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Is export orientation a major motivator for the adoption of food safety systems in the Turkish dried fig firms ?

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Abstract

Food safety management systems (FSMSs) and the scrutinisation of the food safety practices that are intended for adoption on the firm level both offer strategic value to the dried fig sector. This study aims to prove the hypothesis that export orientation is a major motivating force for the adoption of food safety systems in the Turkish dried fig firms. Data were obtained from 91 dried fig firms located in Aydin, Turkey. Interviews were carried out with firms' managers/owners using a face-to-face questionnaire designed from May to August of 2010. While 36.3 percent of the interviewed firms had adopted one or more systems, the rest had no certification. A binomial logistic econometric model was employed. The parameters that influenced this decision included contractual agreements with other firms, implementation of good practices by the dried fig farmers, export orientation and cost-benefit ratio. Interestingly, the rest of the indicators employed had no statistically significant effect on adoption behaviour. This paper focusses on the export orientation parameter directly in order to test the validity of the main research hypothesis. The estimated marginal effect suggests that when dried fig firms are export-oriented, the probability that these firms will adopt food safety systems goes up by 39.5 percent. This rate was the first range observed among all the marginal probability values obtained and thus verified the hypothesis that export orientation is a major motivator for the adoption of food safety systems in the Turkish dried fig firms.

Keywords: adoption drivers, aflatoxin control, dried fig firms, export inclination, food safety

Abbreviations

AFT:	aflatoxin, APAD: Aydin Provincial Agricultural Directorate,
BLRM:	The binary logit regression model, BRC: British Retail Consortium,
CDFs:	cumulative distribution functions,
EU:	The European Union,
FSMSs:	Food Safety Management Systems,
GAP:	Good Agricultural Practices,
GMP:	Good Manufacturing Practices,
GSP:	Good Storage Practices,
HACCPs:	Hazard Analysis of Critical Control Points,
IFS:	International Food Standard,
RASFF:	the Rapid Alert System for Food and Feed,

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1 Introduction

Within the Near East and North Africa region, Turkey is the largest producer and exporter of many kinds of agricultural products. Owing to its favourable climatic and ecological conditions, Turkey has a great share in the trade and production of many traditional agricultural products in the world. In addition, Turkey has a leading position as a producer and exporter of hazelnuts, dried apricots and dried figs on the global level (Anonymous, 2011).

Depending on climatic and agricultural factors, Turkey produces approximately 45–60 thousand tonnes of dried figs and exports 42–56 thousand tonnes of those figs annually, placing Turkey at the top of this field (CAC, 2011). Aydin and Izmir, located in western Turkey, are the two regions that produce dried figs for the export market. The fig cultivar *Calimyrna* (Sari Lop) is the main fountainhead for this crucial production.

Roughly 90 % of the dried figs produced in Turkey are exported, and fig processing firms have different handling capacities, from 100 to 5,500 tonnes per year. The dried figs are processed and marketed in many forms such as whole, paste, sliced and cubed according to the domestic and foreign market requirements of the Turkish food sector. The European Union (EU) member states are the main importers of Turkish figs, accounting for 70 to 75 percent of Turkish exports (Cobanoglu, 2007; Aksoy *et al.*, 2009).

However, the dried fig sector is currently suffering from the presence of aflatoxin (AFT) in its produce, which comes mainly from contamination by the *Aspergillus* species, particularly *A. flavus* and *A. parasiticus* (CODEX, 2008). Human exposure to higher levels of aflatoxin contamination increases cancer incidence, including risk of hepato-cellular carcinoma, especially in six to nine-year-old girls, as well as neural tube defects in the general population (Peng & Chen, 2009; Sun *et al.*, 2011; Umoh *et al.*, 2011; Woo *et al.*, 2011). One of the reasons that the aflatoxin is one of the most challenging mycotoxins is the fact that it could be produced by the responsible fungi not only at pre-harvest time but also at post harvest stages, including storage. Eventually, a lack of regulations or poor enforcement of regulations, which inevitably leads to the contamination of such contaminated commodities, could result in severe human and animal diseases. Aflatoxin B1, B2, G1 and G2 are the most important members of the aflatoxin group, which chemically are coumarin derivatives with a fused dihydrofurofuran moiety (Tajkarimi *et al.*, 2011).

As major shares of the dried figs produced in Turkey have been exported to the EU countries, information on foodstuffs found to have public health implications is disseminated as notifications via the Rapid Alert System for Food and Feed (RASFF) to all member states and to the exporting country. The total notification numbers intended for aflatoxin in dried figs that originate from Turkey have shown a clear increase (Fig. 1). In the year 2000, Turkey received 29 contamination notifications for its dried figs and other fig products; of those, 15 notifications were for aflatoxin alone. In 2010, the total of notifications rose to 256, of which 57 were for aflatoxin (RASFF, 2011).

