Standards and Institutional Capacity: An Examination of Trade in Food and Agricultural Products*

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Abstract. The ability of developing countries to cope with emerging standards in food and agricultural products is influenced by their institutional capacity. This paper develops original measures of four dimensions of standards-related, institutional capacity: information, conformity, enforcement, and international standard-setting. These measures are incorporated into a gravity model to investigate whether these capacities offset the negative effects of Aflatoxin B1 standards on food and agricultural product trade. The results indicate that informational capacity and conformity capacity do indeed have such offsetting effects. The evidence with regard to enforcement and international standard-setting is less clear.

I. INTRODUCTION

Standards and technical regulations (STRs) on food and agricultural exports have become a serious concern for developing-country exporters.[1] In this paper, we assess whether or not institutional capacity can offset the negative effects of STRs on developing-country exports of these products. By 'institutional capacity', we mean the quality of governance or the ability of governments and private entities to deliver essential services. For example, Finger and Schuler (2000) point out that, since developing countries must install world-class systems to comply with STRs at the international level, this requires significant investments often beyond reach. This financial burden prohibits developing countries from strengthening their institutional capacity to overcome STR-related impediments to their exports.

Within the World Trade Organization (WTO), STRs are addressed by the Agreement on Technical Barriers to Trade (TBT Agreement), the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), and GATT Article XX on the safety and health of human, plant, and animal life.[2] According to the

[1] For example, recent reports in the *Financial Times* have raised concerns about the tendency for food safety regulations to become protectionist measures. For more details, see Barnes (2004) and Wallis (2004).

[2] There are differences among these three agreements. Article XX of the GATT provides discipline for the exceptional use of quantitative trade restriction for all legitimate, non-economic policy purposes. The TBT Agreement provides discipline for the use of standards and regulations on all products, including industrial and agricultural products, except those covered by the SPS Agreement. The SPS Agreement provides guidelines for regulations on food and agriculture

TBT Agreement, STRs are related to product, process, and production methods of 'all products, including industrial and agricultural products' and cover 'terminology, symbols, packaging, marking, or labeling requirements'.[3] Wilson (2002) explained that, while product standards usually deal with the 'specifications and characteristics of particular products', process standards detail 'manufacturing or quality control measures' to ensure product quality and safety (p. 428). According to Wilson, standard setting has been driven mostly by the systems that have emerged through private sectors.

It is important to keep in mind that STRs are not necessarily barriers to trade.[4] For example, STRs can stimulate exports either by enhancing the productivity of exporters through harmonized standards or by improving the confidence of consumers in imported products through increased food safety (Wilson and Abiola, 2003). However, recent quantitative studies indicate that STRs are becoming significant barriers for developing-country exports. These studies have quantified the negative impacts of STRs on food and agricultural trade (e.g., Otsuki, Wilson and Sewadeh, 2001a,b; Wilson and Otsuki, 2003; and Wilson, Otsuki and Majumdsar, 2003). However, these research efforts have taken the institutional capacity of exporting countries into consideration.

In this paper, we assess whether institutional capacity matters in overcoming STR-related barriers to food and agriculture trade in the form of Aflatoxin B1 regulations.[5] We develop original measures of four dimensions of institutional capacity,

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products to protect plant, animal and human life, as well as risks arising from various sources of disease-carrying or disease-causing organisms or materials.

[3] Annex 1.1 and 1.2 of the TBT Agreement.

[4] In the literature related to standards and technical regulations, various terms have been used depending on products covered. When food and agriculture products are the subject, the term *food (and safety) regulations* has been mainly used. For more general studies or studies involving manufacturing goods, the term *standards and (technical) regulations* has been used concurrently. Standards often refer to voluntary measures, while regulation refers to mandatory measures. We prefer using *standards and technical regulations* rather than using only *regulations* because the latter term might mislead readers to think food and agricultural regulations are mandatory, while in fact they are not always so. In addition, *both* voluntary food standards *and* mandatory food regulations are believed to influence the exports of developing countries negatively (Maksus and Wilson, 2001).

