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Contents

Abstract

This paper examines the impact of food safety standards on processed food exports in developing countries. An intercountry cross-sectional econometric analysis of processed food exports in developing countries was undertaken. The Sanitary and Phytosanitary Standard (SPS) is incorporated into the model to capture the impact of food safety standards. The empirical model shows that food safety standards imposed by developed countries tend to have a negative implication for processed food exports from developing countries. Since SPS is less transparent than tariffs or quotas, practically, there is ample room for developed countries to tweak the standards to be stronger than necessary to achieve optimal levels of social protection, and to twist the related testing and certification procedures to make their own competing products competitive with imports. However, because of the potential benefits that could emerge from imposing food safety standards such as a reduction of transaction costs and trade friction, developing countries should view SPS not just as a trade barrier but an opportunity to upgrade quality standard and market sophistication. Multilateral efforts are needed to mobilize additional financial and technical assistance to help redress constraints in developing countries in meeting the required food safety standards imposed by developed countries.

I. Introduction

There has been a structural change in the composition of agriculture trade in developing countries over the past three decades. Traditional (unprocessed) food exports have continuously declined and have been replaced by processed food exports. Developed country markets have been a major destination of processed food exports from many developing countries. However, access to developed country markets poses many challenges. One of the key challenges is the ability of developing countries to meet increasingly more stringent food safety standards imposed by developed countries. In principle, the Sanitary and Phytosanitary Standard (SPS) Agreement and the associated World Trade Organization (WTO) dispute settlement mechanism could ensure that food safety standards are not abused or misused for protectionist aims. Although these standards are subject to frequent changes and often difficult and costly to meet, such changes are to be expected, given advances in scientific knowledge about health hazards and improvements in food processing technology. Imposing food standards could, therefore, improve market performance by reducing transaction costs and trade frictions as exporters could use such standard as a guide to realize the expectations of importers concerning food quality and safety. In addition, they could also increase elasticity of substitution between similar goods produced in different countries so that relatively more efficient producers would be permitted to thrive through export expansion. However, in practice, there have been provoked suspicions that food safety standards are being used as a nontransparent, trade impeding protectionist tool, rather than as a legitimate instrument for the protection of human, plant, and animal health. In particular, developing countries are usually at a disadvantage in making use of these procedures, because of their limited capacity to access and absorb best practice technology and information. They are also constrained by inadequate resources from challenging perceived inequities (Athukorala and Jayasuriya 2003 and 2005). Therefore, the impact of food safety standards on processed food exports in developing countries is still inconclusive.

The SPS has become a more important issue since demand for a more stringent SPS in developed countries tends to increase following their rising incomes and growing health consciousness. Particularly, as traditional trade barriers such as tariffs and quantitative restrictions continue to decline, food safety standards have become an interesting tool for protectionists to block trade.

The purpose of this paper is to examine the impact of food safety standards on processed food exports in developing countries. An intercountry cross-sectional econometric analysis of determinants of processed food exports in developing countries was undertaken. The SPS is incorporated into the model to capture the impact of food safety standards. The paper is organized as follows. Section II presents trends and patterns of processed food exports in developing countries over the past four decades. An overview of SPS is provided in Section III. Section IV discusses determinants of intercountry differentials in export performance of processed food. Variable measurements and econometric procedures are presented in Section V. The results are discussed in Section VI. The final section provides conclusions and policy inferences.

II. Trends and Patterns of Processed Food Trade: A First Look

Over the past three decades, there has been a notable composition shift in world food trade. The relative importance of "classical" food products, such as coffee, tea, sugar, and cocoa, has been eroded and replaced by the processed food trade (see Appendix 1 for a list of processed food products).[1, 2] An increase in world demand for processed food has been associated with evidence of diet upgrades. Changes in internationalization of food habits have been shaped mainly by rising incomes, growing health consciousness, and urbanization. Factors such as international migration, communication revolutions, and international tourism also contribute to the diet upgrades. In addition, declines in tariff and nontariff barriers, through many rounds of international negotiations both in developed and developing countries have facilitated the expansion of processed food trade.

The share of processed food exports in total world food exports increased from 44% in 1980 to around 63% in 2006. The composition shift has been attributed mainly to developing countries, particularly since the early 1990s. While the share of processed food exports in total world food exports tripled in developing countries during 1980–2006, the share was rather stable in developed countries (Figure 1).[3] The increasing importance

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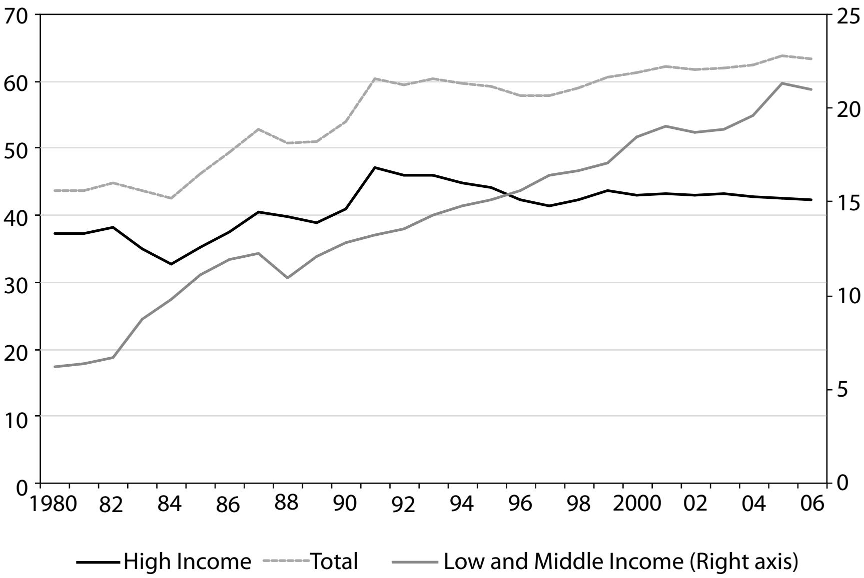
1 While international trade in many of these processed food products is not entirely "new", their trade has experienced very rapid expansion in recent years, and they are often described as "new food exports" or "nontraditional food exports". To maintain the focus on these new dynamic export items, traditional beverages (such as tea and coffee) and cereal grains (wheat, maze, rice, etc.) exported in bulk are excluded from the analysis.

2 Generally, the definition of processed food products is based on the International Standard Industry Classification (ISIC). All commodities that belong to ISIC Section 3 are all classified as processed food. However, export data used in the analysis are reported under the Standard International Trade Classification (SITC). Thus, the SITC commodities listing at 5-digit level is cross referenced to that of the ISIC listing at 4-digit level. See Athukorala and Jayasuriya (2005) for detailed discussion and definition of processed food.

3 Developed countries refer to high-income countries according to the World Bank classification. Note that the results are not significantly different when developed countries are defined to include only US, Canada, EU15, Japan, Australia, New Zealand, and East Asia Tigers. Developing countries refer to low- and middle-income countries according to the World Bank classification.

