Year
OKSWP0909

Economics Working Paper Series
OKLAHOMA STATE UNIVERSITY

Mycotoxin Regulations and Trade

Abdul Munasib
Assistant Professor of Economics
Department of Economics and Legal Studies in Business
Oklahoma State University
343 Business Building
Stillwater, OK 74078-4011
Phone (405) 744-8763
Fax (405) 744-5180
e-mail munasib@okstate.edu

Devesh Roy
Research Fellow
Markets, Trade, and Institutions Division
International Food Policy Research Institute (IFPRI)
2033 K. St., N.W.
Washington, DC, 20006-1002 U.S.A.
Phones (202) 862-5691
Fax (202) 467-4439
e-mail d.roy@cgiar.org

Department of Economics
Oklahoma State University
Stillwater, Oklahoma

339 BUS, Stillwater, OK 74078, Ph 405-744-5110, Fax 405-744-5180
Harounan Kazianga harounan.kazianga@okstate.edu
Abdul Munasib munasib@okstate.edu

Mycotoxin Regulations and Trade

Abdul Munasib & Devesh Roy

Abstract

This research assesses the effects of mycotoxins regulations on international trade flows. Mycotoxins regulations reflected in the mandatory maximum residue limits impose costs on the producers that could take the form of both variable and fixed costs. Little empirical research exists on the effects of food safety regulations on international trade flows. The same holds true for the assessment of the effects of aflatoxins regulations on trade flows. In case of aflatoxins standards, Otsuki, Wilson and Sewadeh (2001) in an earlier paper explored the trade effect of the proposal of European Commission (EC) to harmonize aflatoxin standards announced in 1998. It was later implemented in 2002. The paper predicted the trade effect of setting aflatoxin standards under three regulatory scenarios: standards set at pre-EU harmonized levels (status quo), the harmonized EU standard adopted across Europe, and a standard set by the Codex.

Otsuki, Wilson and Sewadeh (2001) used the Gravity Model, an empirical model that has been used for a long period of time in empirical analysis of trade flows. Since the publication of the paper, two main developments have occurred in the evolution of the gravity model of trade both of which have important implications for assessing the effects of mycotoxins regulations on trade. First, bilateral trade costs as used in Otsuki, Wilson and Sewadeh(2001) – and several other papers of that vintage – was not the measure of trade costs that followed theoretical derivation of the gravity model. Anderson and van Wincoop (2003) showed that trade costs had to be measured as a multilateral resistance term as opposed to a bilateral cost.

The second major development was regarding the issue of zero trade in trade models. Following Melitz (2003) and Melitz et al. (2008) gravity models have been derived using a theoretical framework where firms differ in productivity and there are fixed costs to exporting which are partner specific. Hence, only firms that have a level of productivity beyond a certain threshold can export. If no firm/farm has productivity levels high enough to benefit from exporting, zero trade at the product, and even at the aggregate level, is possible between two countries.

Our methodological framework is based on Melitz (2003), Melitz, Helpman and Rubinstein (2008), and Djankov, Freund and Pham (2008), all of which consider the fixed costs of exporting. In our case we capture the effect of aflatoxin regulations as being reflected in costs of exporting which could vary across markets.

I. Introduction

The objective of this research is to assess the effects of mycotoxins regulations on international trade flows. Mycotoxins regulations reflected in the mandatory maximum residue limits impose costs on the producers that could take the form of both variable and fixed costs. Mycotoxins regulations result in costs, especially fixed costs of exporting, that can have three types of effects: (1) *Volume of trade effect* – countries already trading with one another could trade less, (2) *Missing trade or lost trade effect* – As regulations are tightened producers/countries could be screened off the export market (alternatively producers/countries could find it unprofitable to export), (3) *Market reallocation effect* – Following points (1) and (2), exporters could reallocate their supplies across markets including reallocation towards domestic markets.

