Export Performance of Firms in Developing Countries and Food Quality and Safety Standards in Developed Countries[*]

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Abstract

The risk of morbidity and mortality related to food consumption makes food safety and quality a public policy issue as consumers can not determine food safety in advance and firms can not warrant food safety completely. Lessons on the regulation of food safety from the experiences of developed countries are introduced in the first part of this paper. Then, we direct our attention to the empirical analysis of the impact of food quality and safety standards of the European market on the export performance of food companies based in Turkey. Export of food products, for which the European Union is the largest market, has an important share in total exports of Turkey similar to many other countries in the MENA region. Recently, EU has started to increase the stringency of her regulations related to food quality, safety and environmental standards. We compare the export performance of firms with respect to their willingness to comply with these increased standards. We also investigate the impact of vertical integration, experience, and adoption of HACCP principles. Our data, derived from face to face interviews with around 100 firms operating in the 5 sub-sectors of the Turkish food industry, indicate that export performance of firms with higher compliance to standards, and stronger vertical integration is better. Thus, European market rewards the investments made for higher food quality and safety.

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1. Introduction

Reports by World Health Organisation and many academic studies indicate that food safety issues are becoming an increasingly serious threat to public health in developing countries. Lack of adequate regulations related to food safety as reflected in many unrecognised cases of food borne illnesses puts especially children and infants at high risk (for example, food borne diarrhea is the most common cause of death in children and infants). According to a World Health Organisation study in 1993, 70 percent of the approximately 1,5 billion global episodes of diarrhea occurring annually (which result in 3 million deaths among children under five) has been estimated to be caused by biologically contaminated food (Motarjemi et al 1993). Same study also states that contaminated food has been recognised as playing a major role in the epidemiology of cholera and other forms of epidemic diarrhea, substantially contributing to malnutrition. Parasites also pose significant health risks; for example, in rural areas of Africa, Asia and Latin America, cysticercosis is endemic with an infection rate of 2 to 15 percent of the population as compared to less than one-hundredth of a percent in the USA (Roberts et al 1994). Therefore, improving food safety and quality must be an integral part of any policy that aims to tackle the triangle of poverty, hunger and health problems.

A very recent study by Unnevehr and Hisrchhorn (2000) presents numerous aspects of food safety and quality issues in developing countries. They explore possible public interventions in improving food safety, lessons from experiences of developed countries in dealing with this kind of market failure[1], determination of efficient level of food safety investment (introduction of risk analysis, risk assessment and risk management), how quality relates to safety, the implications of food safety and quality standards of developed countries on the food exports of developing countries, and the international and regional organizations which may be consulted for potential expert help and financial assistance related to food safety and quality improvement. These issues have been dealt with to a certain extent in developed countries, and research in many of these issues is still being conducted. Furthermore, the introduction of new technologies such GMO's (Genetically Modified Organisms), make the food safety issues much more dynamic. One can not give adequate care to each of these issues in a single paper, and thus we will focus on the impact of increasing food quality and safety standards in the developed countries on the exporters of food products from developing countries in our paper. An introductory information related to design and implementation of regulation policies will also be provided in the first part of the paper.

One consequence of higher economic growth is the increase in the demand for quality and safety in certain commodities, in particular food. In Europe and the USA, the

[1] Food safety and quality is a good example of market failure.

quality and safety standards related to the products in food industry are becoming stricter. Especially, the European Union started to change the legislations on food safety and quality as described in the White Paper (2000) swiftly. Establishment of European Food Authority in 2000 is an important signal for the determination of EU on this issue. As many firms in MENA countries, such as Turkey, are exporting food products into European Union, it is very important to determine how they should deal with these increased food safety and quality standards in order to protect their market shares. A careful investigation should also be carried out related to the use of these standards as non-tariff barriers.

In the literature, the firm level determinants of export performance have been studied extensively. Recent surveys of this literature have been carried out by Katsiekas et al. (1996) and Zou and Stan (1998). Many different variables have been employed but performance variables related to compliance with safety and quality standards were not explicitly introduced. Towards closing this gap, face to face interviews with 100 firms in 5 different food subsectors in Turkey have been undertaken, and the collected data has been analyzed to determine (i) whether the compliance with safety and quality standards is rewarded in the EU market, (ii) whether the impact of strong vertical integration and care for environmental quality is positively related to export performance, and (iii) whether there are differences across subsectors or not. The new regulation approach, known as Hazard Analysis at Critical Control Points (HACCP) in developed countries is also briefly introduced.

Another important contribution of this study is the use of non-parametric kernel estimation method. This method of estimation does not impose any *a priori* functional relationship between variables, and thus, it will be very useful in our case since a theoretical model describing the functional relationship between exports and the performance variables mentioned above does not exist. The nonparametric kernel estimation method also makes it possible to compute the impact of independent variables on the export performance for *each observation point* in the data set. With this feature we will be able to compare the behavior of export performance across subsectors as well.

In section 2, we briefly summarize current findings related to food safety and quality regulations and introduce HACCP system; section 3 explores some issues on the interactions between competitiveness and food safety and quality standards. In section 4, our data set is introduced; in section 5 we present our model and estimation results. Section 6 concludes.