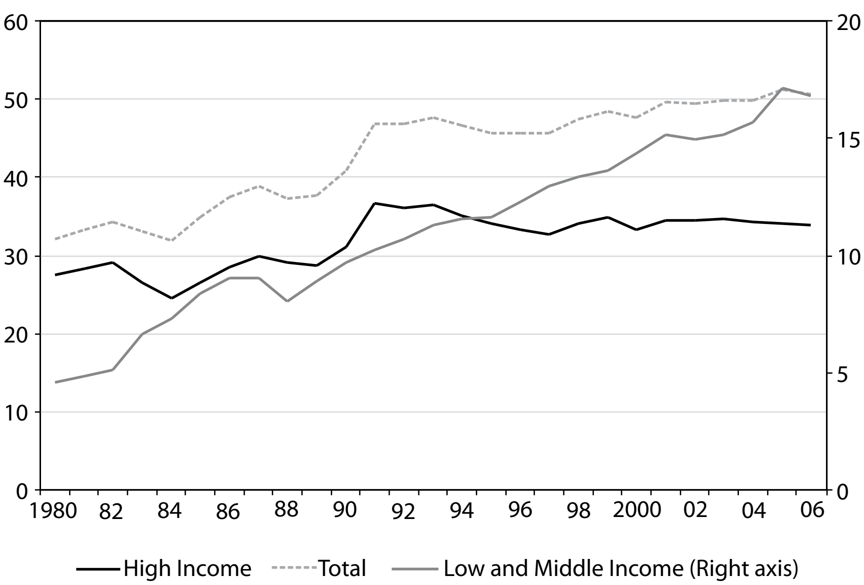
of processed food exports has also resulted in a structural shift in world agriculture trade. The share of processed food exports in world agriculture exports increased to 51% in 2006 from only 32% in 1980 (Figure 2).

Figure 1: Share of Processed Food Exports in Total World Food Exports (percent)



Note: Food exports include SITC 0+1+4+22-121. See Appendix 1 for descriptions of processed food.
Source: United Nations Comtrade database (Rev.2), DESA/UNSD, all downloaded April 2008.

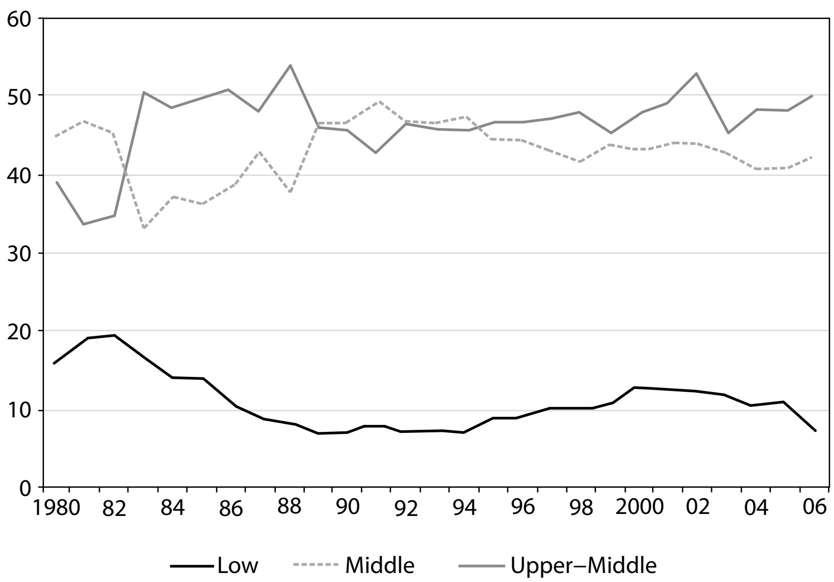
Figure 2: Share of Processed Food Exports in Total World Agriculture Exports (percent)



Note: Agriculture exports include SITC 0+1+2+4-27-28. See Appendix 1 for descriptions of processed food.
Source: United Nations Comtrade database (Rev.2), DESA/UNSD, all downloaded April 2008.

Although processed food exports in developing countries have continuously increased, not all countries have shared in the benefits. In general, countries belonging to upper-middle and middle-income countries according to the World Bank classification have performed better in expanding processed food exports than low-income countries. Figure 3 shows that more than 90% of total developing countries' processed food exports are contributed by upper-middle and middle-income countries. The share of processed food exports in these countries accounted for more than half of total food exports. After the late 1980s, the gap between upper-middle and middle-income countries contributing to processed food exports has become narrow. This resulted from the faster growth of processed food exports in middle-income countries. On average, annual growth rate of processed food exports in middle-income countries was 10% during 1980–2006, compared to 11.2% in upper-middle income countries and 7.1% in low-income countries.

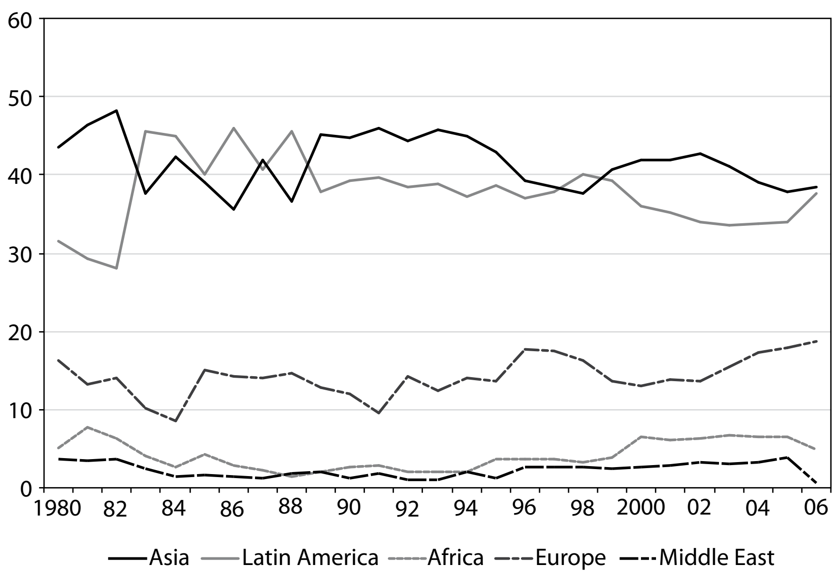
Figure 3: Share of Processed Food Exports in Low, Middle, and Upper-Middle Income Countries, 1980–2006 (percent)



Source: United Nations Comtrade database (Rev.2), DESA/UNSD, all downloaded April 2008.

In terms of the regions, developing Asia and Latin America tend to perform better than other regions in expanding processed food exports. The shares of processed food exports from Asia and Latin America in total developing countries' processed food exports, over the past three decades, were around 41% and 38%, respectively. The contribution of processed food exports from the Middle East was lowest at around 2%, while Africa and Europe contributed 4% and 14%, respectively (Figure 4).

Figure 4: Share of Processed Food Exports in Developing Asia (percent)



Source: United Nations Comtrade database (Rev.2), DESA/UNSD, all downloaded April 2008.

Developed countries are the key export destinations of processed food exports from developing countries. Among developed countries, G3 countries import more than 50% of total developing countries' processed food exports. The European Union (EU) is the most important export destination, followed by the US and Japan, respectively (Table 1). Since the early 1990s, the importance of the G3 market has slightly declined and developing countries have become more important for developing countries' processed food exports. The share of processed food exports to developing countries doubled during 1990–2006 while the share of G3 market declined by almost 10 percentage points. Developing countries in Latin America, Europe, and Asia are the key import destination for developing countries' processed food products. Since the early 2000s, the share of processed food exports to developing Europe and Asia has become higher than that to Latin America. The share of processed food exports to Latin America declined from 7.2% in 2000 to 5.8% in 2006 while that to developing Asia and Europe increased to 10%, from 7% and 5.6%, respectively. For Africa and Middle East, the shares slightly increased but were still less than 5% of total developing countries' processed food exports.

