Abdelhakim Hammoudi · Cristina Grazia
Yves Surry · Jean-Baptiste Traversac
Editors

Food Safety, Market Organization, Trade and Development

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Editors
Abdelhakim Hammoudi
INRA Institut National de la Recherche Scientifique
Ivry sur Seine
France

Cristina Grazia
Alma Mater Studiorum Università di Bologna
Dipartimento di Scienze e Tecnologie Agro-Alimentari
Bologna
Italy

Yves Surry
Swedish University of Agricultural Sciences
Department of Economics
Uppsala
Sweden

Jean-Baptiste Traversac
INRA Institut National de la Recherche Scientifique
Ivry sur Seine
France

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Introduction

1

Abdelhakim Hammoudi, Cristina Grazia, Yves Surry, and Jean-Baptiste Traversac

1.1 Food Safety, Trade and Development: The Role of Supply Chain Organization

Agrifood systems are increasingly being examined and judged by public opinion on their ability to deliver safe food products. In particular, the various disease outbreaks that occurred in recent decades at international level (mad cow disease, dioxin, salmonella, *E. coli*) have dramatically raised awareness of how intensive and highly industrialised systems can cause profound damage to consumers and producers. They also highlighted the difficulties and the cost of regulating food safety within a context of dramatically increased global trade. Regulations were already in force long before these crises, but have been drastically strengthened since then. Increasingly strict regulations have thus emerged at national and supranational level, for instance those set by European and multilateral organisations, to frame the activity of producers and downstream supply chain actors (*i.e.* retailers, importers, food agencies and other public bodies). These regulations usually combine food control mechanisms, norms regulating the final product (*e.g.* maximum thresholds on residues of biochemical and microbiological contaminants), trace-

A. Hammoudi (✉) • J.-B. Traversac
INRA, Institut National de la Recherche Agronomique, Ivry sur Seine, France
e-mail: abdelhakim.hammoudi@ivry.inra.fr; jean-baptiste.traversac@agroparistech.fr

C. Grazia
Dipartimento di Scienze, Università di Bologna, Bologna, Italy
e-mail: c.grazia@unibo.it

Y. Surry
Swedish University of Agricultural Sciences, Uppsala, Sweden
e-mail: yves.surry@slu.se

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ability and risk management systems (*e.g.* HACCP[1]), prescriptions on good agricultural practices on field and farms, and liability rules.

At the international level, the Codex Alimentarius (FAO UN/WHO) provides guidance to governments in setting food safety regulations, while the International Organization for Standardization (ISO) establishes voluntary norms, from product specification to management systems (Henson and Humphrey 2009). These changes in the regulatory environment have also been driven and encouraged by private agents (producers, processing companies, retailers). Indeed, private actors have reacted by setting voluntary standards, which are most often complements to public regulations and specify the means (or processes) needed to comply with public performance (or output) requirements. A number of standards have thus been set either in-house or within the framework of buyer-supplier relations to regulate procurement. Among the most remarkable of these, collective private standards 'Business-to-Business' (B2B) are imposed by downstream actors (retailers, agro-industry) on their suppliers (GlobalGAP, BRC, SQF, GFSI, IFS).[2] In contrast to the 'Business-to-Consumers' (B2C) standards, the B2B standards are not signalled to consumers.[3] They involve strict rules in terms of infrastructure, equipment and production practices and are mostly referred to as 'obligations of means' (or process standards). They are viewed as highly constraining by operators in both developing and developed countries. A noteworthy feature of these standards is that they most often go far beyond a simple translation of public performance standards into process constraints. Indeed, as in the case of GlobalGAP, they may also impose further performance requirements which are frequently stricter than the public norms, *e.g.* EU regulations.

These private norms[4] have spread beyond the regional and national boundaries within which they were set and have imposed themselves as an almost necessary condition to access international markets. Hence, despite being voluntary in nature, the increasing proportion of complying firms at international level has made them *de facto* mandatory for suppliers in developing countries and Europe. These standards are generally recognised as an essential tool to comply with public performance constraints, but they are also often viewed as illegitimate substitutes for public regulations. Private standards are the subject of recurring complaints,

[1] Hazard Analysis and Critical Control Points.

[2] GlobalGAP = Global Good Agricultural Practice, BRC = British Retail Consortium, GFSI = Global Food Safety Initiative, SQF = Safe Quality Food, IFS = International Food Standard.

[3] Unlike B2B standards, B2C are strategic differentiation tools and contribute to market segmentation.

[4] In this book, we refer to the notion of 'norms' to indicate administrative rules (SPS, developed countries regulation) and private norms defined by enterprises or by enterprise lobbies (generally defined as standards by English scholars). The type of norms is specified, if necessary, by the qualification of its private or public origin.

especially by developing countries, where firms face significant compliance difficulties. These countries claim that private standards are barriers to exports.[5] To a lesser extent, their criticisms also apply to the European norms, which are often mentioned as being much more restrictive than the Codex Alimentarius (Morten 2009; Debaere 2005; Otsuki et al. 2001).

Despite the strengthening that occurred in recent decades, the regulations are still required to stiffen further under the pressure exerted by consumers observing successive disease outbreaks, most often emphasised by high media coverage. The effects of crisis are exacerbated by the interdependencies among economies and by their rapid diffusion at international level.[6] The spread of foodborne disease incidents is most often accompanied by economic crises spreading over several sectors, as a consequence of consumer boycott behaviour. The recent *E. coli* crisis in Europe drastically highlighted how the international spread of crisis can spiral out of control as a result of the intensity of exchanges and the globalisation of economies. This and previous crises have damaged consumer health in the 'incriminated' country and in partner countries. From an economic perspective, no producer or country can expect to take advantage of the crisis by taking over the demand lost by the incriminated competitors, because as the *E. coli* experience has shown, excessively prudent consumer behaviour subsequently impacts on the income of other supply chains perceived as belonging to the same 'family' as the incriminated product and thus potentially harmful.[7] Since trade globalisation exacerbates international competition, it requires inter-country and intra- and inter-supply chain coordination to manage and reduce the food safety risks. A more focused analysis is thus required on current methods and mechanisms for food safety regulation and on their effectiveness in this context of high interdependencies among economies.

Regulatory design needs to take into account one of the most significant traits of current agrifood market dynamics, namely the growing volume of intermediate actors in international trade (importers, traders, retailers) and their role in controlling supply safety (Rouvière and Latouche 2014; OCDE 2007). The unquestionable influence of intermediate players on trade and their strategies for food safety management drastically change processes, especially in developing countries, by imposing profound restructuring of production systems (Henson and

[5] Many economists address the issue of the competitive advantages induced by a strengthening of food safety requirements. These constraints can increase competitive advantages for specific types of agents (the biggest, the best equipped in terms of skills, the best managerial strategies).

[6] The *E. coli* crisis was due to germinated seeds coming from Egypt. It resulted in 4,000 cases of illness in Germany, 130 other cases in 12 countries of the European Union and 12 in Canada and the United States. During 3 months, from May 2011 to July 2011, it caused 76 deaths in Europe (Trivin 2011).

[7] Consumers reacted during the crisis and even after the issuing of an alert on cucumbers with a boycott of all types of vegetables eaten raw. For example, Belgium decided to exclusively ban imports of Spanish cucumbers, while Russia banned imports of all vegetables coming from Spain and Germany.

Humphrey 2009; Hammoudi et al. 2009). Indeed, faced with import requirements, most often driven by the rise in private standards, supply chains in developing countries have evolved to a higher concentration at farm level (large estates, cooperatives) and/or vertically integrated structures (Maertens and Swinnen 2009). These dynamics sometimes lead to the creation of large export companies, often as a result of Foreign Direct Investments (FDI) (Maertens and Swinnen 2009). Numerous exporters in developing countries commit to this dynamic of integration and concentration favouring large production volumes. This production mode replaces small farmers, who are thus increasingly excluded from agricultural activities (Dolan and Humphrey 2000; Minot and Ngigi 2004; Weatherspoon et al. 2001). However, the issue of exclusion is complex and a comprehensive theory is still being sought. Different studies reveal paradoxical effects of norm inclusion in trade. A number of studies (*e.g.* Minten et al. (2009) for the case of Madagascar) have shown how the reinforcement of norms in the North may lead locally to intensification of the system of micro-contracts, generating a supply-chain coordination surplus.[8] In Kenya, for example, small producers are in the frontline in supplying European markets, despite the emergence and spread of strict private standards (Minot and Ngigi 2004). Such contractual relations are able to foster better access to credit and to provide incentives for the use of better quality inputs by small farmers. Nevertheless, an evaluation of the sustainability of this model, in Kenya or elsewhere, requires careful consideration of the consequences of the recent crisis in Kenyan exports and the eroding reputation of Kenyan supply chains as a result of border rejections for non-compliance with European maximum residues limits (MRL) for pesticides (Jaffee 2003). Thus, the food safety issue has clearly led North-South trade to much more integration and coordination in buyer-supplier relationships. These interactions are partially governed by complex contractual relations, notably in buyer-driven supply chains based on private standards, as in the case of the UK's horticultural trade with Africa (Lee et al. 2012; PIP 2009; Gereffi et al. 2005).

However, a number of questions arise on the effects of these dynamics. The current rapid changes in trade call for an international standard-setting system that is able to respond more quickly to new situations. International organisations have called for improvement of public food safety planning (Tritscher et al. 2013), but the legitimacy of private norms when they become mandatory is questionable (Brunsson and Jacobsson 2000). Is this reorganisation, mostly driven by Northern constraints, profitable for the South? Should public authorities in Southern countries adopt a *laissez-faire* approach? Or should they guide or regulate these changes? In some far from unusual situations, most notably in Africa, estate constraints simply do not make concentration conceivable, while supplying from

[8] This organizational design, combined with farmer assistance and technical supervision programmes to achieve compliance with the sanitary norms required by supermarkets, causes little exclusion and allows family farmers to benefit from export activities.

small farmers is almost essential for export development (see Chap. 11).[9] However, the diversity of local conditions requires an *ad hoc* approach to this question.

This book analyses the issues related to the emergence of food safety norms at international level and their consequences on the supply chains of emerging and developing countries. The 11 chapters deal with the more general debate on existing regulations and provide some instruments for a more focused discussion on suitable advances in these regulations in a perspective of proactive international co-regulation. The state-of-the-art of regulations and private strategies in the field of food safety are described and the most recent academic research on the subject is put into perspective. A number of contributions are presented, aimed at a better understanding of the behaviours of actors (producers and intermediate players) and their consequences in terms of cost of compliance with sanitary constraints.

The contributions to this book[10] are organised in three parts. The first part describes the different approaches to food safety regulation (multilateral, public, private) prevailing at present, focusing on their legal and economic rationalities. In Chap. 2, Alberto Alemanno provides an overview of international food safety governance and summarises the ongoing debate on establishment of a global food safety regime. The development trends and changes that have taken place over recent decades in the regulatory environment, the interactions between public regulations and private standards, and their potential effects on developing country suppliers are discussed by Morag Webb in Chap. 3, with the focus on the horticulture sector. The emergence of retail-driven food safety regulations is addressed by Tetty Havinga in Chap. 4, illustrating the logic and rationale of retail food safety governance and discussing the consequences for food producers and their incentive for compliance. In Chap. 5, Cristina Grazia, Abdelhakim Hammoudi and Oualid Hamza present the most recent advances in the Theory of Industrial Organisation, focusing on the strategic interactions between public and private actors in food safety management. The role of the public control system and its influence on the development of private standards is addressed. Madga Aguiar Fontes, Eric Giraud-Héraud and Alexandra Seabra Pinto analyse the consumer perspective in Chap. 6, dealing with consumer expectations on food safety and their predictable behaviour in the event of foodborne disease outbreaks. The specific rationale of consumer

[9] Stinglhamber and Schiffers (2014) point out the favourable effects of extensive production in African countries for small farmers arising from compliance with sanitary norms. The spatial spread of small farmers facing phytosanitary requirements is favourable compared with intensive production systems concentrated in the same area.

[10] This book follows up an International Seminar on the theme "Food safety, trade, and development: The role of supply chain structure and organisations" (Paris, December 12, 2012), sponsored by Agence Française de Développement (AFD) and Institut National de la Recherche Agronomique (INRA). Several contributions to this book were presented at this International Seminar while some others resulted from the ongoing European research project SAFEMED (ARIMNET program, http://www.arimnet.net/index.php?p=fp safemed) coordinated by Abdelhakim Hammoudi and its associated network of researchers and professionals.

behaviour towards the risk of foodborne disease is presented and the role of quality signals in promoting consumer trust is explored.

The second part of the book deals with the relations between norms/standards and economic development. Chapter 7 provides an overview of the theoretical arguments and the empirical evidence regarding the impact of food standards on trade and development in developing countries. Johan Swinnen, Miet Maertens and Liesbeth Colen discuss the controversial views on the role of standards as barriers or catalysts to trade, the impact of standards on the structure and governance of food supply chains, the inclusion or exclusion of smallholder farmers and equity issues, and inter-sectorial effects of standards. Existing studies that quantify the impact of food safety standards, with particular attention to access to international markets by developing countries, are reviewed and discussed in Chap. 8. Departing from a critical review of empirical studies based on both country-level and firm-level data, Keiichiro Honda, Tsunehiro Otsuki and John S. Wilson suggest possible policy prescriptions for developing country governments and firms.

The third part of the book provides a specific analysis focusing on a number of emerging and developing countries and sectors. In Chap. 9, Helen H. Jensen and Jiehong Zhou present an overview of food safety problems in China and the changes and efforts made by the government and private sector to meet the need for improved food safety. Chapter 10 addresses trade effects for firms and welfare effects for small-scale farmers in the Peruvian asparagus export sector. Using company-level data, Monica Schuster and Miet Maertens contribute to two ongoing debates: whether standards act as barriers or catalysts for exports from developing countries; and whether standards have an excluding or including effect on small-scale famers in export supply chains. Focusing on smallholder green bean growers in Kenya, Zambia and Ethiopia that supply EU supermarkets, Chap. 11 explores the risk of marginalisation of smallholder farmers and the strategies used to deal with this risk and maintain inclusion in export markets. Julius J. Okello discusses the role of collective action and public-private partnerships. Chapter 12 explores public and private food safety regulations and implications for the export market. Using bilateral trade data, Müge Tunaer Vural and Sedef Akgüngör analyse the effects of ISO 22000 diffusion on fresh produce exports by developing countries with a specific focus on the Turkey. In so doing they also provide an overview of current and mandatory standards in this country.

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The Multilateral Governance Framework for Food Safety: A Critical and Normative Overview

2

Alberto Alemanno

Abstract

Amid contemporary global interconnectedness, contaminated food can spread more rapidly and affect wider regions, thus causing global illness worldwide. Today not only new food safety risks can spread among countries, but also old, previously controlled, risks can be re-introduced into countries. As a result, although public concerns about food safety risks vary across countries and change over time, there is a general sense that consumers, especially in the industrialized world, have become increasingly concerned about the risks stemming from food consumption. Yet, as it is constantly reminded to us by food safety accidents, the world currently lacks of a global international food system. Instead, several international organizations have been entrusted with a food safety mandate. This chapter provides first a systematic analysis of the multilateral governance framework for food safety and, second, it offers some ideas on how to overcome the current institutional fragmentation.

Keywords

Food governance • Food safety • World Trade Organization • Codex Alimentarius • Sanitary and phyto-sanitary measures • Technical barriers to trade

2.1 Introduction

It is almost a truism to observe that in an age of increasing globalization of the food supply, food safety is no longer a domestic issue alone. Indeed, because of the ever-increasing food trade, regulatory failure in the food safety system in the food-

A. Alemanno (✉)
Hautes Etudes Commerciales (HEC), Jouy en Josas, France
e-mail: alemanno@hec.fr

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exporting country can easily endanger the health of the unsuspicious consumers of the importing country. Moreover, amid contemporary global interconnectedness, contaminated food can spread more rapidly and affect wider regions, thus causing global illness worldwide. Today not only new food safety risks can spread among countries, but also old, previously controlled, risks can be re-introduced into countries.