Little empirical research exists on the effect of food safety regulations on international trade flows. The same holds true for the assessment of the effect of aflatoxins regulations on trade flows. In case of aflatoxins standards, Otsuki, Wilson and Sewadeh (2001) in an earlier paper explored the trade effect of the European Commission (EC) proposal to harmonize aflatoxin standards announced in 1998. It was later implemented in 2002. The paper predicted the trade effect of setting aflatoxin standards under three regulatory scenarios: standards set at pre-EU harmonized levels (status quo), the harmonized EU standard adopted across Europe, and a standard set by the Codex.[1]

Otsuki, Wilson and Sewadeh (2001) used the Gravity Model, an empirical model that has been used for a long period of time in empirical analysis of trade flows. Since the publication of

---

[1] In addition, the authors examined the trade-off between human health and trade flows for each of these three regulatory scenarios based on risk assessment studies.

the paper two main developments have occurred in the evolution of the gravity model of trade both of which have important implications for assessing the effects of mycotoxins regulations on trade. The first development relates to the measurement of trade costs where it was shown by Anderson and van Wincoop (2003) that bilateral trade costs as used in Otsuki, Wilson and Sewadeh (2001) – and several other papers of that vintage – was not the measure of trade costs that followed theoretical derivation of the gravity model. Anderson and van Wincoop (2003) showed that trade costs had to be measured as a ‘multilateral resistance’ term as opposed to a bilateral cost.

The second major development was regarding the issue of zero trade in trade models. Note that both at the product level and at the aggregate level some countries do not trade with each other on a sustained basis. Following Melitz (2003) and Melitz et al. (2008) gravity models have been derived using a theoretical framework where firms differ in productivity and there are fixed costs to exporting which are partner specific. Hence, only firms that have a level of productivity beyond a certain threshold can export. Thus, if no firm/farm has productivity levels high enough to benefit from exporting, zero trade at the product, and even at the aggregate level, is possible between two countries.

Taking the Otsuki, Wilson and Sewadeh (2001) as the starting point this methodological brief suggests methodologies for assessment of the effect of aflatoxins regulations on trade that takes into account the pertinent developments in empirical trade. The development of the methodological framework is based on Melitz [2003], Melitz, Helpman and Rubinstein [2008], and Djankov, Freund and Pham [2008] all of which consider the fixed costs of exporting. In our case we capture the effect of aflatoxin regulations as being reflected in costs of exporting which could vary across markets.

II. Model

2.1. Aggregate Trade

The starting point of the derivation of the estimable equation that takes into account the points raised above (fixed costs of exporting and the possibility of zero trade) is the Melitz (2003) model. We model the world economy with J countries, indexed $j = 1,2,...,J$, each consuming and producing a continuum of products. Country j's utility is given as:

$$(1) \qquad u_j = \left[\int_{z \in S_j} x_j(z)^{\rho} dz \right]^{\frac{1}{\rho}}, \qquad \rho \in (0,1),$$

where $x_j(z)$ is consumption of product z and S_j is the set of products available for consumption. Elasticity of substitution $\sigma = 1/(1-\rho)$ is assumed to be the same for all countries. Since σ is also the constant demand elasticity of each product, country j's demand for product z is,

$$(2) \qquad x_j(a,z) = \frac{p_j(a,z)^{-\sigma} Y_j}{P_j^{1-\sigma}},$$

where $p_j(a,z)$ is the price of product z in country j, a is a productivity parameter (more on this later), Y_j is the income of country j, and the ideal price index is given as:

$$(3) \qquad P_j = \left[\int_{z \in S_j} p_j^{1-\sigma} dz \right]^{\frac{1}{1-\sigma}}.$$

There are $\sum_{j=1}^{J} N_j$ products in the world where country j has a measure N_j of firms and each firm produces a distinct product.

Monopolistic competition in the final product implies,

(4) $$p_j(a,z) = \tau_{ij}\frac{c_j a}{\rho} = p_j(a),$$

[This is the export price. Distinguish between mill price & export price].

where a measures the number of bundles of the country's inputs used by the firm per unit of output and c_j measures the cost of this bundle. Also, τ_{ij} is the iceberg transport cost between countries i and j where $\tau_{jj} = 1$ and $\tau_{ij} > 1\ \forall i \neq j$. As in Melitz [2003], $(1/a)$ is the firm's productivity level. The cumulative distribution function $G(a)$ with support $[a_L, a_H]$ describes the distribution of a across firms where $a_H > a_L > 0$. Function $G(a)$ is assumed to be the same for all countries. We assume that there are fixed costs of exporting resulting from imposition of standards. Note, from (2) and (4) we can write $x_j(a,z)$ simply as $x_j(a)$.

