Implications of changing aflatoxin standards for EU border controls on nut imports

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Abstract

Due to the toxic effect of Aflatoxin (AF), the European Union has implemented strict standards regarding its maximum acceptable levels in tree nuts and peanuts. This paper evaluates the impact of changes in AF standards, a lessening of the maximum residue levels on the frequency of border controls. To do that, a count data model was proposed and estimated to test the determinants of border controls on EU imports of these products, based on political economy considerations, past alerts, path dependence effects and other scientific and economic variables. The revision of these standards has involved changes in controls and border refusals as measured by notifications at the Rapid Alert System for Food and Feed. Changes in AF standards are estimated to have significant impact on the frequency of border controls.

Keywords: Aflatoxins, Market access, Non-tariff measures, tree nuts, SPS.

1 Introduction

The analysis of the trade impacts of non-tariff measures (NTMs) is becoming common, mainly through gravity-type models (Ferro *et al*, 2015). However, the discussion of economic and political determinants of standard-like measures is still emerging (Swinnen, 2010, 2016; Beghin *et al.* 2015). Few empirical analyses exist to evaluate the factors that influence the frequency of standard-like measures. In particular, this paper evaluated the frequency of border controls related to aflatoxins (AF) in nuts. The estimated model assesses the impact of two major regulatory changes in the EU, which included the harmonization of AF standards, at the beginning of the century, and a later downward adjustment of the standard to converge with Codex provisions after 2009. While different authors (Jouanjean et al, 2015; Tudela-Marco *et al.*, 2016) have considered path dependency effects on the explanation of food controls, we focus here on the evaluation of a specific problem (AF) on a specific group of products (nuts).

AF contamination is a source of significant economic losses for nut[1] exporters to the EU (Wu, 2004; Wu and Guglu, 2012). There are trade disagreements regarding AF standards' setting. First, AF contamination is recognized as unavoidable and of cumbersome control (Buzby, 2003). Second, AF standards are widely different through countries. Finally, health risks depend directly on the level of economic development of importing and producing countries and of the exposure of a product to contamination.

The model defined in this paper, based on political economy considerations, allows determining to what extent standard enforcement have responded to economic pressures or to a logic mainly based on scientific awareness or exporter's safety reputation. In particular, we are interested in how economic and political variables affect standard enforcement in periods subjected to different levels of AF standards, including the initial tightening and the further lessening of the AF standards applied by the EU on AF.

Previous work has underlined the dependence of edible nut exporters on the heavy EU restricting controls of AF carried out by Member States (Otsuki et al., 2001). AF are commonly cited as a main reason for reporting 'notifications' in the Rapid Alert System for Food and Feed (RASFF). By 2003, the EU had imposed a maximum residue level (MRL) of AF of 4 *ppb* in tree nuts, including pistachios. Many exporters to the EU emphasized that the standard constituted an unjustifiable trade barrier (WTO, G/SPS/R/14, 1999). At those times, the Codex set less stringent AF standards at 10 ppb (Henson et al 2000). Finally, the European Food Safety Agency (EFSA) adopted in 2009 a statement concluding that public health would

[1] Nuts in this paper include almonds, groundnut, Brazil nuts, cashews, chestnuts, hazelnuts, macadamias, pecans, pine nuts, pistachios, peanuts and walnuts.

not be adversely affected by increasing of the MRLs for AF total from 4 to 10 ppb, which implied a further lessening of the previous EU standard.

The RASFF database provides with information on import controls and actions taken in response to risks detected in imported food to the EU. The number of RASFF notifications can be taken as a direct measure of NTMs. The RASFF has been used previously to analyze the impact of SPS measures on the EU trade (Jaud et al, 2013; Kallummal et al, 2013; Kleter et al, 2009). In the next sections, after reviewing the main regulations on AF on nuts by the EU, the proposed model will explain and predict the frequency of border notifications on AF, which will be useful to estimate the impact of regulatory changes on nuts imports.