[5] Aflatoxins are a group of toxins developed by molds that are associated with liver disease and cancer. They are easily built up in warm and humid environments and can be found on such agricultural products as cereals, nuts, and dried fruits. The major Aflatoxins are B1, B2, G1, and G2. For further discussion, see Food and Agricultural Organization (1997, 2004) and Otsuki, Wilson and Sewadeh (2001a,b).

namely, information, conformity, enforcement, and international standard-setting. We incorporate these measures into a gravity model of trade in cereal and nut products. In doing so, we intend to accomplish two objectives. One is to assess whether the impact of STRs on trade is negative. Second is to assess whether the dimensions of institutional capacity in exporting countries matter in overcoming trade barriers raised by STRs.

II. PREVIOUS RESEARCH

This paper relates to the literature in two separate areas of inquiry, namely the assessment of the impacts of both STRs and institutional capacity on trade. We briefly consider each in turn.

The Impacts of Standards and Technical Regulations on Trade

There have been a number of studies investigating the impact of STRs on trade.[6] These can be broken down into economic welfare analyses, qualitative case studies, and quantitative analysis. Most of the economic welfare analyses are theoretical in nature (e.g., Beghin and Bureau, 2001). However, there are a limited number of empirical studies in this category (e.g., Calvin and Krissoff, 1998). As noted by Beghin and Bureau (2001), measuring the welfare impacts of STRs is complex. To take just one element of the complexity, calculating the impact of STRs on the supply and demand elasticity of food and agricultural products can be imprecise.

Many studies of food and agricultural STRs can by characterized as qualitative analysis with simple descriptive statistics. These studies suggest that there are indeed negative effects of STRs on food and agricultural trade and that these effects are much greater on the exports of developing countries, especially small- and medium-sized producers (Finger and Schuler, 2000; Wilson and Abiola, 2003; and Dunn, 2003).

The reasons for the negative effects of STRs on developing-country exports can be classified as external and internal. External reasons include: 1) the inconsistency of STRs in importing countries (Barrett et al., 2002; Hufbauer, Kotschwar, and Wilson, 2002), 2) the high costs of the certification process (Barrett et al., 2002; Wilson, 2002),

[6] OECD (2003) surveyed research papers on the impact of food and agricultural regulation on trade. Josling, Roberts, and Orden (2004) provide a detailed discussion on several significant issues on the effects of food regulations on trade.

and 3) the geographical uniqueness inherent in STRs (Dunn, 2003). The most significant internal reasons are: 1) the lack of financial resources (Finger and Schuler, 2000), and 2) and the lack of human and institutional capacity (Wilson, 2002).

Quantitative empirical research on STRs has been limited (Maskus and Wilson, 2001; OECD, 2003). Otsuki, Wilson, and Sewadeh (2001b) conducted a gravity model investigation of the effect of European Union (EU) Aflatoxin regulation on the exports of selected food and agriculture products from African countries to the EU. They also conducted a simulation study on whether or not new EU standards (harmonized Aflatoxin standards introduced in 2002) would have a more negative impact on the exports from African countries than less-strict international standards. The authors estimated that, compared to the Codex international standard, the new EU Aflatoxin standard would cost African countries US$670 millions in lost exports, while causing 1.4 less cancer deaths per billion annually in EU countries. This study was extended by Otsuki, Wilson, and Sewadeh (2001a) and by Wilson and Otsuki (2003).

A similar effort by Wilson, Otsuki and Majumdsar (2003) analyzed the impacts of drug-residual standards in beef, again using a gravity-model framework and comparing existing standards to the Codex international standard. The authors found that, by moving to the international standard, global beef trade would rise by over US$3.2 billion, with the exports of some developing countries increasing significantly.