For safety reasons, it is advisable to limit both the total AFT content (compounds B1, B2, G1 and G2) and AFT B1 content of foods. According to Annex 1 of Regulation (EC) No. 1881/2006 (EC, 2006), the maximum allowable amounts of AFTs in dried fruit, including dried figs in the EU countries, are as follows. Ground nuts, tree nuts, dried fruit and processed products thereof intended for direct human consumption or use as ingredients in foodstuffs may have $2\,\mu g\,kg^{-1}$ AFT B1 content and $4\,\mu g\,kg^{-1}$ total AFT content. Although concerted efforts, backed by scientific research done in Turkey, have been made to drive up these limits for dried figs, the EU Commission recently published a decision stating that it was not in a position to agree on the proposed maximum level of $10\,\mu g/kg$ for total AFT in ready-to-eat dried figs (EU, 2011).

CODEX (2008) should recommend that Turkey apply good agricultural practices (GAP), good manufacturing practices (GMP) and good storage practices (GSP) in dried fig production and throughout the entire processing stage. GAP, GMP and GSP may be evaluated within food safety management systems (FSMSs), and they have strict relationships with implementations of hazard analysis of critical control points (HACCP). In light of this, investigations conducted prior to the dried fig firms' adoption of new food safety practices offer strategic merit to Turkey's dried fig sector, which aims to sustain its success as the traditional market leader.

Numerous interesting papers and outlines have reviewed the factors that affect the implementation of FSMSs in food businesses and/or stakeholders in the food supply chain. Such factors depend on location, sector and stakeholders. A review of these research outlines has revealed that there are multidimensional perspectives on the adoption and/or implementation of food safety systems and practices. Key drivers include legislative mandates and insurance requirements (Loader & Hobbs, 1999), customer and employee demands (Henson & Hooker, 2001), the prospect of enhancing corporate image (Romano *et al.*, 2004), the desire to achieve procedural and operational efficiency and the desire to adhere to good practices (Khatri & Collins, 2007; Jayasinghe-Mudalige & Henson, 2007). The benefits of adopting FSMSs include enhanced access to markets, cost effectiveness, (Taylor, 2001; Romano *et al.*, 2004), time savings, production efficiency, employee development, more accurate information and communication, enhanced, encouraged compliance with organizational regulations and improved product quality and safety (Trienekens & Zuurbier, 2008). Possible challenges include the excessive cost of implementation, organizational culture (Taylor, 2001; Fairman & Yapp, 2004), excessive documentation (Yapp & Fairman, 2006), lack of technical skills and knowledge relevant to food safety regulation, the complexity of development and implementation, lack of time and the difficulty involved in vetting suppliers (Jayasinghe-Mudalige & Henson, 2007; Khatri & Collins, 2007). Recently, Mensah & Julien (2011) identified the key drivers, benefits and challenges of implementing food safety management systems (FSMSs). These factors

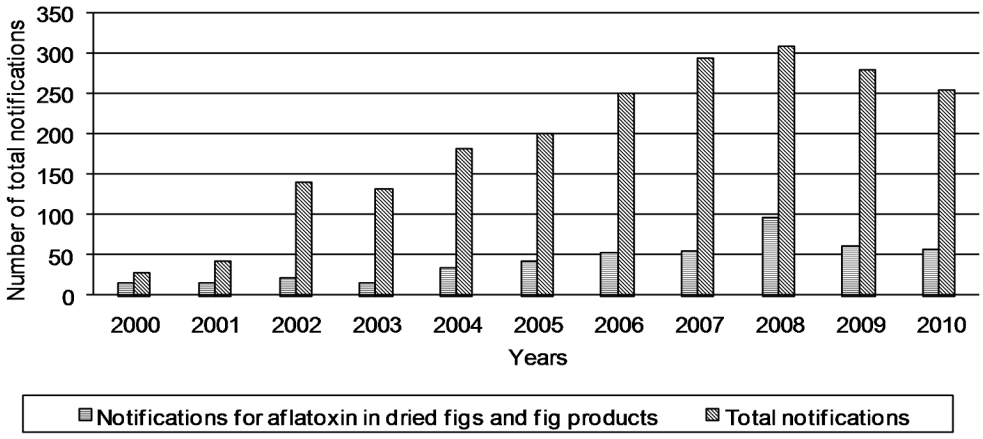

Fig. 1: *The share of notifications for aflatoxin in dried figs and fig products within total notifications transmitted for the fig products originating in Turkey, Source: RASFF, 2011. Rapid Alert System for Food and Feed. The RASFF web portal.*

have been examined in great detail in Italy, Canada, Australia, the United States, Turkey, New Zealand, Europe, Africa, the Caribbean and the Pacific for meat and dairy, poultry processing, primary products, general processing and distribution and catering sectors.

