sloof (1996) provide surveys of the more recent literature in political economy theory.

<sup>2</sup> More detail on the survey process can be found in Roberts and DeRemer (1997) and Thornsbury, Roberts, DeRemer, and Orden (1999).

Barriers identified in the USDA Survey can be further categorized by product category and type of market restriction. Simple cross-tabulations provide an overview of the extent of questionable technical barriers when evaluated in each of these categories. As shown in Table 1, the largest number of barriers is found among the fruit and vegetable commodities (105) followed by livestock and poultry (89), grains and feed (39) and further processed foods (38). Questionable technical barriers applied to fruit and vegetable products were more often identified in the East Asia and Americas regions. Trade in livestock and poultry products, grains and feed, and further processed foods was more often restricted in the European region.

**Table 1. Questionable technical barriers identified in the 1996 USDA Survey by geographical region, product category, and type of market restriction**

Product Category	Geographic Region						Totals
	Africa	Americas	East Asia	Europe	Middle East	Oceania	
All products	1	2	1				4
Fruits & Vegetables	1	43	47			14	105
Grains & Feeds	5	8	5	12	1	8	39
Livestock & Poultry	7	22	14	34	2	5	84
Further processed foods	2	6	7	13	7	3	38
Other	3	10	4	8	1	6	31
<b>Totals</b>	<b>19</b>	<b>91</b>	<b>78</b>	<b>67</b>	<b>11</b>	<b>36</b>	<b>302</b>
Market Restriction							
Access	1	29	32	26		19	107
Expansion	16	53	42	29	10	14	164
Retention	3	19	4	12	1	3	42
<b>Totals</b>	<b>20</b>	<b>101</b>	<b>78</b>	<b>67</b>	<b>11</b>	<b>36</b>	<b>313*</b>

\* one barrier may result in more than one type of market restriction

Individual barriers can be further categorized based on how the market is being restricted. Market access barriers are questionable import bans denying any exports of a particular U.S. product to a country. There are 107 such barriers identified in the Survey. A greater number, 164, of market expansion barriers are identified that hinder, but do not prohibit, U.S. exports of a certain product to a country. Market retention barriers are those measures, under consideration

by a foreign government, which may adversely affect U.S. exports after 1996. Only 42 market retention barriers are identified in the Survey.

### ***Political Economy Determinants of Technical Barriers***

Despite the efforts to limit misuse of technical barriers through the Uruguay Round Agreements, the 1996 USDA Survey results suggest that these regulatory measures continue to provide disguised economic-based protection for domestic industries. An empirical approach similar to those used in previous studies of other trade and agricultural policy decisions can be applied to analyze the political economy factors underlying the incidence of questionable technical barriers. Much of the empirical political economy analysis in the literature is concentrated on reduced-form equations explaining a policy outcome or policy decision modeled as a function of independent variables that serve as proxies for theoretical political economy measures. The purpose of the empirical models is not to test political economy theory, but rather to identify the common factors underlying observed regulatory levels and to quantify the economic and political relationships that give rise to questionable technical barriers (Brooks, Cameron, and Carter 1998). Such a positive analysis can then be used as a basis for making predictions about future behavior.

Two separate measures from the USDA Survey are used to investigate determinants of the incidence of questionable technical barriers faced by U.S. agricultural products. The first measure is a binary variable,  $Y_N$ , where the sample results from  $N$  Bernoulli trials with two possible outcomes for each trial; a country either enacts questionable technical barriers to U.S. agricultural exports or does not. The two outcomes are proxies for an unobservable continuous response variable,  $y_i^*$ , measuring the incidence of protection provided by such barriers. The observed variable,  $Y_N$ , is the presence or absence of technical barriers that are potentially subject to challenge and takes the form

$$y_i = 1 \text{ if } y_i^* > 0 \text{ and} \\ y_i = 0 \text{ otherwise.}^3$$

The second measure, NO, is a discrete count variable where zero represents the 71 countries where no questionable technical barriers were identified and a positive integer represents the number of such barriers identified for each of the remaining 63 countries in the USDA Survey. Each observation is drawn from a Poisson distribution with observed frequencies,  $y_i$ ,  $y_i = 0, 1, \dots, N$  and the

$$\text{Prob}(Y=y_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!} \quad ^4$$

### ***Measures of Political Economy***

Independent variables in the models are categorized into three broad groups-- characteristics of the domestic agricultural sector, of trade policy, and of the aggregate economy of a country (see Table 2). Specific measures included are those identified from earlier theoretical and empirical political economy models as good proxies for influential factors in agricultural trade and policy decisions.<sup>5</sup> An additional variable is included to capture potential effects from the survey design.