Table 1: Key Export Partners, 1980–2006
(% of developing countries' total processed food exports)

	G3 Countries	USA	EU	Japan		
1980	59.9	13.3	38.4	8.3		
1990	63.0	21.0	29.6	12.4		
2000	59.5	20.1	23.9	15.5		
2006	53.4	16.8	26.4	10.2		
	Developing Countries	**Asia**	**Latin America**	**Europe**	**Africa**	**Middle East**
1980	18.1	3.2	6.3	1.4	3.1	4.0
1990	15.4	3.3	5.8	1.0	2.2	3.0
2000	25.2	7.1	7.2	5.6	3.1	2.2
2006	32.8	8.8	5.8	10.5	4.0	3.7

Source: United Nations Comtrade database (Rev.2), DESA/UNSD, all downloaded April 2008.

III. Food Safety Standards

The SPS is a measure of food safety standards building on the existing disciplines contained in the General Agreement of Tarrifs and Trade and the Standards Code of 1979. The SPS Agreement recognizes the right of member countries to adopt the necessary SPS measures to protect human, animal, and plant life or health subject to conducting a risk assessment and provided that these are not disguised measures to restrict trade (WTO 1996). Measures implemented by WTO member countries are to be based on scientific principles and not maintained without sufficient scientific evidence. WTO members are also to base their SPS measures on international standards, where they exist (harmonization requirement). Members can adopt more stringent regulations if there is a scientific justification or as a consequence of risk assessment carried out in accordance with Article 5 of the SPS Agreement. Importing countries are required to accept SPS measures of the exporting countries as equivalent to their own, if the exporting country can demonstrate that its health measures achieve the same level of protection as for the importing country (equivalency requirement). The SPS Agreement also requires that WTO members notify the WTO and their trading partners of changes in their SPS measures (transparency requirement). These notifications may contain information on the imposition or removal of a procedure or requirement that may act as barriers to trade.

According to the Sanitary and Phytosanitary Agreement of the WTO, food safety standards include all relevant laws, decrees, regulations, requirements and procedures including, *inter alia*, end product criteria; processes and product methods; testing, inspection, certification, and approval procedures; quarantine treatments including relevant requirements associated with the transportation of animals and plants, or with the materials necessary for their survival during transport; provisions on relevant statistical methods, sampling procedures and methods of risk assessment; and packaging and labeling requirements directly related to food safety.

The temptation to use SPS as a trade barrier of agriculture products has been increased over the past decade. The SPS notifications to the WTO increased from 200 cases in 1995 to almost 1,000 cases in 2003 (Regmi et al. 2005). Fresh or chilled meat and fruits and vegetables were the most targeted products, accounting for 24% and 12%, respectively, of product-specific SPS notifications while all processed food products accounted for 50% of product-specific SPS notification. The use of SPS tends to be asymmetric across countries. Table 2 shows the share of detentions imposed by the US to total US detentions. On average, Asian countries, particularly the People's Republic of China (PRC); India; Indonesia; Thailand, and Viet Nam had the high proportion of detention cases in the US market, followed by Latin America. In the PRC, for example, the share of detentions to total US detentions increased from 8% in 2002, to almost 10% in 2004 while in Viet Nam, the share rose to 6.6% from 5.7% during the same period. Interestingly, among these countries, Mexico tended to have the highest proportion of processed food detentions in the US market. The cases of detentions in this countries accounted for more than 15% in 2002–2004.

The possibility of exporters meeting food safety standards is far lower in developing countries than developed countries. We calculate the incidence of detention in both developed and developing countries, i.e., export value of food products to a number of detained shipments. A higher numerical value of the ratio would suggest a higher possibility of exporters meeting food safety standards. The data on detention are from the US Food and Drug Administration (FDA) to which information on a country's performance in meeting food safety standards is reported. The information, for each shipment detained, includes the name/address of the exporters, the product, and the reason for detention. According to data availability, the ratio used in this study covers three periods, i.e., 2002, 2003, and 2004. It is found that incidence of detention in developing countries was around 3.4 in 2002–2004, compared to 5.5 in developed countries, reflecting the lower possibility of developing countries to overcome food safety standards. In particular, the incidence of detention was relatively low in Asia. Export value per detention in Asia ranged from US$0.25 million per case (Pakistan) to US$6.94 million per case (Thailand), compared to an average of US$9.04 million per case in Latin America (Table 2).

The increasing importance of SPS was a result of a progressive decline in tariff and nontariff measures. Asymmetric information about product quality between producers and consumers also results in development of food safety standards. In addition, because of the nature of processed food products (e.g., ready to eat, perishability, and variability in their quality and multiple quality attributes, some of which are difficult to measure), they are often subject to a higher degree of scrutiny regarding quality and food safety (SPS), to protect human, animal or plant life, or health. However, the relationship between food safety and processed food exports is inconclusive. On one hand, SPS could improve market performance by reducing transaction costs, especially in terms of searching information, and trade frictions as exporters could use such standards as a guidance to realize the expectations of importers concerning food quality and safety. Standards can also increase elasticity of substitution between similar goods produced in different countries so that relatively more efficient producers would be permitted to thrive through export expansion. On the other hand, food safety standards could become an impediment to trade in developing countries as importing countries may deliberately craft food safety measures that impose a cost or other disadvantage on foreign competitors to provide protection for domestic producers. In addition, even when comparable food safety measures are applied in developed countries to both domestic and imported products based on genuine health reasons, they can impede imports only from developing countries, i.e., imported products, because of asymmetry in compliance cost (Athukorala and Jayasuriya 2005).

Table 2: Asymmetry in Use of SPS, 2002–2004

	Detentions/Total US Detentions (%)					Detentions/Total US Detentions (%)			
	2002	2003	2004	2002–04		2002	2003	2004	2002–04
Indonesia	3.49	4.10	6.20	4.60	Australia	0.27	0.12	0.03	0.14
Malaysia	0.37	0.30	0.29	0.32	Austria	0.15	0.00	0.07	0.07
Philippines	3.20	3.80	3.41	3.47	Belgium	0.06	0.14	0.08	0.10
Thailand	4.43	4.34	3.29	4.02	Canada	2.16	3.18	2.53	2.62
Viet Nam	5.74	6.03	6.57	6.11	Denmark	0.09	0.14	0.08	0.11
PRC	7.96	7.83	9.36	8.38	Finland	0.06	0.00	0.00	0.02
Korea	2.04	3.34	2.75	2.71	France	1.07	0.66	0.48	0.73
Taipei,China	3.07	2.00	1.85	2.31	Germany	0.70	0.12	0.08	0.30
Bangladesh	0.46	0.20	2.26	0.97	Greece	1.20	0.93	0.39	0.84
India	4.55	4.89	4.89	4.78	Iceland	0.18	0.07	0.03	0.10
Pakistan	0.32	0.55	0.70	0.52	Ireland	0.06	4.01	0.20	1.43
Sri Lanka	0.21	0.50	0.63	0.45	Israel	0.32	0.50	0.24	0.35
Ecuador	1.46	0.73	0.82	1.00	Italy	2.86	2.00	2.51	2.46
Honduras	0.24	0.55	0.15	0.32	Japan	2.68	4.12	2.31	3.04
Nicaragua	0.29	0.32	0.31	0.31	Netherlands	0.35	0.39	0.49	0.41
Colombia	0.53	0.50	1.07	0.70	New Zealand	0.23	0.23	0.07	0.18
Costa Rica	0.65	0.82	0.49	0.66	Norway	0.29	0.11	0.14	0.18
Dominican Republic	2.82	5.78	8.08	5.56	Portugal	0.15	0.37	0.05	0.19
El Salvador	0.11	0.12	0.17	0.13	Russia	0.24	0.27	0.29	0.27
Guatemala	3.61	1.25	1.32	2.06	Spain	3.67	2.21	1.41	2.43
Peru	0.75	0.98	0.73	0.82	Sweden	0.02	0.12	0.07	0.07
Argentina	0.93	0.27	0.39	0.53	Switzerland	0.23	0.07	0.02	0.11
Brazil	1.07	1.39	1.75	1.40	United Kingdom	1.55	2.25	1.82	1.87
Chile	1.02	0.84	1.04	0.96					
Mexico	19.44	12.17	13.76	15.12					
Uruguay	0.05	0.07	0.25	0.12					
Ghana	0.35	0.48	0.31	0.38					
Nigeria	0.15	0.20	0.12	0.16					
Poland	2.44	1.34	1.55	1.77					
Turkey	1.61	1.52	1.29	1.47					