Demirbaş & Karagözlü (2008) determined the main constraints in meeting food safety and quality requirements in the Turkish dairy industry. According to this study's outlines, most managers have limited education, and most firms process small volumes of milk and have little control over the raw milk supply owing to limited resources. In a wider study, Koletzko (2008) drew a general framework of the food safety situation in Turkey. He arrived at the conclusion that Turkey will probably experience great difficulty reaching the EU standards of food safety in the near future. Koç *et al.* (2011) have used swot analyses to assess food quality assurance schemes in Turkey. Their study focused on farmers' perceptions of food quality assurance systems that are employed with rapid rural appraisal results.

A review of the literature suggests that no detailed work on the adoption of food safety practices in the dried fig firms has yet to be conducted, although relatively few studies have been carried out to identify some parameters in the sector, which are summarized in the following paragraph.

Javanmard & Mahmoudi (2008) carried out a SWOT analysis of organic dried fig production in Iran. They stressed that there are small scale processing characteristics in Iranian firms, as well as fluctuations in Iranian climate and price conditions, as well as other influential factors in this country. Javanmard (2010) indicated that poor hygienic conditions in Iranian fig harvesting, drying procedures, collecting sites and sorting and packaging plants caused higher mould contamination and risk of the *A. flavus* growth in dried fig production from this country. Gündoğmuş (2010) declared that conventional fig farming is very sensitive to probable future changes in the price and availability of fossil fuels, making fig farming economically as well as environmentally unsustainable.

Cobanoglu *et al.* (2010) calculated that the difference in the economic costs of implementing conventional and good practices intended for aflatoxin management in the dried fig supply chain was $1.14 for per kg of dried figs in total. The total differentiation consisted of $0.51 at the producer stage, $0.22 at the middleman stage and $0.41 at the processor stage.

As a large part of the dried figs would be exported to the EU from Turkey, many strict regulations and implementations, such as low allowable level of aflatoxin limit in the Union, could play a major constraint in future Turkish fig production. Thus, investigation of the roles of some critical motivators and/or barriers such as export orientation, cost and benefit ratio, human resources, etc. in Turkey will help to sustain Turkey's leading position in the EU as a dried fig producer and trader. The main aim of this study is to validate the hypothesis, "Is export orientation a major motivator for the adoption of food safety systems in the Turkish dried fig firms?" or, to put another way, "Is there a propulsive force behind export orientation?" The study assumes that temporary and permanent employee numbers and the actual capacity of each firm could vary over a prolonged interval.

2 Materials and methods

2.1 Theoretical framework

The model employed to investigate the relationship between adoption and parameters of adoption utilized a mixed set of qualitative and quantitative analyses. Qualitative models are applicable to a wide array of purposes in adoption studies, although they are criticized for their intentional inability to offer partial adoption (Feder *et al.*, 1985). The determinants could thus be estimated by using the linear probability model, probit model or logit model. The linear probability may have many critical constraints such as non-normality of distribution, heteroscedasticity, values of estimated probabilities falling outside the interval of zero and one as well as a very small value of R^2 (Singh *et al.*, 2010). Moreover, the assumption that there exists a linear relationship between the value of an independent variable and the probability of a dependent variable is not realistic (Gujarati, 1999). The probit and logit models thus provide better alternatives for such estimation. The major difference between these two models is the flatness of the tails of their cumulative distribution functions (CDFs). The logit model has slightly flatter tails (Greene, 2002), which means that the probit curve approaches the axes more quickly than does the logit curve. Gujarati (1999) points out that the choice between the two methods is largely dictated by the convenience of estimation and the availability of suitable computer programmes.

The probit and logit are the most frequently applied models for identifying socio-economic phenomena, especially for investigating the relationship between dependent discrete variables (adoption) and explanatory variables (Polson & Spencer, 1992). It has been shown that none of these models has any advantage over the other (Capps Jr. & Kramer, 1985). In order to measure the discrete output, many multivariate statistical techniques can be employed to estimate a binary dependent variable from a list of independent variables. The binary logit regression model (BLRM) can serve as a better fitting alternative in such a situation (Polson & Spencer, 1992). It needs fewer assumptions than the other two methods indicated, and even when the assumptions needed for discriminant analysis are satisfied, the BLRM still runs well (Kleinbaum, 1994; Karki & Bauer, 2004). Therefore, the binomial logit model was used because of its simplicity and computational ease. The parameters of the model were estimated using the maximum-likelihood method.