2 Aflatoxins and nuts in the EU

The EU is the biggest importer of edible nuts in the world. About 40 percent of EU imports are originated in two partners: the USA, providing mainly almonds and walnuts, and Turkey (hazelnuts and dried fruits as grapes and apricots). Most packaging and processing for edible nuts is carried out in the EU, with clear concerns about the safety conditions of the products. Natural contamination of nuts with AF causes a special challenge for their safety and quality. Contamination of these commodities by AF can occur at any stage of the value chain especially when storage and drying facilities are inappropriate. The most toxic and common AF is B1 and affects generally groundnuts and tree nuts, Brazil nuts, pistachio and walnuts (FAO-WHO, 1997) and involves chronic exposure watched in various forms as cancer and death cases (US Centers for Disease Control and Prevention, 2004; Emmott, 2012). Nevertheless, the Committee on Food Additives (JECFA) evaluated that a reduction of standards from 20 *ppb* to 10 *ppb* in the EU would represent a drop of the population risk of about only two cancer deaths per year per billion people. It is not strange that AF standards are controversial and possibly seen as an unjustified barrier to trade.

In 2002, the EU formally adopted a unified and strict MRL policy on AF contaminants (European Communities, 2001 and 2002). In 2006, the EU modified the harmonized maximum levels for certain foodstuffs, but the policy regarding AF remained (European Communities, 2006). The harmonized EU AF standard was more stringent than the Codex, which contains the standards recommended by the Food and Agriculture Organization (FAO) and World Health Organization (WHO). The EU officially amended AF maximum levels for tree nuts at the Standing Committee on the Food Chain and Animal Health in October 2009. MRL for total AF for further processing (15 *ppb*) and ready-to-eat (10 *ppb*) almonds, hazelnuts and pistachios were accepted for EU implementation, aligned with the Codex maximum levels. The European control frequency at import also decreased for certain origins (Iranian pistachios and US almonds).

AF is the hazard category with the highest number of notifications in RASFF. As shown in Figure 1, in 2003, the RASFF registered a total of 695 notifications on AF in traded nuts. The number of notifications substantially grew after the EU harmonization and became more than three times as much as compared to 2002. Iranian pistachios were the most notified product in that period. After 2009, notifications significantly decreased compared to the three previous years. This could be related to the change of legislation and the corresponding compliance of imported nuts.

During the period of analysis covered in this research, the most notified products were pistachios, with 2972 notifications, followed by peanuts (2381 notifications), almonds (905), pecans (178) and Brazil nuts (119), involving rejections or information notifications. There is a wide dispersion and heterogeneity across exporting countries of nuts and groundnuts to the

EU. Iran and Turkey have been the most notified countries receiving together half of notifications, China accounts for 13%, followed by United States (9%), Argentina (6%) and Brazil (5%).

The present study focuses on the AF notifications of tree nuts for the period (1998-2015) imported from 65 countries and coded into HS6 product categories, generating an outcome variable defined as the notification count by HS6 code, country of origin and year. For the empirical analysis, we included trade data to consider the effect of annual bilateral imports over the period 1998-2015. Our empirical framework concentrated only on notifications of 15 EU member states to keep the number of countries for the selected period invariant.

3 Conceptual framework

The framework of analysis presented here aims at identifying the variables that influence on the RASFF notifications received by a given nut product, origin and year $N_{i,j,t}$. We first draw on the Grossman-Helpman framework of political influence (1994). This approach has permitted the modeling of logic of food standards (Swinnen and Vandemoortele, 2011) and has given rise to several applications about the implementation of health standards on trade (Vigani and Olper, 2013). In our case, the initial step is to assume that public administration - in this case, the Commission and the national public services controlling food imports- are willing to optimize producers and consumers welfare and consequently, enforce a standard and carry out the corresponding border controls. We can start from a welfare objective W for the public administration:

$$W = \varphi \; (\omega_s, \omega_c) \qquad \text{Eq. 1}$$

Where ω_s and ω_c are the producers and consumers' welfare.