Source: US Food and Drug Administration.

IV. Determinants of Intercountry Differentials in Export Performance of Processed Food

This section reviews other potential factors in addition to food safety standards (SPS) that can explain intercountry differentials in export performance of processed food products in developing countries *(PROEX)*. The first factor is related to agricultural resource endowment *(ARE)*. As processed food industries depend on a large domestic resource content, an expansion of *ARE* would increase their production capacity. Second, domestic market *(CS)* is hypothesized to be another prerequisite factor in determining its export success. As processed food products are relatively luxurious compared to traditional agriculture products, to enable firms to achieve economies of scale and to reduce costs to break into foreign markets, domestic markets must be lucrative enough. Thus, a positive relationship between the size of the domestic market and expansion of processed food exports is expected.

While a country's size and resource endowment are obviously the prerequisite factors, trade policy regimes (*OPEN*) in a country are hypothesized to become even more important in determining intercountry differences in export performance of processed food. Trade liberalization would provide incentives for producers to export instead of selling in the domestic market.[4] The significant positive relationship between openness in trade policy regime and an expansion of processed food exports is expected. In particular, the higher degree of trade openness is hypothesized to be able to reduce the importance of *CS* and *ARE* factors. When a country could easily reach international markets, importance of relying on domestic market to achieve economies of scale tends to be reduced. Likewise, countries could import raw materials instead of relying only on domestic resource endowment so that raw material costs across countries would become more comparable (Athukorala and Sen 1998). These arguments imply that the interaction terms between trade openness and domestic market (*OPEN* · *CS*), and between trade openness and domestic resource endowment (*OPEN* · *ARE*) are hypothesized to be negative.

A number of trade facilitations could also help to support an expansion of processed food. These include a well-functioning financial market (*DC*) to provide financial support to all relevant supply chains of processed food industries. Sufficient financial support could allow firms to manage well the risks and uncertainties mainly related to transport and storage of raw materials and commodities, and to improve production and distribution technologies. Infrastructure (*INFRA*) is another key variable that can determine export performance of processed food industries. This includes well-developed roads, railways, ports, telephone lines, power systems, terminal markets, storage, and processing facilities.

[4] See Rea and Josling (2003) for detailed discussion on the role of trade liberalization on processed food trade and developing countries.

Table 3: Cases of Detentions in the US Market, 2002–2004

	Cases of Export Detention			Export Value (million $)			Value per Detention (million $/case)			
	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002–04
Indonesia	229	230	365	488.1	522.3	742.8	2.13	2.27	2.04	2.13
Malaysia	24	17	17	37	36.7	161.3	1.54	2.16	9.49	4.05
Philippines	210	213	201	349.5	409.6	415	1.66	1.92	2.06	1.88
Thailand	291	243	194	1586.5	1730.9	1732.3	5.45	7.12	8.93	6.94
Viet Nam	377	338	387	652	778.3	617.4	1.73	2.30	1.60	1.86
PRC	523	439	551	1233.9	1646.6	1866.2	2.36	3.75	3.39	3.14
Korea, Republic of	134	187	162	103.5	103.1	103	0.77	0.55	0.64	0.64
Taipei,China	202	112	109	161.3	162.7	184.3	0.80	1.45	1.69	1.20
Bangladesh	30	11	133	92.2	87.8	183.2	3.07	7.98	1.38	2.09
India	299	274	288	485.6	561.7	515.9	1.62	2.05	1.79	1.82
Pakistan	21	31	41	8.8	8.6	6.3	0.42	0.28	0.15	0.25
Sri Lanka	14	28	37	9.6	19	20	0.69	0.68	0.54	0.62
Ecuador	96	41	48	919	978.1	904.1	9.57	23.86	18.84	15.14
Honduras	16	31	9	365.1	358	409.2	22.82	11.55	45.47	20.22
Nicaragua	19	18	18	102.4	95.8	102.9	5.39	5.32	5.72	5.47
Colombia	35	28	63	285.9	257.3	252	8.17	9.19	4.00	6.31
Costa Rica	43	46	29	767.6	811.3	732.7	17.85	17.64	25.27	19.59
Dominican Republic	185	324	476	73	70.6	69.6	0.39	0.22	0.15	0.22
El Salvador	7	7	10	16.4	19	19.5	2.34	2.71	1.95	2.29
Guatemala	237	70	78	486.8	513.9	536.8	2.05	7.34	6.88	3.99
Peru	49	55	43	232.1	276.4	355.5	4.74	5.03	8.27	5.88
Argentina	61	15	23	185.6	171.9	163.4	3.04	11.46	7.10	5.26
Brazil	70	78	103	285.7	300	245.6	4.08	3.85	2.38	3.31
Chile	67	47	61	1659	1890.4	2054.2	24.76	40.22	33.68	32.02
Mexico	1277	682	810	3296.3	3793.5	4353.8	2.58	5.56	5.38	4.13
Uruguay	3	4	15	20.6	18.7	19.8	6.87	4.68	1.32	2.69
Ghana	23	27	18	3.2	4	4	0.14	0.15	0.22	0.16
Nigeria	10	11	7	2.5	1.8	1.3	0.25	0.16	0.19	0.20
Poland	160	75	91	53.5	56.8	49.5	0.33	0.76	0.54	0.49
Turkey	106	85	76	71.5	93.8	108.9	0.67	1.10	1.43	1.03
Australia	18	7	2	124.4	132.5	140.7	6.91	18.93	70.35	14.73
Austria	10	0	4	0.8	0.7	1	0.08	n.a.	0.25	0.18
Belgium	4	8	5	22.1	28	31.9	5.53	3.50	6.38	4.82
Canada	142	178	149	3473.6	3784	3970.3	24.46	21.26	26.65	23.94
Denmark	6	8	5	22.2	22.1	16.7	3.70	2.76	3.34	3.21
Finland	4	0	0	0.5	0.4	0.3	0.13	n.a.	n.a.	0.30
France	70	37	28	57.5	63.9	65.9	0.82	1.73	2.35	1.39
Germany	46	7	5	29.1	35.1	47.5	0.63	5.01	9.50	1.93
Greece	79	52	23	105.4	92.1	101.8	1.33	1.77	4.43	1.94
Iceland	12	4	2	175.5	157.6	166.8	14.63	39.40	83.40	27.77
Ireland	4	225	12	4.3	7.1	6.5	1.08	0.03	0.54	0.07
Israel	21	28	14	82.4	113.6	118.7	3.92	4.06	8.48	5.00
Italy	188	112	148	49.1	53.9	55.3	0.26	0.48	0.37	0.35
Japan	176	231	136	179.7	213.8	196.2	1.02	0.93	1.44	1.09
Netherlands	23	22	29	209.6	190.7	171.2	9.11	8.67	5.90	7.72
New Zealand	15	13	4	244.9	237.2	278.8	16.33	18.25	69.70	23.78
Norway	19	6	8	140.3	137.5	116.4	7.38	22.92	14.55	11.95
Portugal	10	21	3	12.3	11.7	12.3	1.23	0.56	4.10	1.07
Russia	16	15	17	276.6	257.9	225.8	17.29	17.19	13.28	15.84
Spain	241	124	83	480.9	560.6	534.8	2.00	4.52	6.44	3.52
Sweden	1	7	4	3.2	3.5	4.3	3.20	0.50	1.08	0.92
Switzerland	15	4	1	6.2	8.2	7	0.41	2.05	7.00	1.07
United Kingdom	102	126	107	46.1	88.1	77.8	0.45	0.70	0.73	0.63
Developed Countries	1256	1256	799	5746.5	6200	6347.8	4.58	4.94	7.94	5.53
Developing Countries	**5314**	**4349**	**5089**	**15087.5**	**16868.2**	**18066.6**	**2.84**	**3.88**	**3.55**	**3.39**
Total	6570	5605	5888	20833.9	23068.1	24414.4	3.17	4.12	4.15	3.78