2.2 Empirical research

Dried fig processing firms work in an environment with vague prescriptions for the adoption of food safety systems. The author supposes that firms evaluate the benefits of such systems according to their particular preferences. The benefit of an alternative is a function of the characteristics of a firm, which is denoted by

$$U_0^* = b_0' x + \varepsilon_0 \tag{1}$$

where U_0^* is the benefit of preferring an alternative, x is a vector that includes the characteristics of the firm, b_0' is a parameter vector and ε_0 is the error term that permits indefiniteness.

The benefit of adopting a food safety system can be estimated as

$$U_A^* = b_A' x + \varepsilon_A \tag{2}$$

where U_A^*, b_A' and ε_A are the benefit, parameter vector and stochastic function of adopting a food safety system, respectively.

If the firm does not decide to adopt a food safety system, we have

$$U_N^* = b_N' x + \varepsilon_N \tag{3}$$

where U_N^*, b_N' and ε_N are the benefit, parameter vector and stochastic function of not adopting a food safety system, respectively.

Thus, the difference in net benefit between adopting and not adopting is

$$U^* = U_A^* - U_N^* = (b_A' - b_N')x + (\varepsilon_A - \varepsilon_N) = b' x + \varepsilon \tag{4}$$

where U^*, b' and ε are the net benefit, parameter vector to be specified and stochastic function, respectively.

As the firm's net benefit is a latent variable, we cannot measure it without intermediaries. But if $U^* > 0$, then the measured preference will be the adoption of a food safety system, and if $U^* \leq 0$, then the measured preference will be the non-adoption of a food safety system.

$$\text{Adoption} = \begin{cases} 1, & U^* > 0 \\ 0, & U^* \leq 0 \end{cases} \tag{5}$$

If we suppose that the stochastic function ε shows a logistic distribution with a mean of 0 and a variance of $\pi^2/3$, the probability that adoption = 1 or 0 can be explained as

$$\begin{aligned} P(\text{Adoption} = 1) &= P(U^* > 0) = P(\varepsilon < b' x) \\ &= \tfrac{1}{1+e^{-b' x}} = \Lambda(b' x) \end{aligned} \tag{6}$$

$$\begin{aligned} P(\text{Adoption} = 0) &= P(U^* \leq 0) = P(\varepsilon \geq b' x) \\ &= 1 - \tfrac{1}{1+e^{-b' x}} = 1 - \Lambda(b' x) \end{aligned} \tag{7}$$

The likelihood function can be stated as

$$L = \prod \left[\Lambda(b' x)\right]^{Adoption} \left[1 - \Lambda(b' x)\right]^{1-Adoption} \tag{8}$$

The parameter vector b in (8) can be specified using the maximum likelihood method. The marginal effect for a variable x_i can be measured as indicated below:

$$\frac{\partial P}{\partial x_i} = \Lambda(b' x)\left[1 - \Lambda(b' x)\right] b_i \qquad (9)$$

2.3 Data collection

Data were gathered from 91 dried fig businesses located in Aydin, Turkey. As mentioned, Aydin and Izmir regions are responsible for almost all of Turkey's dried fig production. In addition, 70–75% of Turkey's dried fig products come from Aydin alone. A list of active dried fig firms was obtained from the Aydin Provincial Agricultural Directorate (APAD). Since the total number of active dried fig firms was only 91, the researcher had the opportunity to carry out the interviews by using face-to-face questionnaires designed during May-August of 2010. The detailed distribution of the firms located in the region was Acarlar (3), Atca (1), Bozdogan (2), Buharkent (1), Centrum (1), Germencik (15), Incirliova (7), Kosk (12), Kuyucak (1), Nazilli (34), Ortaklar (5), Sultanhisar (2), Umurlu (6) and Yenipazar (1).

Survey questions were prepared in accordance with the standards prescribed in the international literature, current legislation on Codex, Turkish Food Codex and EU regulations for the processing of dried figs. The main titles of the survey questions were collected in two mainframes. These were: (1) organization and processing structure of the firms and (2) the situation of market-based incentives such as cost/finance, management, good practices, sales and reputation intended for defining food safety practices and perceptions of the firm managers' on FSMSs. Each sub-section was investigated with approximately more than thirty questions. As a first stage, an initial questionnaire was pre-tested at the dried fig firm level in order to measure the responses of the managers. Then, the survey questions were developed in light of the managers' replies.

2.4 Identification of variables

Table 1 defines specific statements related to the research's core topic. The dependent variable evaluated was a dichotomous decision about whether or not to adopt food safety systems. It was discovered that 36.3 percent of the firms had adopted one or more systems, whereas the rest had no certification. The present study's main intent was to determine whether export orientation genuinely motivated Turkish dried fig firms' adoption of food safety systems. To investigate the validity of the hypothesis, the parameters indicated below (see also Table 1) were used as independent variables as well as the implications of a previous study (Cobanoglu, 2007) but also structural parameters of Jayasinghe-Mudalige & Henson's (2007) framework.