Define $\pi_{ij}(a)$ as the operating profits from sales of a country j product to country i. Then a_{ij} is the cutoff such that $\pi_{ij}(a_{ij}) = 0$. Then, only a fraction $G(a_{ij})$ of N_j firms export to country i. If $a_{ij} \leq a_L$ then no firms from j exports to i and if $a_{ij} \geq a_H$ then all firms from j exports to i, the latter being a rather unlikely event.

[Describe the profit function and the cutoff here]

Next, to characterize bilateral trade volumes, we follow Melitz, Helpman and Rubinstein [2008]. Define,

(5) $$V_{ij} = \begin{cases} \int_{a_L}^{a_{ij}} a^{1-\sigma} dG(a) & \text{for } a_{ij} \geq a_L \\ 0 & \text{otherwise} \end{cases}.$$

This identifies "productivity zone" such that if a firm in country j falls within this zone it will export to country i. Then, the value of country i's imports from country j is,[2]

[2] See appendix for derivation.

(6) $$M_{ij} = \left[\frac{\tau_{ij} c_j}{\rho P_i}\right]^{1-\sigma} Y_i N_j V_{ij},$$

and the relative value of imports from two similar countries j and k to country i is,

(7) $$\frac{M_{ij}}{M_{ik}} = \frac{\left[\frac{\tau_{ij} c_j}{\rho P_i}\right]^{1-\sigma} Y_i N_j V_{ij}}{\left[\frac{\tau_{ik} c_k}{\rho P_i}\right]^{1-\sigma} Y_i N_k V_{ik}} = \left[\frac{\tau_{ij} c_j}{\tau_{ik} c_k}\right]^{1-\sigma} \frac{N_j V_{ij}}{N_k V_{ik}}.$$

Taking log on both sides of equation (7) gives,

(8) $$\ln\frac{M_{ij}}{M_{ik}} = (1-\sigma)\ln\frac{\tau_{ij}}{\tau_{ik}} + (1-\sigma)\ln\frac{c_j}{c_k} + \ln\frac{N_j}{N_k} + \ln\frac{V_{ij}}{V_{ik}}.$$

Since the volume of exports from j to i, $E_{ji} = M_{ij}$, equation (8) implies,

(9) $$\ln\frac{E_{ji}}{E_{ki}} = f\left(\ln\frac{\tau_{ij}}{\tau_{ik}}, \ln\frac{c_j}{c_k}, \ln\frac{N_j}{N_k}, \ln\frac{V_{ij}}{V_{ik}}\right).$$

Equation (9) is specified at an aggregate level. Below, we will move to product level by specifying the estimable equation for maize and groundnuts. To summarize, equation (9) establishes the determinants of the relative value of exports from two similar countries j and k to country i as a linear function of the following.

(a) $\left(\ln\frac{\tau_{ij}}{\tau_{ik}}\right)$: relative iceberg costs.

(b) $\left(\ln\frac{c_j}{c_k}\right)$: relative input usage.

(c) $\left(\ln\frac{N_j}{N_k}\right)$: relative number of firms.

(d) $\left(\ln\frac{V_{ij}}{V_{ik}}\right)$: relative productivity zones.

Equation (9), therefore, facilitates a gravity equation where $\left(\ln\frac{E_{ji}}{E_{ki}}\right)$, the left hand side of (9), is regressed on the logs of above mentioned proxies. Our variable of interest is Aflatoxin standards. We want to exploit the variation in exports of a single country to different countries. This is because export to different countries are subject to different Aflatoxin standards. Using equation (6) we get,

$$(10) \qquad \frac{M_{ij}}{M_{kj}} = \frac{\left[\frac{\tau_{ij}c_j}{\rho P_i}\right]^{1-\sigma} Y_i N_j V_{ij}}{\left[\frac{\tau_{kj}c_j}{\rho P_k}\right]^{1-\sigma} Y_k N_j V_{kj}} = \left[\frac{\tau_{ij}P_k}{\tau_{kj}P_i}\right]^{1-\sigma} \frac{Y_i V_{ij}}{Y_k V_{kj}},$$