2. Regulations on Food Safety and Quality: Lessons for Developing Countries

Quality and food safety standards in the food sector have been an essential component of food consumption parallel to economic development. With the increases in income, consumers in developed countries started to be selective on the products they use (Mahe and Ortalo-Magne 1998, Roberts et al. 1999). We can define food safety as food being free from chemical and biological danger or from anything else which may generate adverse health effects (Unnevehr and Hirschhorn 2000). Health hazards from food can arise from the raw materials used, from handling and through the other stages involved in the processing, transportation, storage and the sale of the food. Major food hazards include microbial contamination (salmonella), pesticide residues and veterinary drugs (organochlorines, dioxins), and environmental contaminants (cadmium, lead) (Abalaka 1999).

Food quality has dimensions related to both production process and final product. Its determinants can be grouped into four as hygienic properties, nutritional properties, functional properties and organoleptic properties (Abalaka 1999). Briefly, it can be defined as the subjective or objective valuation of food with respect to any or all of these four properties. Although safety and quality can be thought as two different dimensions, in practice safety is a prerequisite for the quality.

The risk of morbidity and mortality related to food consumption makes these issues a public policy issue as consumers can not determine food safety in advance and firms can not warrant food safety completely (Antle 1999, Unnevehr and Jensen 1999). Henson and Caswell (1999) explore contemporary issues in food safety regulation. One important component of their analysis is the evolution of criteria for instituting food safety regulations. It is essential that all stake-holders including consumers, food manufacturers, food retailers and farmers be involved. The scientific approach to food safety regulation handles this issue in the framework of risk analysis, which is a structural approach whereby risks to human health are evaluated and the best means for their control are identified (FAO/WHO 1995, 1997). This approach consists of a three-stage process: (1) risk assessment, which includes hazard identification, hazard characterization, exposure assessment, and risk characterization, (2) risk management which includes risk evaluation, option assessment, option implementation, monitoring and review, and (3) risk communication, the distribution of information about the risk and chosen methods of control among interested parties.

The economic rationale for food safety regulation stem from the concept of a social optimum level of risk, defined by the equality of the marginal costs and marginal benefits of changes in the level of food safety (Henson and Traill 1993, Henson and Caswell 1999, Antle 1999). In practise, it has been applied through the regulatory

impact analysis, which is a quantitative assessment of the benefits and costs. This technique has been applied in most of the OECD countries.

Another important concern in food safety and quality studies is the identification of best possible form of state regulations among different alternatives. Command and control (direct regulations) and the market enhancing regulations represent the two general forms of regulations. In the environmental economics literature, the best form of regulations has been studied extensively. Out of these studies, market enhancing (information-based) regulations such as taxation, have been shown to be superior to command and control, such as process and performance standards, in general. Nevertheless there are exceptions to this, and food safety seems to be among these exceptions. Performance standards are costly during the inspection process and due to difficulties to measure pathogen standards, they are not suitable. Today trends are towards warranting food safety during the production process. In many countries especially in EU this type of regulation system mostly adopted is HACCP, Hazard Analysis at Critical Control Points.

HACCP system establishes process control through the identification of points that are most critical to control and to monitor in the production process. It has a preventive focus and it is designed to provide enough feedback to direct corrective activities (Unnevehr and Jensen 1999). The seven key principles of HACCP system can be summarized as follows (NACMCF 1992):

1. assess the hazard, list the steps in the process at which significant hazards can occur and describe the prevention measures;
2. determine the critical control points (CCPs)[2] in the process;
3. establish critical limits for each CCP
4. establish procedures to monitor each CCP
5. establish corrective actions to be taken when monitoring indicates a deviation from the CCP limits;
6. establish record keeping for the HACCP system, and
7. establish procedures to verify that the HACCP system is working correctly.

Although HACCP is a process system, there is also performance standard dimension in it. As seen in the above principles, HACCP obligates demonstration of critical control points and measurable indicators related to them; it replaces expensive measuring methods with moderate ones by changing the focus of measurement. Secondly, it identifies critical control points in the production process, and thus food safety hazards can be prevented, eliminated, or reduced to acceptable levels before they occur. Thirdly, it gives enough freedom to firms on design and implementation, and thus is effective in reducing the cost of compliance; a number of studies have

[2] A CCP is any point in the chain of food production where the loss of control would result in unacceptable food safety risk.

shown that HACCP is a cost-effective and functional approach to food safety regulation (Unnevehr and Jensen 1996, Crutchfield et al. 1997). Food Safety and Inspection Services (FSIS) in the USA has done a regulatory impact analysis for a period of more than 20 years related to HACCP (Roberts et al. 1996). This study shows that total benefits of HACCP regulations range between 7.13 and 26.59 billion dollars and total cost ranges between 1 and 1.2 billion dollars. Thus, application of HACCP turns out to be desirable.

Application of HACCP system is being mandated in an increasing number of developed countries. Starting from 1995, European Union requires food companies to implement HACCP (EU Directive 93/43). In the USA, HACCP system is effective in seafood (1994), and in meat and poultry (1996), and is being spread to other food sectors (Morris 1997). Similar trends are also seen in Canada, Australia and New Zealand (Peters 1997). Mostly due to the trade connections, it is also being increasingly practised in developing countries (Merican 1996). It would be a wise step to facilitate its wide application in MENA countries as well.