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<sup>3</sup> When the errors are normally distributed a PROBIT econometric model is used. Maddala (1983) and Greene (1997) among others provide detailed explanations of the underlying statistical model.

<sup>4</sup> The Poisson regression model can be extended to include an individual unobserved effect into the condition mean. This adjustment will allow the variance of the process to differ from the mean and account for cross-sectional heterogeneity in the data (Greene 1997).

<sup>5</sup> The potential for proxy variables to introduce bias into the estimation has been widely recognized since such variables are imperfect representations of the underlying latent true variable. However, research has shown that the asymptotic bias in parameter estimates is worse if some important proxy is omitted (Greene 1997).

**Table 2. Variable names and definitions used in the econometric models**

<b>Variable</b>	<b>Variable Definition</b>	<b>Units</b>
<b>Dependent Variables</b>		
YN	Questionable technical barriers identified in the 1996 USDA Survey (1=yes, 0=no)	0,1
NO	Number of questionable technical barriers identified in the 1996 USDA Survey	0,1,2,....
<b>Characteristics of the Agricultural Sector</b>		
AGGDP	1995 GDP from the agricultural sector	Percent
LABAG	1995 labor force employed in agriculture	Percent
AGPENT	1995 agricultural import value relative to domestic value-added in agriculture	Percent
USAG	1992-1995 average growth in agricultural trade balance with the U.S. (change in exports to the U.S. – imports from the U.S.)	Percent
<b>Characteristics of Trade Policy</b>		
TRED	Change in projected 1999 tariff faced by agricultural exports as a result of Uruguay Round commitments from the country's trading partners	Percent
TARIFF	Projected 1999 applied MFN average tariff rate for agricultural imports	Percent
WTO	1996 WTO membership (1=full, 0=other)	0,1
<b>Characteristics of the Aggregate Economy</b>		
GDP	1995 GDP	\$ per capita
IMP GDP	1995 aggregate imports relative to GDP	Percent
TRDBAL	1995 aggregate trade balance (exports-imports)	\$ per capita
<b>Characteristics of the Survey Design</b>		
FAS	1996 FAS post in country (1=yes, 0=no)	0,1

***Empirical Results***

Econometric estimates of the political economy determinants of questionable technical barriers applied to 1996 U.S. agricultural exports are shown in Table 3. Parameter estimates, and the corresponding p-values, are reported for two model specifications for each measure of the incidence of reported barriers.

**Table 3. Results of the empirical models**

	<b>Model I</b>	<b>Model II</b>	<b>Model III</b>	<b>Model IV</b>
<b>Variable</b>	<b>YN</b>	<b>YN</b>	<b>NO</b>	<b>NO</b>
<b>Constant</b>	1.299 (0.106)	0.909 (0.066)	1.759 (0.034)	1.540 (0.040)
<b>AGGDP</b>	-4.853 (0.047)	-4.313 (0.041)	-6.294 (0.060)	-6.372 (0.050)
<b>LABAG</b>	-2.382 (0.065)	-1.750 (0.125)	-0.981 (0.498)	-0.770 (0.531)
<b>AGPENT</b>	-0.001 (0.086)	-0.001 (0.006)	-0.0005 (0.389)	-0.0003 (0.328)
<b>USAG</b>	-0.030 (0.049)	-0.027 (0.042)	-0.009 (0.595)	-0.007 (0.569)
<b>TRED</b>	0.007 (0.659)		-0.024 (0.043)	-0.021 (0.044)
<b>TARIFF</b>	-0.025 (0.096)	-0.026 (0.047)	-0.001 (0.952)	
<b>WTO</b>	0.502 (0.344)		-0.088 (0.832)	
<b>GDP</b>	-0.000002 (0.508)	0.00001 (0.613)	-0.000001 (0.963)	0.000002 (0.941)
<b>IMPGDP</b>	-1.077 (0.234)		-1.909 (0.061)	-1.945 (0.035)
<b>TRDBAL</b>	0.0005 (0.115)		0.0002 (0.558)	
<b>FAS</b>	1.901 (0.001)	1.894 (0.0001)	1.677 (0.0001)	1.691 (0.0001)
Sample Size	N=93	N=96	N=93	N=97
Significance level of chi-square statistic	.00000001	.00000001	.00000001	.00000001