The Impacts of Institutional Capacity on Trade

The general importance of institutional capacity for trade is well understood by both policy makers and researchers. For example, building institutional and human capacity in developing countries has become the core focus of trade-related capacity building (e.g., Kostecki, 2001). Institutional capacity especially matters in the efforts of developing countries to increase their trade activities, since the complexities of multilateral trade negotiations have often exceeded this capacity (OECD, 2001). Responding to these considerations, trade economists and policy analysts have investigated the effects of institutions on trade.

Utilizing six indicators of governance quality, de Groot et al. (2004) studied the effect of institutional quality on bilateral trade.[7] These authors affirmed the hypothesis that institutions matter in trade and asserted that countries with similar institutional capacity tend to trade more with each other. Extending this study, Jansen and Nordas (2004) investigated the impact of three domestic institutional variables on bilateral trade. Controlling for the quality of domestic transportation infrastructure and trade policy, these authors concluded that government effectiveness has a positive effect on bilateral trade flows. However, their study did not confirm that two other institutional quality indicators, rule of law and control of corruption, have statistically significant effects.

Studies on the impact of STR-related institutional capacity have been limited. The only available study on the effects of standards, interlinking institutional capacity, on agricultural trade is that by Stearns and Reardon (2002) for the case of the dry bean industry. The current paper, then, extends this effort further.

III. DIMENSIONS OF INSTITUTIONAL CAPACITY

The focus of this paper is product and process STRs imposed horizontally on broad products. Major components in compliance procedure for this category of STRs are information gathering, conformity assessment, enforcement, and standard setting. Therefore, we address four dimensions of institutional capacity: informational capacity, conformity capacity, enforcement capacity, and international standard-setting capacity. For each of these four dimensions, we develop an index of capacity in which the score ranges from 0 to 1 with 0 indicating no capacity at all. An explanation of these indices, as well as the sources of data for each, is presented in Table 1. In what follows, we consider each dimension in turn.

Informational Capacity. The lack of information about STRs on food and agricultural products often negatively impacts exporters of developing countries (OECD, 2001). In order to export food and agricultural products, exporters must go through a series of steps to satisfy safety requirements in the importing countries. The first step is to ascertain what sorts of safety regulations exist in importing countries, and this can be a

[7] The six indicators were voice and accountability; political stability; government effectiveness; regulatory quality; rule of law; and control of corruption.

difficult task. Indeed, it is often necessary for governments or development NGOs to take the initiative in this process.

We measure informational capacity indirectly through three indicators: 1) the proportion of the population using the Internet, as measure by Internet users per 10 thousand inhabitants, obtained from the International Telecommunication Union (ITU), 2) the Education Index from the United Nations Development Programs (UNDP), and 3) the online service delivery index of national government websites by the World Market Research Centre Global e-Government Survey carried out by the Brown University. Admittedly, these indicators do not *fully* explain informational capacity in each country but rather serve as a relevant *proxy* for informational capacity.

Conformity Capacity. Once producers and exporters obtain information about the relevant STRs, they need to find a way to satisfy the requirements. A general requirement is to obtain certification from accredited laboratories or organizations, a conformity assessment process. The role of governments or private agencies becomes vital at this stage, since it is too costly for local food and agricultural product producers and exporters to hire an accredited laboratory, usually located in the importing or other developed countries (Barrett et al., 2002). The governments of exporting countries, therefore, need to be able to provide accreditation or certification services at a reasonable fee. Or they at least should be able to link local producers and exporters with an internationally recognized, accredited laboratory.