The welfare objective W will affect import controls. In addition, we can assume that in a given year t, the notification count $N_{i,j,t}$ is also influenced by other political economy considerations related to by lobby activities by nuts producers ℓ_s and consumers ℓ_c. As for producers, aflatoxin standards can be affected by the import level from different countries, M_{ij}, and by the domestic production of each kind of nuts in the EU (Q_{it}) that may increase the producers' lobbying activities (ℓ_s). In order to measure consumer awareness, the RASFF database identifies events requiring rapid action, which are called "alerts" (EC Regulation 16/2011). Alerts include products that Member States have withdrawn or are in the process of being withdrawing from the market (A_{ij}). Lobbyng activities by consumers are affected by A_{ij} and also by scientific evidences on AF problems (S) that will be discussed later.

As for other factors, previous research (Jouanjean *et al*, 2015) suggests that more developed countries, measured by *per capita* GDP (*pcGDP*) are less likely to fail a SPS control, due to more developed pre-export facilities. Bagwell and Staiger (2001) and Ederington (2001) suggested that policy substitution could take place: Countries could implement or strengthen NTMs as an alternative protection method as tariffs are reduced. So applied tariffs (MFN or preferential, depending on the case) are introduced in the model to control for this effect. The dynamics of the explanation of RASFF notifications can be also included by testing the hypothesis that the history of MS actions significantly influences present control measures so the follow-up of notifications issued in one year may affect the probability of future notifications. This may reflect a precautionary behavior in a MS related to risks that appeared in previous periods, or that further controls are needed to re-establish confidence before real product improvements have taken place to meet the standard requirements (Baylis *et al*, 2009; Jouanjean *et al*, 2015). Such perceptions can be specific of the product concerned but are also dependent on the reputation or spillover effects involved when a significant number of notifications concern the origin of the product (exporting country's reputation). The country reputation relates to how total number of notifications received by the country in the total nut sector in previous periods, $N_{j,t-1,}$ exert an influence on current border controls on a specific nut or HS6 position[2]: in summary, we proposed a choice model, including some path dependent effects, expressed by:

$$N_{ijt} = \phi\ (\ell_s, \ell_c, W, N_{ijt-1}, N_{jt-1}, pcGDP) \qquad \text{Eq. 2}$$

Table 1 summarizes the variables we consider here to explain the number of AF notifications, including those that proxy ℓ_s, ℓ_c and *W*. In a reduced form, we assume that the expected notification count μ given a set of regressors X, μ = E ($N_{ijt} \mid$ X), for the product (*i*), the exporter (*j*) and at period (*t*), is predicted by equation (1):

$$\mu = \exp[\underbrace{\beta_0 + \beta_1 N_{ij(t-1)}}_{\textit{Past product notifications}} + \underbrace{\beta_2 N_{j(t-1)}}_{\textit{Country reputation}} + \underbrace{\beta_3 A_{ij(t-1)}}_{\textit{roduct alerts}} + \underbrace{\beta_4 \ln S_{(t-1)}}_{\textit{Scientific awareness}}$$

$$+\underbrace{\beta_5 \ln pcGDP_{j(t-1)}}_{\textit{Per capita GDP of the exporting country}} + \underbrace{\beta_6 \ln M_{ij(t-1)}}_{\textit{Import level}} + \underbrace{\beta_7 \ln Q_{i(t-1)}}_{\textit{Production level}} + \underbrace{\beta_8 \text{Tariffs}_{it}}_{\textit{Tariffs}} + \underbrace{\delta_i + \delta_j}_{\textit{Fixed effects}}\ ]$$