As a result, although public concerns about food safety risks vary across countries and change over time, there is a general sense that consumers, especially in the industrialized world, have become increasingly concerned about the risks stemming from food consumption. Yet, as it is constantly reminded to us by food safety accidents, the world currently lacks of a global international food system. Instead, several international organizations have been entrusted with a food safety mandate. The main organizations with responsibility for food safety are the Food and Agriculture Organization (FAO), the World Health Organization (WHO), their Codex Alimentarius Commission (CAC) and the World Animal Health Organization (OIE). Food safety is partly addressed by other international organizations including the World Trade Organization (WTO), the United Nations Environment Program (UNEP), the Organization for Economic Cooperation and Development (OECD) as well as by a set of international mechanisms governing co-operation in food safety matters, such as the International Food Safety Authorities Network (INFOSAN). To render things more convoluted, other non-governmental actors, such as multinational corporations dominating the global food supply chain, consumer nongovernmental organizations (NGO) and private standard-setting institutions, have initiated a series of food safety initiative in recent years whose effects on the North-South relationship appear undesirable (Henson and Humphrey 2009).

The resulting fragmentation of the international food regime is the product of history. Although informal international cooperation has existed for some time among national food regulators (Kelly and Bachorik 2005), the emergence of a network of international organizations with food-related activities is more recent and full coordination among these organizations has not been achieved. Indeed, compared with that of a domestic food safety system, the structure of the current global food safety system appears to be incomplete and presents several gaps. Traditionally, food safety regimes have developed and implemented domestically, along jurisdictional lines.

While the adoption of these national regimes may be legitimate to protect public health in an increasingly integrated food market, their enactment, as it tends to produce trade restrictive effects, may also be motivated by a desire to protect domestic industries from imports from foreign countries. This explains the rationale behind the establishment of most of the above-mentioned international organizations. Indeed, contrary to conventional wisdom, the main drive behind the creation of most of these international organizations is not to be found in food safety but in the international efforts aimed at overcoming regulatory divergence stemming from different domestic food standards. As a result, the *raison d'être* of virtually all these organizations is—at least in relation to their food-related

mandate—to achieve harmonization of food safety standards so they cannot be used as discriminatory non-tariff barriers to trade.[1] In other words, the food-related responsibilities that have been entrusted to those organizations have more to do with the free trade imperative than with food safety per se. In the light of the above, it is no surprise that it is the WTO, an international organization without an explicit food mandate, which offers today—together with the Codex Alimentarius Commission—the greater contribution to the international regulation of food safety. Trade being the main driver behind the existing internationalization of the food supply chain, it is especially the WTO that is called upon to play a pivotal role within the emerging multilateral food safety governance. Yet, this leading role is increasingly questioned by the competing claims of private-driven initiatives aimed at governing the regulation of the food supply chain.

The aim of this chapter is to provide an overview of the emerging phenomenon of international food law by identifying the main features of today's multilateral, yet fragmented, framework for food safety governance. After briefly systematizing the roles played by the different international organizations (part 2), part 3 focuses on and provides for a critical assessment of the emerging "Multilateral governance framework for food safety" as it is presently offered by the World Trade Organization together with Codex (Roberts et al. 2004). The chapter will then offer some reflections over the ongoing debate over the debate over the establishment of a global food safety regime (part 4), before developing some conclusions.

2.2 An Overview of International Organizations Dealing with Food

The Food and Agriculture Organization (FAO), World Health Organization (WHO), Codex Alimentarius Commission (CAC) and the World Organization for Animal Health, formerly known as the International Office of Epizootics (OIE), have complementary food safety mandates to protect the health of consumers, to prevent the spread of disease and to ensure that the procedures followed in the trade of food products are fair. In the following section (2.2.1), the food safety mandate of these organizations as well as their structures will be examined. The next section (2.2.2) is devoted instead to those international organizations that, although they don't have received an expressed food safety mandate, are actively involved in food safety issue because of their environmental, economic or trade responsibilities.

[1] The international community has long been aware of the need for harmonization of global food safety standards. Early in the twentieth century, countries engaged in food trade realized that the different sets of food laws in different countries could be an enormous source of non-tariff trade barriers. Such barriers could stifle international food trade, whether intentionally or not (Alemanno 2007).

2.2.1 International Organizations with a Food Safety Mandate

2.2.1.1 Food and Agriculture Organization of the United Nations (FAO)

FAO is a specialized agency of the United Nations that leads international efforts to defeat hunger. In particular, its main objective is to ensure food for all by securing improvements in the efficiency of production and distribution of all food and agricultural products. Serving both developed and developing countries, FAO acts as a neutral forum where all nations meet as equals to negotiate agreements and debate policy. FAO is also a source of knowledge and information, and helps developing countries and countries in transition to modernize and improve agriculture, forestry and fisheries, ensuring food nutrition and food security for all.

The idea of establishing an international organization to overlook the agriculture and food situation worldwide arose following the process of codification of international law during late nineteenth and early twentieth century. In June 1905 an international conference was held in Rome, which led to the conclusion of an international convention for the creation of an International Agricultural Institute. Finally, FAO was established on 16 October 1945 in Quebec City, Canada. Since 1951 its headquarters are located in Rome, Italy. The agency is directed by the Conference of Member Nations, which meets every 2 years to review the work carried out by the organization and to approve a Programme of Work and Budget for the next 2-year period. The Conference elects a council of 49 member states (serve 3-year rotating terms) that acts as an interim governing body, and the Director-General, that heads the agency.

Overall FAO policy is agreed by consensus by member Governments at the biennial FAO Conference. Many FAO food safety activities are carried out in the Economic and Social Department, Food and Nutrition Division although there are also many food safety-related activities integrated into programmes carried out by FAO's Agriculture and Fisheries Departments. Many of FAO's food safety activities are carried out in collaboration with other international organizations. The main food safety activities of FAO are: Codex Alimentarius (with WHO); the safety evaluation of food, agricultural and veterinary chemicals (with WHO); the International Code of Conduct on the Distribution and Use of Pesticides; and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. FAO has also an extensive programme of education and training related to food safety, carried out mainly through its decentralized structure.

2.2.1.2 World Health Organization (WHO)

The World Health Organization (WHO), which has 194 member countries, is a specialized agency of the United Nations (UN) that acts as a coordinating authority on international public health. Established on April 7, 1948, with headquarters in Geneva, Switzerland, the agency inherited the mandate and resources of its predecessor, the Health Organization, which had been an agency of the League of Nations.

The WHO Constitution states that one of the chief functions of the Organization shall be "to achieve the highest possible standard of health for all". As a result its major tasks are to combat disease, especially key infectious diseases, and to promote the general health of the people of the world.

In addition, WHO has broad mandates of relevance to food safety, including: acting as the directing and coordinating authority in international health work; promoting and conducting research in the field of health; and assisting in developing an informed public opinion among all peoples on matters of health. In particular the WHO's Constitution entrusts the organization with the mission "to develop, establish and promote international standards with respect to *food*, biological, pharmaceutical and similar products". However, in the area of food safety, WHO has refrained—at least until today—from adopting any legally binding instruments.[2]

The Food Safety Programme is the focal point for food safety activities in WHO; other WHO programmes with food safety related activities include the Cluster on Communicable Diseases (CDS) and the Programmes on Chemical Safety (PCS), Nutrition (NUT), Water, Sanitation and Health (WSH), and International Health Regulations. Many of WHO's food safety activities are carried out in collaboration with other international organizations, including: International Programme on Chemical Safety (with FAO and the International Labor Organization (ILO)); Global Environment Monitoring System/Food Contamination Monitoring and Assessment Programme (with UNEP, FAO and the International Atomic Energy Agency (IAEA)); and, similarly to FAO, with the Codex Alimentarius.

Being the activities of Codex the most relevant for the purposes of the international food regime, the next section will be focusing in more detail on this FAO/WHO joint venture.

2.2.1.3 Codex Alimentarius Commission (CAC)[3]

The Codex Alimentarius Commission was originally founded in 1962 by FAO and the WHO as an intergovernmental body in charge of implementing their Joint Food Standards Programme[4] and setting up the Codex Alimentarius.[5] This Codex, drawing on the previous experience of the *Codex Alimentarius Europeus*, may be defined as a set of general and commodity-specific standards, guidelines, and recommended codes of practice aimed at protecting the health of consumers and ensuring fair trade practices.

[2] For an introduction to WHO law, see Gosting (2008).

[3] For an overview of the Codex Alimentarius' activities, see Stewart and Johanson (1998), Bizet (2000) and Livermore (2006).

[4] The purpose of this programme was to protect the health of the consumers and ensure fair practices in the food trade; to promote co-ordination of all food standards work undertaken by international governmental and nongovernmental organizations.

[5] More precisely, the Codex was established since the adoption of two resolutions to set up the organization in the Eleventh session of the FAO Conference in 1961 and the Sixteen World Health Assembly in 1963.

The CAC elaborates international standards, codes of practice, guidelines and related texts addressing the safety and quality of foods moving in the international food trade.[6] To date, it has developed more than 240 standards ranging from processed foods to raw foods and from maximum levels for pesticides to guidelines for contaminants. Although advisory in nature, as we have seen above, these standards become reference standards through the Sanitary and Phytosanitary (SPS) Agreement. The Codex's Membership is open to FAO and WHO Members interested in developing food standards. More than 185 countries are represented in it today.

Codex, which is led by a 10-Member executive committee, also comprises 6 Regional Coordinating Committees, 8 General Subject Committees, 12 Commodity Committees and 3 ad-hoc Inter-governmental Task Forces. Among these subsidiary bodies, there are at least eight whose main focus is related to food safety, namely: the Codex Committee on Food and Hygiene, Food Additives and Contaminants, Pesticide Residues, Residues of Veterinary Drugs in Food, and Meat Hygiene and Intergovernmental Task Forces on Food Derived from Biotechnology and Animal Feed. Moreover, all the activities related to the elaboration of general principles for food safety, such as the risk analysis working principles, have been considered by the Codex Committee on General Principles. Most of these committees meet annually or biannually. The Codex allows the establishment of new subsidiary bodies to address new or emerging issues.

As will be illustrated below, the Codex Commission acquired greater visibility only in 1995 when the WTO SPS and TBT[7] Agreements were adopted. Indeed, the SPS Agreement identifies standards, guidelines and recommendations adopted by the Codex Alimentarius Commission as the international benchmark for food safety. For the purposes of the SPS Agreement, WTO does not differentiate between standards, guidelines and recommendations elaborated by Codex. They all benefit from the same status under WTO law. For food safety, the SPS Agreement refers to standards developed by Codex in the following sectors: codes and guidelines on hygienic practices, contaminants, food additives, methods of analysis and sampling, veterinary drug and pesticide residues. With the new role given by the SPS Agreement to Codex, the main centre of gravity of Codex activities has shifted from a focus on the (vertical) work of the commodity committees to the (horizontal) work of the general subject committees.

It is worth underlining that not all Codex Members are Members of the WTO. Although Codex standards are referred to by the WTO/SPS framework, Codex does not establish food standards for the WTO. It mainly establishes food standards for the use of its Members. As has been stated during the 45th Session of the Codex

[6] Its stated goal is "to guide and promote the elaboration and establishment of definitions and requirements for foods to assist in their harmonization and, in doing so, to facilitate international trade". See Codex Alimentarius Commission for more details. Available at http://www.fao.org/docrep/005/y2200e/y2200e05.htm.

[7] TBT Agreement stands for the WTO Agreement on Technical Barriers to Trade.

Executive Committee, " [...] the work of Codex should move forward without concern arising from misunderstandings or misinterpretations as to how Codex standards and related texts might be used".[8]

To understand the functioning and operation of Codex it is necessary to look at the Codex Alimentarius Commission Procedural Manual. When a Codex Committee proposes to elaborate a new or revised standard, it should verify whether it fits within the priorities set up by the Commission in the Medium-Term Plan of Work, before contacting the Codex or its Executive Committee for approval. Subsequently, the elaboration of standards, as provided for by the Codex Elaboration procedure contained in the Manual, may follow two types of procedures:

- Uniform Normal Procedure
- Uniform Accelerated Procedure.

The normal procedure consists of eight steps. It starts with the decision to elaborate a standard and the appointment of the subsidiary body in charge of it (step 1). It follows with the preparation of a proposed draft standard, after having heard either the JMPR[9] or the JECFA,[10] depending on the matter at issue (step 2). The proposed draft is then distributed among CAC members for their comments (step 3). After receipt, the comments are considered by the subsidiary body (step 4) and a draft standard is to be submitted to the CAC for adoption, which has to take into due account the comments received (step 5). Once the standard is adopted, it is sent around members for their comments (step 6), which have to be considered by the member and the CAC (step 7). The procedure terminates with the adoption of the final standard by CAC after having considered both the amended draft standard and Members' proposals (step 8).[11]

Following the adoption of standards, Members have the chance to accept them. The CAC provides for specified forms of acceptance:

- Full acceptance: the country will apply the standard to all products and will not restrict distribution of products complying with the standard;
- Acceptance with specified deviations: the country will apply the standard to all products except those specific aspects which are not accepted;
- Free Distribution: the country will not restrict distribution of products complying with the standards. This allows the accepting country to retain a separate national standard without blocking imports complying with the food standard.

[8] Executive Committee of the Codex Alimentarius Commission, 45th Session, FAO Headquarters, Rome, 3–5 June 1998.

[9] JMPR stands for FAO/WHO Meetings on Pesticide Residues.

[10] JRFA means Joint FAO/WHO Expert Committee on Food Additives.

[11] See Procedural Manual of the Codex Alimentarius Commission (2005).

All discussions at Commission level are made through discussions with Member State delegations. In principle, decisions are adopted by consensus. Codex's history shows that this has been the case until quite recently (Jukes 1998:10). This was possible since a national delegate, on returning to her country, could easily ignore the consensus decision taken at the Codex meeting (ibid.). However, given the heightened status accorded to Codex standards, this is no longer the case. Under the Code Manual of Procedure, where every effort to reach an agreement fails, decisions may be taken by vote. In the event of a vote, decision is by majority of Members present at the particular session. Compliance with the adopted standard is then voluntary under Codex principles. Under the Statements of Principle Concerning the Role of Science in the Code Decision-Making Process, "when the situation arises that Members of the Codex agree on the necessary level of protection of public health but hold different views about other considerations, Members may abstain from acceptance of the relevant standard without necessarily preventing the decision by Codex".[12]

2.2.1.4 International Office of Epizootics (OIE)

The French-based OIE, now known as the World Organization for Animal Health, was created in 1924 as a Member States-led organization to improve hygiene and public health by preventing the spread of diseases in animals and animal products in international trade. It is the oldest veterinary organization in the world and, similarly to Codex, has a significant record of establishing international standards. Its structures comprise an International Committee, composed of delegates from its Member States meeting annually, a central office acting as an executive and several commissions serving as deliberative organs. Amongst its missions, OIE develops international standards, guidelines and recommendations relating to animals and animal products. More precisely, its main commissions deal with epizootic diseases, fish diseases and standards and have developed an International Animal Health Code and an International Aquatic Animal Health Code, which are periodically updated. OIE's standards may be found in the OIE's Code, which lists standards for international trade, and Manual, which sets forth standard diagnostic procedures for animal diseases as well as vaccine standards related to international trade. Although this 178 Members organization is not part of the UN system, it regularly cooperates with FAO and WHO in global food safety issues. Unlike the Codex and the IPPC,[13] the OIE has not experienced major reforms in its standards-setting process and structure since the entry into force of the SPS Agreement.

As the establishment of international standards for animal and animal products does not raise the same concerns as do the Codex's standards relating to human health, the OIE has not experienced limited controversies when setting standards.

[12] CAC Statements of Principle Concerning the Role of Science in the Codex Decision-Making Process and the Extent to Which Other Factors Are Taken into Account (Decision of the 21st Session of the Commission 1995, ALINORM 95/37).

[13] IPPC stands for International Plant Protection Convention.