We measure conformity capacity by the ratio of the number of International Standard Organization (ISO) 9000 certifications to the number of establishments in each country. ISO 9000 certifications are awarded for quality management systems that have satisfied the production process criteria set by the ISO. Although certifications are awarded not only in the food and agricultural industry, but also in other manufacturing industries, the number of certifications awarded will reflect the capacity of governments to help food and agricultural producers and exporters, as well as the capacity of exporters themselves.[8]

[8] The ISO 9000 certification data include not only certifications awarded to agriculture and food sector but also those to other manufacturing sectors. However, it is still valid to use these data since food and agricultural industry depends on other manufacturing industries for the process and delivery of food and agricultural products. For instance, the capacity of the food container

In fact, the ISO 9000 series is being increasingly adopted as one of hazard analysis critical control points (HACCP) systems in the food and agricultural industry (Unnevehr and Jensen, 1999), and the role of HACCP in facilitating agricultural trade has been recognized going back to Caswell and Hooker (1996).[9] Reasons for the potential success of ISO 9000 in promoting agricultural trade include: the role of registrars in the registration process in the form of government laboratories, private testing organizations and early adopters; ongoing audits after the awarding of a certificate; the preference of multinational enterprises for ISO 9000 suppliers; and the role of technical personnel in ISO 9000 acquisition (e.g., Guler, Guillén and Macpherson, 2002). Empirical evidence for the role of ISO 9000 in promoting exports is also available for both trade in general (e.g., Clougherty and Grajek, 2006) and for agricultural trade in particular (e.g., Capmany et al, 2000).

The ISO certification data are obtained from the official website of the ISO. The establishment data were obtained from the *International Yearbook of Industrial Statistics* published annually by the United Nations Industrial Development Organization (UNIDO). As will be seen below, the number of countries for which conformity capacity data are available significantly limits our sample size. For this reason, we will at times drop this indicator in order to assess the robustness of our results over different sample sizes.

Enforcement Capacity. Government capacity to enforce compliance for STRs is also important in measuring institutional capacity. Although it does not directly address the capacity of developing countries to overcome potential trade barriers that STRs may cause, it is still a good indicator to ascertain whether exporting countries are ready to overcome extra impediments by STRs. This is because importing countries may feel safer to import the food and agricultural products from those countries with a well maintained STRs enforcement system in place. That said, however, before this tastes-and-preferences

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industry can affect the exports of processed foods. Therefore, including ISO 9000 certification for sectors other than food and agricultural industry will help to capture the capacity of exporting country in general.

[9] The HACCP system is a process standard rather than a product standard. For further discussion, see Unnevehr and Jensen (1999).

effect kicks in, there might be short-run, negative impacts of enforcement capacity on export flows. We will assess this in our empirical analysis below.

We measure enforcement capacity by three different sub-components as illustrated in Table 1: SPS enquiry points, TBT enquiry points, and a National Plant and Protection Organization. The maximum point 1 is allocated for each component of enforcement capacity. Then, the average score is calculated for these three sub-components. Sub-components are scored according to the existence of government agencies or private agencies recognized by governments that deal with food and agricultural STRs. The country with an independent food and agriculture STR related agency are given 1 and 0.5 otherwise. Data are obtained from the WTO document database.

International Standards-Setting Capacity. The last element of institutional capacity is the level of each government's involvement in designing international STRs and implementation schemes for enforcement. The lack of representation and participation by developing countries in international standards-setting negotiations are chronic problems for developing-country exporters. In fact, developing countries are often referred to as 'standards-takers' (e.g., Wilson and Abiola, 2003).

We measure international standards-setting capacity through the membership status at the International Plant Protection Convention (IPPC) and the Codex Alimentarius (Codex), which are related to food and agricultural STRs, as well as participation at annual or biannual meetings of the WTO, the IPPC, and the Codex. It is important to look at the membership status and participation level at these meetings, since it is claimed that developing countries are not able to influence the international standards-setting process due to their low level of participation at the international standard organizations (Wilson and Abiola, 2003). Data are taken from the websites of these three organizations.

In the remainder of this paper, we incorporate each of these four dimensions of institutional capacity into a gravity model of trade in food an agricultural products. Before turning to this model, however, we consider some basic descriptive statistics for institutional capacity. These are presented in Table 2. As we can see in this table, conformity capacity is available for only half of the exporting countries of our fuller sample due to data limitations in developing countries. However, as Table 2 makes clear, and as we would expect, institutional capacity in developing countries falls below that of developed countries.