from which follows,

$$(11) \qquad \ln\frac{M_{ij}}{M_{kj}} = (1-\sigma)\ln\frac{\tau_{ij}}{\tau_{kj}} + (\sigma-1)\ln\frac{P_i}{P_k} + \ln\frac{Y_i}{Y_k} + \ln\frac{V_{ij}}{V_{kj}},$$

and thereby,

$$(12) \qquad \ln\frac{E_{ji}}{E_{jk}} = f\left(\ln\frac{\tau_{ij}}{\tau_{kj}}, \ln\frac{P_i}{P_k}, \ln\frac{Y_i}{Y_k}, \ln\frac{V_{ij}}{V_{kj}}\right),$$

where the left hand side is the (log of) the ratio of exports of country j to countries i and k. The ratio $\left(V_{ij}/V_{kj}\right)$ is the ratio of productivity zones pertaining to exports to i relative to k. To focus on the effect of varying Aflatoxin standards, (12) might be more applicable than (9).

2.2. Moving to product level analysis

Equations (9) and (12) are at the aggregate levels involving total exports. Following Djankov et al. (2008), we assume that similar relationships hold at the industry level. In that case we can stretch the same idea for specific industries that are subject to Aflatoxin standards. Let there be R industries indexed by $r = 1,2,...,R$. Going back to operating profits,

(13) $$\pi_{ij}(a) = (1-\rho)\left(\frac{\tau_{ij} c_j a}{\rho P_i}\right)^{1-\sigma} Y_i - c_j f_{ij},$$

[comes from equations (4) and (5) in Melitz (2003)].

where f_{ij} is the coefficient of fixed cost of export. The condition $\pi_{ij}(a_{ij}) = 0$ implies,

(13) $$(1-\rho)\left(\frac{\tau_{ij} c_j a_{ij}}{\rho P_i}\right)^{1-\sigma} Y_i = c_j f_{ij}.$$

Now, consider an individual industry r with the export fixed cost coefficient f_{ij}^r. Then,

(14) $$(1-\rho)\left(\frac{\tau_{ij} c_j a_{ij}^r}{\rho P_i}\right)^{1-\sigma} Y_i = c_j f_{ij}^r.$$

For instance, suppose that industry r has an additional fixed cost of meeting certain standard whereas industry q does not. In that case an industry r firm needs to be more productive than industry q and $a_{ij}^r < a_{ij}^q$, everything else being the same. To calculate the bilateral trade volumes for industry r then we have the following equations,[3]

(15) $$V_{ij}^r = \begin{cases} \int_{a_L^r}^{a_{ij}^r} a^{1-\sigma} dG(a) & \text{for } a_{ij}^r \geq a_L^r \\ 0 & \text{otherwise} \end{cases}$$

(16) $$M_{ij}^r = \left[\frac{\tau_{ij} c_j}{\rho P_i}\right]^{1-\sigma} Y_i N_j^r V_{ij}^r,$$

(17) $$\ln\frac{E_{ji}^r}{E_{ki}^r} = f\left(\ln\frac{\tau_{ij}}{\tau_{ik}}, \ln\frac{c_j}{c_k}, \ln\frac{N_j^r}{N_k^r}, \ln\frac{V_{ij}^r}{V_{ik}^r}\right),$$

[3] See appendix for detailed derivation.

$$(18) \qquad \ln\frac{E_{ji}^{r}}{E_{jk}^{r}} = f\left(\ln\frac{\tau_{ij}}{\tau_{kj}}, \ln\frac{P_i}{P_k}, \ln\frac{Y_i}{Y_k}, \ln\frac{V_{ij}^{r}}{V_{kj}^{r}}\right),$$

where, an r superscript indicates that the variable pertains to industry r (e.g., N_j^r is the number of operating firms in industry r in country j).

As before, equation (18) will be better suited for our purpose. The key variable, the variable of interest, is $\left(V_{ij}^{r} / V_{kj}^{r}\right)$. This compares the productivity zone for industry r exports by comparing the zones for the countries i and k.