Eq. (3)

where δ_I and δ_j represent fixed effects for product (*i*) and exporter (*j*). β_1 reflects a path dependence parameter, and β_2 expresses the country collective reputation due to the number of notifications received by the nuts sector by each exporter. We expect that coefficients β_1 and $\beta_3 > 0$ show a positive response of current notifications to previous controls and alerts. Note that alerts correspond to food that is actually on the market presenting serious risk and requires rapid action in a member state. It is expected that when an alert appears in year t-1, controls in the border will tend to increase in year t. β_6 and β_7 are also expected > 0 as larger imports and domestic production may increase consumer and producer awareness towards more frequent controls and border measures. β_2 can be positive or negative as it includes the response of border controls to country reputation through the increase in notifications, but could also indicate the adoption by exporters of control measures to improve compliance, diminishing the issuing of notifications. β_5 is hypothesised to be < 0 as it is expected that higher per capita GDP imply better quality control at the exporting country. β_8 is expected to be <0 assuming policy substitution among tariffs and NTMs. Finally, β_4 is expected to be > 0 as the odds of border controls may react positively to higher scientific awareness on the AF problem in nuts.

Impacts of regulatory changes can be analyzed through two dummy variables d_1 and d_2, the first one referring to the period 1998-2001, previous to harmonization of AF standards (d_1 = 1 for t < 2002, and 0 for t > 2002) and the second one referring to the period 2010 – 2015, after the convergence to Codex standard (d_2 = 0 for t < 2010, and 1 for t > 2010). Both dummies

[2] We use the reputation concept used by Jouanjean et al. (2015) who in turned drew on Tirole (1966) which defined collective reputation as the influence of a group's members to predict individual future behaviour.

interact with $N_{ij(t-1)}$, $N_{j(t-1)}$ and $A_{i(t-1)}$ so we can assess whether policy changes affected the path dependence effects and the notifications' response to alerts.

As for scientific awareness, there are various methods have been used to specify an information index based on news or scientific articles count. Smith et al (1988) suggest the index as the number of articles published on the topic of interest in each period. More specifically, Brown and Schrader (1990) suggest another different technique to deal with cholesterol problem in shell egg consumption in the US: the index was built by counting the number of articles with unfavorable news minus the number of articles with favorable news. Chern and Zuo (1997) developed the cumulative method employed by Brown and Schrader (1990) by introducing new fat and cholesterol information index considering then a differentiated carryover weight for favorable and unfavorable articles. Based on Chern and Zuo (1997), Hassouneh *et al* (2012) developed a food scare information index, using a monthly count of newspaper articles published in the most popular Egyptian newspaper, to analyze the effect of the avian influenza on price transmission along the Egyptian poultry marketing chain.

In our study, the scientific incidence index (S) built upon a count of scientific articles and references (both supporting and non-supporting) have been published in each year in the period 1998-2015, to deal with aflatoxins problems of nuts in Europe. We introduced this variable to determine the impact of scientific incidence on European behavior in controlling imported nuts and groundnut. This index presents an approximation to social society' awareness about the impact of aflatoxin contamination on European consumer health.

4 Data and estimation procedure

The Poisson and Negative Binomial (NB) models have been widely used to model count data. The NB model is more flexible than Poisson regression model and overcomes the problem of over-dispersion that bias Poisson regression models (Cameron and Trivedi, 2013). Therefore, the NB model can be implemented to quantify more effectively the parameters in case of over-dispersion. Furthermore, the high number of zeros in the response variable suggests the use of a zero-inflated negative binomial (ZINB) regression model (Lambert 1992; Greene 1994).

Our original database includes 65 countries including exported volumes for HS6 product categories to the EU15. Table 2 presents the descriptive statistics of variables used in our estimation. We noted that the standard deviation of almost all variables is greater than the mean, which indicates the problem of over-dispersion in our dataset. In addition, we noted a large number of zero count observations (96.7% in our exercise).