IV. GRAVITY MODEL

The gravity model approach used in this paper is an extension of that used by Otsuki, Wilson, and Sewadeh (2001b) to the year 2001[10] In addition to variables used in that study, we include variables for the four dimensions of institutional capacity described above. The gravity model specification is as follows:

$$\ln(V_{ij}) = b_0 + b_1 \ln(GDP_i) + b_2 \ln(GDP_j) + b_3 \ln(POP_i) + b_4 \ln(POP_j) + b_5 \ln(DIST_{ij})$$
$$+ b_6 \ln(ST_j) + b_7 \ln(INF_i) + b_8 \ln(CON_i) + b_9 \ln(ENF_i) + b_{10} \ln(INT_i) + \varepsilon_{ij}$$

In this specification, V_{ij} is the 2001 trade value between exporting country *i* and importing country *j*. GDP_i and GDP_j are the 2001 gross domestic products (GDPs) of exporting country *i* and importing country *j*, respectively. In a standard interpretation of the gravity model, both GDP variables would be expected to have a positive sign. In the case of the exporter, this would reflect productive capacity, and the case of the importer, it would reflect absorptive capacity. That said, however, for agricultural and food products, Engel effects could make the sign of the importer GDP ambiguous.

POP_i and POP_j are the 2001 populations of exporting country *i* and importing country *j*, respectively. In a standard interpretation of the gravity model, both population variables would be expected to have a negative sign, with larger countries being more self-sufficient. On the other hand, larger populations on the export side could be associated with increased exports based on economies of scale and contribute towards a positive sign. Additionally, larger populations on the import side could be associated with import substitution effects that also contribute to a positive sign.

$DIST_{ij}$ is the geographical distance between exporting country *i* and importing country *j*. Its expected sign is negative. ST_j is the maximum-level, Aflatoxin B1 standard imposed by importing country *j*. A larger value indicates a reduction of the standard's

[10] The gravity model has a very large literature. For some notable examples, see Leamer and Stern (1974), Anderson (1979), and Bergstrand (1985). For some important, recent contributions, see Deardorff (1998), Feenstra, Markusen, and Rose (2001), and Evenett and Keller (2002).

level, so the expected sign is positive. The variables INF_i, CON_i, ENF_i, and INT_i are the information, conformity, enforcement, and international standard setting capacity of the institutional capacity of exporting country *i*. With the possible exception of enforcement capacity, each is expected to have a positive sign. As mentioned in the previous section, in the case of enforcement capacity, it is conceivable that there could be short-term, suppressive impacts on trade flows in inferior products.

The base year is 2001. The US dollar values of food and agricultural trade between countries were obtained from the United Nations Statistical Office. The specific product categories are cereal and cereal products (SITC 04) and preserved or prepared nuts including groundnuts (SITC 0577 and 05892).[11] GDP, measured in terms of purchasing power parity (PPP), and population were taken from the World Bank's World Development Indicators (WDI) database. Distance data were obtained from the Centre D'etudes Prospectives et D'informations Internationales (CEPII) database.[12] Finally, the Aflatoxin B1 standard data for 2001 were obtained from the FAO surveys of mycotoxin standards on food and feed stuffs (FAO 1997, 2004). The number of countries covered for cereal and cereal products is 52, including 30 developing countries, and the number of countries for nuts and nut products is 49, including 25 developing countries.

V. ESTIMATION RESULTS

The results of the gravity model described above are presented in Table 3 for cereals and cereal products and in Table 4 for nuts and nut products. We consider each in turn.[13]

Columns 1 and 2 of Table 3 present the results of a gravity model of trade in cereals and cereal products without any institutional capacity variables for all exporters

[11] As is common practice, we use import data instead of export data because countries tend to keep better track of import data than export data for tariff purposes. Cereals (SITC 04) covered in this study include wheat, meslin, rice, barley, maize, and related food products. Nuts (SITC 0577 and 05892) covered in this study include coconuts, brazil nuts, cashew nuts, almonds, hazelnuts, walnuts, chestnuts, pistachios, and related products including preserved and prepared nuts. Cereals and nuts are known to be agriculture products that Aflatoxins can be easily built up.