III. Estimation, Results and Conclusion

Since we want to exploit the variation in exports of a particular product of a country to different trading partners, our estimation equation comes from equation (18), which we rewrite as,

$$(19) \qquad e_{ik}^{r} = f(\delta_{ik}, \mu_{ik}, y_{ik}, v_{ik}^{r}),$$

where, $e_{ik}^{r} = \ln\frac{E_{ji}^{r}}{E_{jk}^{r}}$, $\delta_{ik} = \ln\frac{\tau_{ij}}{\tau_{kj}}$, $\mu_{ik} = \ln\frac{P_i}{P_k}$, $y_{ik} = \ln\frac{Y_i}{Y_k}$, $v_{ik}^{r} = \ln\frac{V_{ij}^{r}}{V_{kj}^{r}}$. The dependent variable is the ratio of export volumes of industry *r* (of country *j*) to countries *i* and *k*. The measures and proxy variables from the RHS variables are the following:

(a) δ_{ik} = ratio of trade costs (ration of bilateral distance).

(b) μ_{ik} = ratio of (ideal) price indices of the importing countries.

(c) y_{ik} = GDP ratios of the importing countries *i* and *k*.

(d) v_{ik}^{r} = ratio of 'productivity zones' of industry r corresponding to the importing countries i and k (aflatoxin regulation standards).

In estimating this equation, two main econometric issues arise. The first one is the issue of the price indices? The standard practice is to use country fixed effects to proxy for the ideal price indices (Finstra). The second econometric issue is related to zero trade. One practice in the literature to capture the bias arising from zero trade is to do a Heckman correction where a Probit model is run the first stage to capture existence of trade between a trading pair [Melitz et al. 2008].

Our initial estimation results show that aflatoxin regulations have significant effects on trade flow ratios. Our estimations account for both zero trade and address the impact of aflatoxin regulations in a way that is theoretically consistent. In the regression tables, the fact that non-selection hazard (the inverse Mills ratio) is significant indicates that accounting for zero trade is needed. Since,

$$\frac{V_{ij}^{r}}{V_{kj}^{r}} = \frac{\text{allowable mycotoxin in country } j}{\text{allowable mycotoxin in country } k},$$

a positive coefficient indicates that raising aflatoxin standards lowers trade volume.

As the regressions tables show, the coefficients of $\left(V_{ij}^{r} / V_{kj}^{r}\right)$ in the OLS regressions come up with negative signs. This is likely due to the misspecification of the OLS regressions. Once the zero trade issue and the fixed effects are taken into account the signs change to the expected (positive) signs in the Heckman regressions.

References

Anderson, James E. and Eric van Wincoop. (2003). “Gravity with Gravitas”. American Economic Review. 93(1): 170-192.

Helpman, Elhanan, Marc Melitz and Yona Rubinstein (2008). “Trading Partners and Trading Volume.” Quarterly Journal of Economics, Vol. CXXIII May 2008 Issue 2: 441-487.

Hummels, David. (2001). “Time as a Trade Barrier.” Mimeo, Purdue University.

Melitz, Marc (2003). “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity” Econometrica 71, 1695-1725.

Otsuki, Tsunehiro, John S. Wilson, Mirvat Sewadeh. (2001). “Saving two in a billion: quantifying the trade effect of European food safety standards on African exports.” Food Policy 26 (2001) 495–514.

Djankov, Caroline Freund and Cong S. Pham. (2009). “Trading on Time,” (Forthcoming in REStat).

Appendix

Aggregate volume of imports,

$$M_{ij} = \int_{a_L}^{a_{ij}} [x_j(a) p_j(a) N_j] dG(a)$$

$$= \int_{a_L}^{a_{ij}} \frac{p_j(a)^{-\sigma} Y_i}{P_i^{1-\sigma}} p_j(a) N_j dG(a) \qquad \text{[using (2)]}$$

$$= Y_i N_j \int_{a_L}^{a_{ij}} \left[\frac{p_j(a)}{P_i} \right]^{1-\sigma} dG(a)$$

$$= Y_i N_j \int_{a_L}^{a_{ij}} \left[\frac{\tau_{ij} c_j a}{\rho P_i} \right]^{1-\sigma} dG(a) \qquad \text{[since these are the traded quantities, } \tau_{ij} > 1\text{]}$$

$$= Y_i N_j \left[\frac{\tau_{ij} c_j}{\rho P_i} \right]^{1-\sigma} \int_{a_L}^{a_{ij}} a^{1-\sigma} dG(a) \qquad \text{[using (4)]}$$

$$= \left[\frac{\tau_{ij} c_j}{\rho P_i} \right]^{1-\sigma} Y_i N_j V_{ij} \qquad \text{[using (5)]}$$