A question emerges on how explaining trade flows with zero notifications. The reason for this becoming an issue is because two processes could produce zero notifications, according to literature on trade modeling (Burger *et al*, 2009; Portugal-Perez et al, 2010; Reyes, 2012). The first process is the absence of trade, which leads to zero notifications. The second process that can also produce zero notifications is the compliance with the EU food control system. Such double process obliges to discriminate trade flows through a two-stage estimation. The first stage consists of a logit regression, which determines the likelihood of zero notifications, with variables correlated with such probability, including the lagged import flows. The second stage explains the notification count for the group of products with non-zero probability of trade, and therefore, of having a positive number of notifications.[3] The double process can be represented through a ZINB model that contains an extra proportion of zeros (p) specified by the following probability density function:

$$Prob(N = N_{ijtk} \mid \Omega)$$
$$\begin{cases} p + (1-p)\pi(N_{ijtk} = 0 \mid \Omega) \; if \; N_{ijtk} = 0 \\ (1-p)\pi(N_{ijtk} \mid \Omega) if \; N_{ijtk} > 0 \end{cases}$$

Where the NB distribution is represented by $\pi(N_{ijtk} \mid \Omega)$

The choice of the preferred model that best represents the data is based on goodness of fit tests (Table 3). The most commonly used criteria for comparison purpose between models are Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the likelihood ratio test and the Vuong statistic test. All four statistical tests indicate that the ZINB would preferred over the NB. Therefore, the former will be used to analyze the relationship between the AF notification of nuts and the explanatory variables.

In this exercise, the dependent variable (N_{ijt}) is a non-negative count variable explained in terms of a set of covariates. The estimation of regression parameters using the maximum likelihood method is presented in Table 4. All variables that are correlated with the probability of zero notifications were included in the logit part of the ZINB model.

5 Findings and discussion

Elasticities or rates of responses of the AF notification count with respect to one percent or one unit change in the model variables are shown in Table 5, with specific parameters estimated for the period before the harmonization of AF standards ('Pre-EU harmonization' 1998-2001), for the period before the harmonization of EU standards to CODEX maximum levels ('Pre-CODEX' 2002- 2009) and for the period after the harmonization of EU standards to CODEX ('Post-CODEX" 2010-2015).

Our results show that the European controls of AF in imported nuts depend on the past history of product and exporter's AF notifications, showing that countries or sectors able to have the "house in order" are less sensitive to deficiencies in compliance (Diaz Rios and Jaffe, 2008). These reputation effects are more relevant for the 'Pre-EU harmonization' period. This is also the case for the notification response to alerts, which refer to events requiring rapid action in the market. Such reduction of the path dependence effects on product notifications and past alerts in the later periods would suggest that the safety controls are increasingly more systematic and less dependent on reputation or past controls. Country reputation effects (on variable N_{Jt-1}) are significant and negative, which indicates that countries facing an increase in notifications may manage the surge of notifications by shifting exports or strengthening export controls in later years. Again, such reactions are more pronounced in the 'Pre-EU harmonization' period.

The negative and significant elasticity of the notification count to *per capita* GDP suggests that development may be coupled with increased capacity to comply with EU standards, though absolute elasticity is quite low. Similarly, notifications are positively affected by

[3] The signs of the coefficients in the logit model are usually opposite to those in the NB part.

previous production and import values, which would be in line with the hypothesis that producers concerns could affect import controls, although again with low elasticities. Also in line with the hypothesis is the negative sign of the variable related to the applied tariffs, what reveals existence of policy substitution. An interesting finding is that the elasticity of the notification count to the number of published scientific references is significant, showing that 1% increase in scientific references on EU food standards would imply 4.9% increase in the AF notification count.

As illustrated in Table 6, a scenario of no implementation of CODEX regulations was simulated for the period 2013-2015. We observed that the notification count under such scenario would have almost doubled the observed count, with varying patterns among different suppliers and products. South Africa, United States and Argentina appear to be the most benefited countries of applying the Codex limit. These countries have followed a proactive strategy to prevent AF contamination and establish efficient certifications systems (Diaz Rios and Jaffee, 2008). The lessening of the AF standard is effective when a significant number of controls already complied with the more flexible CODEX standard but it did not meet the tighter MRL. In the opposite situation, Egypt, Turkey and China, seem to be less benefitted by lessening of the EU standard, perhaps because their proportion of safety problems above CODEX levels was already significant. Therefore, the change in the number of NTMs benefits some countries more than others. In these countries, the reduction of AF problems would depend more on their own control capacity than on the change in EU regulation.