3. Competitiveness, Food Safety and Quality Standards

Food quality and safety is an example of information asymmetry between sellers and buyers. Sellers know the quality and safety attributes of their products much better than buyers, and it is hardly possible for buyers to fully assess these attributes during the transaction. With these features, this issue falls into the boundaries of adverse selection problem (Akerlof 1970). Adverse selection here refers to the fact that buyers may choose low quality or less safe food items because of lack of information. Existence of asymmetric information increases the transaction costs and hence generates private incentives to decrease such costs (Holleran et al. 1999). Akerloff (1970) showed that institutional warranties such as quality assurance standards play an important role to solve such problems. Holleran et al. (1999) state that food quality and safety standards are voluntarily accepted and applied by the firms to improve their competitiveness. This motivation guides the firms towards quality assurance systems. There are various quality and food safety assurance institutions. Fundamental operation principles in these institutions are the documentation, third party control and accreditations. Quality assurance systems (QAS) supply the quality and safety demand by consumers. QASs aim to increase the competitiveness by providing confidence on quality and safety in the food production chain (Morris 2000). These structures are being accepted as important business strategies in the agriculture sector, for example, in UK.

Transaction costs between buyers and sellers have several dimensions: 1) information search cost for quality assurance and food safety, 2) negotiation cost, 3) monitoring

and enforcement cost (Hobbs 1996). Obviously increases in transaction costs make the transaction less likely. Hence the firms are integrating themselves to QASs to reduce the transaction costs, especially related to the first dimension. In addition, Mazzocco (1996) and Bredahl and Zaibet (1995) show that most of the firms integrated to QASs have seen not only declines in the cost of transactions but also have experienced improvements related to their production process and final product. Among these, increases in productivity, better management, improvements in consumer relations, elimination of deficiencies in production processes (discovered during the documentation stage of QAS, for example), better adaptation of new personnel, and the conservation of current customers. Bredahl and Zaibet (1995) showed that total cost of integrating to QASs for the firms they studied was less than the benefits acquired directly or indirectly through the channels mentioned above. Consequently, they state that integrating to QASs with consideration of quality and safety standards is an important strategy for firms.

ISO 9000, an example of QAS, is in the international platform for more than 10 years. Especially in UK use of ISO 9000 standards is widespread. Nearly half of the certificates given in the world are issued in UK. Firms in food industry are also getting these certificates rapidly. Holleran and Bredahl (1997), Lloyds (1995), and Seddon et al. (1993) investigated the reasons why firms were trying to obtain ISO 9000 (QASs in general) in detail. Firms are trying to get quality assurance certificates for two reasons: one is related to firm driven factors, and the other one is customer and regulation driven. Lloyds (1995) showed 82% of the firms in food sector got ISO 9000 to increase efficiency. Other researchers demonstrated that internal motivations were important to get ISO 9000 in non-food sectors as well. Firm's size, existing quality assurance systems and complexity of the production processes are also important in this context. Seddon et al. (1993) indicate that big firms are getting ISO 9000 for internal reasons and small ones are getting them for mainly external factors. The motivation for small firms to get quality assurance systems is mainly associated with acquiring new customers and conserving the old ones rather than decreasing the cost of production.

<Insert Table I here>

Integration to QASs will be especially important for food companies based in developing countries and exporting into developed countries where the food safety and quality standards are rising continuously. Table I. shows the food exports of MENA countries into industrial economies for the period 1993-1996. The European Union market is the largest recipient of fresh food products from the MENA region. Given the transition to even higher European food safety and quality standards as summarized in White Paper (2000), food companies based in the MENA region should be preparing themselves for these new market conditions so as not to lose their shares. Firms must bear in mind the possibility of the use of these standards as non-

tariff barriers. Kramer (1988), Hooker and Caswell (1996), and Henson and Loader (1998) study this aspect of the standards. WTO is trying to prevent the use of standards as non-tariff barriers through the Sanitary and Phytosanitary and Technical Barriers to Trade Agreements. Henson and Loader (1998) showed that entrance into the markets in developed countries by firms based in developing countries (LDC) would be getting difficult in practice. Nimon and Beghin (1999) investigated certificates given by EU to firms showing satisfactory environmental performance; they showed that none of the 48 EU issued certificates related to 249 products was given to the firms in developing countries. Thus, the use of standards as non-tariff barriers needs to be closely followed. Similar developments have been seen in international supply chains as well. The firms in countries that have high food quality and safety standards are requesting the same standards from the firms located in the lower end of the production chain. In this regard, governments should also provide expert help to the firms on what constitutes a violation of WTO agreements on food safety and quality standards as a disguised tariff barrier. If such cases are detected they could be taken to the WTO dispute panel for a resolution[3]. Although the misuse of food safety and quality standards is an important issue, it seems that the EU market is not falling into this category because the standards are being raised for both the domestic and foreign producers. So, in the rest of this paper we will study the impact of compliance with higher standards on the export performance of the firms to determine whether it is worth investing for higher food safety and quality.

Our empirical analysis will be based on exports of Turkish food industry into the European Union. Turkey changed her economic policy in 1980s towards more liberal economy and higher exports. During this transition, the structure of the exports changed from agricultural products towards industrial ones. Export of food products, for which the European Union is the largest market, has an important share in total exports of Turkey. Recently, EU has started to increase the stringency of her regulations related to food quality, safety and environmental standards as described in White Paper (2000). In the following sections, export performance of the firms in Turkish food industry will be analysed in the context of food quality, safety and environmental standards in the EU market. The current situation and measures to improve the competitiveness of Turkish food industry will be investigated by using the firm-level data.

