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Quality Response and Competitiveness of Fish Exports in Oman

L. Zaibet* and A. Al-Marshudi

Department of Agricultural Economics and Rural Studies, College of Agriculture, Sultan Qaboos University, P.O. Box 34, Al Khod 123, Sultanate of Oman

دور الجودة في تنافسية صادرات الأسماك العمانية

لقمان زعبيط و أحمد المرشودي

خلاصـــة: تعتـــبر عوائد السعة المتزايدة و تفرقة المنتجات و جودتها من العوامل المحددة في التجارة الدولية. و بناء على ذلك وفي ضوء إنفـــتاح الأسواق العالمية فإن تطوير الصادرات يعتمد على قدرة كل بلد على المنافسة على مستوى التكلفة و الجودة. و تعتبر نظم ضبط الجودة و سلامة الأغذية، مثل نظام الأيزو 9000 ونظام تحديد المخاطر و النقاط الحرجة HACCP، من العوامل المساعدة على إنسياب الـــتجارة الدولية. هذه النظم يمكن أن تحقق التميز على مستوي التكلفة وكذلك الجودة و هي عوامل أساسية في المنافسة الدولية و تحقيق الأرباح. هذه الورقة تبحث في العلاقة بين جودة المنتجات و تعظيم الأرباح و التنافسية.

ABSTRACT: Received trade theory presumes an important role for increasing returns to scale, product-differentiation, and quality as determinants of trade flows. In a global world, exports can only be expanded if a nation is competitive in terms of cost and quality of traded products. Food safety and quality systems, such as HACCP or ISO 9000, are indirectly included in international agreements (GATT) as facilitators of trade. These systems may lead to cost leadership and product improvement, which are key factors to higher competitiveness and sustained benefits in international markets. This paper estimates a modified Armington model that links product differentiation and safety programs to market shares, *i.e.* competitiveness.

Keywords: fish exports, Oman, quality response, competitiveness, product-differentiation.

Food processing firms, along with other business organizations, are launching improvement programs and strategies based on the latest management concepts for survival in the global market. Among the most popular of these concepts are the Hazard Analysis Critical Control Point (HACCP), ISO 9000 series of standards, Total Quality Management (TQM), and Business Process Reengineering (BPR). The main thrusts of adopting these systems include improving productivity and efficiency, decreasing costs, and increasing market share and customer satisfaction. Globalization and growing international competition from the emerging economies will bring additional pressure on developing countries' firms to implement quality control systems for successful export trade.

In developing countries most firms are interested in quality programs to ensure market access. Importing countries are imposing different regulatory and technical barriers that have the potential for restricting imports from these countries. The interest in applying food quality systems, such as HACCP, therefore, is motivated mostly by government laws designated to overcome such barriers. With globalization, market access is only a necessary but not a sufficient condition for survival. Competitiveness is the other requirement needed for survival.

In Oman, the government has made tremendous efforts to improve the fisheries manufacturing industry. For example, it has improved the business environment, trade policy, research and development, education and training. Gains in competitive advantage, however, will only come following the application of improved technologies, development of higher productivity and productive efficiency and a reduction in costs. These

*Corresponding author.

factors, which are controlled by individual firms, depend upon a company's ability to conduct effective management strategies.

The fisheries sector represents a major traditional economic activity in the Sultanate of Oman. At present, the value of seafood exports is second only to oil. The current economic vision of diversification of national income has prioritized development of the fisheries sector. Oman has exported seafood products to over 30 countries in the Gulf region (GCC), Europe, USA, and Asia (Table 1). Exports to the European Union (EU) amounted to 23% of the total over the period 1995-1997, thereby illustrating the importance of this market in capturing a relatively high share of Oman's exports. Following a ban on Omani exports in 1998, exports to the EU dropped dramatically. This resulted due to non-compliance of Omani processing firms to EU regulations.

The purpose of this paper is to develop a framework to measure quality response. Specifically, a modified Armington model is estimated to show the effect of non-price factors, namely food product differentiation and safety. The outcome of the paper shows how quality assurance programs can enhance the competitive position of seafood firms in international markets. The rest of the paper is organized into three sections. The first overviews product quality and safety systems in the food sector. The second discusses the influence of quality assurance on competitiveness, while the third section presents the theoretical framework and empirical results. Finally, the major implications deriving from the study are presented and discussed.

