Quantification of the economic impact of EU aflatoxin standards on developing and transition countries’ exports applying gravity model

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Background

Globalization raised the importance of food safety and quality concerns. Developed countries implement precautionary food regulation policies to protect their affluent consumers from unsafe food imported from developing and transition countries. The countries are strongly encouraged by the World Trade Organisation (WTO) to adopt internationally recommended standards, but they are also allowed to implement policies, setting even stricter standards. The alarming number of trade disputes at WTO however evidences cases of abuse of such policies. The fear is that the dwindled traditional trade barriers could be substituted and even surpassed by Food Regulatory Measures (FRM). While claims on protectionist nature of FRM are valid in principle, there is little empirical evidence about their economic effects.

Aspergillus flavus mold growing on unfilled ear tip.

Photo reproduced from APS Digital Image Collection: Diseases of Field Crops, 1998, The American Phytopathological Society, St. Paul, Minn.

Problem Statement

The question of quantification of trade impact of FRM is absolutely essential for the new trade agenda. This problem is on focus of trade policy debate for developing countries, yet it is not considered seriously for transition countries. Such a research for these recently liberalized markets gains a special significance due to their active participation in world trade. Their exports to developed countries include cereals, fruits and vegetables, which are especially exposed to natural toxin (e.g. aflatoxin) hazards and often face stringent food standards.

Objective

This research aims at understanding the role of developed countries’ aflatoxin standards in dynamics of exports from developing and transition countries, by assessing the trade patterns and quantifying the effects on trade between 11 importing (developed) countries and 20 exporting (developing and transition) countries.

GIPSA's Mycotoxin Reference Methods for aflatoxin support the evaluation and standardization of rapid test kits used in the official inspection system.
Source: USDA GIPSA

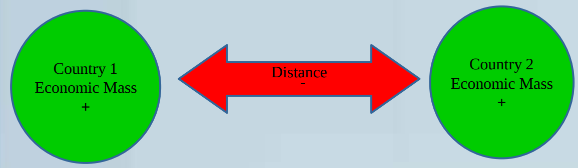
Standard wheat corn
Source: USDA GIPSA, Grain Photo Gallery

Results

The results of cross-country time-series (N=28 T=4) analysis are presented in Table 1. As our choice of the model specification is RE, we will focus the RE estimations only. Signs of relevant coefficients are as expected. Thus GDP per capita of importer countries has a positive sign and is highly significant. On the contrary, GDP per capita of the exporter turns out to be insignificant: similar findings are reported in Otsuki et al (2001), Wilson & Otsuki (2001) and again in Iacovone (2002). The explanation lies in the ambiguous interaction of the counteractive effect of domestic absorption on the one hand, and the scale effect on production on the other. Distance impacts negatively (logically) and is highly significant. Belonging to the EU supports the trade flow positively (and significantly) whereas being in ASEAN group does not play a significant role.

Most interestingly, the result for aflatoxin B1 proves the hypothesis that the stringency level of food (cereals) regulations on aflatoxin is negatively associated with trade flows from developing and transition countries. The corresponding coefficient is positive and statistically highly significant. It indicates that 1% tightening of the standards would reduce trade flows from developing and transition countries by 1.07%.

The Gravity Model



(+) (-) (+, -)
Bilateral Trade Volumes = f(Economic Masses, Distance, Other Factors)

Economic Masses, Distance: country-pair specific

Other Factors → country-pair-specific; industry-specific

(country-pair specific, country-pair-specific: **Fixed Effects**)

Source: Moenius, J. (2003). The Effect of Technical Standards on Trade Flows: Why is Japan Different?

Method

The research employs gravity equation method using the dataset generously made available by T. Otsuki of the World Bank to explain trade patterns between developed (EU, USA, Japan) on the one side and transition and developing countries on the other side and to determine the effect of Western (es aflatoxin standards on transition countries’ exports of cereals. The combination of a gravity model with econometric estimates is potentially useful approach to identify the role of regulations in foregone trade. Our study differs in from the previous work of Otsuki et al. (2001) and Wilson & Otsuki (2001) in that we apply Hausman test of specification after fixed- and random-effects models, and provide an evidence for the viability of the latter model.

Analysis

We undertook a cross country econometric analysis for identification of impacts of MRL-s on international trade flows.