Regulatory incentives and liability encouragements were not used, as mentioned. According to the legislation known as law no. 5996 (OGRT, 2010), which was enacted on June 11, 2010 and published on June 13, 2010, all stakeholders in food supply chains, from farmers to consumers, must completely obey rules regarding traceability, labelling and the protection of consumer rights. All plants in Turkey must also follow HACCP standards. Prior to the passage of this law, food firms were required to implement hygienic sanitation and processing practices that were based on the HACCP principles specified in law no. 5179, which was passed May 27, 2004 (OGRT, 2004). The implementation of food safety systems, such as the IFS (International Food Standard), BRC (British Retail Consortium) and ISO 22000, has always been performed voluntarily in Turkey.

This particular list of independent variables was compiled for three reasons. First, most of these variables have been used in studies on other food businesses. Second, although many investigations have been carried out on food businesses located in developed countries, the parameters analyzed might have vast variability in developing countries such as Turkey. Third, Turkey has a complicated culture and a long tradition of processing and marketing dried figs. Thus, the author synthesized and employed the parameters used here on the basis of previous studies and with consideration for the fact that actual conditions could be overlooked due to the sector's long history. Therefore, this investigation was able to yield a detailed outlook on adoption tendencies in Turkey. All of the parameters, explained at length below, were expected to have positive effects on adoption decision. The following paragraphs will explain each variable in detail.

(1) Physical conditions (cost/financial implications): A 5-point Likert type-scale, from fully disagree (=1) to fully agree (=5), was employed to analyze the statement that sufficient physical conditions can have an affirmative effect on the adoption of food safety systems.

(2) Employment level (human resources): Employment level was coded as follows: 1 – if the number of employees was 1–10; 2 – if the number of employees was 11–50; 3 – if the number of employees was 51–100; 4 – if the number of employees was 101–1000; and 5 – if the number of employees was greater than 1000.

(3) Improvement of the dried fig quality (plant processing procedures): A 5-point Likert-type scale, from fully disagree (=1) to fully agree (=5), was used to evaluate the statement that the adoption of food safety systems improves the quality of the dried figs. A high score indicated a high probability of adopting food safety systems.

Table 1: *Descriptive statistics of the specific statements engaged in the study.*

Characteristics	*Explanations*	*Mean*	*Min.*	*Max.*	*Std. Dev.*	*Expected sign*
Depended variable						
Adoption	1 if any standard is adopted 0 if any standard is nonadopted	0.36	0	1	0.483	
Independed variables						
Market-based incentives						
A. Cost/financial implications (CT)						
1. Physical conditions	5-point Likert type-scale, from fully disagree (=1) to fully agree (=5)	2.85	1	5	1.639	+
B. Human resources (HR)						
2. Employment level	1 if the number of employees between 1–10 2 if the number of employees between 11–50 3 if the number of employees between 51–100 4 if the number of employees between 101–1000 5 if the number of employees more than 1000	2.27	1	5	1.044	+
C. Plant processing procedures (PPP)						
3. Improvement of the dried fig quality	5-point Likert-type scale, from fully disagree (=1) to fully agree (=5)	2.25	1	5	1.371	+
4. Contractual agreements with other firms	5-point Likert-type scale, from fully disagree (=1) to fully agree (=5)	1.93	1	5	1.348	+
D. Good practice (GP)						
5. Implementation of good practices by the dried fig farmers	5-point Likert-type scale was employed, from fully disagree (=1), when there were plenty of good practices, to fully agree (=5)	1.70	1	5	1.188	+
E. Sales (SL)						
6. Increasing market share	5-point Likert-type scale, from disagree (=1) to fully agree (=5)	2.92	1	5	1.416	+
7. Attraction of new customers	5-point Likert-type scale, from disagree (=1) to fully agree (=5)	3.30	1	5	1.059	+
8. Export orientation	1 if the firm exports the dried figs 0 otherwise	0.48	0	1	0.502	+
F. Reputation (RT)						
9. Brand name extensions	5-point Likert-type scale, from disagree (=1) to fully agree (=5)	2.73	1	5	1.165	+
10. Cost-benefit ratio	5-point Likert-type scale, from disagree (=1) to fully agree (=5)	2.53	1	5	1.247	+
11. Consumer reaction	5-point Likert-type scale, from disagree (=1), when there were high consumer expectations, to fully agree (=5)	3.48	1	5	1.277	+

(4) Contractual agreements with other firms (plant processing procedures): A 5-point Likert-type scale, from fully disagree (=1) to fully agree (=5), was used to assess the statement that the adoption of food safety systems would increase the amount of processed products for other firms via contractual agreements. The author anticipated that there would be a positive correlation between these scores and adoption probability.