FOOD SAFETY SYSTEMS AND COMPETITIVENESS IN INTERNATIONAL MARKETS. International trade has been mostly limited to large corporations and multinational firms. In today's business environment, however, international trade has become a necessity for all firms (Root, 1987). There are many reasons pushing companies to enter international markets, including the development of new technologies that lead to economies of scale. In an industry with increasing returns to scale, a firm's optimum size could be very large, in terms of the volume of production, relative to the requirements of the domestic market. Limited markets at home and growing foreign markets have persuaded firms to enter new markets in search of greater sales volumes in order to reduce unit costs and to strengthen competitiveness.

While there is no generally accepted definition of competitiveness (Porter, 1990) most of the literature includes, implicitly or explicitly, changes in "market share" as an indication of a firm's or an industry's competitiveness (Scott, 1985; Bredahl *et al.*, 1995). Competitiveness could be defined as the ability of a firm, an industry, or a nation to maintain or increase

TABLE 1

The value of Omani fisheries exports by major regions.

Year	GCC	Europe	USA	Other	Total
1995	7.8	5.3	0.7	9.7	23.6
1996	6.5	5.4	0.7	11.5	24.2
1997	5.1	6	0.7	14.1	25.8

Source: Statistical Yearbook, Ministry of Commerce, 1998.

market share through a sustained period of time (Larson and Rask, 1992). This definition provides a basis for measurable competitiveness. Competitive position may be quantified using a number of indicators such as domestic market share, import market share from foreign countries, export penetration to foreign countries and cash receipt performance (Featherstone and Uhm, 1993).

International competitiveness is determined by price and non-price effects. Trade theory has revolved around price effects and those factors that determine the ability of industries or nations to reach price competitiveness (Lall, 1991). Other parameters that constitute key determinants to competitiveness include technology, scale economies, input costs, infrastructure, natural resources endowments, geographic location and government policy (Abbott and Bredahl, 1994; Larson and Rask, 1994). Porter (1990) has developed a theory of international competitiveness that summarizes all the above into four sets of forces *viz.* factor conditions, demand conditions, related and supporting industries, and firm strategy. The first three sets of factors directly influence a firm's competitiveness but are not controlled by the firm.

Non-price factors that are under the firm's control include product differentiation and quality content. Products are differentiated either horizontally (*i.e.*, brand) or vertically (*i.e.*, quality) (Reitzes, 1992). An extensive literature exists that considers the role of product differentiation and quality decisions in a firm's behavior as determinants of trade flows and trade policy (Reitzes, 1992). The adoption of quality assurance systems, which determine the quality of products, is among the factors controlled by firms and affect competitiveness. The focus of this paper is to identify a number of factors that could be measured at the firm's level which determine the adoption of quality assurance and consequently, determine indirectly the firm's competition.

Competing in international markets requires internationally accepted quality procedures. A firm may sell in international markets but cannot sustain its sales (position) and profits unless a strategy is adopted that illustrates a commitment to international production practices. The most critical element in planning international market entry strategies is the choice of

product. A firm may sell a product as long as it meets mandatory legal and technical requirements (such as HACCP) of the import market. An entry strategy, on the other hand, means the adaptation of domestic markets to foreign buyers' preferences, income and use conditions which requires a more comprehensive plan, including food safety and quality assurance programs.

Recent trade agreements, namely the Uruguay Round and its successor, the World Trade Organization (WTO), assumed that food quality regulations could become an effective trade barrier. Quality assurance will constitute a key element in international trade and competitiveness in food products (Hooker and Caswell, 1996). In food export markets there are at least two known food quality systems: the Hazard Analysis Critical Control Point (HACCP) and ISO standards.

HACCP is a preventive system designed for safe food control, the concept of which is applicable to the food chain starting from production, processing, packaging, storage, and distribution. This system was developed in the U.S.A. in 1974 (the U.S. Food and Drug Administration) and adopted by the United Nation's *Codex Alimentarius* Commission in 1993 (Codex, 1995). HACCP is based on concepts of good manufacturing practices (GMPs) and food sanitation procedures. HACCP quality control identifies potential hazards (biological, chemical, and physical), quantifies them, and then determines where in the processing flow the identified hazards can be eliminated. Although HACCP is not concerned with product quality it guarantees a food product which is perfectly safe.