Source: The US FDA

In addition to trade facilitation, favorable macroeconomic conditions also play a pivotal role in shaping and influencing incentives for investment in production and marketing activities in processed food industries (Jaffee and Gordon 1993). In particular, price instability (*PIS*) and an overvalued real exchange rate (*RER*) could induce higher costs of production and lower returns on farm inputs and food products, thereby reducing investment incentives and possible expansion of food exports. However, price stability, particularly agriculture prices, may relate to significant distortions when government implements considerable price controls, floor prices, and buffer stocks. Such distortions would lead to misallocation of resources thereby adversely affecting producers and trade incentives. This implies that coefficient associated with price stability is inconclusive depending on how price stability is achieved.

Finally, foreign direct investment (*FDI*) could influence processed food exports but the direction of its influence is inconclusive. On one hand, an involvement of multinational enterprises (MNEs) could generate positive effects to processed food industries, particularly exporting firms. MNEs have an international production network so that flows of information on home country and other markets are completed. In addition, they tend to undertake a large proportion of the world's total research and development and are principal bearers of technology across international borders (Borensztein et al. 1998, Lipsey 2000, Vernon 2000). With these advantages, one would expect that MNE affiliates are likely to face lower production and entry costs in export markets. However, technology and capital in producing manufactured food products are mobile in the world food market and raw materials of these products are relatively inexpensive to transport. MNEs may, therefore, intend to locate closely to consumer market to minimize distribution costs so that an increase in *FDI* could lead to an overall reduction of processed food exports.

All in all, the above discussion illustrates the empirical model of processed food exports as follows:

$$PROEX = f\left(\underset{(?)}{SPS}\quad \underset{(+)}{CS},\ \underset{(+)}{ARE},\ \underset{(+)}{OPEN},\ \underset{(-)}{OPEN\cdot CS},\ \underset{(-)}{OPEN\cdot ARE},\ ,\ \underset{(?)}{DC},\ \underset{(+)}{PIS},\ \underset{(+)}{RER},\ \underset{(?)}{FDI},\underset{(+)}{INFRA}\right) \tag{1}$$

where *PROEX* = export performance of processed food products
SPS = food safety standards
CS = country size/domestic market
ARE = agricultural resource endowment
OPEN = trade policy regime
DC = financial availability
PIS = price instability
RER = real exchange rate
FDI = foreign direct investment inflows
INFRA = infrastructure

V. Variable Measurements and Econometric Procedure

The empirical model is estimated based on 79 developing countries[5] during the period 1990–2006. The country coverage is based on data availability. The whole sample periods are divided into six nonoverlapping 3-year periods (except for the last subgroup for which the data are averaged only from 2-year periods). Three-year periods are applied, instead of a yearly basis, to reduce business cycle fluctuations associated with data series. Export performance of processed food products is proxied by real value of processed food exports (*PROEX*).[6]

As mentioned in Section III, SPS is measured as the incidence of detention, i.e., export value of food products to a number of detained shipments in the US market, the most comprehensive and available information for detained shipments. The share of agriculture products, measured in value added in constant 2000 United States dollar (US$), to total population at the initial period is used to reflect *ARE*. Deflating by population is to control for domestic consumption demand. As pointed out in Athukorala and Sen (1998), the initial value of share of food, i.e., processed and unprocessed (SITC 0, 1 and 4) in total exports could also be used to proxy resource endowments. Both measurements are, therefore, applied in this study. The expansion of *CS* is measured by gross domestic product (GDP) per capita in which GDP is measured in real terms at 2000 US$ prices.

While there is no unique measure of trade policy regime, this study applies two well-known proxies, namely trade to GDP (*OPEN1*) and implied tariff rate (*OPEN2*) (total tariff revenues as a percentage of total trade) in measuring trade policy openness. Tariff revenues are composed of customs and other import duties, taxes on exports, profits of exports or import monopolies, exchange profits, exchange taxes, and other taxes on international trade and transactions collected on a cash basis. In fact there are other proxies for trade policy regime such as binary index, which takes value 1 for open economies and zero otherwise, originated by Sachs and Warner (1995)[7] and the ratio of merchandise trade to good GDP, excluding nontraded activities. However, because of

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5 The 79 developing countries include Albania, Algeria, Argentina, Azerbaijan, Bangladesh, Belize, Bolivia, Brazil, Bulgaria, Burundi, Cameroon, Cape Verde, Central Africa, Chile, People's Republic of China, Colombia, Costa Rica, Croatia, Dominica, Ecuador, Egypt, El Salvador, Ethiopia, Fiji Islands, Gabon, Gambia, Georgia, Ghana, Grenada, Guatemala, Guyana, Honduras, Hungary, India, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyzstan, Latvia, Lithuania, Madagascar, Malawi, Malaysia, Mali, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Nicaragua, Niger, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Romania, Russia, Saint Kitts, Saint Lucia, Saint Vincent, Senegal, Seychelles, Sri Lanka, Thailand, Togo, Tunisia, Turkey, Uganda, Uruguay, Ukraine, Venezuela, Zambia, Zimbabwe.

6 Real processed food exports are derived from deflating nominal value of processed food exports by agriculture export prices. In some countries, an agriculture deflator derived from the national accounts is used.

7 Sachs and Warner (1995) employ the following policy criteria to distinguish countries with closed (inward-oriented) from those with open (outward-oriented) policy regimes: (i) nontariff barrier coverage of intermediate and capital goods import of 40% or more; (ii) an average tariff on intermediate and capital goods imports of 40% or more; (iii) a black market exchange rate that is depreciated by 20% or more relative to the official exchange rate; (iv) a socialist economic system; and (v) state monopoly on major exports.

incomplete and not updated data,[8] this study applies only the former two measures to reflect trade openness.