2.2.2 International Organizations Without an Explicit Food Safety Mandate

2.2.2.1 UN Environment Programme (UNEP)

UNEP is the designated authority of the United Nations system in environmental issues at the global and regional level. It coordinates UN environmental activities, assisting developing countries in implementing environmentally sound policies and practices. It was founded as a result of the United Nations Conference on the Human Environment in June 1972 and has its headquarters in Nairobi, Kenya. UNEP also has six regional offices and various country offices. Its mandate is to coordinate the development of environmental policy consensus by keeping the global environment under review and bringing emerging issues to the attention of governments and the international community for action.[14]

The organization also coordinates with global international organizations with food safety mandates. Two UNEP activities are particularly relevant to food safety: the International Programme on Chemical Safety (IPCS) (with WHO) and the Global Environmental Monitoring System (GEMS). UNEP also provides the secretariat for the Convention on Biological Diversity (CBD), a multilateral environmental agreement. The Protocol on Biosafety was agreed by Parties to the CBD in January 2000. The Protocol focuses on trans-boundary movement of any living modified organism (LMO) resulting from modern biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity, other than those that are pharmaceuticals for human use that are addressed by other international agreements or organizations. In particular, the Protocol sets out procedures for advance informed agreement between importing and exporting countries for LMOs intended for deliberate release into the environment. The Protocol sets out the minimum information that must be supplied by the exporting country prior to the intentional trans-boundary movement of LMOs. The information required includes a risk assessment report; however, the focus is environmental risks rather than risks to human health. In relation to LMOs for direct use as food or feed, or for processing, when a Party to the Protocol makes a final decision regarding the domestic use, including placing on the market, of an LMO that may be subject to trans-boundary movement, the Party is required to inform other Parties of that decision. The information to be provided to other Parties would include the risk assessment report. The objective of the risk assessment is to identify and evaluate the potential adverse effects of LMOs on the conservation and sustainable use of biological diversity taking also into account risks to human health. The Protocol contains provisions for using the precautionary approach in the decision-making process.

[14] The mandate and objectives of UNEP emanate from United Nations General Assembly resolution 2997 (XXVII) of 15 December 1972 and subsequent amendments adopted at UNCED in 1992, the Nairobi Declaration on the Role and Mandate of UNEP, adopted at the Nineteenth Session of the UNEP Governing Council, and the Malmö Ministerial Declaration of 31 May 2000.

2.2.2.2 Organization for Economic Cooperation and Development (OECD)

OECD was established in 1961 as an international organization aimed at promoting policies designed to contribute to the development of the world economy; sound economic expansion in member countries as well as non-member countries in the process of economic development and the expansion of world trade. Today the OECD counts 34 member countries and defines itself as a forum of countries committed to democracy and the market economy, providing a setting to compare policy experiences, seeking answers to common problems, identifying good practices, and coordinating domestic and international policies of its members. It works through consensus.

As for its involvement in food regulatory activities, the OECD has first undertaken some analysis of the costs and benefits associated with food safety risks and regulations, or of the trade impacts (for example, regulatory reform of the agri-food sector, trade considerations of food safety and quality, commodity market analysis, etc.). Second, with respect to biotechnology and other aspects of food safety, the role of the OECD is to assist governments improve the safety assessment process, enhance international harmonization and mutual recognition, increase public confidence in the regulatory system, and improve interactions with nongovernment organizations through the establishment of discussion fora, etc. OECD's involvement in biotechnology dates back to 1982 and encompasses three principal domains: human health, agriculture and food and environmental applications. A key objective is to provide a balanced view of modern biotechnology in order to permit governments and society at large to make decisions concerning its development and use in the short and long-run. While the benefits from modern biotechnology can be immense, particularly in the area of health, it also brings with it a number of uncertainties that may be viewed differently among countries and stakeholders. Such differences can result in severe trade tensions and disputes, which can hamper further development and limit potential benefits of biotechnology. The OECD thus contributes to reducing trade tensions or disputes, by its objective analytical work, by its efforts at regulatory harmonization and by providing for on-going discussions and consensus-building.

2.2.2.3 World Trade Organization (WTO)

The WTO was established in 1995 following completion of the Uruguay Round negotiations, and replaced the General Agreement on Tariffs and Trade (GATT), which commenced in 1948. Today it has a Membership of 160 countries and territories representing more than 97 % of total world trade. The WTO's main mission is to liberalize international trade. To accomplish its mission it administers and implements multilateral trade agreements; it provides a forum for multilateral trade negotiations; it seeks to resolve trade disputes; it contributes to transparency of national trade policies; it promotes cooperation with other international institutions involved in global economic policy-making.

Whilst WTO does not have a mandate to develop food safety standards, it does place disciplines on the use of food safety measures to avoid their use as unjustified

or disguised barriers to trade.[15] Although public health and food safety issues are dealt with in several WTO Agreements,[16] the WTO Regulation of food is mainly contained within the SPS Agreement adopted during the 1994 Uruguay Round.[17]

Among the several international organizations dealing with food-safety related activities, the WTO is the only one providing for a set of legally binding obligations for WTO Members when they adopt food regulations (Alemanno 2007). As has been stated, the GATT/WTO agreements today provide for a "Multilateral governance framework for food safety" (Roberts et al. 2004:35). It is in the light of the above that the remaining part of the chapter will be analyzing closely the WTO framework for food.

2.3 The International Food Trade Regime

2.3.1 Historical Background and Evolution of the GATT/WTO Regulation of Food

GATT's primary purpose was to promote trade in goods by reducing tariffs and eliminating quantitative restrictions. Its main focus has thus for a long-time been on the so-called border measures (as opposed to the "within the border measures" or domestic measures) (Bhagwati and Hudec 1996). Its main organizing principle, aimed at tackling these obstacles to trade, was (and still is) the principle of non-discrimination, prohibiting discrimination among GATT members (the "most-favoured-nation" obligation of Article I) and between foreign suppliers and domestic suppliers (the "national treatment" obligation of Article III). This Agreement already recognized the need to subject domestic regulations to international scrutiny so that the discriminatory and protectionist uses of technical regulations would not offset the trade benefits stemming from the gradual lowering of tariffs. GATT 1947 therefore sets forth various rules aimed at preventing such abuses, amongst which were Article XI, prohibiting quantitative restrictions and Article III requiring member states to respect "national treatment" for "like products" when adopting their internal taxes and regulations for imports.

[15] See, e.g. Scott (2007:76–138), Epps (2008) and Gruszczynski 2010:107–155).

[16] See GATT, the Agreement on Technical Barriers to Trade (TBT), the Agreement on Sanitary and Phytosanitary Measures (SPS), the General Agreement on Trade in Services (GATS), the Agreement on Agriculture (in the Preamble, as well as in Article 20 of this Agreement non-trade concerns in the Agricultural sector are mentioned), the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs). In particular, this last Agreement facilitates the international recognition of denominations of origin and certificates of specificity which have been granted in accordance with the relevant Community regulations.

[17] Key terms such as sanitary (to protect human life and health) and phytosanitary measures (to protect animal and plant life and health) are defined in the SPS Agreement, Annex A.

As tariffs and quotas fell worldwide due to the success of the first six successive GATT Rounds,[18] countries appeared to be increasingly relying on the adoption of national regulations as a way of protecting their own industries.[19] Notably, Member States have gradually increased the adoption of food safety requirements and controls. While the adoption of these national measures may be legitimate to protect human health and the environment in an increasingly integrated food market, their adoption may also be motivated by a desire to shield domestic industries from imports coming from foreign countries.[20] After the 1964–1967 Kennedy Round, which resulted from the seventh round of negotiations, Member States' concerns about the increasing adoption of divergent national standards contributed to the launching of a debate on how to tackle the problem of the so-called non-tariffs barriers. On that occasion, most of the countries agreed on negotiate a code which, without interfering "with the responsibility of governments for safety, health and welfare of their people", may seek "to minimize the effects of such actions on international trade".[21] Against this backdrop, during the negotiations that followed the 1979 Tokyo Round, the "Standards Code", which covered mandatory and voluntary technical specifications, mandatory technical regulations and voluntary standards for industrial and agricultural products, was signed by 43 countries. It prohibited discrimination and the protection of domestic production through specifications, technical regulations and standards, but it also urged its Members to base their national measures on international standards and to cooperate in order to harmonize their norms. In particular, regulations governing product characteristics were subject to a 'least-trade restrictive' requirement regardless of whether they were discriminatory or not. However, Member States failed to adequately comply with the Code. In 1980, a GATT Working group was established to measure the impact of Non-Tariff Barriers (NTBs) to trade and found product requirements to be among the most significant. This shift of attention from tariffs to NTBs to trade brought health, food safety and environmental polices under the scrutiny of the GATT and, subsequently, the WTO, thus paving the way for a greater GATT/WTO involvement in these areas of regulation.

As the Standards Code showed itself not to be adequate in addressing the issue of the regulatory barriers to trade, notably in the area of sanitary and phytosanitary measures, the Uruguay Round negotiations attempted to remedy this weakness. Also, the GATT framework, being based on Articles I, III, XI and XX, was

[18] The main result from each of the first six rounds of negotiations to strengthen the GATT framework was to revise and update the list of tariff bindings, thus reducing the tariff impact on trade. Non-tariff measures (or 'beyond the borders' barriers) did not fall within the object of the negotiations.

[19] For the negotiating history of the SPS Agreement, see Marceau and Trachtman (2002) and Zarrilli (1999:3).

[20] For a detailed history of the evolution of GATT rules on domestic regulations, see Sykes (1995:63–68).

[21] GATT, Secretariat, COM.IND/W/13, 20, 23 and Spec(71), 143, Idem.

perceived as being incapable of addressing disputes over sanitary and phytosanitary measures.

By 1986, when the Uruguay Round was launched, nearly 90 % of U.S. food imports were affected by non-tariff barriers to trade, up from only 57 % in 1996.[22] To tackle this increasingly abusive use of technical regulations, multilateral disciplines governing the use of technical measures had to be revised, expanded and strengthened. Thus, in the Punta del Este's Ministerial Declaration launching the Uruguay Round negotiations, it was stated that the goal was to set up disciplines that would minimize the "adverse effects that sanitary and phytosanitary regulations and barriers can have on trade in agriculture".[23] It is in light of the above that, during the Uruguay Round, not only was the Standards Code amended so as to reappear as the Agreement on Technical Barriers to Trade (TBT), but a new agreement was also negotiated: the Agreement on Sanitary and Phytosanitary Measures (SPS). The two agreements are designed to prevent technical legislation, which is intended for the protection of human health or safety, the protection of the health or life of humans animals or plants, consumer protection against deceptive practices and environmental protection, being used to create or resulting in unjustified barriers to international trade. Since sanitary and phytosanitary measures introduce specific concerns for trade in goods, a separate Agreement, the SPS, was 'carved out' of the TBT.[24] As a result the two Agreements differ in scope. While the TBT covers all technical regulations and voluntary standards, and the procedures to ensure that these are met,[25] the SPS agreement applies to all measures to protect human, animal and plant life and health.[26] While both the SPS and the TBT apply to food, the TBT is more relevant to labelling requirements than to safety.

As will be illustrated below, the purpose of this agreement is to minimize the negative effects on trade stemming from SPS measures, such as food safety regulations, by encouraging harmonization of SPS measures through the adoption of international standards, guidelines and recommendations where they exist. As it has been aptly said, the SPS is a "refined system of applied subsidiarity, subtly

[22] Tutwiler M. A., Food Safety, the Environment and Agricultural Trade: The Links, 2, International Food & Agricultural Trade Policy Council (Washington) cited in Vogel (1995).

[23] GATT Punta del Este Ministerial Declaration of 20 September 1986. Point (iii) under the Agriculture title. Available at http://www.sice.oas.org/trade/Punta_e.asp.

[24] This separation between technical barriers and sanitary and phytosanitary measures has been inspired by the NAFTA Agreement. See NAFTA, Chapters 7B and 9. Available at http://www.nafta-sec-alena.org.

[25] Most of the regulations falling under the TBT Agreement aim at protecting consumers through information, mainly in the form of labelling requirements, and at promoting fair trade practices. Other regulations include classification and definition, essential composition and quality factors, packaging requirements and measurements (size, weight, etc.) so as to avoid deceptive practices.

[26] It follows that while it is the type of measure which determines whether it is subject to the TBT, it is the purpose of the measure which is relevant in determining whether a measure is covered by the SPS agreement.

allowing national autonomy subject to certain constraints" (Trachtman 2006). The complex constraints imposed by the SPS Agreement, combined with the international standards to which it refers, established a system for reviewing certain types of State action at international level, notably food safety regulations. Finally, the negotiations also led to the conclusion of an Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreements) imposing obligations to provide minimum protection to a set of intellectual property rights, including geographical indications (GIs) of commercial identity for both agricultural products and food. Thus, the Uruguay Round, by strengthening the previous regime, improved the legal architecture for food safety technical regulations and standards.

2.3.2 Food Measures Under the GATT

The original GATT agreement of 1947—like the 1994 GATT agreement—left countries free to establish whatever food safety regulations they wished. The only constraints on the exercise of their legislative autonomy were set by Article III:4,[27] which required that these regulations had to be applied in a non-discriminatory way on imported and domestic goods, and Article XI,[28] prohibiting all restrictions "instituted or maintained on the importation or exportation of any product". Thus, the GATT implied that a country's regulation may take whatever form it chooses but must apply equally to domestic and imported products and not amount to an import or an export prohibition. Similarly to Articles 34–36 of the Treaty on the Functioning of the European Union (TFEU), it may appear that these GATT provisions mandate the prohibition of quantitative restrictions on importation and exportation of goods as well as those measures having an equivalent effect. However, the non-discrimination obligation looks rather weak if compared with the *Dassonville* interpretative formula of Article 34 TFEU. While the GATT states that Members' food measures may take whatever form it likes provided they apply equally to domestic and imported good, the EU—according to the catch—all *Dassonville* formula—prohibits all national measures capable of acting as obstacles to trade, regardless of whether they are discriminatory, unless they are justified on a legitimate ground. However, notwithstanding this clear prohibition against

[27] According to this provision: "The products of the territory of any contracting party imported into the territory of any other contracting party shall be accorded treatment no less favourable than that accorded to like products of national origin in respect of all laws, regulations and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution or use. The provisions of this paragraph shall not prevent the application of differential internal transportation charges which are based exclusively on the economic operation of the means of transport and not on the nationality of the product".

[28] This provision establishes that: "No prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licences or other measures, shall be instituted or maintained by any contracting party on the importation of any product of the territory of any other contracting party or on the exportation or sale for export of any product destined for the territory of any other contracting party".

quantitative restrictions, for many years GATT Members failed to abide by this rule (notably Article XI) by tolerating quantitative restrictions in the fields of agricultural products, textiles and clothing.

Like the EU,[29] the WTO maintains general exceptions which enable a Member to justify a violation of the general prohibition of quantitative restrictions. Similarly to Article 36 TFEU, Article XX GATT[30] allows any Contracting Party to depart from GATT obligations by adopting restrictions on imports and exports justified *inter alia* for the protection of health and life of humans, animals and plants (GATT, Article XX(b)).[31] Apart from having been invoked in relation to Articles III and XI, WTO's adjudicating practice shows that Article XX has also been invoked to justify alleged violations of Article I (MFN principle), Article II (tariff concessions), Article IV (anti-dumping and countervailing duties), Article X (publication and administration of trade regulations), Article XIII (non-discriminatory administration of quantitative restrictions) and Article XVII (state trading enterprises).

Notwithstanding the existence of this general exception, it may not be very common to find a discriminatory measure that is justified on this public policy ground. As has been stated, Article XX recognizes (Jackson 1999:233):

"the importance of a sovereign national being able to promote health interests, even if contrary to its general obligations under the WTO Agreements".

According to the WTO case law,[32] a party invoking this exception must prove that:

- the policy in respect of the measures for which Article XX(b) is invoked falls within the range of policies aimed at protecting public health, and that
- the measures for which the exception is invoked are necessary to fulfil the policy objective.

In particular, to satisfy the necessity test it must be proven that there are no alternative measures consistent with the GATT, which the Member State could reasonably be expected to adopt in order to achieve its health policy objective.[33] Accordingly, to properly apply this test, it is necessary to establish the scope of the

[29] As has been stated, Article 30 EC (now Article 34 TFEU) has clearly been formulated with Article XX in mind. See Scott (2002:286).

[30] Article XX states: "[s]ubject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures: [...] (b) necessary to protect human, animal or plant life or health".