The specification of gravity model is as follows:

$$\ln TC_{ij} = b_0 + b_1 \ln GNPPC_i + b_2 \ln GNPPC_j + b_3 \ln DIST_{ij} + b_4 \ln AC_i$$
$$+ b_5 D_{EU} + b_6 D_{COL} + b_7 D_{ASEAN} + b_8 D_{MERCO} + b_9 D_{NAFTA} + b_{10} D_{t96} + b_{11} D_{t97} + b_{12} D_{t98} + \varepsilon_{ij} \quad (1)$$

TC_{ij} denotes the value of trade in cereals from country j to country i. Parameter b’s are coefficients, and ε_{ij} is the error term. GNPPCi and GNPPCj are real per-capita GNP of importing country i and exporting country j, DIST is the geographical distance between country i and j.. AC_i is the maximum level of aflatoxin B1 (for cereals) imposed on imports by the importing country i.

We include dummy variables for the years in order to control for systematic differences across time. A dummy as a criterion of belonging to trade blocks is also considered. OLS, OLS with robust standard errors, FE (Fixed-Effects) and RE (Random-Effects) regressions are run for cereals. As OLS estimates are generally not efficient for longitudinal data settings, we go for fixed effects model first to enhance our specification. Suspecting that not only intercepts for countries vary, but also slopes, we check for Random-Effects (RE) specification. Results are presented in Table 1. Hausman specification test indicates insignificant P-value of 0.8 which is clearly exceeding 0.05 limit thus favouring the RE model (Table 2).

Table 1: Model Coefficients

Dep. Var. logtrade_cereal	OLS with robust standard errors		Fixed-Effects		Random-Effects	
	Coef.	t	Coef.	t	Coef.	z
loggnppcim	-0.0939216	-0.69	0.2472293	2.84	0.2283483	2.60
loggnppcex	0.2610845	3.31	3.751351	1.31	0.0868525	0.33
logdist	-0.4946729	-3.58	-1.648771	-10.78	-1.559009	-10.29
logafla_cereals	0.5603828	3.2	1.108981	8.47	1.072227	8.13
deu	2.265606	5.65	2.82035	6.94	2.846661	7.00
dcol	2.634194	2.31	2.441997	2.66	2.46444	2.66
dasean	3.915946	9.82	-1.902262	-1.43	-1.554953	-1.16
dmerco	4.769613	10.55	3.576771	4.13	3.695671	4.33
dnafta	1.111024	0.94	-1.956169	-2.47	-1.728341	-2.19
dt96	-0.059225	-0.18	-0.0347827	-0.14	0.0556896	0.23
dt97	-0.0968162	-0.31	-0.0450539	-0.17	0.1294469	0.55
dt98	0.0643496	0.2	0.0232606	0.08	0.2403415	1.02
_cons	8.669017	4.31	-15.89969	-0.64	14.55732	5.38

Table 2: Results of Hausman Specification Test

---- Coefficients ----

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
loggnppcim	0.247	0.228	0.019	.
loggnppcex	3.751	0.087	3.664	2.847
logdist	-1.649	-1.559	-0.090	0.021
logafla_ce~l	1.109	1.072	0.037	.
deu	2.820	2.847	-0.026	0.002
dcol	2.442	2.464	-0.022	.
dasean	-1.902	-1.555	-0.347	.
dmerco	3.577	3.696	-0.119	0.146
dnafta	-1.956	-1.728	-0.228	0.052
dt96	-0.035	0.056	-0.090	0.065
dt97	-0.045	0.129	-0.175	0.138
dt98	0.023	0.240	-0.217	0.173

Test: Ho: difference in coefficients not systematic

chi2(12) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 7.78

Prob>chi2 = 0.8021

(V_b-V_B is not positive definite)

References:
1. Wilson J.S. (2001). Bridging the Standards Divide:Recommendations for Reform from a Development Perspective. Background Paper for the World Development Report 2001 / 2002.
2. Wilson J.S. and T. Otsuki (2004). To spray or not to spray: pesticides, banana exports, and food safety. Food Policy 29 (2004) 131–146.
3. Otsuki T. and J.S. Wilson (2001). Food Safety Regulations and Global Food Trade Patterns. Selected Paper for the 2001 AAEA Annual Meeting.

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