ISO 9000 is a series of six standards: 8402, 9000, 9001, 9002, 9003, and 9004 promulgated by the international organization for standards to enhance trade between members of the European Union and those wishing to do business with them. These standards have become accepted worldwide as a quality assurance system and an integral part of TQM. By definition, "ISO 9000 is a standard for quality management systems . . . for ensuring the continued operation of the whole process, from purchasing of material to final delivery of finished goods to a quality management standard (Brian, 1991).

ISO 9000 Standards are used in contractual relationships between a company (supplier) and its suppliers (subcontractors) on one hand, and the company and its customers on the other. In this regard, ISO 9000 certification is interpreted as the "capability of the supplier to control the processes that determines the acceptability of the product or service being supplied" (Rabbitt, 1993). It is also expected that the adoption of the standards will facilitate trade between contracting companies and reduce search costs for purchasing materials and services.

In the food sector, HACCP has received more attention and has become mandatory for food production, import, and export. ISO 9000 standards, however, provide an excellent framework for the inclusion of the HACCP principles. The HACCP monitoring, corrective action, record-keeping, and verification requirements are already contained within ISO 9002.

New approaches to trade theory (such as the gravity model) explain trade flows by the existence of stimulating variables as opposed to resistance variables. Common standards (such as ISO 9000 or HACCP) could very well play this role. As a consequence, GATT 1994 recognized the important contribution of ISO and conformity assessment systems in facilitating the conduct of international trade (GATT, 1994). Therefore, it recommended ISO to be the basis for preparation of regional and national standards to remove unnecessary barriers and increase the volume of international trade. Failure to adopt accepted internationally-recognized food standards has resulted in many shipment rejections by importing countries. The FAO reported that "in the late 1980s, one country turned back some 18,000 food shipments valued at US $ 1,100 million in a single year" because of the lack of appropriate procedures and standards (FAO, 1996).

A MODIFIED ARMINGTON APPROACH FOR QUALITY RESPONSE. The Armington model has been used to differentiate commodities by country of origin, assuming goods from different exporting countries are imperfect substitutes within an importing country's commodity market. The Armington model emphasizes importer's non-competitive behavior. Export behavior, however, remains the same as in a competitive model. The modification occurs only in importer behavior *vis-a-vis* sources of supply (Abbott, 1988).

In the Armington model, commodities are distinguished by kind and by origin. A distinction is made between goods and products; goods of different origins are called products which are assumed to be imperfect substitutes for one another. The second assumption of the model is the separability of the import demand. The importer is assumed to have a separable utility function, which is maximized through a two-stage optimization. In the first stage, the importing country determines its demand for the set of goods regardless of their origin. In the second stage, it determines its demand for the particular product within the set of commodities. Finally, the Armington model assumes a constant elasticity of substitution for each product pair, in the same set of commodities.

A typical formulation of the model is as follows (Goldstein and Khan,1985):

$$M_{1ij}/M_{1i} = b_{ij}^{\sigma ij}\left(P_{1ij}/P_{1i}\right)^{-\sigma ij} \quad (1)$$

where M_{1ij} is the quantity of imports demanded in country i of good 1 of country j origin. M_{1i} is the quantity of good 1 demanded in country i from all other sources, s_{ij} is the elasticity of substitution for product ij and P_{1ij} and P_{1i} are the respective prices of product 1j and good 1.

Since preference of certain goods over others may be based on the quality perceived for these products, we used a modified Armington model to study the export behavior of Oman's fish exports to the EU. We analyzed the substitutability of fish products of Omani origin to products from other origins. Also we placed special emphasis on quality and safety regulations in the UK, namely the 1990 Food Safety Act, and their impact on imports from Oman.

The approach used in this paper follows Bismut and Martins' (1987) modified Armingtonian model that includes the degree of horizontal product differentiation or variety in the product bundle. This model offers a convenient framework to explain the competitiveness of exports by combining product differentiation with the size of product range and relative prices (Martins, 1993).