(5) Implementation of good practices by the dried fig farmers (good practice): A 5-point Likert-type scale was employed for good practices, from fully disagree (=1; indicating that the firm already employed ample good practices) to fully agree (=5), in order to evaluate the statement that implementing good practices can have a positive effect on the adoption of food safety systems.

(6) Increasing market share (sales): A 5-point Likert-type scale, from disagree (=1) to fully agree (=5), was used to assess the statement that the adoption of food safety systems improves market share in the dried fig processing sector.

(7) Attraction of new customers (sales): A 5-point Likert-type scale, from disagree (=1) to fully agree (=5), was used to analyze the idea that the adoption of food safety systems attracts new customers.

(8) Export orientation (sales): In fact, the key indicator in this paper is export orientation. When a firm exported dried figs, it was given a score of 1; otherwise, 0.

(9) Brand name extensions (reputation): A 5-point Likert-type scale, from disagree (=1) to fully agree (=5), was used to evaluate the notion that implementing food safety systems accelerates brand name extensions.

(10) Cost-benefit ratio (reputation): This study used a 5-point Likert-type scale, from disagree (=1) to fully agree (=5), to evaluate the idea that the adoption of food safety systems provides more benefits than costs. The dried fig firms will adopt one and/or more food safety standards if the expected benefit covers the correlating costs.

(11) Consumer reaction (reputation): A 5-point Likert-type scale, from disagree (=1; when there were high consumer expectations) to fully agree (=5), aimed to evaluate the statement that high consumer expectations can have a positive effect on the adoption of food safety systems.

3 Results

Table 2 shows the parameters and characteristics of the firms included in the study. While the managers of the firms were between 26 and 74 years of age, their education level was usually a high school degree. Their experience in the dried fig industry ranged between 1–50 years. Their activities concentrated mainly in dried fig processing, and the firms might process from 3 to 10000 tonnes (1789.205 tons) of dried figs per year, although the firms offered 1.26 product mixes on average (dried figs, dried apricots, chestnuts, etc). The number of temporary and permanent employees in the firms surveyed were 95.55 (5–2000) and 12.13 (0–350), respectively. This outline proved that the firms had different annual dried fig processing capacities depending on whether they possessed small, middle or large-scale characteristics.

McFadden R^2 values of 0.2 and 0.4 are considered highly satisfactory. In the model that the present study analyzed, R^2 was close to 0.6, and so this model was highly satisfactory. In addition, 91.2 percent of the adoption decisions were correctly specified. Thus, it could be said that the binomial logit model was appropriate, as shown in Table 3.

First, the researcher obtained results that confirmed their expectations about the signs of all the coefficients apart from increasing market share. This study's claim asserted that the adoption of food safety systems might be necessary for any firms intending to export dried figs, especially to the EU markets. It was reasoned that such businesses would be unable to sell sufficient amounts of their goods in the foreign market without safety certification systems in place, though they would still be able to sell dried figs in their domestic market. The negative sign for providing an increase in the market share's coefficient could reflect the fact that a large number of the firms are willing to target internal markets and are unwilling to adopt any food safety system.

The reasons why the parameters obtained provided no statistically significant impact on the adoption decision of any standard may arise from the perceptions of the firm managers/owners toward those parameters. The HACCP practices have been implemented for the last few decades in Turkey in all the firms operating in the food sector due to legal regulations, although these practices' convenience and efficiency may be argued. This interesting scenario was confirmed by Baş *et al*. (2007), as they indicated that the main barrier to implementing a HACCP-based food safety management system was the Turkish agricultural industry's lack of prerequisite programs, lack of knowledge, inadequate Turkish sources related to HACCP, cost and time.

Thus, the firm managers/owners trusted that many of the parameters investigated in the study would have critical importance to their firms' futures and would provide them with market competition over rival firms. Although the managers/owners of the firms reported that they believed in the indispensable prominence of FSMSs, the main implications and factors related to

Table 2: *Characteristics of the firms and firm managers/owners.*

Characteristics	*Explanations*	*Mean*	*Min.*	*Max.*	*Std. Dev.*
Age	Years	44.93	26	74	9.694
Education level	1: primary school, 2: high school, 3: university, 4: postgraduate	1.91	1	4	0.902
Experience in dried fig industry	Years	19.44	1	50	11.887
Product mix	Number	1.26	1	3	0.664
Temporary employees	Number	95.55	5	2000	272.851
Permanent employees	Number	12.13	0	350	46.536
Reel firm capacity	annual dried fig processing capacity (tons)	782.97	3	10000	1789.205