[12] See http://www.cepii.fr/.

[13] The difference in the degree of freedoms between regressions for nuts and cereals occurs due to the different number of countries imposing the maximum level of Aflatoxins that can be allowed on nuts and cereals. The number of countries covered for cereal or cereal preparations is 52 and 49 in the analysis for nuts or nut products.

and developing-country exporters, respectively. In the case of all exporters, the GDP and population variables have the standard signs, the distance variable has the expected sign, and the Aflatoxin B1 variable has the expected sign. Except for the case of the importer population variable, each coefficient is statistically significant at the one percent level. This is also true for developing-country exporters, although the sign on the importer population variable has reversed. Overall, this standard gravity model appears to perform well for cereals and cereal preparations.

Columns 3 and 4 of Table 3 introduce the information, enforcement, and international standard-setting capacity variables. We refrain in these two columns from introducing the conformity capacity variable to maintain sample size. In both columns, the GDP variables maintain their expected signs and are still significant at the one percent level. None of the population variables are now statistically significant, however. The informational capacity variable has the expected, positive sign and is statistically significant. In Column 3, the enforcement capacity variable displays the trade suppressive effect we mentioned in the previous section as a possibility, although this is not statistically significant in the case of developing-country exporters. International standard-setting capacity is not statistically significant.

Columns 5 and 6 expand the set of institutional capacity variables to include conformity capacity, restricting sample size significantly.[14] For this restricted sample, exporter GDP loses its statistical significance and exporter population takes on a positive, statistically significant sign, possibly reflecting economies-of-scale effects. Even for this restricted sample, however, the distance and Aflatoxin B1 standard variables maintain the expected signs and statistical significance. Informational capacity maintains its sign and statistical significance, and conformity capacity is also positive and statistically significant at the one percent level. For cereal and cereal preparation exports, then, informational and conformity capacity appear to be effective means to overcome barriers to trade in the form of STRs.

[14] The difference in the degree of freedoms within the same product line is due to the availability of the conformity capacity data. Data for a conformity capacity variable are only available for 58 countries while those for other institutional variables for 116 countries.

Table 4 repeats the exercise of Table 3 for the case of nuts and nut products. Throughout the regressions of this table, importer GDP has the standard sign and is statistically significant at the one percent level. Exporter GDP is less robust and typically takes on a non-standard, negative sign that is statistically significant. Importer population also has the standard sign and is statistically significant at the one percent level. Exporter population is positive throughout and statistically significant at the one percent level, perhaps reflecting scale effects. Both distance and the Aflatoxin B1 standard variables have the expected signs throughout and are statistically significant at the one percent level.

With regard to the institutional capacity variables in Table 4, informational capacity is positive in sign as in Table 3, but is not statistically significant in Columns 5 and 6, perhaps due to the restricted sample size. Conformity capacity is once again positive and statistically significant at the one percent level as in Table 3. As in Table 3, enforcement capacity has a negative sign, displaying the trade suppressive effect we mentioned in the previous section. It is not statistically significant, however. The international standard-setting capacity is not robust with regard to sign for nut and nut products, and remains statistically insignificant throughout. For both the cases of nut and nut products and for cereals and cereal preparations, then, the dimensions of institutional capacity that appear to be most important are those of informational and conformity capacity.

VI. CONCLUSION

Food and agricultural STRs and the lack of institutional capacity to comply with them have become a serious concern to developing countries. There have been some efforts to measure quantitatively the impact of STRs on food and agricultural trade. However, attempts to investigate the impact of institutional capacity in a quantitative way have not been addressed. This paper has offered a preliminary start in this investigation, developing measures of informational capacity, conformity capacity, enforcement capacity, and international standard-setting capacity.