The ratio of private domestic credit over GDP (*PDC*) is used to proxy the availability of financial support to all relevant supply chains of processed food industries. PIS is measured by the deviation of agricultural prices (deflator) to their trends (*PIS*). The trend of agricultural prices is derived using the Hodrick-Prescott filter method. The *RER* in this study is measured as a nominal exchange rate (in terms of the US$) adjusted by price differentials. Both consumer prices and GDP deflators are used as a proxy of price differentials. FDI is measured as net inflows of FDI as a percentage of GDP. Road density *(ROAD),* which is measured as total road networks divided by total population, is used as a proxy of infrastructure.[9]

Data on processed food exports; agriculture exports; the share of food, including both processed and unprocessed, in total exports; and agriculture exports are from United Nations Comtrade database (UNCOMTRADE), Revision 2 (Rev. 2) while real GDP per capita, agricultural products, agricultural price deflator, consumer and producer prices, trade to GDP, tariffs, total import value, total network of roads, private domestic credit, FDI, and total population are compiled from the World Bank's *World Development Indicators* (CD-ROM).

To examine the determinants of processed food exports, an unbalanced panel econometric procedure is applied for six nonoverlapping 3-year periods, 79 developing countries with 273 panel (unbalanced) observations, during 1990–2006. The unit root test (testing for stationary and nonstationary series) for panel data is first performed to ensure that there is no unit root for all dependent and independent variables. Because all data are stationary (no unit root), the level of both dependent and independent variables can be used without concern on spurious regression. Both fixed and random effects are performed in this study. Equation (1) is rewritten in terms of fixed and random effects models as follows:

$$\begin{aligned} PROEX_{i,t} &= \alpha_0 + \alpha_1 CS_{i,t} + \alpha_2 ARE_{i,t} + \alpha_3 OPEN_{i,t} + \alpha_4 OPEN_{i,t} \cdot CS_{i,t} + \alpha_5 OPEN_{i,t} \cdot ARE_{i,t} + \alpha_6 SPS_{i,t} \\ &\quad + \alpha_8 DC_{i,t} + \alpha_9 PIS_{i,t} + \alpha_{10} FDI_{i,t} + \alpha_{11} RER_{i,t} + \alpha_{12} ROAD_{i,t} + \beta_i + \chi_t + \varepsilon_{i,t} \end{aligned} \tag{2}$$

8 The binary index was calculated only during the period 1982–1994.

9 Note that other infrastructure variables such as electric power consumption and transport services to total trade are also included but it becomes statistically insignificant and has the incorrect sign. This may be because a number of missing data are not matched with other variables in the model.

where β_i is the cross-sectional fixed effect for processed food exports of country *i*, to control for country-specific characteristics[10], χ_t is the time effect to control for time-specific shocks. Inclusion of the latter is for capturing some time-varying variables that may be missing from the simple specification in equation (2), and $\varepsilon_{i,t}$ is the independently and identically distributed error terms across countries and years.

VI. Results

Table 4 reports the estimation result of the panel model. Random effect is a preferred estimation technique to fixed effect in this study because the former model performs better in terms of key diagnostic tests, particularly normal distribution and stationarity of the error terms. The estimation results are corrected for serial correlation and heteroskedasticity problems. A limitation of the random effect estimator, compared to the fixed effect counterpart, is that it can yield inconsistent and biased estimates if the unobserved fixed effects are correlated with the remaining component of the error term. However, this is unlikely to be a serious problem in this study because the number of explanatory variables (*N*) is larger than the number of "within" observations (*T*) (Wooldridge 2002). The Hausman test could not provide appropriate measures in choosing between random and fixed effects in this study because the model tends to violate two key assumptions of applying the Hausman test, namely strict exogeneity and homoskedasticity (Wooldridge 2002). Note that two-stage least squares is applied in this study to redress the possibility of simultaneity problem that could emerge between real GDP per capita and processed food exports.[11] Natural logarithms formula is applied for all variables. Because of better explanatory power and diagnostic tests, the estimation result reported in Table 4 is based on the model in which the initial level of (real) agriculture products over population, trade to GDP, and GDP deflator are used as proxies of initial resource endowments, trade policy regime, and *RER*, respectively.[12]

A coefficient corresponding to *SPS*, which contains information on the ratio of export value to a number of detained shipments in the US market, is positive and statistically significant. The positive coefficient illustrates that an increase in a number of detentions would lead to a decline in export volume of processed food. Providing robust statistical support, food safety standards tend to become an impediment to trade in developing countries, instead of reducing transaction costs and trade friction resulting in export promotion. As mentioned in Section III, the negative impact of food safety standards could emerge since importing countries may deliberately craft food safety measures that impose a cost or other disadvantage on foreign competitors to provide protection

[10] Note that world demand would be included in the cross-sectional fixed effect as this variable does not vary significantly across developing countries.
[11] The lag value of real GDP growth per capita is applied as an instrumental variable.
[12] Results of other alternatives are available from the author on request.

for domestic producers. In addition, even when comparable food safety measures are applied in developed countries to both domestic and imported products based on genuine health reasons, they tend to impede imports only from developing countries, i.e., imported products, because of asymmetry in compliance cost and less transparency in measures than in tariffs or a quota (Athukorala and Jayasuriya 2005). Resource, manpower, and institutional constraints are naturally more binding for developing country exporters to overcome food safety standards. In particular, SPS could diverge considerably across importing countries, making meeting standards costly and cumbersome for exporters.

Table 4: Estimation Results

	PROEX	
	Coefficient	**T-statistics**
Constant	0.81	0.22
SPS	0.05	2.13*
CS	0.61	2.09*
ARE1	1.84	3.64*
OPEN1	1.93	3.59*
ARE1*OPEN1	−0.35	−2.98*
DC	0.19	2.14*
RER	0.36	4.88*
FDI	0.004	0.20
PIS	−0.004	−0.10
ROAD	0.09	0.10
ROAD^2	0.05	0.55
Asiadummy	1.33	4.14*
Latindummy	0.46	1.55***
Europedummy	1.62	2.64*
No. of observations (group)	284 (79)	
R-sq	overall = 0.57	
SE	0.40	
Residual (unit root)	−19.68	

* = 5% significance, ** = 10% significance, *** = 15% significance.

CS = real GDP per capita (constant 2000 US$); *ARE1* = initial agriculture, value added (constant 2000 US$) over population; *OPEN1* = trade to GDP; *SPS* = food safety and quality concern (*SPS*); *DC* = domestic credit over GDP; *PIS* = agriculture price instability; *RER* = real exchange rate (*eP*/P*); *FDI* = foreign direct investment inflows as a percentage of GDP; *ROAD* = road density.

Note: Time effects were not included in the fixed effect model because of their statistical insignificance. Two-stage least square is performed. The lag value of real GDP per capita is used as an instrument.

There is limited empirical evidence in examining the impact of food safety standards on processed food exports. Among the few available studies of problems faced by developing countries, Otsuki et al. (2000) provide an analysis of the trade impact of a 1998 European Commission (EC) regulation that raised the maximum permissible level of a toxic substance (i.e., a certain type of aflatoxin) in foodstuff and animal feed to a higher level than international standards specified by the Codex Alimentarius. The result suggests that the EU standards, although they could reduce health risks, would also reduce exports by more than 60% or US$670 billion from developing countries. Meanwhile, Wilson (2002) provides evidence that an EU regulation, which requires that dairy products be manufactured from milk produced by cows kept on farms and milked mechanically, virtually precludes imports from many developing countries where milk production is a smallholder activity. This regulation is also imposed to ban import of camel cheese from Mauritania, leading to a considerable cost in improving such products, especially to a small enterprise (Athukorala and Jayasuriya 2005).