[31] Already in 1969, Jackson noted that in theory all GATT obligations may be rendered subject to the exceptions of Article XX, because of the wording "nothing in this Agreement shall [...] prevent".

[32] EC-Measures Affecting Asbestos and Asbestos-Containing Products WT/DS135/R adopted on the 12 March 2001 paragraphs 8.170 and 8.177 (hereinafter: EC-Asbestos), paragraph 8.169.

[33] Thai-Cigarettes, Panel Report WT/DS10/R, adopted on 7 November 1990, paragraph 75.

health policy objective pursued by the invoking Member State and consider the existence of measures consistent with GATT which may have been reasonably available to the same Member State.

Finally, according to the so-called *Chapeau* of Article XX, it is necessary to assess whether the adopted public health measure is not applied in a discriminatory manner (this applies solely to Article XI, not III:4) and whether it did not constitute a disguised restriction on international trade.

While the core regulatory discipline of the GATT is contained in Articles III:4, XI and XX(b), the rules governing food safety measures and standards are specifically expressed in the SPS and TBT agreements, which were adopted during the Uruguay Round. In particular, the SPS Agreement, which is engaged in balancing health concerns against the goal of free trade, may be seen as an extension of Article XX GATT. In fact, it expands the scientific and procedural requirements that Member States have to abide by when adopting an SPS measure, by, in particular, urging them to develop and to adopt international standards. Yet, while the GATT did not specifically require the use of international standards, both the good faith and least-trade restrictive requirements imposed by Article XX already subtly expressed a preference for the adoption of an international standard over a unilateral one. This interpretation of the rationale underpinning these requirements of the *Chapeau* of Article XX seems to have been confirmed by the Appellate Body (AB) in the US-*Shrimp* case where, in applying this provision, it held:

"Clearly, and 'as far as possible', a multilateral approach is strongly preferred. Yet it is one thing to prefer a multilateral approach in the application of a measure that is provisionally justified under one of the subparagraphs of Article XX of the GATT 1994; it is another to require the conclusion of a multilateral agreement as a condition of avoiding 'arbitrary or unjustifiable discrimination' under the chapeau of Article XX. We see, in this case, no such requirement".[34]

Therefore, although Article XX does not impose their adoption, reliance on international standards may provide a *de facto* presumption of good faith within the meaning of that provision (Trachtman 1999).[35]

Although building upon Article XX GATT, the SPS scientific and procedural obligations are independent from GATT, so that Members are obliged to comply with the SPS Agreement regardless of whether their SPS measure is otherwise consistent with a provision of GATT.[36] Should, then, an SPS measure be in conformity with the SPS Agreement, that measure is presumed to be consistent with GATT.[37] This relationship of autonomy from GATT has been confirmed by

[34] Article 21.5 Report—Malaysia, United States—Import prohibition of certain shrimp and shrimp products (WT/DS58/AB/RW, October 21, 2001) (hereinafter "US-Shrimps"), paragraph 124.

[35] See, also, for a similar intuition, Marceau (1999).

[36] See EC-Measures concerning meat and meat products (hormones) Panel Report WT/DS26/R 1997, paragraph 8.36.

[37] Article 2.4, SPS.

the WTO judicial bodies' case law. While under the GATT, under established case law,[38] it is the defending Member who bears the entire burden of proof of showing that its measure falls within Article XX(b), under the SPS it is the complaining party who bears the initial burden of proof of showing a *prima facie* case of inconsistency with the SPS.

This Agreement provides new rules for WTO Members such that, in the event of a trade dispute relating to food safety, the WTO judicial bodies would apply the rules contained within the SPS Agreement to determine whether the complaining party was justified in its complaint and, hence, whether the contested measure is allowed under WTO law. Therefore, the SPS Agreement forms the basis upon which Members operate so as to ensure compliance with their WTO obligations.

2.3.3 The WTO Food Regime: The SPS Agreement and Its Main Obligations

The SPS Agreement, which forms part of the 1994 World Trade Agreement,[39] applies to all measures adopted by WTO Members to protect human, animal or plant life or health "which, directly or indirectly, may affect international trade".[40] Notably, SPS measures—as defined in Annex A of the Agreement—are those aimed at protecting animal or plant life or health arising from food-borne risks, pests, diseases, disease-carrying organisms, additives, contaminants, toxins or disease-causing organisms in foods.[41] More precisely, SPS measures can take the form of inspection of products, permission to use only certain additives in food, designation of disease-free areas, determination of maximum levels of pesticide residues, quarantine requirements, import bans, etc... The basic aim of the SPS Agreement is to maintain the sovereign right of any Member to provide the level of

[38] EC-Hormones Panel Report, WT/DS/AB/R, February 1998, paragraph 8.42; Australia—Salmon measures affecting the importation of salmon, WT/DS18/R modified Panel Report, November 1998 (hereinafter: Australia-Salmon) paragraph 39.

[39] According to the 'single package' philosophy, being a mandatory portion of the WTO Agreement, the SPS Agreement binds all WTO Members.

[40] The Agreement covers all relevant laws, decrees, regulations, testing, inspection, certification and approval procedures and packaging and labelling requirements directly related to food safety. See Article 1(1), which, being similar to Article III GATT, is likely to be interpreted in conformity with its jurisprudence. Case law on this provision suggests that what is being sought is equality of competitive conditions between domestic and imported goods. See Reports of the Panels in Italian discrimination against imported agricultural machinery (1959) BISD 7S/60, paragraph 12 and in US—Standards for reformulated and conventional gasoline, WT/DS2/R, paragraph 6.25.

[41] Following an *a contrario* reasoning, measures for environmental protection to protect consumers or for the welfare of animals are not covered by the SPS Agreement. The SPS Agreement being *lex specialis* vis-à-vis the GATT and the TBT, these measures are subject to other WTO Agreements, such as the TBT and Article XX GATT.

health protection it deems appropriate,[42] but to ensure that these sovereign rights are not misused for protectionist purposes and do not result in unnecessary barriers to international trade. Article 2 of this Agreement gives Member States the right "to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health", as long as such measures are not inconsistent with the provisions of the SPS Agreement. Thus, this Agreement, by supplementing the original Article XX GATT, provides Member States with a (multilateral) framework to develop their domestic public health policies, such as food safety.

In order to circumscribe the regulatory authority of national governments when adopting food safety measures, the SPS Agreement chose science as the privileged tool enabling the interpreter to determine whether an adopted food safety measure is legitimate (i.e. a genuine food standard) or illegitimate (i.e. a disguised protectionist measure). In particular, the SPS Agreement's scientific discipline builds upon four key science-based provisions.[43]

2.3.3.1 Scientific Discipline

The primary scientific justification requirement may be found in Article 2.2 SPS. That Article requires that any Member States' sanitary and phytosanitary measure be "based on scientific principles and [. . .] not [be] maintained without sufficient scientific evidence" and be the least-trade restrictive solution available. Article 5.1 SPS translates this duty into operational terms by dictating that countries should ensure that their measures are "based on an *assessment*, as appropriate to the circumstances, *of the risks* to human, animal or plant life or health". Article 5.7, referred to in Article 2.2, authorizes a departure from the previous two provisions, permitting the adoption of provisional measures in a situation of insufficient scientific evidence.[44]

2.3.3.2 Harmonisation

Under Article 3.1, Members are encouraged to base their standards on international standards, guidelines or recommendations where they exist. Members may

[42] Annex A, paragraph 5, of the SPS Agreement defines "Appropriate level of sanitary or phytosanitary protection" as "[t]he level of protection deemed appropriate by the [WTO] Member establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory." The Note attached to this definition states that many WTO Members refer to this concept as the "acceptable level of risk". See also the Preamble of the SPS Agreement which stipulates that "no Member should be prevented from adopting or reinforcing measures necessary to protect human, animal or plant life or health".

[43] For a detailed analysis of the scientific discipline established by the SPS Agreement, see, e.g., Prevost (2009:633–737), Gruszczynski (2010:107–155) and Scott (2007:76–138).

[44] Article 5.7 SPS reads: "[i]n cases where relevant scientific evidence is insufficient, a Member may provisionally adopt sanitary or phytosanitary measures on the basis of available pertinent information, including that from the relevant international organizations as well as from sanitary or phytosanitary measures applied by other Members. In such circumstances, Members shall seek to obtain the additional information necessary for a more objective assessment of risk and review the sanitary or phytosanitary measure accordingly within a reasonable period of time".

introduce or maintain standards which result in a higher level of protection than would be achieved by measures based on such international standards, if there is scientific justification for such increased protection or where the Member has engaged in a process of risk assessment as laid down in Article 5 of the Agreement. As to the international standards upon which Member States should rely upon, Annex A to the SPS Agreement refers to three different standard-setting organizations, depending on their respective area of competence.[45] Thus, Member States should look at the following:

(a) for food safety: the standards, guidelines and recommendations established by the Codex Alimentarius Commission (CAC);
(b) for animal health and zoonoses: the standards, guidelines and recommendations developed under the auspices of the International Office of Epizootics (OIE);
(c) for plant health: the international standards, guidelines and recommendations under the auspices of the Secretariat of the International Plant Protection Convention in cooperation with regional organizations operating within the framework of the IPPC.[46]

2.3.3.3 Notification

Finally, under Article 7 WTO Members have a duty to notify to the SPS Committee all new SPS measures, and all modifications to existing measures that do not conform to international standards and that produce a significant effect on international trade. Notifications aim to make traders or the regulatory authorities in their countries aware of new legislation that may have a significant effect on trade so that they can have access to it and, if appropriate, submit comments before their adoption.[47] Also developing countries, which tend to be placed in a difficult position by the overall SPS scientific regime, benefit from this system as it provides an international framework to discuss SPS measures irrespective of the political and economic weight of the adopting countries. As a result, the SPS Committee oversees the implementation of the SPS Agreement and provides for a regular forum for discussion of trade concerns raised by the WTO Members in relation to the proposed adoption domestic measures related to animal health (around 40 % of its work), food safety (28 %), plant health (25 %) and other issues. The Committee meets normally three times a year and all the 160 WTO Members, acceding countries and observers, have the right to attend its meetings. Discussions of trade concerns, especially market access issues, brought to the attention of the

[45] For an overview of these three organizations, see Stewart and Johanson (1998:27–52).

[46] The IPPC is a treaty signed in 1952 and administered by FAO through the IPPC Secretariat. It aims at securing common and effective action to prevent the spread and introduction of pests of plants and plant products, and at promoting appropriate measures for their control. The Convention deals with the protection of plant life and therefore has no direct relevance to food safety.

[47] The number of notifications continues to increase. The incorporation to the SPS Agreement of China and other regional trading blocs has also led to an increase in notifications.

Committee by Members, are central to its work. Over 10,000 food safety, plant and animal health requirements have been notified, and a growing number of countries are actively providing the information. Since the entry into force of the Agreement, on 1 January 1995, more than 300 health-related trade concerns were raised (human or animal health or plant protection). The specific trade measures that are most frequently discussed in the committee tend to deal with bovine spongiform encephalopathy (BSE), avian influenza (bird flu), foot and mouth disease, and various plant diseases and pests such as fruit flies. The most common complaints are that importing countries are not following the international standards. Another frequent complaint consists of long delays in completing risk assessments.

2.3.4 A Critical Analysis of the Multilateral Food Safety System Offered by the WTO/Codex

The overall effectiveness of the multilateral governance food safety framework as laid out by the SPS Agreement has generally been perceived as satisfactory when examined in the light of its declared objective: to minimize the negative trade effects of domestic food safety rules.[48] It is indeed true that its three-pronged discipline (i.e. the harmonization, scientific evidence and notification requirements), by framing the WTO member's ability to adopt food safety measures, seems to have reduced the scope for arbitrary and unjustified decisions and contributed, as a result, to mitigate the overall number of potential trade tensions stemming from their adoption. In particular, thanks to the notification system performed by the SPS Committee upon all newly adopted measures, the WTO food safety system has been capable of preventing and solving many disputes before they actually arose. This seems particular true if one compares the abundant number of trade concerns raised in front of the Committee and the limited number of disputes litigated under the SPS Agreement. Out of more than 300 trade concerns raised to the SPS Committee,[49] only 15 of them led to the establishment of Panels.[50]

[48] See, e.g. Marceau and Trachtman (2002), Gruszczynski (2010) and Epps (2008).

[49] WTO, SPS trade concerns, G/SPS/GEN/204/Rev.12, 2 March 2012. Developing countries are increasingly active in raising concerns: since 2008, they raised half or more of the new concerns in each year. Over the 17 years, developed countries raised 201 concerns, developing countries raised 173 concerns, sometimes with more than 1 raising or supporting an issue, and least developed countries raised 3.

[50] The United States' and Canada's complaints regarding the EU ban on meat treated with growth-promoting hormones; complaints by Canada and the United States against Australia's restrictions on imports of fresh, chilled or frozen salmon; one at the request of the United States to examine Japan's requirement that each variety of certain fruits be tested with regard to the efficacy of fumigation treatment; Japan's restrictions on apples due to fire blight requested by the United States; the Philippines complaints against Australia's quarantine procedures; complaints by the European Communities against Australia's quarantine procedures; complaints by the United States, Canada and Argentina concerning EC measures affecting the approval and marketing of biotech products; complaints of the European Communities against the United States and Canada

However, while it is tempting to judge the overall effectiveness of the system by dismissing the disputes ligated under the WTO as the 'tip of an iceberg', a methaphor suggesting that the wide majority of trade concerns tend instead to be solved below the surface, it is equally true that these disputes threaten the viability of the whole multilateral governance food safety system. In particular these disputes, often intractable and endless, shed light on the flaws of the current system. It is indeed by focusing on these cases that several voices have criticized and denounced over the years the inherent limits of the current multilateral food safety regime (Alemanno 2007, 2012:228–229; Prevost 2009). Thus the SPS regime has been denounced as undermining national food regulation by 'unmistakably elevat [ing] the policing of trade restrictive measures above the ability of national governments to address risk' (Sykes 2002:368). Its requirements were criticized for 'stripping national regulators of their discretion' (Afonso Pereira 2008:1693), 'gobble all domestic laws that have any impact on international trade' (Schramm 2007:125) and 'choke the ability of a sovereign nation to decide how best to promote the values of its people' (Keane 2006:331). In particular, Sykes (2002:354) argue that the "scientific evidence requirement" in the SPS Agreement is an undue barrier to regulators who genuinely intend to protect public health rather than take protectionist measures.

While these criticisms take a general stance against the interpretation and overall nature of the multilateral governance food safety regime laid down by the WTO SPS Agreement, the next sections will provide a more nuanced, and possibly more constructive and encompassing normative account of the main features limiting the effectiveness of the existing global food safety regime. After identifying the main weaknesses of each requirement and mechanism embedded into the multilateral governance of food safety, it develops some proposals aimed at addressing *de jure condito* those flaws. In so doing, it identifies the following major weaknesses in the system:

(a) the limits of the scientific discipline
(b) the legitimacy of the standard-setting discipline
(c) the effectiveness and representativeness of the SPS notification system

(a) The Limits of the WTO Scientific Discipline

The increased reliance on science as a benchmark against which to check the legality of regulatory action stems from the belief that, "by bringing constraints on valid lines of argument being based on data and methods used to estimate risk" (Crawford-Brown et al. 2004:465), science ensures that a given SPS measure

on their continued suspension of obligations relating to the EC-Hormones dispute; New Zealand's complaint against Australia's restrictions on apples; Canada's and Mexico's complaints regarding against the United States on the Certain Country Labelling (Cool) Requirements; China's complaint against certain United States measures affecting imports of poultry; and Canada's complaint against Korea's measures affecting the importation of bovine meat and meat products from Canada.

addresses a real, objectively established health risk. Under this view, scientific justification, operating in a denationalized dimension, would be more effective than non-discrimination in spotting protectionist measures and in dismantling sham health measures discovered to be *de facto* trade barriers.[51] As a result, WTO Members are—at least in principle—free to adopt all measures they deem necessary to protect food safety and they are also given considerable discretion in determining the Appropriate Level of Protection (ALOP) they seek to achieve through their measures.[52] Yet, as illustrated by several food safety disputes litigated in recent years under this Agreement, occasionally consumers may perceive some kind of risks that cannot be proven by available scientific knowledge. In particular, consumers may develop fears about some foods developed by new technologies,[53] such as animal cloning, genetic engineering and nanotechnologies, and reject them even though they have been scientifically tested and have proven 'safe', i.e. equivalent to their conventional counterpart.[54] Public perceptions, by weakening consumer confidence in a given food product, often mature into public concerns which, in turn, inform national risk decision-making and eventually crystalize into regulations.[55] Being public perceptions culturally determined (Weber and Ancker 2010:480–491), it is not surprising that the ensuing regulations differ among countries and, as such, result in obstacles to trade. Interestingly enough, albeit scientifically unsubstantiated, the resulting regulations do not necessarily imply a protectionist intent or discriminatory effect and reflect what society fears in a given historical moment.