Model (1) could be modified to account for varieties. Following Martins, let's consider a two-level CES function with two composite goods A and B.

$$\cup = \left(a \sum_{i=1}^{n_a} x_{a_i}^{\theta_i} + b \sum_{i=1}^{n_b} x_{b_i}^{\theta_i} \right) \quad (2)$$

where x_{ai} and x_{bi} represent the varieties of the differentiated food offered by producer A and producer B, respectively. It is assumed that the two producers are distinguished by origin. It is also assumed that the number of varieties n_a and n_b are very large and only limited numbers m_a and m_b are available. The ratio of parameters a and b (a/b) represents the base period quantity share of producer A in total imports by producer B (Goldstein and Khan, 1985).

Maximization of the above utility from under a budget constraint yields the following market share ratio (v).

$$v = \left(\frac{b}{a}\right)^{-\sigma} \left(\frac{m_a^{\beta a}}{m_b^{\beta b}}\right) \left(\frac{P_a}{EP_b}\right)^{(1-\sigma)} \quad (3)$$

where $\beta_a = (1-\sigma)/(1-\sigma_a)$ and $\beta_b = (1-\sigma)/(1-\sigma_b)$, and m_a and m_b represent product varieties that are available on the market.

By logging either sides, equation (3) becomes:

$$\log v_i = c + \beta_i \log X_i + \beta_j \log X_j + (1-\sigma)\log \frac{P_i}{EP_j} \quad (4)$$

Alternatively, the market share, deflated by the observed price index is:

$$\log \frac{v_i}{P} = C + \beta_i \log X_i + \beta_j \log X_j - \sigma \log \frac{P}{EP} \quad (5)$$

where $P = \dfrac{P_i}{EP_j}$.

Equation (5) will be estimated to test the effect of relative prices $P = P_i/EP_j$ and product varieties X_{i1} and X_j on market shares. The interpretation to these effects depends on σ (Martins, 1993): If $\sigma > 1$, the higher the substitutability between aggregate producers, the stronger the impact of price competitiveness and the creation of new varieties. But the more that varieties are substitutable, the lower the impact of introducing new products. When $\sigma < 1$, there is no price competitiveness constraint but at the same time horizontal differentiation has an adverse impact on market shares.

DATA AND EMPIRICAL RESULTS. To estimate the market share equation (5) we need to define the dependent variable (the relative market share) as well as proxy variables for product varieties, X_i and X_j. The market share is given by the formula:

$$v = \frac{M_i}{\sum_k M_k - M_i}$$

where M_i is the value of imports from origin i, *i.e.* Oman and M_k is the value of imports from other countries. For the variables X_i and X_j, as no direct information is available on the number of products (varieties), we may use two proxies (Martins): (1) the volume of production or total catch and (2) GDP in the country of origin (Oman) and average GDP in the rest of the EU.

These data, along with prices, were collected from FAO (Fisheries) Statistics and MAF Annual Reports of Fisheries. Finally, a dummy variable was added to reflect on the FSA of 1990 in the UK (T = 0 for years

TABLE 2

Estimation of the relative market share equation.*

	C	B_j	B_i	$+\sigma$	T	R^2
Model (1)	-138	4.84	8.56	1.00	-4.48	.70
Proxy = GDP	(-6.8)	(4.54)	(3.68)	(3.53)	(-2.8)	
Model (2)	-130	5.77	3.05	0.76	0.53	.89
Proxy = Production	(-1.06)	(0.71)	(4.66)	(2.89)	(0.64)	

**t*-statistics are in parenthesis.

before 1990 and 0 afterwards). Estimation of equation (5) by OLS is presented in Table 2.

Parameter estimates are all significantly different from zero at the 5% level in the first model where the GDP is used as a proxy for the number of varieties. In the second model only B_i and σ are significantly different from zero and R^2 is relatively high in both models. The value of the elasticity of substitution (σ) of Oman's exports is relatively low ($\sigma < 1$). These values show the impact of price competitiveness to be insignificant but the effect of (non-price factors), *i.e.* horizontal differentiation, is more important. Also product differentiation proxies in both models indicate that these factors are significant in explaining market shares.