There are a number of concerns on the food safety standards imposed by developed countries but there have not been estimated costs, especially in terms of export reductions. Table 5 shows concerns related to measures maintained by selected developed countries and raised by developing countries. For example, an Australian quarantine regulation requires that chicken meat imported from Thailand must be heated at 70 Celsius for 143 minutes to avoid the possibility of carrying a certain disease. This tends to adversely affect texture of Thai's chicken products so that the Thai government has been negotiating with the Australian government to abandon this regulation. Since October 2007, the US has prohibited the importation of cooked poultry meat processed from the PRC because of the avian influenza problem. The PRC questioned the scientific justification behind such a decision and there has been no response from the US yet.

Table 5: Concerns Related to Measures Maintained by Selected Developed Countries

Australia	
Raised by:	PRC, Thailand
Supported by:	Sri Lanka, Indonesia, Malaysia, Philippines, Viet Nam, European Community
Issues:	**Import restrictions on prawns and prawn products; revised generic IRA for prawns and prawn products** During 2001–2007, Thailand, on behalf of ASEAN, drew attention to Australia's notifications regarding its risk analysis and interim measures on prawn and prawn products, which required risk management measures for White Spot Syndrome and Yellow Head Virus. Thailand urged Australia to lift the interim measures taken on the basis of this risk analysis, as ASEAN believed the measures were not based on scientific evidence and were more trade-restrictive than necessary. On 20 September 2007, Australia accepted Thailand's proposal on alternative cooking parameters for prawns. Australia was willing to consider similar proposals from other exporting countries as well to discuss equivalent measures such as zoning and compartmentalization.
Raised by:	Thailand
Issues:	**Import restrictions on chicken meat** In 2002, an Australian quarantine regulation required that chicken meat imported from Thailand must be heated at 70 Celsius for 143 minutes to avoid the possibility of carrying a certain disease. This tends to adversely affect the texture of Thai's chicken products so that the Thai government has been negotiating with the Australian government to abandon this regulation.

continued.

Table 5: *continued.*

European Community	
Raised by:	The PRC
Issues:	**Import restrictions on cooked poultry products from the PRC** In October 2007, the PRC raised the concern that since July 2004, the European Communities had suspended the importation of cooked poultry meat from the PRC because of the presence of the highly pathogenic avian influenza virus in the country. However, the SPS guidelines explicitly state that heat treatment deactivated the virus and should not be applied to cooked poultry meat. The EC Health Commissioner agreed to lift the prohibition of cooked poultry meat from the PRC into the European Communities, and the PRC requested that this should be done as soon as possible in accordance with the SPS agreement. This issue has now been resolved, i.e. the ban has been lifted.
Raised by:	India
Supported by:	US, Canada, Chile
Issues:	**Geographical risk assessment** In June 2005, India expressed concerns regarding the categorization of India in the suspected list of the EC geographical risk assessment. The assumptions made by the European Community while conducting the risk assessment needed to be reconsidered, as this assessment had never been reported in Indian cattle and buffalos. India had made these concerns known to the European Community on several occasions. The EC categorization had the potential to disrupt India's beef trade not only with EC member States but also with its other trading partners. The US, Canada and Chile was also concerned that the European Community was applying similarly stringent measures to countries with significantly different risk factors, a practice that lacked scientific justification and ran counter to existing international standards. It was not entirely transparent how country classifications would be determined or what requirements would be applied in the meantime.
Japan	
Raised by:	PRC
Issues:	**Import suspension of heat-processed straw and forage for feed** According to the PRC, following a foot and mouth disease (FMD) outbreak in May 2005 in a few PRC provinces, Japan issued an overall import suspension of straw and forage for feed from the PRC. However, the straw and forage exported to Japan originated from FMD-free areas, and was subjected to heat treatment that was more than sufficient to kill FMD viruses, under joint monitoring of PRC and Japanese inspectors. Japan's ban lacked scientific evidence in contravention to the SPS Agreement. The PRC invited Japanese officials to undertake the necessary controls and discussions with the competent departments. In June 2007, the PRC reported that much progress had been made toward the resolution of this concern through bilateral meetings.
US	
Raised by:	PRC
Issues:	**Import restrictions on cooked poultry products from the PRC** The US has prohibited the importation of cooked poultry meat processed from poultry originating from the PRC since October 2007 because of the avian influenza problem. The PRC questioned the scientific justification behind such a decision. In particular, the restrictive measures associated with avian influenza should not be applied to cooked poultry meat that had been subjected to heat treatment to destroy the virus. There has been no response from the US yet but the PRC hopes that the US would lift the ban as soon as possible.

Sources: Athukorala and Jayasuriya (2005) and Committee on Sanitary and Phytosanitary Measures (2008).

For other explanatory variables, we found the statistically positive relationship between the initial agricultural resource endowments (*ARE1*) and real value of processed food exports (*PROEX*). This result supports the hypothesis that processed food products still rely on domestic resource content so that quantity improvement in the agriculture sector would be able to increase the export volume of processed food. The statistically positive significance of real GDP per capita (*CS*) supports the hypothesis that fast growing developing countries are relatively well placed to benefit from emerging trading opportunities in processed food products. This would be because processed food products are rather luxurious in nature, compared to traditional food products, so that a large domestic market is needed to enable firms to achieve economies of scale and to reduce costs to more easily to break into foreign markets. The positive relationship between processed food exports and real GDP per capita is also found in Jaffee and Gordon (1993) and Athukorala and Sen (1998).

The coefficient on *OPEN1* is statistically significant with the expected positive sign. Providing robust statistical support, superior export performance in processed food is closely linked with the openness of trade policy regime. The relatively high value of the coefficient associated with *OPEN1* tends to point out that the nature of trade policy regime is crucial in explaining intercountry differentials in export performance of processed food. In addition, we found the negative and statistical significance of the interaction term between *OPEN1* and *ARE1*. This clearly illustrates that trade policy openness would significantly reduce the importance of relying on domestic resource content.

Improvement in trade facilitation in terms of credit availability could help to support processed food exports. This result is consistent with Jaffee and Gordon (1993) that sufficient financial support in all relevant supply chains of processed food industries could allow firms to well manage risks and uncertainties and improve production and distribution technologies. The statistical insignificance of road density in *PROEX* equation may emerge from the relatively high correlations among road density (*ROAD*), real GDP per capita (*CS*), and initial resource endowments (*ARE*). However, Jongwanich and Magtibay-Ramos (2009) clearly shows that road density (*ROAD*) becomes statistically significant in determining changes in the structure of agriculture exports towards processed food products. This would be because processed food products have more numerous members of food supply chains than traditional agriculture products. Thus, improvement in infrastructure could have a positive implication on processed food exports. Meanwhile, maintaining cost competitiveness could influence an expansion of processed food exports given a positive and statistically significant *RER*.