[3] Currently, applications for disguised trade measures to WTO panel have been made by mainly developed countries with India being the only exception.

4. Data

We have designed a survey to collect firm-level data from firms operating in the five subsectors of Turkish food industry: canned vegetables, tomato products, fruit juices, olive oil, and fish products. The firms are chosen among those exporting into the European Union. The number of firms selected from each sub-sector varied (31 in canned vegetables, 32 in tomato products, 9 in fruit juices, 15 in olive oil, and 17 in fish products) because of the heterogeneity in the total number of firms across sub-sectors. Nevertheless, our sample included almost all firms in the export market in each of these subsectors (the minimum export share of the included firms in each sector is around 85% at least). Our survey comprised of four main parts: questions (i) on compliance with quality and safety standards, (ii) on vertical integration, (iii) on environmental performance, and (iv) on exports. Face-to-face interviews are carried out with the firms. When relevant, the answer for each question is taken for the three consecutive years 1997, 1998, and 1999. By using the collected data, indices for compliance with quality and safety standards, vertical integration and environmental performance have been constructed for each year, which will be explained in detail below. Then, we have analysed the impact of quality and safety index on the export performance of the firms along with the impact of vertical integration, environmental performance, and some other firm specific factors such as experience in export markets and implementation of HACCP principles.

5. Model

We draw on the literature on the firm-level determinants of the export performance. Recent surveys of this literature have been carried out by Katsiekas et al. (1996) and Zou and Stan (1998). Zou and Stan (1998), a more recent and extensive survey as compared to Katsiekas et al. (1996), show that several indicators of export performance such as level of exports, growth rate (financial indicators), goal achievement and perceived success (non-financial indicators) are used in different studies. They identify 33 different independent variables thought to have impact on the export performance. Among these, we can mention export planning, market research utilization, product adaptation, product strengths, promotion intensity, distribution channel relationships, management's international experience, firm's size, firm's technology, export market barriers, and domestic market characteristics. These variables can be grouped into several categories: (i) external (such as export market barriers, and domestic market characteristics) and (ii) internal factors (such as product strengths and management's international experience); a different classification often done in marketing literature groups the independent variables as (i) controllable (such as product adaptation, product strengths, and promotion intensity) and (ii) uncontrollable (such as management's international experience, as export market

barriers, and domestic market characteristics). Their meta analysis of the empirical studies in the literature shows that the evidence on the impact of these 33 variables on export performance is mixed. Among these variables, compliance with quality, safety and environmental standards are not listed; product strengths can be seen the closest variable. Thus, we decided to construct an index for the compliance with quality, and safety standards. Similar indices are also developed for the vertical integration of the firms and their environmental performance. By identifying their impact on the export performance of the firms, we will not only address our main goal of investigating how the firms in developing countries should respond to increased standards in the developed countries, but also we will close an important gap in the literature of firm level determinants of export performance. We now explain the details related to the construction of these variables.

The compliance with quality and safety standards, represented by quality index, is derived from 23 questions in the survey. Among these questions, we can mention the ones related to (i) the existence of quality control systems in the raw-material, production and final product stages; (ii) the existence of periodical education programs for employees on standards and general operations; (iii) the existence of quality assurance certificates such as ISO 9000; (iv) the existence of the research and development department; (v) whether the firm tries to collect feedback from the customers; (vi) whether their exports have ever been subject to detentions due to quality and safety standards; (vii) whether there are recent investments for higher quality products and/or for higher food safety; (viii) whether good manufacturing practices are applied or not. For each question, positive responses are scored as 1 and negative responses as 0; then a total score is obtained for each firm and for each of the three years. This makes up the quality index variable. For a similar index construction in a different context, one can look at, for example, Dasgupta et al. (1995). A higher value of quality index indicates a better compliance with quality and safety standards.

The environmental index measures the importance given to the compliance with environmental standards by the firm and it is a measure for the environmental performance. The index is based on the questions such as the existence of cleaning-up facilities if the production generates pollution, whether there are recent investments to reduce pollution generated, whether the product has any eco-labels, whether the energy source is coal or natural gas, and whether the firm considers better environmental performance as a factor to increase the exports. Similar to the quality index, positive responses are scored as 1 and negative responses as 0; then a total score is obtained for each firm as a proxy for environmental performance.

The vertical integration index is a proxy for the control of the firm on the production process starting from the purchase/production of raw material to the final destination of the produced item. It has been constructed by summing the scores regarding the

control of the firm on each of the following stages: (i) procurement of the raw material (whether it has been produced by the firm or purchased from other firms), (ii) production of the final product (whether the firm produces the exported product or purchases it from other firms), (iii) marketing, and (iv) distribution. For any stage, if the control belongs to firm, a higher score is assigned, and then the scores for each stage are summed up to get the vertical integration index. A higher score indicates stronger vertical integration.

Finally, the experience of firms in the export market is also included in the model (which is measured by the number of years of exporting into the European Union). Existence of the HACCP certification is the last factor considered as it is being increasingly required in the European market.

Export performance is measured by the value of exports in dollars. These numbers are taken from the firms themselves in the survey. Some of the firms were reluctant to give this information and thus, number of observations in the regressions below are less than the number of firms interviewed.