6 Concluding remarks

Edible nuts exports to the EU remain heavily dependent on restrictive controls of AF carried out by Member States, which affect the economy of nuts producers. In this paper, a model to explain the RASFF notification count was conceptually defined and estimated to assess the effect of changing AF standards in the EU. NTMs appear to react to domestic consumer and producer concerns, but they also depend on the export capacity of nut suppliers to the EU and even more on the scientific awareness on the effects of AF on health. Implementation of NTMs is affected by product and country reputation, with significant impact of events requiring rapid action in the market. The count model on RASFF notifications allows to evaluating the impact of changing AF standards, once isolated the effect of economic and political variables. Countries that employed substantial efforts to upgrade the safety of their exports will probably be the most benefited of removing or lessening of NTMs. Although this paper provides some light on the factors explaining the enforcement of food safety controls, further research is needed to analyze the trade effects on nut exports to the EU derived on the change of AF standards. Standard reforms could be also considered endogenous in the model, which opens an interesting field for future research.

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Table 1. Conceptual variables and explanatory events

Conceptual variable	Explanatory events and indicators
Capacity of Exporting countries	Development level (*per capita* GDP_j)
Consumer concerns ($\boldsymbol{\omega_c}$ and $\boldsymbol{\ell_c}$)	Alerts (A_i), Scientific awareness (S)
Producer concerns ($\boldsymbol{\omega_s}$ and $\boldsymbol{\ell_s}$)	Imports from different origins (M_{ij}) Production of different nuts (Q_{it}) $Tariffs_{it}$
Path dependence effects	Previous product notifications (N_{ijt-1}) and country reputation (N_{jt-1})

Table 2. Descriptive statistics

Variable	Unit	Source	Mean	Std.Dev	Min	Max
Nijt	no.	RASFF	0.31	7.24	0	489
Nijt-1	no.	RASFF	0.30	7.23	0	489
Njt-1	no.	RASFF	3.94	26.21	0	490
A_{ijt-1}	no.	RASFF	0.01	0.23	0	10
M_{ijt-1}	€ (2010 prices)*	Comext-Eurostat	351.33	797.19	1	764641430.10
Q_{t-1}	1000 T	Eurostat	13.74	23.39	6.47	966.71
$GDPpc_{t-1}$	US$ (2010 prices)	World Bank	458.38	326.10	244.137	54232.65
S_{t-1}	no. of references	Google scholar	441.22	224.20	95	834
$Tariffs_{it}$	percent	WTO - Integrated database	3.10	1.58	0	7

***** The actual variable in the estimation of Equation (1) is (1 + M_{ij}) Source: Authors' calculations

Table 3. NB and ZINB models. Goodness of fit parameters

	Zero-Inflated Model (ZINB)	Negative Binomial Model (NBM)
AIC	23420	26942
BIC	32960.00	27209.51
Log Likelihood	-11672.16	-26883.60
Num. observations	75960	
Vuong Test[4]	22.76***	

Source : Authors' calculations

[4] Vuong test value represents z-score statistic. The model was estimated using R-language

Table 4. Estimated parameters of ZINB Model

	ZINB	
	Negative binomial	**Logit**
(Intercept)	**-1.50447** (0.12020)***	**2.58930** (0.10508)***
N_{ijt-1}	**0.02125** (0.00180)***	**-2.69360** (0.12514)***
N_{jt-1}	**-0.01520** (0.00168)***	**-0.00756** (0.00165)***
A_{ijt-1}	**0.21035** (0.02918)***	**0.74469** (0.31713)*
Ln ($pcGDP_{t-1}$)	**-0.00029** (0.00012)*	0.00013 (0.00011)
Ln (M_{ijt-1})	**0.00022** (0.00005)***	**-0.00034** (0.00006) ***
Ln (Q_{it-1})	**0.00488** (0.00215)*	**0.01582** (0.00255)***
Ln (S_t)	**0.04900** (0.00834)***	**0.01892** (0.00766)*
$Tariffs_{it}$	**-0.06204 (0.01263)***	
Dummy 1998-2001	**-1.34639** (0.08990)***	
Nijt.1	**0.11488** (0.02097)***	
Njt.1	**-0.09371** (0.01915)***	
A_{ijt-1}	**0.54243** (0.07669)***	
Dummy 2010-2015	**-0.82279** (0.07627)***	
Nijt.1	**0.04583** (0.00583)***	
Njt.1	**-0.01044** (0.00297)***	
A_{ijt-1}	**-0.18422** (0.05195)***	
Country fixed effects	***	
Product fixed effects	***	
Log(theta)	-0.05344 (0.05483)	
AIC	23397.09972	
Log Likelihood	-11659.54986	
Num. obs.	75960	