The results of this paper confirm the statistically significant impact of Aflatoxin B1 standards on exports of developing countries even after controlling for four institutional capacity variables and updating to a more recent year than previous studies. It also tentatively suggests that the dimensions of institutional capacity that are most important in overcoming standards in food and agricultural products are informational and conformity capacity. In the case of informational capacity, we must admit that we are using a proxy. Consequently, there is some risk that we have captured ‘closeness’ in a gravity sense or ‘connectedness’ in an informational sense rather than institutional capacity itself. Nevertheless, given the ‘closeness’ and ‘connectedness’ aspects of institutions as a means of overcoming transactions costs, this is not completely off the mark. In the case of conformity capacity, we are somewhat on firmer ground, with an explicit measure of a relevant certification status and evidence from other studies mentioned above of empirical relevance of ISO 9000 certifications. These results hold across two food and agricultural product categories.

The quantitative investigation of the effect of institutional capacity on trade flows affected by STRs has the potential to provide information regarding how to best link trade liberalization and trade-related capacity building.[15] Efforts have been made to assist developing countries to comply with WTO Agreements and international SPS standards. However, as seen in the results of Tables 3 and 4, developing countries can still face a serious trade barrier caused by STRs to their exports. Further, an exclusive focus on establishing enforcement systems might not constitute a complete assistance package to farmers and food producers in developing countries. Attention must be given to informational and conformity capacities as well.

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[15] The importance of linking trade liberalization and trade-related capacity building has been emphasized in Chapters 3 and 8 of Goldin and Reinert (2007).

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Table 1. Measuring Institutional Capacity

Dimension	Content	Explanation	Data Source
Informational	Indices for information technology readiness	Average score for three components: 1) population using internet index, 2) the education index, and 3) the e-government index	1) ITU website 2) UNDP website 3) UNPAN website
Conformity	The existence of conformity assessment and recognition systems	Certifications per establishment - The ratio of the number of ISO 9000 certifications awarded to the number of establishments	1) Survey of ISO 9000 certifications in 2001 at the ISO website. 2) International Yearbook of Industrial Statistics
Enforcement	Formal, independent STRs-related government agencies Legal activities at the international level	Average score for three components: 1) the existence of enquiry point and government authority under the SPS Agreement, 2) the existence of enquiry point and government authority under the TBT at the WTO Website, and 3) the existence of National Plant and Protection Organizations (NPPO).	WTO website
International standard-setting	Participation status in STRs-related international organizations	Average score for five components: 1) WTO Ministerial Meeting Participation, 2) Codex Membership, 3) Codex Convention Participation, 4) IPPC Contracting Party, and 5) IPPC Convention Participation	1) WTO website 2) and 3) Codex website 4) and 5) IPPC website

Table 2. Institutional Capacity Descriptive Statistics

Dimension	Total # of Countries (Developed/Developing)	Developed Mean (S.D.)[a]	Developing Mean (S.D.)[a]
Informational	116 (30/86)	0.55 (0.06)	0.35 (0.09)
Conformity	58 (22/36)	0.23 (0.25)	0.08 (0.12)
Enforcement	116 (30/86)	0.86 (0.20)	0.66 (0.29)
International standards-setting	116 (30/86)	0.64 (0.14)	0.56 (0.21)
Total[b]	58 (22/36)	2.30 (0.42)	1.83 (0.49)

[a] S.D. denotes standard deviation. [b] Sample size restricted to that of conformity capacity.