Our general model, which posits that export performance is a function of the indices constructed above, is as follows:

$$\text{Value of Exports} = F(\text{Quality Index, Environmental Index, Vertical Integration, Experience, HACCP}) \quad (1)$$

This model is estimated by both parametric linear regression and the non-parametric regression. One advantage of non-parametric regression is that it does not require a linear relationship and more importantly, it does not even specify any functional form to start with. Thus, our approach will result in very general indications. We start with the linear least squares regression estimates of our data.

5.1. Estimation with Parametric Linear Least Squares Regression

We combined our survey results for 1997, 1998 and 1999 and estimated the following model:

$$\text{Log(Exports)} = \alpha + \beta_1 \text{Qind} + \beta_2 \text{Envind} + \beta_3 \text{Hist} + \beta_4 \text{Verint} + \beta_5 \text{HACCP} + \text{Error}$$

where Qind refers to quality index, Envind refers to environmental performance index, Hist refers to history, and Verint represents vertical integration. Due to the differences in the magnitudes of the dependent and independent variables, better results are obtained with logarithm of exports as dependent variable. Estimated values for the coefficients are given in Table II below.

<Insert Table II here >

Overall regression is significant, and except HACCP variable, all independent variables are also individually significant. Value of exports is positively related to each of the 5 independent variables; that is to say, better compliance with quality and safety standards, better environmental performance, stronger vertical integration, higher experience, and application of HACCP principles all result in higher exports. The European food market gives positive premium to compliance with food safety, quality and environmental standards.

The same analysis is repeated for each of the three years to see whether the relationship between export performance and the independent variables of our model shows differences across years. Qualitatively, the results are same, but quantitatively some differences are observed. Given that our independent variables are constructed in an ordinal manner, what matters is only the qualitative impact. The estimation results for each of the three years are given in the appendix (Tables IV, V, and VI). It should be noted that the significance of variables changes across years.

After the analysis of our data across years, a natural and interesting extension is the behaviour of our model across the five subsectors of the food industry included in our study; that is to say, it is of interest to identify the impact of our independent variables on the export performance in olive oil, tomatoes products, canned vegetables, fish products and fruit juices sectors separately. Nevertheless, the number of observations was very heterogenous across these five sectors, and in most of the cases it was very limited (17 in fruit juices, 26 in olive oil, 32 in fish products, 84 in tomato products, and 97 in canned vegetables when all three years are combined). As the number of observations are not enough in some sub-sectors, linear least squares regression estimation will not be reliable. To overcome this problem, a nonparametric regression method has been applied. Moreover, estimation with this method has also very useful implications for our general model in (1) as well.

5.2 Across Sectors Analysis — Nonparametric Regression

The use of nonparametric techniques is very important in comparing the impact of quality index (measuring the compliance with food quality and safety standards), environmental index, vertical integration and other variables on the export performance of the firms across five sectors. This could not be done by parametric techniques reliably due to small sample sizes in some sectors as mentioned above.

Nonparametric kernel estimation technique used in this study has several advantages. Firstly, the estimates of the coefficients are not constrained by any a priori assumption

about the functional relationship between the dependent and independent variables. Given the lack of theoretical model describing the relationship between export performance and our list of independent variables related to the compliance with standards, the specification of linear regression above can not be justified easily. Thus, the estimation of our general model in (1) with the non-parametric kernel regression method will be very useful and will make our results more general and applicable. Secondly, with this non-parametric kernel estimation method, it is possible to obtain point estimates of the coefficients for each of the independent variables for *each observation* in the sample. Therefore, if we can identify each of the five sub-sectors in our sample (which can be done by ordering the observations across sectors initially), we can obtain the impact of independent variables on the export performance across sectors. A brief description of the non-parametric kernel method is given in appendix 2. The estimation results with this method are in Table III below.

<Insert Table III here>

The values in Table III represent the average gradient of export performance with respect to the independent variables (that is, the change in export performance per change in the level of the given independent variable). Firstly, estimates of each gradient for each of the sample observation are obtained; then, the averages of these values are taken (only the statistically significant observations are used in the calculation of the averages). As seen in Table III, the impact of each variable on the export performance is positive (except the experience variable in the Fish Products sector). The estimation results in Table II and Table III are very similar to each other (qualitatively), thus the assumption of linearity does not seem to be very strong. Again as seen in Table III, the behaviour of export performance with respect to compliance with standards, vertical integration and other variables is very similar across sectors with the exception in fish products mentioned above.

6. Conclusions

Firm-level determinants of export performance have been analyzed extensively in the literature; however, the impact of compliance with higher quality, safety and environmental standards has not been considered before. Investigation of this relationship is very important especially for food industries of developing countries as their food exports, an important item in their overall exports, are mainly into the developed countries where food quality and safety standards are increasing rapidly. Our analysis also explores the impact of vertical integration on the export performance. In this way, we not only contribute to this literature but also present an empirical analysis of how firms in developing countries should respond to increased standards in developed countries.

Our analysis of the firm-level survey data collected from face-to-face interviews with companies operating in the five subsectors of the Turkish food industry, shows that the vertical integration, environmental performance and quality indices have significant positive impact on the export performance of firms. The results are similar across subsectors and across years included in our study. With this evidence on Turkish firms, we suggest that firms based in MENA countries should try to improve their products with respect to quality and safety features; this will have positive impact on their exports into developed countries, especially into the European Union.