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Source: Authors' calculations

Table 5. Impact on count notifications per period (percentage change of the notification count)

	Pre-harmonization of EU standards	**Pre Codex**	**Post Codex**
Per 1 unit change in	***1998-2001***	***2002-2009***	***2010-2015***[5]
N_{ijt-1}	13.77	2.13	6.73
N_{Jt-1}	-11.05	-1.52	-2.56
$Alerts_{ijt-1}$	77.15	21.03	2.38
Per 1 % increase in			
$Imports_{ijt-1}$		0.022	
European $production_{it-1}$		0.488	
$pcGDP_{(t-1)}$		-0.029	
Scientific $references_t$		4.90	
Fixed effect period	0.26	1	0.44

Source: Authors' calculations

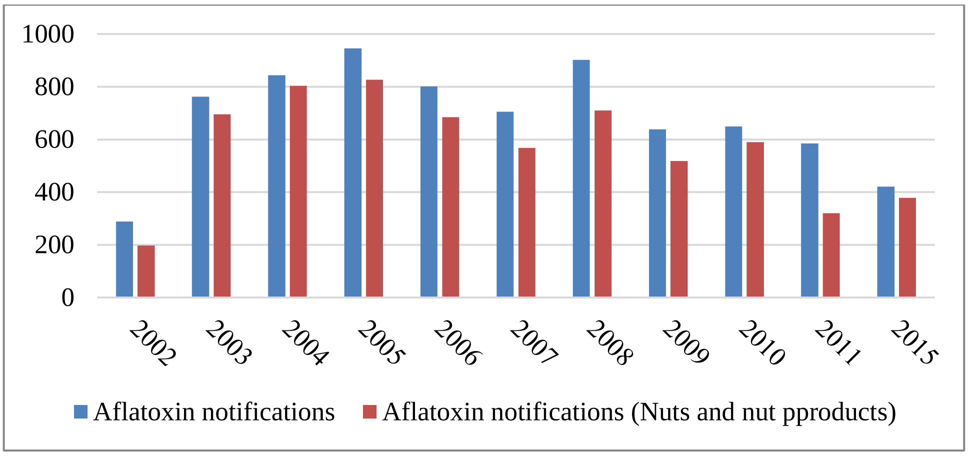
[5] Coefficients are estimated by adding up the coefficients of mentioned variables in the reference period (2002-2009) to the coefficients of the interaction terms for each period in the estimated model depicted in table 5.

Table 6. Average notification count (2013-2015): Non Codex vs Observed w/Codex

Average notification count (2013-2015)		Non Codex scenario	Observed w/Codex	% Impact on notification count
Top 10 notified countries	South Africa	12	3	-78
	United States	67	26	-62
	Argentina	9	4	-53
	India	24	13	-45
	Brazil	19	11	-41
	Nigeria	2	1	-40
	Iran	51	35	-32
	Egypt	10	9	-13
	Turkey	55	49	-11
	China	56	54	-3
Product	Pistachios	98	51	-48
	Groundnut	80	56	-43
	Almond	4	3	-25
Nuts total		196	103	-47

Source : Authors' calculations

Figure 1. AF notifications of nuts and nut products 2002-2015



Source: Authors' calculations based on RASFF annual reports (2002-2015)