Yet, due to the equation between absence of scientific evidence and protectionism inbuilt in the SPS Agreement, these restrictive measures are difficult to reconcile with WTO law and tend to be systematically struck down by the dispute settlement judicial bodies.[56] Because of their inherent complexity and multipurpose objectives, they may also give rise to complex and lengthy trade disputes that cannot easily be solved by the WTO Dispute Settlement System. Indeed, as demonstrated by the *Hormones* and *Biotech* disputes, when public perceptions

[51] For an insightful book on the law and science interface, see Feldman (2009).

[52] Article 2 SPS provides that: "[m]embers have the right to take sanitary and phytosanitary measures necessary for the protection of human, animal or plant life or health, provided that such measures are not inconsistent with the provisions of this Agreement".

[53] Fischoff (1985:83), one of the pioneers in risk perception studies, recognizes that «technological risks can evoke the deepest feelings».

[54] According to most of the regulatory legal frameworks dealing with these substances, the notion of 'safety' related to their scientific equivalence to the conventional product.

[55] In international trade law jargon, the term "public perception", or more in general. "public opinion", is used to refer to fears unsupported by scientific evidence and as such is opposed to scientifically based facts or measures.

[56] Moreover, as illustrated below, due to the 'regulatory chill' effect generated by the WTO/SPS discipline, Members may sometimes be deterred to adopt trade restrictive measures which although addressing public perception and meeting consumer demand cannot scientifically be substantiated.

trigger the adoption of a protective, yet scientifically unsupported, regulatory response, not even the threat of retaliation may induce the loosing importing country to comply with WTO law.

In view of the above, the exact role that public perception of risks, and more in general public opinion and consumer concerns, may, and ought to, play under the above described science-based regime is one of the most challenging, yet little explored,[57] issue under WTO law, in particular under the SPS Agreement.

A look at the case law developed thus far shows that, under the SPS Agreement, adequate scientific support is a *sine qua non* for the legality of any public health measure. Only once the restrictive measure has satisfied the tests of scientific validity, Member States remain free to be more or less responsive to public perception of risks, on the basis of their own regulatory decision-making procedures. In these circumstances, their responses, notably the determination of the ALOP, may indeed vary with the degree of concern and anxiety among citizens vis-à-vis the relevant food product.

The scientific requirement acts therefore as a bottleneck to the acceptance of risk perception under the Agreement.

The ensuing result is that the WTO judicial bodies could condemn a restrictive measure, such the current EU ban on bisphenol A (BPA)-made baby bottles, which lacks scientific rationality and respond to public perception, despite the absence of protectionist intent.[58] A similar treatment might also be reserved to a regulation restricting the sale of food products derived from cloned animals, such as the one currently discussed by the EU.[59] Due to intrusiveness of the regime into the Member States' regulatory autonomy, all of the major SPS cases to date—the *Hormones*, *Salmon*, *Agricultural products* and *Apples* cases—have been lost by the defending Member.

This result is troubling for a variety of reasons.

First, the approach to regulatory decision-making mandated by the SPS Agreement, by reducing this process to a scientific exercise, does not do justice to the complexity inherent to any legislative or administrative process leading to the adoption of food safety regulations. It is generally acknowledged that in democratic societies regulations to protect public health, although largely informed by science,

[57] Notable exceptions are Walker (1998:307), Scott (2004) and Hilson (2005).

[58] Directive 2011/8/EU amending Directive 2002/72/EC as regards the restriction of use of Bisphenol A in plastic infant feeding bottles OJ L26/11.

[59] Although the European Food Safety Authority (EFSA) assessments have not suggested that meat or milk from cloned animals and their offspring poses a risk to public health, the EU, notably the EU Parliament, object on animal health and welfare grounds. In May 2011 the Council of the EU Legal Service concluded that all measures under discussion (including bans of food from cloned animals and from their offspring) entail risks as far as their compatibility with the WTO rules is concerned. It went on to consider that only in the case where a WTO panel would decide that food from cloned animals and from their descendants were not 'like' products, the envisaged measures would not amount to a violation of Article III:4 of the GATT Agreement or of Article 2.1 of the TBT Agreement.

involve social policy choices. Weinberg (1972:209, 222) has famously expressed this idea in his influential work:

"Attempts to deal with social problems through the procedures of science hang on the answers to questions that can be asked of science and yet which cannot be answered by science. I propose the term trans-scientific for these questions... Scientists have no monopoly on wisdom where this kind of trans-science is involved; they shall have to accommodate the will of the public and its representatives".

Therefore, since most regulations are implicitly or explicitly crafted to respond to a particular social, economic, or political context, it would not seem possible to infer regulatory outcomes solely on the basis of scientific data. Thus, the EU decision to ban BPA-made baby bottles does not find support in scientific evidence as EFSA concluded for the safety of the products, rather in value judgments largely shaped by public risk perception. There is indeed no doubt that public perception, a collection of notions that individuals or society form on risk sources relative to the information available to them and their basic common sense (Jaeger et al. 2011), rather than science per se, were the trigger for the adoption of this restrictive regulatory measure. In the light of the above, condemning the EU ban appears normatively doubtful.

Second, the failure of the WTO's supervision of risk policies via the SPS Agreement to accommodate public perception compromises the right of a Member to establish its ALOP, despite this right being expressly enshrined in the Agreement (Scott 2000:157). Since Members may address risk perception and consumer anxieties only after having satisfied the scientific discipline, their ability to determine the level of protection that it deems appropriate for society seems undermined. On this point, Walker (1998:307) rhetorically asks "if...consumer anxieties could not be respected, or domestic politics could not be taken into account, what would remain of the sovereignty inherent in risk management decisions?" It has been argued that in the long run, this prioritization of scientific evidence over the public perception of risk may threaten "public support" for the international trade regime represented by the WTO (Charnovitz 2000:271 et ss.).

Third, the current reticence of the WTO/SPS regime to account for public perceptions fails to consider how perception-responsive regulation may fare under economic welfare analysis.[60] This is relevant insofar as, by carrying the potential to reduce consumer anxieties and the resulting distortions in behavior, these regulations can produce some social benefits. As observed by Robert Howse, "if citizens believe they need a certain regulation, however, 'deluded' such a belief is, their utility will be reduced if they do not get it, in the sense that they will believe themselves exposed to a risk they believe to be significant" (Howse 2000:2337). The impact on trade stemming from those fears can be significant, and often higher that the impact generated by the restrictive measures alone (Chang 2004). For

[60] On the role of economic criteria in devising international trade rules, see Lowenfeld (2008:153–189).

example, whilst EU consumers fearful of growth hormones may face higher prices stemming from higher production costs, these costs may be smaller than those resulting from the distortions in consumption patterns generated by public perception regarding the safety of meat.

Fourth, the existing SPS scientific discipline is, in the way it has been normatively construed and judicially interpreted, producing the perverse effect of providing incentives to WTO members to hide their societies' public perceptions under scientific arguments in order to create (or at least artificially inflate) scientific disagreement on a given phenomenon. As was the case in several SPS disputes litigated so far, this inevitably leads to impasse. Thus, should the EU ban on BPA-containing baby bottles be challenged under the SPS Agreement, it is likely that the EU will try to defend its measure as scientifically-grounded, notwithstanding EFSA's favorable opinion. The EU would also downplay—as it did in *Hormones*—the role played by public perception in the adoption of its restrictive measure, inflate the scientific uncertainty surrounding the issue and stress the temporary measure of its ban. Yet in these circumstances neither Article 5.1 nor 5.7 would easily accommodate this measure and, by failing to reflect risk assessment, it will likely be struck down regardless of its non-protectionist objective.

Fifth, given the negative historical record of compliance with rulings disregarding public perception,[61] there is also a risk that "the credibility of the WTO is also harmed in the complaining state, which observes a legal victory before a panel or the AB but does not get the benefits of that victory" (Guzman 2007:231). Indeed, as demonstrated by the *Hormones* dispute, when public perceptions trigger the adoption of a protective, yet scientifically unsupported, regulatory response, not even the threat of retaliation may induce the loosing importing country to comply with WTO law.

Sixth, by dismissing as 'irrational' all food regulations that fail to satisfy a risk assessment, the SPS Agreement may produce a 'regulatory chill' on health regulation, i.e. "the reluctance of governments to introduce domestic public health laws for fear of inviting trade disputes".[62] Being aware of the difficult task of defending a risk perception-driven regulation under the SPS Agreement, WTO Members may be deterred from adopting protective regulations even before a formal dispute settlement proceeding is initiated to challenge the regulation. As observed, "well-resources companies regularly commission legal opinions from leading domestic and international lawyers that highlight—and have an incentive to overstate—the risks of a successful trade challenge" (Liberman and Mitchell 2010:165). This

[61] While it is true that only the Biotech and the Hormones rulings have not been complied, these were the only SPS disputes thus far where public perceptions of high salient risks were at stake. A similar outcome might be expected in future disputes in relation to, for instance, restrictive measures directed against food coming from cloned animals and their offsprings.

[62] See on this phenomenon, Liberman and Mitchell (2010), p. 165, and Magnusson (2007), p. 8. See also McGrady (2007) for an analysis of this phenomenon on tobacco control policies; Baumberg and Anderson (2008) for alcohol control policies and comments by Ralph Nader cited in Jackson (2003), p. 790.

clearly acts as a deterrent to enact regulations that are likely not to be fully substantiated by scientific evidence. In the case of BPA, it is worth observing that all countries concerned by this substance have limited the adoption of their restrictive measures vis-à-vis a tiny niche of the BPA-made products: baby bottles.[63] This is the case even though they have been considering imposing it to all BPA-containing products.

These remarks reveal that the issue of the role of food risk public perception presents a normative challenge for the WTO. They also illustrate that, although complex, this challenge should not be avoided. What is at stake is not only the viability of the SPS Agreement but also the social acceptance of the multilateral governance of food safety.

This is all the more true and urgent if one considers the significant number of new sources of food risks that, by eliciting public perception, might prompt the adoption of trade restrictive measures which are likely to satisfy a risk assessment within the meaning of Article 5.1. Besides the issues linked to the controversial endocrine disruptors, such as BPA, one may think of food deriving from animal cloning, bio-engineering and nanotechnology applications. Although virtually all food safety agencies which have examined the food products deriving from these technologies have excluded that these may pose a risk to public health, mounting consumer hostility suggests that they may soon be subject to restrictive regulatory measures. Their adoption as well as their survival depends largely on how the issue of public food risk perception will be tackled under the WTO.

(b) The Limits of the Harmonization Requirements via the Codex Alimentarius Commission

As previously illustrated, WTO Members are encouraged to base their food safety measures on international standards, guidelines or recommendations where they exist. In particular, the standards elaborated by Codex, OIE and IPPC are referred to by the SPS Agreement as a basis for presumed compliance with the agreement. As a result, the proper functioning of the SPS Agreement largely depends in part upon the standard-setting activities of the CAC, the OIE and the IPPC.

Although the operation of these organizations has never been immune from politics, the work undertaken by these international standard-setting bodies has never attracted great political attention. This lack of visibility has historically been due to the fact that the standards they elaborate are not legally binding, but merely advisory, so that they rarely drew the attention of non-scientists. However, as already observed (Alemanno 2007:258 et ss.), express reliance on these three organizations within the SPS has inevitably had an impact not only on their functioning, but also on their nature. In particular, the presumption of conformity

[63] Besides Canada, which was the first worldwide mover against BPA, in the U.S., the states of Connecticut, Minnesota, Washington, Wisconsin, Vermont, Maryland, and New York have passed legislation banning or limiting the use of BPA in products used by infants. In the EU France and Denmark acted before the EU.

introduced by the SPS Agreement has been transforming these standard-setting organizations into "satellites organizations" of the WTO (Poli 2004:615) of "quasi-legislators".[64]

Despite these common traits, the Codex, OIE, and IPPC diverge considerably, both in their roles and organization. Amongst the three organizations mentioned within the SPS Agreement, Codex is without doubt the one that has been more politicized as a result of the Uruguay Round. Codex Alimentarius Commission's mandate includes two competing goals: ensuring free movement of goods in international trade and protecting the health of consumers. This dichotomy inherent within Codex's mandate makes it ill-suited to be an effective safeguard for consumer health. To illustrate this statement one may refer to the long and controversial debates surrounding the vote on Codex beef hormone standards in 1995, which subsequently led to the well-known *Hormones* disputes between the US and the EU. Subsequently, the increasing politicization of Codex has been demonstrated by its failure to adopt a recommended standard for recombinant bovine somatotropin (rbST), a synthetically produced version of a naturally occurring hormone intended to increase milk production. To prevent the adoption of this standard the EU invoked, for the first time ever, "other legitimate factors relevant for the health protection of consumers and for the promotion of fair practices in food trade", as recognized in the "Statements of Principles on the Role of Science in the Codex Decision-Making Process and the Extent to Which Others Factors Are Taken into Account" as they had been incorporated within the Codex Procedural Manual in 1997.[65] During the negotiations leading to the drafting of this document, the US and the EU confronted each other on the setting up of guidelines defining the precise role of science in risk management, in order to give a more operative meaning to the Codex Statement of Principles. While the US argued that food standards should rely solely on scientific evidence, the EU sought to introduce a "need" criterion, aimed at preserving farmers against the productivity-enhancing food technologies (Jukes 2000). More recently, it is ractopamine that is questioning the limits of the WTO/Codex decision-making system (Alemanno and Capodieci 2012).

After years of scientific and political deadlock,[66] the Codex Alimentarius Commission narrowly voted, on July 5, 2012 to adopt the first-ever maximum residue levels for ractopamine hydrochloride, a controversial veterinary drug used in animal feed that boosts growth and promotes leanness in pigs and cattle, and, to a limited extent, heavy turkeys. While this decision has been welcomed by the countries who use the drug in livestock production as a victory for 'science-based' standard-setting within Codex, the conditions surrounding its adoption

[64] Marceau and Trachtman (2002).

[65] As amended in 1998, see Second Statement of Principle included in an Appendix to the Codex Procedural Manual entitled "General Decisions of the Commission". For an overview of this discussion, see Jukes (2000).

[66] This deadlock was somewhat unusual within Codex as this UN-sponsored body adopts dozens of food safety standards each year by consensus, with well over a 100 countries participating.

signal the limits faced by the actual food global governance system for food safety epitomized by the institutional collaboration established between the WTO and the Codex Alimentarius. In particular, the high polarization on the political acceptability of the substance as well as the politicization of its underlying science that have accompanied the discussions within Codex are likely to weaken the legitimacy and overall effectiveness of the adopted standard on the multilateral global food safety governance. In particular, this decision, by making it easier for the U.S. and others to challenge countries like China, the European Union and Taiwan for having zero tolerance policies for ractopamine residues in meat products, is likely to lead the World Trade Organisation to judge against those countries that ban the use of ractopamine. Yet this likely outcome begs the question of whether the weight of an international standard adopted with a one vote difference could realistically be considered tantamount to one adopted under consensus. While there is no doubt that legally speaking these standards are equal,[67] one may wonder—along the lines of the European Commission's statement made in the aftermath of the adoption of the Codex standard—whether "for standards to be universally applicable, they (should) also need to be universally accepted".[68] Moreover, what makes the ractopamine case even more complex than previous similar disputes, such as *EC-Hormones*, is the range of public concerns invoked to sustain the legality of the restrictive measures. Not only it is claimed that ractopamine raises human health risks but also animal health and animal welfare considerations are invoked. In the aftermath of the CAC's favorable vote on ractopamine the EU is—at the time of writing—denouncing the legitimacy of this vote and is asking for revoking it thus squashing the existence of an international standard for the MRLs for this substance.