Table 3: *The impact of the parameters included in adoption model.*

Parameters	*Coefficient*	*Std. Error*	*P* †	*Marginal probability*
Intercept	–12.257	3.376	0.000 **	–
Physical conditions	0.307	0.285	0.281	0.058
Employment level	0.283	0.497	0.569	0.053
Improvement of the dried fig quality	0.150	0.374	0.687	0.028
Contractual agreements with other firms	0.650	0.320	0.042 *	0.122
Implementation of good practices by the dried fig farmers	1.219	0.564	0.030 *	0.229
Increasing market share	–0.021	0.353	0.953	–0.004
Attraction of new customers	0.176	0.360	0.625	0.033
Export orientation	2.133	0.954	0.025 *	0.395
Brand name extensions	0.383	0.345	0.266	0.072
Cost-benefit ratio	1.502	0.577	0.009 **	0.282
Consumer reaction	0.051	0.374	0.891	0.010
McFadden Pseudo R^2	0.589			
Log likelihood	–24.441			
Correct Predictions	91.2 %			
Observations	91			

†: *, and ** denote 5 % and 1 % significance, respectively.

adoption behaviours toward any food safety standard are instead controlled by four parameters, all of which have statistical significance: contractual agreements with other firms ($p < 0.05$), implementation of good practices by the dried fig farmers ($p < 0.05$), export orientation ($p < 0.05$) and cost-benefit ratio ($p < 0.01$). One could conclude that these four parameters had more impact on a firm's adoption of any food safety standard than the rest of the parameters, although all parameters evaluated in the model were suitable for estimating adoption decision.

4 Discussion

With regards to processing dried figs under contractual agreements, the likelihood of adopting food safety systems increases when the quantity of processed products for other firms via contractual agreements goes up, that is indicative of the plant processing procedures. With respect to processing shape, the dried figs from Turkey take numerous forms, such as layer, protoben, pulled, lerida, locum, garland, macaroni, baglama and cukulata (Göksu, 2010). On the other hand, even when

firms have sufficient capacity to meet the desired scale of production, they are not likely to need all of the aforementioned styles. When they do receive demand for shapes that they are not processing, they can place orders to other firms. This cross-contamination of companies could create bilateral synergism and generate positive bidirectional outcomes for the firms. In terms of marginal probability, the rate of contract manufacturing for the firms is related to the probability of adopting food safety systems, which could increase by 12.2 percent, all else being equal. Thus, contractual agreements might provide the firms with competitive advantages that would give them a larger market share compared to firms without contractual agreements. On the one hand, the firms that are working under contractual agreements with other firms could meet demands and customer requirements in a timely manner; on the other hand, all the firms placed in this system needed to adopt FSMSs in order to resume sustainable processing and marketing facilities. Contractual agreement might enhance close cooperation among small, middle and large-scale dried fig firms, and this positive interaction could also accelerate food safety practice adoptions. Similar outlines were defined by Kumar *et al.* (2011), who stated that formal milk buyers (dairy cooperatives, private dairy, etc.), unlike informal milk buyers (milk vendors, shopkeepers, etc.), were more likely to comply with food safety measures positively. They stressed that a buyer's association with the modern milk supply chain enforced the prospects of higher compliance with food safety measures. Their study confirmed that the cooperation between farmers with modern milk supply chains helped in the transfer of innovative knowledge and skills and reduced transaction costs. Zhou *et al.* (2011) also declared that contracting is the most widely used form of vertical coordination in the agricultural industry. On the basis of their implications, the contractual definition of quality focuses on the transaction between the firm partners. They identified that during contract negotiations, all stakeholders wish to avoid possible food risk as well as the transaction costs that arise from unknown food quality attributes.

Regarding the implementation of good practices by the dried fig farmers, such implementations, in conjunction with good practices in the dried fig firms, have strategic value. Firms that promote good practices on the part of the farmers also show increased probability of adopting food safety systems. The marginal effects of this parameter suggest its efficacy. When a dried fig firm implemented sufficiently good practices, the likelihood of its adopting a food safety system increased by 22.9 percent. In addition, CODEX (2008) enhanced GAP at the farm level in dried fig production. The code of practices could explain the main principles of good practices that reduce aflatoxin contamination. A similar result of safer products appears in the study by Kumar *et al.* (2011), wherein they explained that the "clean milk production" scheme is one of the incentives attempted by the government of India toward ensuring the safety of farm milk in the dairy chain and meeting the necessities of dairy processing firms as well as growing consumer demand. These incentives are essentially focused on the production practices that require day-to-day actions to protect, remove or decline food safety hazards at the farm level.