The fact that $\sigma < 1$ means that producers in Oman are generally protected against price competitiveness. Product differentiation, however, and other non-price factors need more attention. The dummy variable for the year 1990 was included in the model to capture the impact of the 1990 Food Safety Act issued in the UK. This variable was found to be significantly different from zero in the first model with a negative sign. This means that product safety in the form of government or regional regulations could have a serious impact on Oman's market share.

Conclusion

The implication of the results presented herein is that producers will be advantaged by adopting product safety and differentiation strategies that will sustain and improve market share in the EU. Omani fish companies need to acquire new technologies to take advantage of increasing returns to scale and product differentiation that are major trade determinants. With globalization, exports could be expanded if firms are competitive in terms of product quality and safety. The adoption of quality assurance systems may increase both volume and value of exports. Quality assurance is included in international agreements (GATT) and is required to enter many export markets - it may become crucial to higher and sustained benefits in international markets.

References

Abbott, C.P. 1988. Estimating U.S. agricultural export demand elasticities: Econometric and economic issues. In: *Elasticities in International Agricultural Trade*, C.A. Carter and W.H. Gardiner (Editors) 53-85. Westview Press, Boulder, U.S.A.

Brian, R. 1991. *ISO 9000*. Gower Publishing, Detroit, U.S.A.

Caswell. J. and N. Hooker. 1996. HACCP as an international trade standard. *American Journal of Agricultural Economics* (78):3.

Codex. 1995. *Codex Alimentarius Commission. Codex Alimentarius General Principles of Food Hygiene*. Alinorm 95/13, Rome, Italy.

Craig, R.J. 1994. The no no-sense guide to achieving ISO 9000 registration. *ASME Press*, NY, U.S.A.

FAO. 1996. *This is Codex Alimentarius (2nd Edition)*. FAO, Rome, Italy.

Featherstone, D. and I.H. Uhm. 1993. International competitiveness of Canadian fresh vegetables: a case study of tomato and potato markets. *Paper presented at the Southern Agricultural Economics Association's Annual Meeting*, Tulsa, Oklahoma.

Goldstein, M. and M. Khan. 1985. Income and price effects in foreign trade. In: *Handbook of International Economics*, R. J. Jones and P. Kenen (Editors) 1041-1105. North-Holland, Amsterdam.

Guidoum, M. 1997. Adding value to ISO 9000 implementation. *4th International Quality Conference*. Bahrain Society of Engineering and The Institute of Quality Assurance, Bahrain.

Hamel, G. 1997. The search for strategy. In: *Making Strategy*. The Economist. p. 7. March 1.

Jacobson, M. 1993. Quality management-ISO 9000. *Infofish International* (2):31-36.

Lall, S. 1991. Marketing barriers facing developing countries manufactured exports: a conceptual note. *The Journal of Development Studies* (27):4.

Larson, D.W. and N. Rask. 1992. Industry note: changing competitiveness in world soybean markets. *Agribusiness* 8:79-91.

Martins, J.O. 1993. Export Behaviour with Differentiated Products: Exports of Korea, Taiwan and Japan to the US Domestic Market. In: *International Trade Modelling*. M.G. Dagenais and P.A. Muet (Editors) 37-52. Chapman and Hall, New York, U.S.A.

Porter, M. 1990. *The Competitive Advantage of Nations*. The Free Press. N.Y. U.S.A.

Rabbit, J. and P. Bergh. 1993. *The ISO 9000 Book: A Global Source for Compliance and Certification*. Amacom Books, NY. U.S.A.

Reitzes, J.D. 1992. Quality choices, trade policy, and firm incentives. *International Economic Review* (33):4.

Root, R.F. 1987. *Entry Strategies for International Markets*. Lexington Books, D.C. Health Company, Lexington, Massachusetts, U.S.A.

Scott, B.R. 1985. US Competitiveness: Concepts, Performance, and Implications. In: *US Competitiveness in the World Economy*. B.R. Scott and G.C. Lodge (Editors) 14-15. Harvard Business School Press.

Zaibet, L. and M. Bredahl. 1997. The gains from ISO certification in the UK meat sector. *Agribusiness* 13:375-384.

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