Volume of imports from industry r,

$$M_{ij}^r = \int_{a_L}^{a_{ij}^r} [x_j(a) p_j(a) N_j^r] dG(a)$$

$$= Y_i N_j^r \left[\frac{\tau_{ij} c_j}{\rho P_i} \right]^{1-\sigma} \int_{a_L}^{a_{ij}^r} a^{1-\sigma} dG(a)$$

$$= \left[\frac{\tau_{ij} c_j}{\rho P_i} \right]^{1-\sigma} Y_i N_j^r V_{ij}^r . \qquad \text{[using (15)]}$$

Pictures and Tables

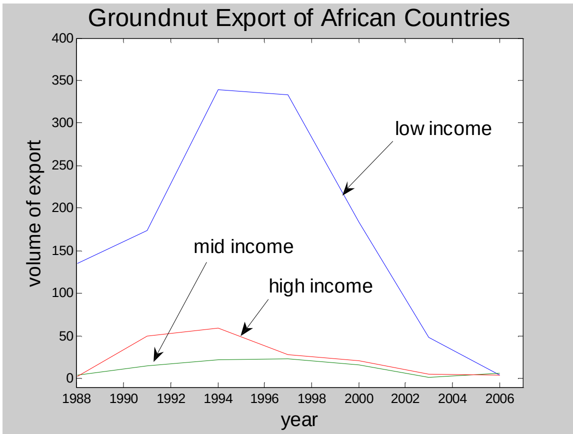
List of Countries

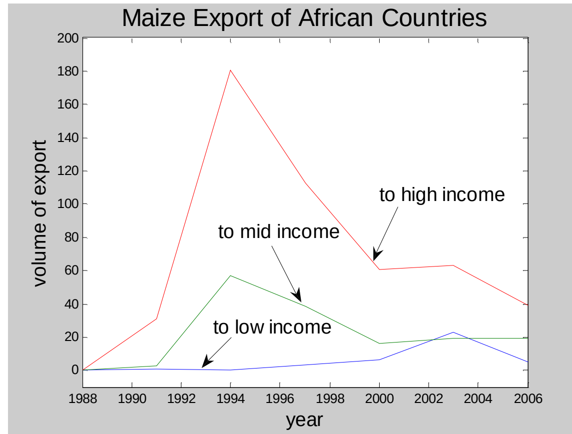
Algeria	Greece	Peru
Argentina	Guatemala	Philippines
Armenia	Hong Kong, china	Poland
Australia	Hungary	Portugal
Austria	Iceland	Romania
Bangladesh	India	Russian federation
Belarus	Indonesia	Senegal
Belgium	Ireland	Singapore
Belize	Italy	Slovakia
Brazil	Jamaica	Slovenia
Bulgaria	Japan	South Africa
Canada	Jordan	Spain
Chile	Kenya	Sri Lanka
China	Latvia	Sudan
Colombia	Lithuania	Suriname
Costa Rica	Malawi	Sweden
Cote D'ivoire	Malaysia	Switzerland
Croatia	Malta	Syrian Arab republic
Cuba	Mauritius	Taiwan province of china
Cyprus	Mexico	Tanzania
Czech republic	Moldova	Thailand
Denmark	Morocco	Tunisia
Dominican republic	Mozambique	Turkey
El Salvador	Nepal	Ukraine
Estonia	Netherlands	United kingdom
Finland	New Zealand	United states
France	Nigeria	Uruguay
Germany	Norway	Viet Nam
	Paraguay	Zimbabwe