White Paper (2000), prepared as a new guideline for food products in the European Union, proposes raising standards to very high levels by 2004. The European Food Authority recommended in White Paper (2000) has already been established before the end of 2000. In light of all these developments and our empirical findings, food companies based in developing countries should take required steps towards environment-friendly products with improved quality and safety features in order to avoid detentions of their products. Governments will also have important role in such a transition as steps towards food products with higher quality and safety should be taken not only for preserving export markets but also for public health considerations.

Finally, the use of HACCP—(Hazard Analysis of Critical Control Points) is becoming obligatory in many different subsectors of the food industry in Europe. Our survey results indicate that most of the food companies in Turkey are either not aware of HACCP system or do not take it into consideration seriously. We believe that similar behavior will be present in food companies based in other MENA countries. Under the recent developments in European food industry in regards to HACCP regulations, it will be worthwhile for governments of the MENA countries to develop policies for the speedy introduction and implementation of HACCP principles in their food industries.

References

Abalaka, J.A., 1999, Assuring Food Quality and Safety: The Role of Governments, presented in the Conference on International Food Trade Beyond 2000, Australia.

Akerloff, G., 1970, "The Market for Lemons: Quality Uncertainty and Market Mechanism," *Quarterly Journal of Economics*, 84, 488-500.

Antle, J.M., 1999, "Benefits and Costs of Food Safety Regulation," *Food Policy*, 24, 605--623.

Bredahl, M., and L. Zeibat, 1995, "ISO 9000 in the UK Food Sector," *The Complete European Food Digest*, 3(2), 29-31.

Crutchfield, S.R, J.C. Buzby, T.Roberts, T. Ollinger, M.Lin, 1997, "An Economic Assessment of Food Safety Regulations: The New Approach to Meat and Poultry Inspection," *ERS, US Department of Agriculture*, Washington, DC.

Dasgupta S., A. Mody, S. Roy, and D. Wheeler, 1995, "Environmental Regulation and Development: A Cross-Country Empirical Analysis" *Policy Research Working Paper* 1448, Policy Research Department, World Bank Washington, DC.

Fan, J. and I. Gibels, 1996, Local Polynomial Modeling and Its Applications, Chapman and Hall, London.

FAO/WHO, 1997, *Risk Management and Food Safety*, FAO, Rome.

FAO/WHO, 1995, *Application of Risk Analysis to Food Standards Issues*, WHO, Geneva.

Henson, S., and J. Caswell, 1999, "Food Safety Regulation: An Overview of Contemporary Issues," *Food Policy*, 24, 589-603.

Henson, S. and R. Loader, 1998, "Impact of Sanitary and Phytosanitary Standards on Developing Countries and the Role of the SPS Agreement," presented at the Food Quality and Safety Standards in Trade in Agricultural and Food Products, London.

Henson, S., and W.B. Traill, 1993, "The Economics of Food Safety," *Food Policy*, 18 (2), 152-162.

Hobbs, J., 1996, "Transaction Cost and Slaughter Cattle Procurement: Processors' Selection of Supply Channels," *Agribusiness*, 12(6), 509-523.

Holleran, E., M.E. Bredahl, L. Zeibat, 1999, "Private Incentives for Adopting Food Safety and Quality Assurance," *Food Policy*, 24, 669-683.

Holleran, E., M.E. Bredahl, 1997, "Food Safety, Transaction Costs and Institutional Innovation in the British Food Sector," in Schiefer, G., R. Hilbig (eds*) Quality*

Management and Process Improvement for Competitive Advantage in Agriculture and Food, University of Bonn, Bonn.

Hooker, N.H., and J.A. Caswell, 1996, "Regulatory Targets and Regimes for Food Safety: A Comparison of North America and European Approaches," in J.A. Caswell (ed.) *The Economics of Reducing Health Risk from Food*, University of Connecticut.

Katsikeas, C.S., N.F. Piercy and C. Ioannidis, 1996, "Determinants of Export Performance in a European Context," *European Journal of Marketing*, 30(6), 6-35.

Kramer, C.S., 1988, "Harmonizing Health and Sanitary Standards in the GATT: Proposals and Issues," *Discussion Paper Series* No: FAP88-02, National Center for Food and Agricultural Policy, Washington, DC.

Lee, T., and A. Ullah, 1999, Nonparametric Bootstrap Tests for Neglected Nonlinearity in Time Series Regression Models," manuscript, University of California, Riverside.

Lloyds Register Quality Assurance, 1995*, ISO 9000: Setting Standards for Better Business*, Hoboken, NJ.

Mahe, L.P. and F. Ortalo-Magne, 1998, "International Cooperation in the Regulation of Food Quality and Safety Attributes," paper presented at the OECD Workshop on Emerging Trade Issues in Agriculture, Paris.

Mazzocco, M., 1996, "HACCP as a Business Management Tool," *American Journal of Agricultural Economics*, 78, 770-774.

Merican, Z., 1996, "Dealing with an Expanding Global food Supply," *Journal of Food Protection*, 59, 1133-1137.

Morris, C., 2000, "Quality Assurance Schemes: A New Way of Delivering Environmental Benefits in Food Production*?" Journal of Environmental Planning and Management*, 43(3), 433-448.

Morris, C., 1997, "HACCP Update," *Food Engineering*, (July-August), 51-56.

Motarjemi, Y., F. Kaferstein, G. Moy, and F. Quevedo, 1993, "Contaminated Weaning Food: A Major Risk Factor for Diarrhoea and Associated Malnutrition," Bulletin of the World Health Organisation, 71(1), pp. 79-92.