Table 3. Gravity Model Results for Cereals and Cereal Preparations

	1	2	3	4	5	6
Exporters	All	Developing	All	Developing	All	Developing
Constant	-16.84**	-8.61**	-12.26**	-4.21	-4.00	7.00
	(-12.43)	(-4.44)	(-5.67)	(-1.32)	(-1.31)	(1.33)
lnGDP importer	0.53**	0.29**	0.58**	0.32**	0.72**	0.47**
	(7.86)	(3.11)	(8.33)	(3.11)	(8.65)	(3.62)
lnGDP exporter	1.25**	1.13**	0.80**	0.75**	0.16	-0.25
	(21.05)	(9.70)	(5.62)	(3.39)	(0.76)	(-0.65)
lnPOP importer	-0.04	0.05	-0.07	0.05	-0.19*	-0.04
	(-0.53)	(0.51)	(-0.92)	(0.45)	(-2.13)	(-0.27)
lnPOP exporter	-0.46**	-0.60**	0.05	-0.19	0.74**	0.95**
	(-7.48)	(-5.15)	(0.36)	(-0.88)	(3.62)	(2.54)
lnDIST	-1.11**	-0.90**	-1.18**	-0.95**	-1.50**	-1.52**
	(-19.41)	(-10.73)	(-19.53)	(-10.49)	(-20.28)	(-11.81)
lnST	0.38**	0.42**	0.38**	0.41**	0.48**	0.46**
	(4.56)	(3.64)	(4.36)	(3.27)	(4.61)	(2.85)
lnINF			2.24**	1.59*	4.62**	4.27**
			(4.28)	(2.38)	(6.09)	(3.54)
lnCON					0.18**	0.35**
					(2.67)	(3.47)
lnENF			-0.32**	-0.21	-0.19	-0.11
			(-2.98)	(-1.79)	(-1.55)	(-0.81)
lnINT			0.18	0.12	0.28	0.12
			(0.75)	(0.41)	(0.83)	(0.23)
Observations	2270	1176	2017	989	1332	572
Adjusted R-squared	0.32	0.19	0.34	0.19	0.39	0.27

Note: t-scores are in parentheses. '*' denotes significance at the 5 percent level and '**' at the 1 percent level.

Table 4. Gravity Model Results for Nuts and Nut Products

	1	**2**	**3**	**4**	**5**	**6**
Exporters	All	Developing	All	Developing	All	Developing
Constant	-17.38**	-13.60**	-15.06**	-4.26	-10.39**	-1.75
	(-11.53)	(-6.93)	(-6.69)	(-1.39)	(-3.17)	(-0.36)
lnGDP	1.23**	0.96**	1.32**	1.11**	1.45**	1.22**
importer	(13.94)	(8.28)	(14.37)	(9.06)	(12.72)	(7.60)
lnGDP	0.16**	-0.01	-0.09	-0.79**	-0.39	-1.17**
exporter	(2.83)	(-0.10)	(-0.66)	(-4.17)	(-1.88)	(-3.53)
lnPOP	-0.73**	-0.47**	-0.82**	-0.61**	-0.94**	-0.68**
importer	(-7.77)	(-3.72)	(-8.32)	(-4.53)	(-7.69)	(-3.83)
lnPOP	0.54**	0.59**	0.81**	1.38**	1.02**	1.74**
exporter	(8.21)	(5.17)	(5.83)	(7.40)	(4.89)	(5.24)
lnDIST	-0.66**	-0.46**	-0.70**	-0.59**	-0.97**	-0.73**
	(-11.39)	(-5.48)	(-11.46)	(-6.62)	(-12.47)	(-5.76)
lnST	0.47**	0.78**	0.39**	0.78**	0.35*	0.58*
	(3.35)	(4.32)	(2.70)	(4.11)	(1.95)	(2.29)
lnINF			1.30**	3.38**	0.08	2.02
			(2.54)	(5.81)	(0.10)	(1.90)
lnCON					0.26**	0.23*
					(3.51)	(2.21)
lnENF			-0.14	-0.08	-0.03	-0.04
			(-1.78)	(-0.99)	(-0.29)	(-0.38)
lnINT			0.17	0.41	-0.66	-0.02
			(0.64)	(1.30)	(-1.86)	(-0.03)
Observations	1622	991	1413	803	897	459
Adjusted R-squared	0.28	0.24	0.30	0.29	0.33	0.30

Note: t-scores are in parentheses. '*' denotes significance at the 5 percent level and '**' at the 1 percent level.