(c) The SPS Notification System and Its Current Limits

The notification system, by mandating WTO members to notify their SPS measure before adoption, aims at injecting transparency into the adoption of SPS measures across WTO members. This transparency requirement is operationalized by Annex B of the SPS Agreement that provides that WTO Members promptly publish all SPS measures that they adopt and provide an explanation of the reasons for these measures upon request. Members are then directed, except in urgent circumstances, to allow a reasonable period of time between the publication of the SPS measure and its implementation. Paragraph 3 of Annex B specifically imposes on WTO Members the requirement to ensure that one "enquiry point" exists that provides

[67] Panel Report, European Communities—Trade Description of Sardines, WT/DS231, paragraph 7.138.

[68] Press Release by the EU following the adoption of an international food safety standard for ractopamine, July 6, 2012, available on the Internet at <http://ec.europa.eu/food/international/organisations/codex_en.htm> (last accessed on August 16, 2012).

answers to all reasonable questions from interested WTO Members as well as supplying all relevant documents.[69]

As witnessed by the two reviews of the functioning and the operation of the SPS Agreement these transparency requirements have been further operationalized by the adoption of a set of procedural rules by the Committee.[70] These procedures, *inter alia*, clarify the definition of the comment period, encourage the notification of measures conforming to international standards, and provide links for access to full texts of regulations and their translations. While these recommended procedures do not create legal obligations, they aim at facilitating Members' implementation of the provisions of the SPS Agreement. Yet managing information on transparency remains challenging for many developing country Members, and many have expressed their need for assistance and support to resolve individual transparency difficulties, for example with the process of sending notifications to the WTO. Critically enough, there are 20 developing countries and 23 LDCs which have not submitted any notification so far.

More efforts should be undertaken to render the transparency requirements a reality of today's multilateral governance for food safety.

The job of the SPS Committee is not only to passively collect these notifications, but—in line with Article 12 (1)—also "to provide a regular forum for consultations". In particular, Article 12.2 encourages Members to hold ad hoc consultations, including through the good offices of the Chairperson of the SPS Committee, to facilitate the resolution of specific trade concerns. In this respect, it provides that:

"The Committee shall encourage and facilitate ad hoc consultations or negotiations among Members on specific sanitary or phytosanitary issues. (...)."

In particular, with reference to the good offices of the Chairperson, paragraph 6 of the Working Procedures of the Committee[71] provides that:

"With respect to any matter which has been raised under the Agreement, the Chairperson may, at the request of the Members directly concerned, assist them in dealing with the matter in question. The Chairperson shall normally report to the Committee on the general outcome with respect to the matter in question."

However, despite the potential of this mechanism in solving disputes, the yearly summary prepared by the WTO Secretariat of the specific trade concerns[72] raised at SPS Committee meetings shows that the good offices of the Chairperson have been

[69] Unit SANCO/E03 (International Food, Veterinary and Phytosanitary Questions) is responsible for running the obligations of both the EC SPS Notification Authority (NA) and Enquiry Point (EP).

[70] G/SPS/7/Rev.2.

[71] G/SPS/1.

[72] G/SPS/GEN/204 and its revisions.

'underused' in comparison with the other types of ad hoc consultations provided for in the Agreement. They have in fact only been used on three occasions[73] and this despite the substantial number of specific trade concerns raised at each SPS Committee meeting.

Hence, recent calls to provide 'more explicit guidance of the use of 'Good Offices" have been made.[74] It would indeed appear that one of the reasons for this underuse is the lack of specific guidance concerning access to and the functioning of the mechanism. The idea now is to provide an intermediate administrative step between mere notification of a disputed measure and litigation in front of the WTO judicial bodies.

It is time to make sure that this mechanism will be fully operationalized and produce its full potential as a pre-litigation tool. There is indeed a case to better leverage on the Herculean task to collect the notifications of domestic measures and use the system to nudge parties to solve their conflict before they erupt into a dispute.

2.3.5 Some Conclusions on the WTO/Codex System as the Multilateral Governance Framework for Food Safety 3.5

Due to the globalization of the food supply, food safety has emerged in recent years as a significant global issue with both international trade and public health implications. It is against this backdrop that the WTO SPS Agreement by subjecting the adoption of food safety measures to the requirements of preventive notification, harmonization and scientific basis, strives at striking a balance between the imperative of free trade and the legitimate goal of public health protection. Yet as demonstrated by our analysis, none of these requirements has been designed not has been interpreted to address the challenges of food safety per se. They have rather been operationalized in the name of free trade. As a result, despite its chief role within the multilateral governance of food safety, an integrated and institutionalized food safety dimension is simply lacking in the WTO. None of the other organizations seems capable to emerge as providing a valid alternative or at least to complement the current system. Unfortunately, given its predominantly trade-oriented mandate, Codex is clearly not capable per se of filling this gap. Rather, as predicted *in tempore non suspecto*, "Codex seems condemned to

[73] By Argentina, Chile, South Africa and Uruguay in respect of measures adopted by the European Communities in relation to citrus canker, in March 1998 (G/SPS/GEN/204/Rev.6/Add.3, paragraphs 25–88 (Concern No. 27)); by the United States in respect of restrictions imposed by Poland on wheat and oilseeds, in November 1998 (G/SPS/GEN/204/Rev.6/Add.2, paragraphs 444 and 445 (Concern No. 25)); and by Canada in respect of import restrictions imposed by India on bovine semen, in March 2001 (G/SPS/GEN/204/Rev.6/Add.2, paragraphs 327–335 (Concern No. 61)).

[74] Job(07)/14, paragraph 30.

increasingly struggle with its 'de facto' universal food legislator role" (Alemanno 2007:263 et sqq.) In these circumstances, it seems that the question today facing Codex is whether, when dealing with difficult and controversial issues, such as those discussed above (e.g. ractopamine), it would not be wiser to avoid the adoption of the standard and recognize that the parties could not reach an agreement. While it is true that Codex is increasingly acting as a sort of Food Safety World Parliament, the adoption of standards by majority vote seems to weaken rather that to strengthen its legitimacy by inevitably giving rise to further tensions which may lead to trade disputes. In turn, the WTO/SPS, having outsourced to Codex its positive integration authority, is inevitably affected by this phenomenon.

It is within this context that a debate has recently been sparked about how to tackle at the global level food safety issues.

2.4 How to Reform the Multilateral Governance Framework for Food Safety

As it seems clear from this overview of the fragmented international food regime, no organization has the necessary scope to enhance and ensure global food protection. Although the WTO is emerging, together with Codex and its sister standard-setting agencies, as the *de facto* international food regulator, its mission is to liberalize international trade and not to ensure food safety. Moreover, while Codex standards have been enjoying a high degree of acceptance in the international food community, this has changed over time.

As a result, the multilateral governance of food safety offered by the WTO together with Codex appears incomplete. In these circumstances, following the globalization of the food supply, countries are not only let alone while ensuring the food produced domestically as well as the imported one but they are also seriously limited in their ability to do so.

Because of the uneven safety and quality of the food products they import, states may find this a particularly daunting task. While this is true for industrialized countries, it might be even truer for developing countries that are simply not ready to assume this gatekeeper role in world food safety.[75] It is against this backdrop that several proposals have recently been made to establish a new intergovernmental organization to complement, expand and finally put an end to the fragmented international food regime (de Waal and Guerrero Britto 2005).

According to one of the most recent proposals, to address the incomplete character of the existing international food regime, a treaty-based international organization, similar to Codex "that can serve as the international watchdog organization with rule-setting power" should be established (Chyau 2009:326).

[75] Notwithstanding some international efforts aimed at assisting these countries in accomplishing these tasks (see e.g. Article 9), developing countries may not have the necessary resources for such commitments.

Such an organization, which has been named "the International Food Safety and Inspection Organization (IFSIO)", could remedy the weaknesses in the current global food safety system by providing the needed standards for food inspection and the ability to monitor how its member countries carry out the standards. In particular, the IFSIO would ideally have the following primary functions: (1) Set standards for food inspections, certifications, and HACCP[76] systems; (2) Monitor the implementation of the IFSIO standards and certify the food safety systems of individual member countries; and (3) Provide assistance to developing countries wishing to set up or improve their domestic food safety systems. In other words, just as the Codex standards have been serving as the global reference point for food safety, the IFSIO standards would serve as the global reference point for food inspection and certification.

The creation of such an international organization raises an important number of questions that have to do with both its foundation (legal basis, scope, format, etc.) and, more importantly, its relationship with the existing international organizations dealing with food safety issues, such as Codex.

Another proposal suggests to establish a new "global food industry-intergovernmental organization" to complement industry efforts in protecting the food supply. It should be named "World Organization for Food Protection (WOFP)" (Sperber 2008). Although the conditions for its creation have not been laid down in detail, it could be "a relatively small and nimble organization placed within the UN and parallel to WHO and FAO, supported by Codex with its sole emphasis on food protection".

A more recent, better legally grounded, yet underdeveloped proposal suggests the use of a framework convention protocol approach under the WHO regime (Lin 2011). By leveraging on the incremental nature typical of a framework convention protocol (Gostin 2007), this stepwise approach of international lawmaking could potentially avoid political bottlenecks in contentious areas. In the author's view, a framework instrument could enable the initial codification of both some commonly accepted principles and less controversial elements, with the expectation that it could grow into a set of more legalized commitments in the future.

In our view, fragmentation is one of the main weaknesses of the existing international food regime today. Yet, to overcome this, it does not seem imperative to create a further international organization. It might rather be advisable to focus on the existing international organizations and to improve, strengthen and in some cases foster their relationships. In so doing, the most promising course of action seems to widen the mandate of one of the existing international organizations and turn it into an umbrella organization centralizing best practices and mandating food enforcement strategies. Codex Alimentarius seems to be the ideal candidate to take this role.

[76] HACCP stands for hazard analysis and critical control points.

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Overview of Food Safety Standards

3

Morag Webb

Abstract

Over the past 20 years globalisation, consumer awareness, and changing patterns of food consumption and distribution have made food safety a key public health issue. Food supply chains are increasingly complex, providing greater opportunities for contamination, pathogen development, and spread. Ensuring safe food has become a major challenge that must be managed at every stage of the supply chain—from production to consumption, from field to fork. Governments and the food industry have been under pressure to develop management, control and enforcement systems at all levels, leading to a dramatic growth and evolution of public regulations and private industry standards. Together these have created a stringent and complex set of demands with which food business operators must now comply. This in turn has created challenges for suppliers which, in some cases, limits the ability of small and medium sized enterprises to access lucrative global and local markets. It has affected developing country players in particular where they lack the necessary capital, infrastructure and technical support. This chapter provides an overview of the development and changes that have taken place over the past two decades in the official (government) regulations and controls. It also describes the dramatic growth in private sector schemes, exploring the relationship between private standards and public regulations, and introduces a discussion on their potential importance and impact on developing country suppliers. This overview is provided primarily in the context of the horticulture sector.

Keywords

Food safety • Regulations • Private standards

M. Webb (✉)
Policy Adviser for the Europe-Africa-Caribbean-Pacific Liaison Committee (COLEACP), Brussels, Belgium
e-mail: morag.webb@coleacp.org

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3.1 Introduction

Foodborne illnesses are defined by the World Health Organization (WHO) as "diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food" (WHO 2007). Every person is potentially at risk, and foodborne diseases are a widespread public health problem in both developed and developing countries.

The global incidence of foodborne disease is difficult to estimate, but WHO report that in 2005 alone, 1.8 million people died from diarrhoeal diseases that are considered to be primarily due to contaminated food and drinking water (WHO 2007). In industrialised countries it is estimated that each year up to 30 % of the population suffer from foodborne diseases. The incidence in developing countries is less well documented but probably more severe, both through acute as well as chronic illness, and diarrhoea is a major cause of malnutrition in infants and young children. While most foodborne diseases are sporadic and often not reported, outbreaks can sometimes take on large scale proportions. WHO cite an example in 1994 of an outbreak of salmonellosis due to contaminated ice cream in the USA, which affected an estimated 224,000 persons.

Since the 1980s, globalisation has progressively raised the issue of food safety to a new level. Food supply chains are increasingly complex, providing greater opportunities for contamination, pathogen development, and spread. Outbreaks of foodborne diseases that would once have been contained within a small community can now rapidly become regional or global. Major advances in communication systems mean that food safety incidents that previously would have attracted little attention, are now communicated fast and wide. News of the E. coli outbreak in Germany in 2011, for example, spread so rapidly that it had an almost immediate impact on consumer buying practices throughout much of Europe.

Globalisation, changing patterns of consumption and distribution, and rising consumer awareness and concern, have thus made food safety an increasingly important public health issue. Consumers have a right to expect safe food: the "condition which ensures that food will not cause harm to the consumer when prepared and/or eaten according to its intended use".[1] But with ever more complex supply chains, meeting this expectation is a major challenge and, according to WHO, requires actions at every stage of the supply chain—from production to consumption, from field to fork.

Against this background, the past two decades have seen a dramatic growth and development in food safety initiatives both on the part of governments and the food industry. Changes to the international legal framework were followed by an overhaul of national regulatory systems in many countries (e.g. Europe, India, USA, Australia, Japan,. . .). These fundamental changes to the regulations created a very different set of rules by which food industry players must operate, and had far-reaching consequences. They influenced the evolution of a complex set of

[1] ISO 22000.

industry codes of practice to facilitate and demonstrate compliance, the number and application of which have grown spectacularly since 2000.

Meeting the complex set of regulations and controls now in place is essential to accessing markets. For suppliers this represents a very challenging environment, and these increasingly stringent demands can have the effect of limiting the ability of small and medium-sized enterprises (SME) to enter lucrative markets in both global and local value chains. This is particularly the case for developing country players, who often lack the necessary access to capital, infrastructure and technical support.

This chapter provides an overview of the development and changes that have taken place over the past two decades in the official (government) regulations and controls. It also describes the dramatic growth in private sector schemes, exploring the relationship between private standards and public regulations, and introduces a discussion on their potential importance and impact on developing country suppliers. This overview is provided primarily in the context of the horticultural sector.

3.2 The International Standards and Official Control Systems

The international food safety framework operates according to rules set by the World Trade Organization (WTO). WTO was established following the Uruguay Round of Multilateral Trade Negotiations in 1994, which addressed the liberalisation of international trade in agricultural products, as well as negotiating a reduction in non-tariff barriers to trade. Government controls can in effect act as non-tariff barriers, and the Uruguay Round concluded with two binding agreements that WTO members must apply to address this. These are the Application of Sanitary and Phytosanitary Measures (SPS) Agreement, and the Technical Barriers to Trade (TBT) Agreement.

3.2.1 The SPS Agreement and CODEX

At an international level, official food safety regulations and controls are guided by the SPS agreement. Its purpose is to ensure that measures established by governments in the agricultural sector to protect human, animal and plant health, do not act as disguised restrictions on international trade. These measures include laws, regulations, standards, and official requirements relating to food hygiene and food safety, as well as animal and plant quarantine. According to the Agreement, SPS measures "must not be discriminatory or result in arbitrary or unjustified restrictions on trade".

Three international organizations are responsible for setting international standards to meet the requirements of the SPS Agreement: the International Plant Protection Convention (IPPC) for plant health, the Office International des

Epizooties (OIE) for animal health, and the Codex Alimentarius Commission (CAC) for food safety.

CAC was established by WHO and the United Nations Food and Agriculture Association (FAO) in 1963. It "develops harmonized international food standards, guidelines, and codes of practice to protect the health of consumers and ensure fair trade practices in the food trade".[2] CAC is an intergovernmental body with 185 Member Countries and 1 Member Organization (EU). Under the *Codex Alimentarius*, CAC has compiled a collection of food standards, codes of practice and other recommendations to ensure that food products are not harmful to the consumer and can be traded safely between countries. To ensure fair trade practices, these must be proportionate to risk and based on scientific evidence.