National Advisory Committee on Microbiological Criteria for Foods (NACMCF), 1992, "Hazard Analysis of Critical Control Point System," *International Journal of Food Microbiology*, 16, 1-23.

Nimon, W. and J. Beghin, 1999, "Ecolabels and International Trade in Textile and Apparel Market," *American Journal of Agricultural Economics*, 81(5), 1078-1083.

Pagan, A., and A.Ullah, 1999, *Nonparametric Econometrics,* Cambridge University Press, New York and Melbourne.

Peters, R.E., 1997, "The Broader Application of HACCP Concepts to Food Quality in Australia," *Food Australia*, 49 (6), 270-274.

Racine, J., 1999, N© BETA, Computer Software, University of South Florida.

Roberts, D., T.E. Josling and D. Orden, 1999, "A Framework for Analyzing Technical Trade Barriers in Agricultural Markets," Technical Bulletin No. 1876, *Economic Research Service*, US Department of Agriculture.

Roberts, T., J.C. Buzby and M. Ollinger, 1996, "Using Benefit and Cost Information to Evaluate a Food Safety Regulation: HACCP for Meat and Poultry," *American Journal of Agricultural Economics*, 78(5), 1297-1301.

Roberts, T., K.D. Murrell, and S. Marks, 1994, "Economic Losses Caused by Foodborne Parasitic Diseases," Parasitology Today, 10(11), pp. 419-423.

Seddon, J., R. Davis, M. Loughran, R. Murrell, 1993, "BS 5750 Implementation and Value Added: A Survey of Registered Companies," Vanguard Consulting Ltd., Buckingham.

Unnevehr, L., and N. Hirschhorn, 2000, Food Safety Issues in the Developing World, World Bank Technical Paper No. 469, World Bank, Washington, DC.

Unnevehr, L.J., and H.H. Jensen, 1999, "The Economics Implications of Using HACCP as a Food Safety Regulatory Standard," *Food Policy*, 24, 625-635.

Unnevehr, L.J., and H.H. Jensen, 1996, "HACCP as a Regulatory Innovation to Improve Food Safety in the Meat Industry," *American Journal of Agricultural Economics*, 78, 764-769.

White Paper, 2000, White Paper on Food Safety, Commission of the European Communities, Brussels.

Zou, S. and S. Stan, 1998, "The Determinants of Export Performance: A review of the Empirical Literature between 1987 and 1997," International Marketing Review, 15(5), 333-356.

Appendix 1.

Table I. Fresh Food Exports* from MENA region to Industrial Economies
(Value $1000)

	Year			
	1993	1994	1995	1996
Total Fresh Food Exports	1,869,424	1,998,296	2,515,215	2,439,427
Total Agriculture Exports	3,243,083	3,573,807	4,210,471	4,158,497
Total Exports	37,081,561	40,463,870	48,855,575	46,828,172
Fresh as a percent of agriculture exports	57.64	55.92	59.74	58.66
Agriculture as a percent of total exports	8.75	8.83	8.62	8.88
Fresh Food Exports by Major Market				
European Union	1,528,169	1,595,445	2,007,326	1,965,509
North America	56,089	52,648	73,739	70,083
Japan	264,692	326,421	432,279	390,350

* Fresh food includes meat, fish, fruit and vegetable.
Source: Unnevehr and Hirschhorn (2000).

Table II. Parametric LS estimation results of the general model in equation 1.
(All three years combined.)

Dependent Variable:		LOG (Exports)			
Number of Observations:		256			
	Ind. Variables	Coefficient	Std.Error	t-Stat.	p-value
	C	9.286059	0.603540	15.38600	0.0000
	QIND	0.103405	0.030075	3.438281	0.0007
	ENVIND	0.175316	0.060219	2.911301	0.0039
	HIST	0.033930	0.011207	3.027663	0.0027
	VERINT	0.135666	0.036654	3.701268	0.0003
	HACCP	0.227943	0.265455	0.858687	0.3913
R-squared	0.227520	Adjusted R-squared			0.212070
F	14.72657	p-value			0.0000

Table III. Nonparametric estimation results of the general model in equation 1. Sectoral Analysis.

	Olive Oil	Fish Products	Canned Vegetables	Tomato Products	Fruit Juices
Quality Ind.	0.094	0.129	0.093	0.096	0.092
Environmental Ind.	0.113	0.099	0.114	0.113	0.114
Experience	0.037	-0.013	0.039	0.035	0.040
Vertical Integration	0.104	0.045	0.106	0.101	0.107
HACCP	0.305	0.425	0.300	0.311	0.298

Table IV. Parametric LS estimation results of the general model in equation 1. Year : 1997

Dependent Variable:		LOG (Exports)			
Number of Observations:		78			
	Ind. Variables	Coefficient	Std.Error	t-Stat.	p-value
	C	9.685378	1.166.457	8.303242	0.0000
	QIND	0.098229	0.053098	1.849961	0.0684
	ENVIND	0.075736	0.134443	0.563335	0.5750
	HIST	0.028097	0.018528	1.516448	0.1338
	VERINT	0.155783	0.067918	2.293685	0.0247
	HACCP	0.215321	0.623446	0.345372	0.7308
R-squared	0.164215	Adjusted R-squared			0.106174
F	2.829	p-value			0.021762

Table V. Parametric LS estimation results of the general model in equation 1. Year : 1998