Interestingly, statistical insignificance in the coefficient associated with FDI is revealed. This implies that an involvement of MNEs in processed food industries seems unlikely to stimulate processed food exports. The statistical insignificance of FDI in the processed food industry may result from the fact that there are some MNEs that tend to be involved only in the domestic market. This is particularly true for manufacturing food production, such as confectionery and ready-to-eat products. Because technology and capital used to produce these products are mobile in the world food market, and raw materials of these products are relatively nonperishable and inexpensive to transport, MNEs tend to locate their production close to consumers, and sell products mainly in the domestic market. Thus, the positive effect from FDI to processed food exports, especially in terms of technology and export spillovers, could be distorted by the nature of the processed food industry.[13]

While processed food products are perishable, geographical proximity seems to be one of the important factors in determining the ability to expand export markets. In this study, geographical proximity is captured through regional dummy variables. It was found that coefficients associated with developing Europe, Asia, and Latin America are statistically significant. The significance of these three regional dummy variables could reflect the cost advantages emerging from their shortened distance from the key export destinations of processed food products, which are Europe, Japan, and US. In particular, the coefficient associated with Europe is the highest among these three regional dummy variables. This could be because developed Europe is the largest export destination for processed food products (Table 1) so that developing countries in Europe could get more cost advantages than other developing countries in expanding their processed food exports.

VII. Conclusion and Policy Inferences

This paper examines the impact of food safety standards on processed food exports in developing countries by using an intercountry cross-sectional econometric analysis of determinants of processed food exports. The SPS is incorporated into the model to capture the impact of food safety standards. The empirical model suggests that imposing food safety standards by developed countries tend to have a negative impact on processed food exports from developing countries. The negative impact could emerge because SPS tends to be less transparent than tariffs or quotas. Thus, there is ample room for developed countries to tweak the standards more strongly than necessary to achieve optimal levels of social protection, and to twist the related testing and certification procedures to make their competing imports more competitive. In addition, resource,

[13] Note that in the food industry, especially processed food, an involvement of foreign firms could also occur through non-FDI channels. Non-FDI channels refer to involvement of MNEs in the host countries' industries without equity participation. The relationship between MNEs and local suppliers would resemble general arm's length transactions in that these buyers and local suppliers contact each other to negotiate their commercial contracts, i.e., price, quantity, quality, delivery, and payments. This implies that if both FDI and non-FDI channels are included in the quantitative analysis, the positive and significant relationship between the role of MNEs and export performance of processed food may be revealed. However, the non-FDI channel could not be captured directly in quantitative analysis. To clearly understand the role of non-FDI channel, especially MNE buyers, firm interviews must be conducted. See for example Kohpaiboon (2006) for four case studies of Thai processed food industries and the involvement of non-FDI channels.

manpower, and institutional constraints are naturally more binding for developing country exporters to overcome food safety standards. Meanwhile, SPS could diverge considerably across importing countries, making meeting standards costly and cumbersome for exporters.

However, the task of complying with SPS should be viewed not just as a barrier, but also an opportunity to upgrade quality standards and market sophistication in the food export sector in developing countries. To redress constraints faced by developing countries, concerted multilateral efforts outside the WTO are needed to mobilize additional financial and technical assistance. In addition, making use of MNE buyer channels would also help local suppliers in developing countries to penetrate international markets successfully since the relationship between MNEs and local suppliers resembles general arm’s length transactions, in that these buyers and local suppliers contact each other to negotiate their commercial contracts regarding price, quantity, and also quality of products and delivery. While MNEs have better knowledge of how to access world markets, food safety standards could be overcome more easily when there is an involvement of MNEs in local suppliers.

Moreover, an improvement in agriculture sector would help developing countries to overcome food safety standards. Improvement in the agriculture sector is related to upgrading land quality and irrigation systems as well as ability to adequately access raw materials such as fertilizers. In particular, upgrading production technology is an essential path to improving quality and productivity in the agriculture sector. Improvements in certain technologies would lead to a more extended seasonal yielding pattern, improved taste and hygiene, and uniform output. Timing (seasonality) of production could be better controlled, thereby reducing risks and enabling producers to diversify their crop/livestock mix. To improve agriculture sector and processed food industries, the government of developing countries must work to reduce distortions in credit markets and to ensure that farmers and firms in processed food industries can adequately and equally access credits.

Over and above providing adequate financial resources, supporting vertical integration, either complete or partial, would become important and relevant in the context of processed food industries. Logistic costs associated with the procurement of raw materials and/or sale of finished products could be reduced. In particular, transport costs can be saved, especially for bulky and perishable raw materials as vertical integration involves bringing together in one location formerly distinct operating units. The level of required inventories can be reduced because internal planning allows for a better match of supply and demand in terms of quantity and location. Problems of risks and uncertainties could also be redressed. In particular, variability of supplies and outlets could be eliminated as more direct control over raw materials can be exercised under completed or even partial vertical integration. The reduction in risks and uncertainties could allow firms to better invest in highly specialized processing and marketing facilities, and to take advantage of potential economies of scale.

Appendix I: List of Processed Food Products

Products	SITC	Product description
1. Meat products (SITC 01)	01	Meat and preparations
2. Dairy products (SITC 02-025)	02 025	Dairy products Eggs and egg yolks, fresh, dried or preserved
3. Fish products (SITC 03)	03	Fish, crustaceans and mollusks, and preparations thereof
4. Flour and cereals (SITC 046+047+048-0483-0488)	046 047 048 0483 0488	Meal and flour of wheat and flour of meslin Other cereal meals and flour Cereal, flour or starch preparations of fruits or vegetables Macaroni, spaghetti, and similar products Malt extract, cereals preparations with less than 50% of cocoa
5. Vegetables (SITC 054+056-05645)	054 056 05645	Vegetables, fresh or simply preserved; roots and tubers Vegetables, roots and tubers, prepared or preserved Tapioca, sago, and substitutes obtained from starches
6. Fruit, fresh or dried (SITC 057+058+05645)	057 058	Fruits, nuts excluding oil nuts Fruit, preserved and fruits preparations
7. Eggs and egg products (SITC 025)	025	Eggs and egg yolks, fresh, dried or preserved
8. Sugar preparations and honey (SITC 06-0611-0615)	06 0611 0615	Sugar, sugar preparations, and honey Sugar, beet and cane, raw, solid Molasses
9. Coffee extracts, instant tea, cocoa-based products (SITC 0712+0722+0723+074)	0712 0722 0723 074	Coffee extracts, essences, or concentrates Cocoa powder, unsweetened Cocoa butter and paste Tea and mate
10. Edible products and preparations (SITC 0149+0583+0483+0488 +098)	0149 0583 0483 0488 098	Other prepared or preserved meat or meat offal Jams, jellies, marmalades, etc., as cooked preparations Macaroni, spaghetti, and similar products Malt extract, cereals preparations with less than 50% of cocoa Edible products and preparations
11. Processed vegetable oils (SITC 4 -4113-4232-4233-4234 -4239-4241-4242-4243-4244 -4314	4 4113 4232 4233 4234 4239 4241 4242 4243 4244 4314	Animal and vegetable oils, fats and waxes Animal oils, fats, and greases Soya bean oil (crude refined or purified) Cotton seed oil (crude refined or purified) Groundnut (peanut) oil (crude refined or purified) Other fixed vegetable oils, soft (crude refined or purified) Linseed oil (crude refined or purified) Palm oil (crude refined or purified) Coconut oil (crude refined or purified) Palm kernel oil (crude refined or purified) Waxes of animal or vegetable origin (crude refined or purified)

Source: Athukorala and Jayasuriya (2005).

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About the Paper

Juthathip Jongwanich examines the impact of food safety standards imposed by developed countries on processed food exports from developing countries. The empirical model shows that food safety standards could impede processed food exports from developing countries. However, because of the potential benefits that could emerge from imposing food safety standards such as a reduction of transaction costs and trade friction, developing countries should view the food safety standard not just as a trade barrier but also an opportunity to upgrade quality standards and market sophistication.

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