Models I and II incorporate the binary dependent variable, YN, as a measure of the presence or absence of questionable technical barriers as identified in the Survey. Model I correctly predicts the value of the dependent variable 80.6 percent of the time. Calculated pseudo-R<sup>2</sup> measures equal .484 (McFadden 1974) and .397 (Aldrich and Nelson 1984). Model II is a more parsimonious specification of the model explaining the presence or absence of



questionable technical barriers.<sup>6</sup> In Model II the number of observations are increased by three compared to Model I, the dependent variable is correctly predicted 85.4 percent of the time, and the pseudo  $R^2$  measures equal .462 and .386 respectively.

Models III and IV include the number of questionable technical barriers identified by country as the dependent variable. Similarly to Models I and II, Model III includes all the independent variables and Model IV is a more parsimonious specification of the model. The significance level for the chi-squared statistic of a log likelihood test of overall model significance indicates that both Models III and IV are highly significant in explaining the number of questionable technical barriers.

Results indicate that when the relative contribution of agriculture to the economy (AGGDP) increases the probability of enacting questionable technical barriers and the number of barriers decreases, similar to results from an earlier empirical analysis of nominal protection coefficients (Anderson and Hayami 1986). As the agricultural sector is a larger proportion of the economy, it may be harder for producers to organize and effectively influence policy outcomes resulting in a lower incidence of questionable technical barriers (Olson 1985). Additional evidence in support of this hypothesis is provided by the negative sign on LABAG (significant in Model I results). As the percentage of agricultural workers in the population increases the probability of questionable technical barriers being reported decreases.

Suprisingly, in this dataset, per capita income (GDP) was not a significant determinant of the presence or absence of questionable technical barriers or the number of barriers reported.

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<sup>6</sup> Many specifications of more parsimonious models were estimated starting with the variables included in Model I and following the general procedures outlined in Leamer (1978) for simplification and proxy variables searches for model selection. In addition, the model reported minimizes Akaike's information criteria which has been proposed as a statistical criteria for selection of regressors in non-linear models when theoretical determinations cannot be made.

Previous empirical results have found income to be a significant determinant of economic intervention (deGorter and Tsur 1991). However, the negative sign on AGGDP is consistent with the hypothesis that policymakers are more likely to tax (disprotect) agriculture when the relative contribution of the sector is higher (Honma and Hayami 1986; Swinnen and van der Zee 1993). Although there is no direct evidence to support the income hypothesis through the GDP variable, the result for AGGDP suggests that technical barriers are relatively less likely to be observed in developing countries with a higher agricultural to nonagricultural GDP ratio.

When the import of agricultural products increases relative to domestic production levels (AGPENT), the probability of enacting questionable technical barriers decreases.<sup>7</sup> The penetration ratio will be larger in countries with relatively small domestic agricultural production sectors compared to national consumption, for example Hong Kong. In these cases, results support the hypothesis that consumers have more to lose if the difference between the domestic and world price increases as a result of regulatory intervention and implies that they are able to dominate the effect of producer gains from regulatory intervention when import competition is greater. The penetration ratio will be smaller in countries where imports are small relative to value-added in agriculture, for example New Zealand. In these cases producers may perceive having more to gain from intervention and results imply that they are able to dominate the effect of any potential consumer gains when there is less import competition.

Interestingly, when the number of questionable technical barriers is considered, the level of agricultural imports relative to domestic value-added (AGPENT) is not significant but the overall level of imports relative to GDP (IMPGDP) becomes significant. Consistent with the

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<sup>7</sup> Even though statistical simultaneity is avoided by measuring the level of agricultural import penetration in the previous year, without time lags imports could be measured as a function of technical barriers. However, as a government typically enacts many types of trade restrictions, it seems more likely that decisions on the use of questionable technical barriers are taken in reaction to the aggregate conditions of agricultural import penetration.

direction of Model I and II results, when imports increase relative to the size of the domestic economy, the number of questionable technical barriers reported decreases. Empirical analyses of other trade policies indicate that in a more integrated economy, policymakers may be reluctant to impose protection, either in response to a dependence on imported goods or a fear of retaliatory action against exports (Kherallah and Beghin 1998).