CODEX Alimentarius includes both product and process standards. The *product* standards rely on end-product testing, and there are more than 300 standards, guidelines and recommendations setting food product characteristics in terms of quality, composition, and safety. These establish safe levels of additives and contaminants, maximum limits for pesticide residues and veterinary drug residues, and guideline levels for environmental and industrial contaminants. The CODEX *process* codes focus on preventive measures and define production, processing, manufacturing, transport and storage practices. Food hygiene is of particular importance, and the CAC has adopted "Guidelines for the Application of the Hazard Analysis Critical Control Point (HACCP) System", recognising HACCP as a tool to assess hazards and establish control systems that focus on preventive measures at key points in the supply chain.

Finally, Codex Alimentarius encompasses a series of guidelines covering, among others: microbial criteria, food nutrient additives, import and export inspection and certification, and guidelines for food labelling.

3.2.2 National and Supranational Regulations

Within the framework set by WTO and the SPS Agreement, national governments and supranational authorities (e.g. EU) establish their own mandatory regulations. These cover food produced locally as well as imports from third countries. Regulations in WTO member countries must adhere to the principles of the SPS agreement and, in most cases, be based on CODEX, though countries may set additional specifications, for example on food supplements, flavourings, additives, and pesticide maximum residue limits (MRLs). If a country decides to apply measures that are stricter than CODEX, it must provide full scientific justification proving that they are necessary in order to achieve the appropriate level of protection, and be based on appropriate risk assessment.

Over the past decade many countries including the EU, India, USA, Australia and Japan have entirely overhauled their national regulations and the trend was, to a

[2] See http://www.codexalimentarius.org/codex-home/en/.

large extent, led by Western Europe. During the 1990s there was a series of food safety incidents in Europe including Salmonella in eggs and Bovine Spongiform Encephalopathy (BSE). The public questioned the response of their governments to these incidents, and began to lose confidence in the safety and integrity of food. EU Member State governments in turn identified weaknesses in their existing systems of regulation and safety enforcement. This prompted the European Commission (EC) to initiate a wide-reaching process of institutional and regulatory reform. The new framework and principles established in Europe are now common to many other public sector regulatory systems worldwide.

3.2.3 The EU Food Safety Model

The new EC policy was outlined in a White Paper in 2000. It set out a programme of change that transformed the general approach to food safety management, based on fundamentally new principles. Firstly, it recognised that food safety is a risk management operation that requires the efficient integration and operation of all elements in the supply chain. Hazards threaten the food chain at many different stages; the new approach required action to be targeted at critical (risk sensitive) points in the supply chain, and to consistently implement a fork to table approach in food legislation.[3] Secondly, the White Paper established the principle that (all) food operators have primary responsibility for food safety.

In 2002, the EC introduced the General Food Law (EC R 178/02) to provide a framework for the new regulatory system. This introduced a third key principle: traceability. This is defined as "the ability to trace and to follow a food. . . through all stages of production, processing and distribution". Scope is based on the "one step forward, one step back" principle, which means that each EU food business operator must be able to identify its immediate suppliers and immediate customers. They must also have in place systems and procedures for record keeping that allow this information to be made available to national authorities on demand.

Another major change, and the fourth key principle, was the introduction of the Due Diligence Clause into the UK Food Safety Act. This specified that: "*It shall be a defence for the person charged to prove that he took all reasonable precautions and exercised all due diligence to avoid the commission of the offence by himself or by a person under his control*". This radically changed food safety management in the UK food sector as individual firms now had to provide evidence that they had undertaken "*all possible steps to prevent the product from causing harm*". Firms became responsible for the safety and quality of their food inputs, the conduct of their suppliers, and the safety of consumers.

These four key principles fundamentally changed the regulatory environment and had far-reaching consequences. They came into being at a time when the food industry, particularly the retail sector, was already in a state of change, and the

[3] See http://europa.eu.int/comm/food/index_en.html.

effect of the new regulations was to speed up and drive the development of comprehensive self-governing systems by the private sector to enable and demonstrate compliance. The following section describes the modus operandi of the private sector schemes and examines their development over recent decades.

3.3 Private Sector Initiatives

Private sector initiatives are largely based around industry codes of practice, or "private standards/schemes" (PS). While the schemes are voluntary—because they are not required by law—increasingly they are necessary in order to do business and so, in practice, are often mandatory. Failure to be PS certified can exclude suppliers from key sectors of the market.

In the fresh produce sector, suppliers are now required to comply with a range of PS that govern production, manufacturing and distribution. They are primarily process-based, and certification against the standards allows suppliers to demonstrate good hygiene, risk management, and quality control practices.

3.3.1 Modus Operandi

Private standards, particularly in the retail sector, are based on a combination of quality management systems (QMS), Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP), and HACCP. In the main, the private "schemes" incorporate both the standards, and a protocol that provides the mechanism to manage implementation (Swoffer 2009). Traceability is a key element so that should an incident occur, firms can demand rapid and complete re-call. While regulations generally demand traceability only within national boundaries (so that produce from third countries is only traced back to the point of import), private standards generally require traceability along the entire supply chain.

Certification of the schemes is subject to third party auditing, and this provides the tool for supply chain operators to demonstrate compliance. Most of the major schemes are based on CODEX principles, and their requirements are harmonised worldwide under the International Standards Organisation (ISO). The ISO 9000 family of standards are designed to help organisations ensure that they meet customer food safety demands as well as statutory and regulatory requirements. ISO 9000 deals with the fundamentals of quality management systems, and ISO 9001 specifies the requirements with which organisations must comply to meet the standard, and to be assessed though third party certification.

ISO 22000 is a derivative of ISO 9000, specifically addressing food safety, and it sets the framework for the majority of private schemes. The underlying principle is that, to be effective, food safety must be established, operated and updated within the overall framework of a company management system. ISO 22000 integrates the CODEX principles of HACCP, and considers hazard analysis as central to the development of an effective food safety management system. ISO 22000 requires

all hazards that may reasonably be expected to occur in the food chain to be identified and assessed, and provides mechanism to establish and document why and which hazards must be controlled.

Against this background, and based on these shared principles, private standards in the food industry have developed at a fast pace. Changes to the international and national regulatory systems played a major part in driving the standards forward, but other factors have also been instrumental in defining the pace and direction in which they have evolved.

3.3.2 The Drivers of Private Standards

Swoffer[4] asserts that the development of stricter private sector controls were brought about by the need on the part of industry to have practical tools to facilitate the implementation and oversight of food safety management. At the time when firms began to face increasing pressure in the commercial and regulatory environment, little was available to help them within the international standards context. CODEX provided the General Principles of Food Hygiene, but while this outlines the fundamental principles, it is generic and gives little by way of practical guidance or implementation mechanisms. Similarly ISO 9000 provided generic quality management systems, but again is difficult to apply and provides little practical guidance for the food industry.

Firms also saw that while the international standards and national regulations set the framework for food safety, they did not have the capacity to adapt rapidly in response to a crisis. Faced with a series of serious food safety incidents in Western Europe during the 1990s, industry recognised the need for management systems that were both practical, and could very quickly respond and change in the event of a situation in order to maintain consumer confidence.

According to Swoffer (2009), there are five main objectives behind PS adoption by firms:

To assure product safety
To provide brand protection
To meet legislative requirements
To promote business improvement and efficiency
To promote consumer confidence

Of these, Fulponi (2006) highlights the latter and argues that the main driver is to maintain and enhance reputation. Following numerous high profile food safety incidents and growing media interest in the subject, consumers (particularly in industrialised countries) are very aware and concerned about the safety of the food they buy. A serious incident can do untold damage to a firm's reputation, sales, and

[4] Personal communication.

shareholder value; companies simply cannot afford to risk losing consumer confidence and trust and so adopt a policy of zero tolerance in food safety.

Risk mitigation is also of major importance and there is little doubt that the UK Due Diligence Clause, and the increasing use of liability laws in industrialised countries, has stimulated the growth and stringency of PS. Standards allow players along the supply chain to demonstrate that they have put in place systems that ensure all necessary precautions (under their control) have been taken to comply with legal requirements and supply safe food. In effect, the PS, and their certification by a third party, act as an insurance policy in the event of civil or criminal prosecution.

Fulponi notes that with increasingly stringent food safety regulations, companies also develop their own brand standards for product differentiation. When governments pass regulations setting minimum standards for products or processes, this can have the effect of reducing the "quality" difference between firms. The result is, potentially, to increase price competition. To avoid this, and to protect revenues, retailers use private label (quality) brand standards that raise levels above those required under the regulations, and thus encourage competition on quality criteria, rather than price.

Though private industry standards for the management of food safety and quality have been in operation for several decades, the pace of their development and use has accelerated and spread dramatically over the past two decades.

3.3.3 History and Development of Private Standards

The inception and earliest examples of private standards for food safety management were associated with the growth of individual brands in the European retail sector, notably in the UK. Swoffer identifies the "Directive of Work" at Marks and Spencer in 1948[5] as one of the earliest initiatives. This stipulates the control of raw materials, specifications for their use, and inspection of production and finished products. He then follows the development of retailer own label schemes over the next decades. In the mid-1980s, retailer brand schemes in Europe became firmly established. As the brands grew, the company internal monitoring and control systems gradually became more formalised. Though the trend was evident throughout Europe, the process was led by the UK where standards development was earlier and more intense, largely driven by the introduction of the Due Diligence Clause.

Auditing of these brand standards was initially conducted internally, but self-auditing was gradually supplemented, and then replaced, by third party certification. This increases objectivity and transparency but, in practice, also had the effect of shifting the cost of auditing and certification onto the supply chain.

[5] See Goldenberg (1989) for more details on this matter.

The 1990s saw the brand schemes complemented by the appearance of business-to-business (B2B) standards. In contrast to private label schemes, these are not generally visible to the consumer, and so are not used for market placing. Instead they are used as procurement and governance tools to improve chain performance and reinforce links between retailers and suppliers. The B2B standards began in the UK with codes of Good Agricultural Practice (GAP) (e.g. the Assured Produce Scheme) and a protocol of good hygiene practices (later the British Retail Consortium Food Standard). These in turn were a major driver for the development of similar food safety initiatives by the private sector throughout Europe (Jaffee 2005).

B2B schemes now form part of the procurement systems of all major retail chains in their national and global operations. Several individual B2B food-safety based schemes are now in operation covering both production and processing. These include BRC, IFS, Dutch HACCP, SQF 2000, and SQF 1000.

In addition to these has been the development of private standard setting coalitions such as the Global Food Safety Initiative (GFSI) and GLOBALG.A.P. In both cases lead firms (comprising many of the major global food and retail industry players) came together to address food safety on a collective basis. They recognised that food safety is a non-competitive issue, and that any potential problem in one company could cause repercussions throughout the sector and damage everyone. Working together, lead firms have attempted to develop cost effective ways to address an industry-wide need, offering a competitive advantage to member firms, and overseeing activities from production to distribution.

The growth in the use of private standards by the food and retail industries has not been without its critics. Suppliers have complained about the additional costs, and the extent to which the standards can act as barriers to market access. Regulators have criticised the extent to which the standards can be seen to conflict with, or to inflate, the food safety rules set by governments.

3.4 Public Standards Versus Private Schemes

A major criticism of the private industry standards is the lack of transparency or opportunity for dialogue in standard-setting. This is in marked conflict with the approach taken by the international standards, which are based on a painstaking process of consultation and consensus. There is also criticism that some schemes exceed the standards set by CODEX; this is seen as attempting to generate competition on food safety, and is at variance with the legal framework under which, by definition, all food must be safe.

In June 2005, the issue of PS (in particular GLOBALG.A.P) and their implications for trade, was raised at the WTO SPS Committee. A number of countries shared the concern that GLOBALG.A.P was more demanding than national or EU regulations, and was becoming trade-restrictive. This prompted lengthy discussions by the Committee on the impact of standards on trade, as well as deliberations as to whether the private standards fall under the remit of WTO and the SPS Agreement. If so, they would have to abide by the rules set by the

Agreement and thus: must not be discriminatory or result in arbitrary or unjustified restrictions on trade, must be proportionate to risk, and be based on scientific evidence.

As GLOBALG.A.P and other private standards are entirely under the control and direction of the private sector, without government involvement, it was ruled that they fall outside the jurisdiction of WTO rules. Nevertheless, the importance and sensitivity of the PS issue as a key factor influencing international trade was recognised and, reflecting this, it has remained as a standing item on the agenda of the SPS Committee ever since.

The discussions thus continue, particularly at the level of WTO and regulators, as to the relationship between the public regulations and private standards. Scannell (2008), presenting on behalf of the EU system, recognises that under the new regulatory approach to food safety, there is a legitimate role for the private sector. The legislation recognizes this as it makes private operators ultimately responsible for food safety (most explicitly under the Due Diligence Clause).

In practice, the regulations and private standards have not "gone their separate ways" in addressing food safety. The main private schemes in operation (and recognised by GFSI) are built on CODEX standards; the basic principles, elements and scope are the same. However, they may differ in format, and the private schemes may go further than the regulations to address issues of specific interest to their business and customers (e.g. company internal auditing, traceability).

In practice, several governments already take into consideration the presence of private standards as a risk mitigation tool. In the UK, for example, discussions are in progress on the application of "Assured Trader Status" to operators that are certified to a recognized scheme, who would then be subject to a reduced level/frequency of government checks for their premises or consignments.

Scannell (2008) suggests that discussions should move beyond considering the relative merits of public regulations versus private standards, and accept that both have a role to play. He recognizes that private food safety schemes are a risk management tool that work in concert with the regulatory framework. Trade can only take place if it is fair and safe—and this is the responsibility of government and the regulatory authorities. Alongside this the private sector must ensure compliance with the regulations and, in addition, take measures to ensure that produce conforms with customer demand.

Nevertheless, the food industry and retail sectors still face major criticisms. Of particular concern is the proliferation of standards facing suppliers, each with its own individual requirements and expense. Costs of compliance, and the cost of demonstrating compliance through certification, are passed down the supply chain; suppliers are thus faced with a complex set of demands and escalating costs, but generally without receiving a premium on sales of certified products. The impact of this is more significant for SMEs, and most particularly in the developing country context.

3.5 Implications for Developing Countries Suppliers

For developing country suppliers, the PS can provide benefits. GLOBALG.A.P, for example, has translated production-related regulatory requirements into a "package" that guides their application in practice. Most major global retailers and food industry players require food safety standards for production and manufacturing, and certification creates the potential for suppliers to access these high-value markets. Standards that encourage good practice can also increase productivity and competitiveness by reducing input costs (e.g. pesticides, fertilisers), and by assisting operators to adopt GAP/GMP, record keeping, improved hygiene, and modern management methods. There can in addition be wider social benefits through, for example, improved worker hygiene, and an increase in the value of skilled labour.

However, while the PS can improve supply chain efficiency and potentially benefit operators, they are exclusionary to those who are unable to meet them.

A decline in many traditional developing country exports in recent decades has prompted investment in non-traditional exports such as fresh fruit and vegetables that use labour intensively, and where they have comparative advantage. A substantial proportion of these exports are produced by smallholders, and many people are employed on farms or in processing and related activities. The horticultural export industry, in particular, is an important source of income and a key contributor to poverty alleviation in rural areas. Against this background, the potential impact of PS on the export trade has become a concern for donors and governments alike. It has gained a political profile, reflected by a plethora of projects, workshops and discussion papers dedicated to the discussion.

UNCTAD (2008) note that private standards may adversely affect producers and exporters in Sub-Saharan Africa (SSA) as they face greater challenges in adjusting to the requirements than their competitors due to factors such as poorer infrastructure, weaker technical, financial and institutional capacities, and the larger investments required to upgrade farms. They also note that the PS can lead to significant cost shifting, often to the detriment of developing country players; passing the cost of PS down the supply chain can have a negative impact on resource-poor farmers.

There have been numerous research papers and reports on the impact of PS on small-scale growers (SSGs) and the potential of the PS to exclude them from high-value retail markets. Most have focused on GLOBALG.A.P as the main pre-farm-gate standard, and numerous studies suggest that the requirement for PS certification may encourage exporters to shift production from outgrowers to company farms, to favour larger outgrowers, or to withdraw outgrowers from compliance schemes (Graffham et al. 2006; Maertens and Swinnen 2009; Fulponi 2007; Kleih et al. 2007).