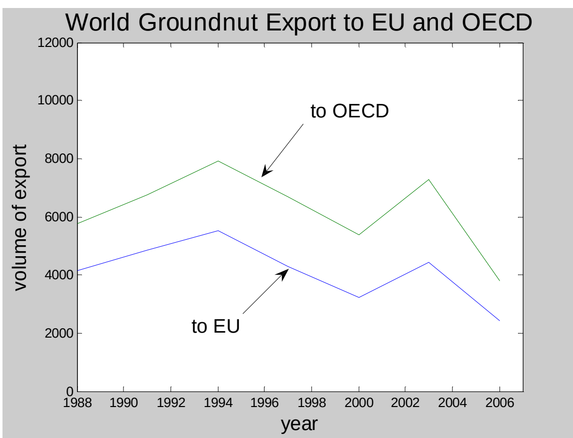
Variable Description

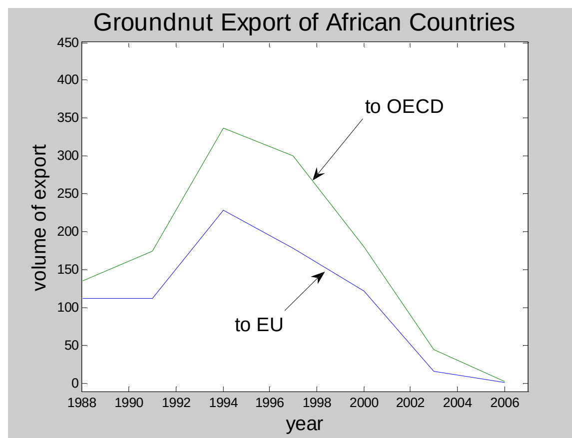
Variable name	Label	Remarks
Eijdum	Positive trade identifier between exporting and importing countries	Binary variable (=1 if trade is non-zero)
Yj	Real GDP of the importing country	GDP source: WDI. US GDP deflator (base = 2005). Deflator source: IMF.
Tauij	Bilateral distance between importing and exporting countries	Great circle distance. Source: CEPII
Vj	Aflatoxin regulations in the importing country	FAO, WHO etc.
i_landlock	Exporting country landlocked	Source: CEPII
i_area	Land area of the exporting country	Source: CEPII
i_distwrld	GDP weighted distance from the major markets	Source: CEPII
i_document	Number of documents need clearance for to export	A measure of cost of doing business. Source: CEPII
i_time	Amount of time from factory to the nearest port	A measure of cost of doing business. Source: CEPII
i_excost	How much money to spend to get clearance	A measure of cost of doing business. Source: CEPII
i_yieldgn	Yield per hector	Source: FAOSTAT
i_gdp	Real GDP of the exporting country	Source: WDI
ij_langenth	Common language and ethnicity between trading countries	Source: CEPII
ij_colony	Colonial ties between trading countries	Source: CEPII
Eijk	Ratio of export from country I to j and I to k	Trade data: COMTRADE. Harmonized Schedule (HS) 6 level.
Tauijk	Ratio of bilateral distance between country pairs (I,j) and (I,k)	
Vijk	Ratio of aflatoxin regulation in importing countries j and k	
Yijk	Ratio of real GDP of the importing countries (j,k)	

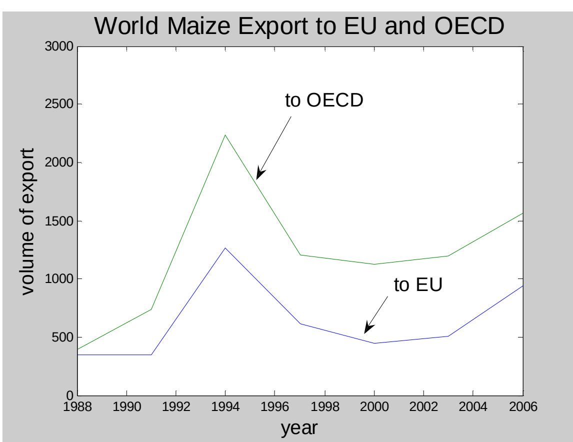
Pictures

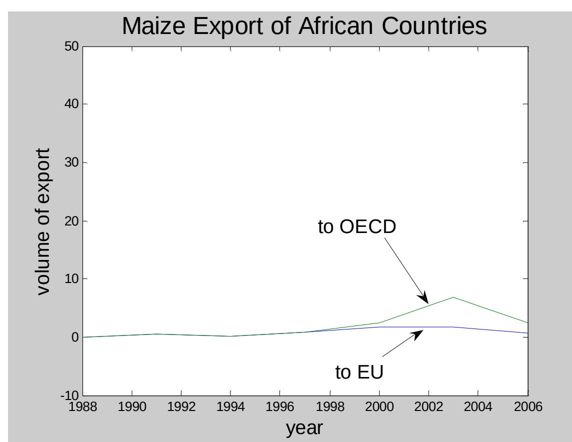

Groundnut Export of African Countries
volume of export
year
low income
mid income
high income