The third factor with a statistically significant effect on adoption decision was export orientation. This parameter spoke directly to the validity of the main research hypothesis. The estimated marginal effect suggests that when dried fig firms are export-oriented, the probability of adopting food safety systems goes up by 39.5 percent. This rate was the first range observed among all the marginal probability values obtained and therefore verified the hypothesis. Export orientation is a major motivator for the adoption of food safety systems in the dried fig firms, as Hassan *et al.* (2006), Jayasinghe-Mudalige & Henson (2007), Trienekens & Zuurbier (2008), Massoud *et al.* (2010) and Mensah & Julien (2011) have asserted in many different sectors. For example, Jin & Zhou (2011) calculated that a positive and statistically significant effect is found for the destination market variable, which is approximated by whether the cooperative serves supermarkets or foreign markets. Zhou *et al.* (2011) also defined a parallel result that the export market has a positive and significant coefficient with adoption standards in both binomial and ordered models that are intended for the implementation of food safety and quality standards in the vegetable processing industry in China. Fig producers in Turkey intend to export their produce to countries in the EU, which have strict food safety regulations and low aflatoxin limits, so the dried fig firms in Turkey must implement sufficiently good food safety practices in order to hold onto the EU market. Although legal regulations want food firms to expend more effort and employ more systematic approaches in the short run, these enforcements could enable the adoption of food safety systems hierarchically in the long run. Moreover, strict aflatoxin limits could lead to the firms' adoption of numerous adequate and efficient safety systems. The present study observed that while the number of food safety systems and good practices adopted by the firms would increase, the dried fig businesses could find themselves at the upper levels of the food business, depending on the volume of processed products in Turkey.

The fourth parameter with a statistically significant effect on adoption decision was the cost-benefit ratio. With respect to estimated marginal effect, when the

dried fig firm managers believe that the benefits of obtaining food safety systems exceed the costs of acquisition, their probability of adopting food safety systems may increase by as much as 28.2 percent. Of the marginal probability values obtained, this figure is quite high and tends to confirm observations made by Hassan *et al.* (2006), Yapp & Fairman (2006), Jayasinghe-Mudalige & Henson (2007), Trienekens & Zuurbier (2008), Massoud *et al.* (2010), Herath & Henson (2010), Jin & Zhou (2011) and Mensah & Julien (2011). Antle (1999) and Holleran *et al.* (1999) investigated the negative incentives of the higher production costs that small farms face when they adopt food safety and quality practices. Jayasinghe-Mudalige & Henson (2007) proposed a revealing argument that although it may be possible for small-scale Canadian red meat and poultry firms to realise precise benefits by adopting such controls, the overall trade-off between the perceived and linked costs was not enough for those Canadian firms to justify such practices. The implications of Jayasinghe-Mudalige and Henson's study are that the trade-off between net gains from adopting accelerated food safety controls over the implementation costs seems to favour only the large federally-registered firms. Moreover, Kumar *et al.* (2011) calculated that the cost of milk production would increase by 0.50 rupees per litre if the desired level of compliance with food safety measures was adopted at the farm level. One can therefore assume that most of the dried fig firms' managers likewise believed that their adoption of food safety standards could provide more gains than its acquired costs.

Market-based incentives and legal regulations may consist of essential economic incentives to adopt food safety systems. This study examined many of the critical factors included in market-based incentives in order to prove the hypothesis that export orientation is one of the major economic motivators for Turkish dried fig firms' adoption of food safety practices and/or systems. Given that most of the dried figs produced in Turkey are exported to the EU countries, which have strict food safety regulations and low aflatoxin limits, the dried fig firms in Turkey appear willing to implement food safety practices sufficiently. Yet the researcher strongly believes that enforcing such practices would initially entail high costs. For example, Cobanoglu *et al.* (2010) calculated that the difference in the economic costs of implementing conventional and good practices intended for aflatoxin management in the dried fig supply chain was $1.14 for per kg of dried figs in total. Fortunately, adequate and efficient food safety controls may overcome these expenditures in the long run.

Finally, the results confirmed that export orientation is a major motivator for the adoption of food safety systems in the Turkish dried fig firms. The research outlines clearly determined that the traditional structure provides more advantages for the dried fig industry devoted to foreign markets, the EU in particular, than it does for other branches of the food sector in Turkey. Although the EU legal regulations are demanding quite strict practices to be implemented, such as very low aflatoxin limits, these obligations could encourage dried fig firms to adopt measures that would give them immense competitive advantages over other food sub-sectors. This dynamism should compel the fig firms to adopt the appropriate and desired food safety compliances and practices. Future research may confirm this observation and might also address the following questions: Do strict practices, intended to address aflatoxin limits and the EU controls on dried figs, truly result in the adoption of adequate and efficient food safety systems in the dried fig firms, compared to other food businesses? Do export orientation and strict aflatoxin limits and controls fully complement each other? Or do these actually have fundamentally different characteristics in terms of the adoption of food safety systems? The researcher feels that in the future, the cogency of these critical adjudications should be investigated.

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