Dependent Variable:		LOG (Exports)			
Number of Observations:		87			
	Ind. Variables	Coefficient	Std.Error	t-Stat.	p-value
	C	8.139.000	1.061.063	7.670.609	0.0000
	QIND	0.130547	0.052530	2.485175	0.0150
	ENVIND	0.271706	0.108410	2.506283	0.0142
	HIST	0.036572	0.019965	1.831798	0.0707
	VERINT	0.146614	0.065854	2.226343	0.0288
	HACCP	0.224455	0.454016	0.494377	0.6224
R-squared	0.302045	Adjusted R-squared			0.25896
F	7.010659	p-value			0.000017

Table VI. Parametric LS estimation results of the general model in equation 1.
Year : 1999

Dependent Variable:		LOG (Exports)			
Number of Observations:		91			
	Ind. Variables	Coefficient	Std.Error	t-Stat.	p-value
	C	1.015.175	0.904338	1.122561	0.0000
	QIND	0.081519	0.049398	1.650237	0.1026
	ENVIND	0.160260	0.091147	1.758258	0.0823
	HIST	0.035854	0.017546	2.043.367	0.0441
	VERINT	0.101132	0.057706	1.752519	0.0833
	HACCP	0.341811	0.416569	0.820541	0.4142
R-squared	0.236411	Adjusted R-squared			0.19149
F	5.263293	p-value			0.000293

Appendix 2.

Nonparametric Kernel Method

One can look at Pagan and Ullah (1999) for detailed description on non-parametric kernel method used in our analysis. Lee and Ullah (1999) present a compact introduction to this technique.

Consider the stochastic process $\{y_t, x_t\}$, $t = 1,2,...,n$; where y_t is a scalar and $x_t = (x_{t1}, x_{t2},..., x_{tq})$ is a $(1 \times q)$ vector which may contain the lagged values of y_t. The regression model is $y_t = m(x_t) + u_t$, where $m(x_t) = E(y_t \mid x_t)$ is the true but unknown regression function and u_t is the error term such that $E(u_t \mid x_t) = 0$.

If $m(x_t)$ is a correctly specified family of parametric regression, then one can construct the ordinary least squares (OLS) estimator of $m(x_t)$. For example, if $m(x_t) = \alpha + x_t\beta = X_t\delta$, where $\delta = (\alpha \quad \beta')'$ and $X_t = (1 \quad x_t)$, is linear we can obtain the OLS estimator of δ by minimizing $\sum u_t^2 = \sum (y_t - X_t\delta)^2$ as

$$\hat{\delta} = (X'X)^{-1}X'y .$$

However, it is well known that if the specified regression $X_t\delta$ is incorrect then the OLS estimates $\hat{\delta}$, and hence $\hat{m}_t = X_t\hat{\delta}$, are inconsistent and biased, and they may generate misleading results.

An alternative approach is to use the consistent nonparametric regression estimation of the unknown $m(x)$ by the local linear least squares (LLLS) method. For obtaining the LLLS estimator we first write first-order Taylor series expansion of $m(x_t)$ around x so that

$$\begin{aligned} y_t = m(x_t) + u_t &= m(x) + (x_t - x)m^{(1)}(x) + v_t \\ &= \alpha(x) + x_t\beta(x) + v_t = X_t\delta(x) + v_t , \end{aligned}$$

where $\alpha(x) = m(x) - x\beta(x)$, $\delta(x) = [\alpha(x)\beta(x)']'$, and $\beta(x) = m^{(1)}(x)$, and $m^{(1)}$ shows the first derivative. Then, solving the problem:

$$\min \sum_{t=1}^{n} v_t^2 K_{tx} = \min \sum_{t=1}^{n} (y_t - X_t\delta(x))^2 K_{tx}$$

with respect to $\delta(x)$, we get the LLLS estimator as:

$$\tilde{\delta}(x) = (X'K(x)X)^{-1}X'K(x)y$$

where $K(x)$ is a diagonal matrix of the kernel (weight) $K_{tx} = K((x_t - x)/h)$ and h is the window width. The LLLS estimators of $\alpha(x)$, $\beta(x)$ and $m(x)$ are calculated as $\tilde{\alpha}(x) = [1 \quad 0]\tilde{\delta}(x)$, $\tilde{\beta}(x) = [0 \quad 1]\tilde{\delta}(x)$ and $\tilde{m}(x) = \tilde{\alpha}(x) + x\tilde{\beta}(x)$. These LLLS estimators are consistent; for further details on properties, see Fan and Gijbels (1996) and Pagan and Ullah (1999).

The LLLS estimators of $\delta(x)$ and $m(x)$are also called the nonparametric kernel estimators which are essentially the local linear fits to the data corresponding to these x_i's which are in the interval of length h around x, the point at which δ is calculated. In this sense the LLLS estimator provides the varying estimates of δ with changing values of x. It depends on the kernel function K and the window width h. The function K is chosen to be a decreasing function of the distances of the regressor x_t from the point x, and the window width h determines how rapidly the weights decrease as the distance of x_t from x increases. In our empirical analysis we have considered an optimal parabolic kernel and the cross validated window width; for further details, one can see Pagan and Ullah (1999, ch.3) and Racine (1999). Econometric estimation of $\widetilde{\beta}(x)$ have been obtained by employing N© BETA, Computer Software (Racine 1999).