Maize Export of African Countries
volume of export
year
to high income
to mid income
to low income


World Groundnut Export to EU and OECD
volume of export
year
to OECD
to EU


Groundnut Export of African Countries
volume of export
year
to OECD
to EU


World Maize Export to EU and OECD
volume of export
year
to OECD
to EU


Maize Export of African Countries
volume of export
year
to OECD
to EU

Descriptive Statistics: Groundnuts

Country subscript	
i	Exporting country
j	Importing country
k	Other importing country

Table: Groundnut Export Including Non-trading Countries

Variable	Obs	Mean	Std.	Min	Max
Eijdum	460532	0.130	0.336	0.000	1.000
Yj	460532	3.908	2.027	-0.841	9.425
Tauij	460532	8.803	0.788	4.742	9.880
Vj	460532	-1.860	5.885	-9.210	4.605
i_landlock	460532	0.091	0.287	0.000	1.000
i_area	460532	12.597	1.805	7.623	16.070
i_distwrld	460532	2.153	0.195	1.823	2.531
i_document	460532	1.927	0.270	1.099	2.485
i_time	460532	3.064	0.422	2.197	4.025
i_excost	460532	6.842	0.473	5.829	8.063
i_yieldgn	460532	9.115	1.891	0.000	10.807
i_gdp	460532	3.885	2.110	-0.841	9.425
ij_langenth	460532	0.148	0.355	0.000	1.000
ij_colony	460532	0.011	0.106	0.000	1.000

Table: Groundnut Exports of only Trading Countries

Variable	Obs	Mean	Std.	Min	Max
eijk	21099	-0.163	3.688	-15.777	17.073
yijk	21099	-0.287	2.802	-10.266	9.204
tauijk	21099	-0.047	0.954	-4.519	4.412
vijk	21099	0.667	4.669	-13.816	13.816

Table: Groundnut Regressions Results

	OLS	Heckman-*jk*FE
yijk	0.617	0.071
	(0.008)***	-0.143
tauijk	-1.524	-1.816
	(0.024)***	(0.036)***
vijk	-0.019	0.034
	(0.005)***	(0.006)***
Non-selection hazard		0.150
		(0.044)***
Constant	-0.045	-0.454
	(0.022)**	(0.082)***
Observations	21099	
Uncensored observations		21099
R-squared	0.28	0.47

Descriptive Statistics: Maize

Table: Maize Trade Including Non-trading Countries

Variable	Obs	Mean	Std.	Min	Max
eijdum	701953	0.087	0.282	0.000	1.000
yj	701953	3.912	2.020	-0.841	9.425
tauij	701953	8.659	0.902	4.742	9.880
vj	701953	-1.200	5.853	-9.210	4.605
i_landlock	701953	0.136	0.343	0.000	1.000
i_area	701953	12.449	1.780	7.623	16.653
i_distwrld	701953	2.071	0.232	1.800	2.592
i_document	701953	1.862	0.298	1.099	2.485
i_time	701953	2.972	0.505	1.792	4.025
i_excost	701953	6.856	0.460	5.829	8.063
i_yieldgn	701953	10.134	1.639	0.000	12.267
i_gdp	701953	4.105	2.092	-0.841	9.425
ij_langenth	701953	0.123	0.329	0.000	1.000
ij_colony	701953	0.018	0.134	0.000	1.000

Table: Maize Trade of only Trading Countries

Variable	Obs	Mean	Std.	Min	Max
eijk	19717	0.007	3.749	-18.493	16.313
yijk	19717	-0.286	2.804	-9.759	9.204
tauijk	19717	-0.050	1.235	-4.519	4.463
vijk	19717	0.595	6.131	-13.816	13.816

Table: Maize Regressions Results

	OLS	Heckman-*jk*FE
yijk	0.185	-0.310
	(0.009)***	(0.148)**
tauijk	-0.988	-2.042
	(0.020)***	(0.041)***
vijk	-0.009	0.009
	(0.004)**	-0.006
Non-selection hazard		0.147
		(0.056)***
Constant	0.016	-0.377
	-0.025	(0.100)***
Observations	19717	
Uncensored observations		19717
R-squared	0.12	0.43