As the 1996 USDA Survey only measures questionable technical barriers to U.S. exports, the change in agricultural exports to the U.S. minus agricultural imports from the U.S. (USAG) is a proxy for the bilateral trading relationship. As the change in the agricultural trade balance becomes more favorable, exports to the U.S. increase relative to imports from the U.S. and the probability of supplying economic-based protection through technical barriers decreases. This result supports the hypothesis that protection will decrease when export competition is lessened and producers perceive having less to gain from regulatory intervention (Gardner 1987).<sup>8</sup>

The negative coefficient on USAG provides some evidence in support of the hypothesis that countries follow a retaliatory regulatory strategy although such a hypothesis cannot be measured directly without information on U.S. technical barriers.<sup>9</sup> In such a tit-for-tat strategy, policymakers increase technical barriers on products from a particular country in retaliation for an increase in such trade barriers applied to their own exports, and the resulting decrease in the bilateral trade balance (Gawande 1995; Romano 1998). As the reduction in the projected tariff rate that a country will face is larger (TRED) the projected future tariff rate faced is smaller and the number of questionable technical barriers observed is smaller. This result is consistent with

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<sup>8</sup> In contrast, inclusion of the 1995 per capita bilateral agricultural trade balance with the U.S. was not significant when included in the empirical models. It may be that producers only recognize and react to longer-term trends in trade balance or that the cross-sectional nature of the dependent variable is masking any short-term policy response.

<sup>9</sup> The statistical relationship between the percentage change in agricultural trade balance with the U.S. and total agricultural trade balance is small, as evidenced by a correlation coefficient of 0.018, indicating that USAG is not just reflective of the overall agricultural trade balance.

the policy implications of Models I and II and provides additional evidence in support of a retaliatory trading strategy.

The projected 1999 most-favored-nation average applied tariff rate on agricultural products, including the tariffication of non-tariff barriers (TARIFF) is negatively related to the probability of enacting questionable technical barriers. This result provides evidence to support the hypothesis that technical barriers may be used as substitutes for tariffs and other non-tariff barriers lowered through GATT obligations (Abbott 1997). In contrast Rodrik (1995) found evidence that tariffs and non-tariff barriers are complements across industries but substitutes when compared over time.

As a measure of policy, only membership in the WTO is insignificant in the reported models and the direction of influence cannot be determined *a priori*. WTO membership commits governments to the provisions of the SPS and TBT Agreements and might be expected to decrease the use of questionable technical barriers. Other researchers have postulated that WTO membership may increase the observation of questionable technical barriers, by allowing countries to challenge previously “hidden” restrictions to trade (Sykes 1995; Roberts 1998).

The dummy variable included to measure the possible impact of the survey design (FAS) is statistically significant and positively related to the reported incidence of questionable technical barriers. Questionable technical barriers are more likely to be reported in countries where an FAS post is present, indicating that such trade restrictions are either over-reported in countries where an FAS post is present or under-reported in countries without an FAS post. Although there is no direct evidence for which direction of reporting is correct, of the 63 countries where questionable technical barriers were present, 45 had more than one barrier reported, indicating an increased likelihood that at least one questionable measure was in place.

## *Conclusions*

Technical barriers can be used as a legitimate instrument to protect the plant, animal, and human resources of importing countries. However when not based on scientific criteria, technical barriers can also serve as a means of providing disguised economic protection for domestic producers. In this article, a series of empirical models were developed to quantify the economic and political relationships that give rise to such questionable technical barriers.

The regression results indicate that the extent of questionable technical barriers can increase when the stakes are higher for domestic producers in an importing country. The incidence of questionable technical barriers increases when agricultural imports are smaller relative to domestic value-added in agriculture. Questionable barriers are also more evident when recent changes in the bilateral agricultural trade balance with the U.S. have been unfavorable. The incidence of questionable technical barriers is higher in countries for which there is a decline in the anticipated future level of protection through other forms of government intervention, suggesting that technical barriers act as substitutes for tariffs and other non-tariff barriers. Results also support an Olsonian hypothesis of increased effective political influence from producer groups of declining size (relative to the aggregate economy).

Taken together, the results from the empirical models indicate that technical regulations are not always determined on the basis of unambiguous scientific evidence. Despite strengthened rules governing the use of technical barriers, political economy considerations continue to influence the incidence of technical barriers as a source of disguised protection in international agricultural markets. Future decisions under the GATT Agreements and continued WTO panel rulings will potentially be an important mechanism for easing on-going tensions and further strengthening trade rules.

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