COLEACP[6] has also found in the case of GLOBALG.A.P that while generally technically feasible for developing country exporters and growers, initial investments and high recurrent costs may mean that certification is not financially viable, particularly for smaller players. Some of the elements that make GLOBALG.A.P most expensive and difficult result from the fact that the standard was designed for a "European" context, and is thus poorly adapted in some respects to the developing country social and agro-ecological production environment.

Recognition of the difficulties faced by DCs and developing companies in achieving and maintaining certification has encouraged the main standard setting coalitions to address the issue by trying to facilitate "entry", and by localising the standards.

In 2008 GFSI established the Global Markets Programme to develop voluntary food safety requirements and protocols for less developed businesses. It was established in recognition of the fact that they may face difficulties (and cost limitations) in moving from their current position direct to full certification. The programme includes both manufacturing and pre-farm gate elements, and provides a staged approach whereby firms and farms can improve (with assistance) over time. More recently GLOBALG.A.P have introduced their "localg.a.p" programme that takes a similar approach. GLOBALG.A.P is also promoting the development of National Interpretation Guidelines as a means of making the standard locally appropriate, as well as overcoming problems of auditor interpretation and inconsistency.

Nevertheless, PS certification in developing countries remains a very challenging and high profile issue, and one that is shifting fast.

The EU remains one of the largest markets for fresh horticultural produce, but in the past 4 years the economic crisis has had a big impact on imports. Keeping end prices down for their consumers is a priority for EU retailers. As a result, prices paid to developing country exports have risen very little, if at all, while at the same time their input and freight costs have risen dramatically. This has resulted in some export sectors being subject to significant financial pressure, and is undoubtedly having an impact on PS food safety certification.

Compliance and certification is expensive, and the costs are passed down the supply chain. In developing countries, the cost of certification of SMEs is often borne by export companies, who are generally in the best position to make the investments on behalf of their own farms as well their outgrowers. An earlier study by COLEACP confirmed this, indicating that costs of infrastructure and investments for smallholder certification are generally covered by exporters or donors, but rarely by smallholder groups themselves.

[6] As its mission statement states, COLEACP is a "non-profit inter-professional association, representing and defending the collective interests of ACP producers/exporters and EU importers of fruits, vegetables, flowers and plants". More information on COLEACP, its structure and function can be gleaned from their homepage: http://www.coleacp.org/en/.

With the financial squeeze currently facing exporters, in some sectors this appears to be having an impact on their ability to continue supporting certification in this way. Firms are already looking towards alternative markets that are less demanding in terms of standards compliance and certification, and are thus more accessible, and perhaps more lucrative. This includes markets in the Middle East, Asia and Russia, as well as the very rapidly growing supermarket sector within developing countries themselves (Barrientos 2012).

3.6 Conclusion

In summary, recent decades have seen major changes to the way governments and the food industry manage food safety. These changes were needed to ensure safe food for consumers in the context of globalisation, with its rapidly transforming patterns of consumption and distribution. They have involved an overhaul of the regulatory frameworks set by national and international (government) regulations, accompanied by the creation of complex systems of self-regulation by the food industry based on private standards. Meeting the complex set of regulations and controls now in place is essential to accessing formal markets but, for suppliers, represents an extremely challenging environment.

Private standards allow retailers to benefit from increased efficiency of their supply chains, competitive advantages, protected revenues, and reduced risk of liability. Consumers can benefit from access to high quality, safe, and affordable food. However, different players and nations vary in their ability to meet the standards, with the smaller and less well-resourced players being least able to comply. Institutional weaknesses, coupled with disproportionately higher costs and greater challenges to becoming certified, can contribute to the marginalisation of weaker economic players including small and poor countries, SMEs, and smallholder farmers.

Thus while trade barriers have declined for many developing countries as a result of the Uruguay Round Agreements, at the same time market entry conditions, in particular from private standards, have risen. Pressure from private standards is not likely to ease in the future; in addition to food safety they are extending more and more into sustainability, with growing demands for environmental schemes and labour standards.

Private standards have developed as the food industry adapts to a rapidly changing trading and regulatory environment. And they continue to evolve in the face of new pressures. One such pressure is an increasing awareness of the extent to which PS can negatively impact on developing country supply chains. This has the potential to damage the reputation of firms with their consumers, who are increasingly concerned with issues of fair and ethical trade. Another is the changing pattern of trade whereby exporters shift to supply markets that are less demanding of private standards, which could in turn potentially result in restricted supplies of some product lines for the most stringent buyers.

The next steps in the evolution of private standards will thus have to take on board not only the efficiency, but also the sustainability of supply chains. And, importantly, sustainability will need to consider not only environmental and social aspects, but also affordability; standards compliance and certification will only function effectively and be sustainable if they are resourced through the fair and proportionate allocation of costs and benefits along the supply chain.

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Retail Driven Food Safety Regulation

4

Tetty Havinga

Abstract

This chapter discusses the increased role of corporate retailers in global food safety regulation and its consequences for food producers. Retail-driven private food safety regulation started in the early 1990s and has become increasingly important in global food regulation. Major European retailers took the lead in the establishment of private food safety standards with third party certification. These retailers require their suppliers throughout the world to participate in this system of private food governance. The first of these standards were developed by national retailers associations. The British Retail Consortium was a front runner here. Later the food standards crossed borders and were adopted by retailers and producers in other countries.

The chapter introduces the dominant transnational retail-driven standards with particular attention to the dissemination outside Europe and the power of retailers in the governance structure of the standards. Today the distribution of the standards still reflects the geographic pattern of their origin. In its early days large corporate European retailers were in complete control but after a short or longer period of time other stakeholders were included in the governance structure of the schemes. However, the major standards are still retail-driven in two ways: retailers own the standard and retailers promote the adoption of the standards by requiring compliance from their suppliers all over the world.

Retailers are engaged in food safety regulation for several reasons, including assuring high product quality, building confidence and protection against liability claims. Although compliance with these retail-standards is not legally mandatory, for many food producers non-compliance is not really an option because it is required by the market (i.e. the supermarkets). The globalization of food supply chains, the increased economic power of corporate retailers and the

T. Havinga (✉)
Institute for the Sociology of Law, Radboud University, Nijmegen, The Netherlands
e-mail: T.Havinga@jur.ru.nl

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shifting balance between public and private food governance enabled large international supermarket chains to become powerful food regulators.

Keywords
Food safety • Private standards • Public regulation • Food retailers

4.1 Introduction

The structure of the regulation of food safety has changed considerably in the past decades. The former command-and-control regulation by national states has been complemented by private and hybrid forms of regulation. The global system of food regulation has been transformed in two ways: a shift from national law to law of the European Union (EU) and other transnational governmental organizations and an increase of various forms of private governance. In the 1980s in most Western European countries food regulation was mainly the domain of the national (or local) government and governmental food inspectorates. Several developments form the background for both transitions. Food supply chains became increasingly international, promoted by faster and cheaper transportation, improved techniques for preservation and cooling of fresh food, growing public purchasing power and changing consumer demands. Several food scares and incidents (such as bovine spongiform encephalopathy (BSE), E-coli outbreaks, dioxin in chicken and milk, and salmonella infections) created public concern about food safety and pressure on governments to tighten up regulations and enforcement. In addition, governmental regulation has been criticized for being inefficient, ineffective and taking the wheel from citizens and businesses. A final development that has contributed to the changing food governance system is the increased power of multinational food retailers.

Both governmental organizations and food industry responded to food scares and growing distrust in existing regulatory arrangements. The European Union obtained a prominent role by strengthening its food safety legislation and establishing the European Food Safety Authority and the Food and Veterinary Office. At the national level, several European countries have established new regulatory agencies or reformed existing agencies to oversee the national food control activities. In the United Kingdom (UK) an independent government department, the Food Standards Agency (FSA), was set up in 2000 to protect the public's health and consumer interests in relation to food. The FSA took over a number of functions formerly carried out by Department of Health and Ministry for Agriculture, Fisheries and Food and the Irish, Scottish and Welsh administrations.

Food industry and civil society organizations criticized governmental food controls for being not adequate. For example, in 2002 Dutch associations of food manufacturers, food retailers, and consumers with joined force voiced their concern about insufficient governmental action in response to food scares and decreasing consumer trust. They argued the necessity of giving more priority to food safety and

to establish a strong and independent food safety authority.[1] Food industry not only demanded governments to reform their food controls, they also engaged in private food safety regulation. In global food supply chains particularly major food retailers play a dominant role in these regulatory arrangements. In this chapter we investigate the role of food retailers in food safety regulation. This includes three main questions. 1) What are the characteristics of these private food safety arrangements: What did retailers do to regulate food safety? What are the forms of the regulation? What is the scope of these regulations? What is the role of retailers in the governance structure? 2) Why did retailers take the role of legislator instead of leaving food safety regulation to governments? 3) Why did food producers comply with these retail-driven regulations? This questions needs to be addressed because compliance with private regulations typically is not legally mandatory.

The next section deals with the development of retail-driven private food safety regulation from the 1990s onwards. The dominant transnational retail-driven standards are introduced with particular attention to their dissemination outside Europe and the power of retailers in the governance structure of the standards. Section 4.3 discusses the reasons for retailers to engage in food safety standards. Subsequently, Sect. 4.4 deals with the reasons for food producers to comply with food safety standards. The final section concludes that major European retailers did play and do play an important role in food safety regulation.

4.2 The Emergence and Dissemination of Retail-Driven Food Safety Regulation

The growing role of retailers in food governance is significant in various analyses of the development of food regulation. Marsden et al. (2010) distinguish three phases in the development of food safety regulation in the United Kingdom (UK) since the 1980s: 1) state-centered regulation focusing on food hygiene and public health (up to the mid-1980s), 2) two tier approach: state-centered system remains for non-corporate producers and retailers next to privately regulated supply chain for corporate retailers up to 2000, and 3) complex public-private model of food governance. In the second and third phases major retailers play a key role in food governance in the UK. Burch and Lawrence (2005) have analyzed the shifting distribution of power in the global agri-food supply chain: in the first food regime (from 1870 onwards) nation states and farmers were the main drivers, in the second food regime (from 1950) processing companies were the main drivers and in the third food regime (emerging from 2000) retailers are the main drivers (see also Smith et al. 2010). In the current food regime the power in agri-food supply chains has shifted away from manufacturers of branded food products to the global

[1] Manifest Nva: food industry (VAI, Nederlandse Voedingsmiddelenindustrie, en SMA, Stichting Merkartikel), retail (Centraal Bureau Levensmiddelenhandel), and consumers (Consumentenbond), January 14, 2002 (http://www.cbl.nl/. Accessed December 16, 2002).

supermarket chains. Both Marsden et al. and the food regimes theory stress the powerful key position of large supermarkets.

Henson (2008) observes that systems of public and private food regulation differ across countries and supply chains. In the UK the system is characterized by strict public regulation, the dominant position of multiple food retailers and private standards audited by third-party certifiers. Conversely, the United States relies heavily on legal liability; manufacturer brands maintained their leadership position and retailers are less important than in the UK.

Food retailers and food manufacturers have developed initiatives for decreasing food safety risks and increasing consumer confidence in safe food. In the 1990s several large food manufacturers and supermarket chains in Europe developed their own quality control system. A company quality control system often included requirements for suppliers in order to control the inputs. The corporate supermarkets want to make sure that the goods they purchase will meet particular standards and qualifications. These goods may be raw materials, parts of or semi-finished products for further manufacturing, or end products ready for sale. For example, in the 1990s several British and Dutch supermarket chains contractually obliged their suppliers to meet a comprehensive quality assurance standard including unexpected inspections at farms, gardens and plants (e.g. Albert Heijn in the Netherlands, Tesco and Sainsbury in the United Kingdom) (Havinga and Jettinghoff 1999; Havinga 2006). Examples of such supermarket standards include Tesco Nature's Choice, which was introduced in 1991 by the British retailer Tesco.[2]

Since the 1990s private retail-driven standards have expanded dramatically. Several private collective standards were created. Food retailers joined forces to harmonize supplier standards. Regulation of food safety by retailers using quasi legislation as an instrument to force trade partners to take food safety measures, evolved from regulation originated from one supermarket chain to regulation of united supermarkets, monitored by independent certification and inspection organizations. National private certification schemes have crossed borders and became global or transnational. Currently dominant transnational retail-driven standards are the British Retail Consortium (BRC)[3] Global Standard for Food Safety, the International Featured Standards Food Standard (IFS), the Safe Quality Food Standard (SQF) and Global Partnership for Good Agricultural Practices (GlobalG.A.P.) (Fuchs et al. 2011; Van der Kloet 2011).

The BRC Global Standard for Food Safety was originally developed in 1997 by the British retailer's organization for own-branded food products. Its aim was to assist retailers in their fulfilment of legal obligations; under British law retailers had the legal obligation to take all reasonable precautions and exercise all due diligence in the avoidance of failure (Havinga 2006). The BRC standard is now a supplier

[2] Tesco still has a company food safety scheme with 15,000 certified firms (www.tesco.com/nurture. Accessed July, 2012).

[3] http://www.brcglobalstandards.com/.

requirement of many supermarkets all over the world. The standard can be applied to any food processing or packing operation where open food is handled, processed or packed and aims 'to guarantee the standardisation of quality, safety and operational criteria and ensure that manufactures fulfil their legal obligations and provide protection for the end consumers'.[4] In course of time the BRC has developed three other standards covering consumer products, packaging manufacture, and storage and distribution next to the Food standard. Initially only retailers were involved in the decision making process of the standard. Later also representatives of food manufacturers and certification bodies were included in the technical committee of the standard; although the retail organization BRC remains the owner of the standards. The scope of the standards has been extended fourfold:

1) Geographically: not only British supermarkets adopted the standard but also supermarket chains in other countries and food manufacturers all over the world require their suppliers to comply with the standard.
2) Scope food: the scope of the standard is not limited to supermarkets own brands anymore. The standard is also used for processing and packaging of other food products.
3) Scope beyond food: the scope has been extended to include not only food production. BRC developed standards for non-food, for packaging, and for storage and distribution.
4) Participation: initially only (British) retailers participated in the committees of the standard. Now also representatives of food manufacturers and certification bodies participate in committees that discuss the content of the BRC Food standard and which revisions are needed.

Other retail-driven food standards expanded similarly. The IFS Food standard was initiated by the German retailer's organization in 2002. In the second edition the French retailer's organization joined the initiative, since then the formal organization is a joint German-French retail project. Retail federations from Italy now also participate in the IFS standard. Both BRC and IFS are developed and applied predominantly by European food retailers. The American supermarkets decided not to join one of the two standards owned by platform organizations of European retailers, nor to develop their own food safety standard. Instead, at the request of its retail members in 2003 the American Food Marketing Institute acquired the Australian food safety standard SQF. The Safe Quality Food standard started as a public voluntary standard in 1994 and was formerly owned by the West-Australian Department of Agriculture. The SQF certification program includes both food processing and primary production.

European retailers also developed GlobalG.A.P. (Global Partnership for Good Agricultural Practices) as a certification program for primary produce. It started as

[4] http://www.brcglobalstandards.com/ (Accessed November 14, 2013).

EurepGAP in 1997 at the initiative of 12 European supermarkets and retailers.[5] Their aim was to take first steps towards the harmonization of their own standards and develop one European standard for Good Agricultural Practices (Van der Kloet 2011).

The European retailers also engaged in another process to harmonize retailer food safety standards. They established the Global Food Safety Initiative (GFSI) in 2000 in order to agree on globally accepted food safety standards. The GFSI retailers decided not to develop a single global food safety standard but to benchmark existing food safety standards. The initiative sets baseline requirements for food safety standards and intends to improve efficiency costs throughout the food chain. By now, eight food safety standards have been benchmarked to be in compliance with the GFSI Guidance Document (sixth edition). One more scheme that was recognized against the fifth edition of the GFSI Guidance document is still going through the benchmarking process against the sixth edition (See Table 4.1).

In 2007 seven major food retailers agreed to reduce duplication in the supply chain through the common acceptance of any of the GFSI benchmarked schemes: Carrefour, Tesco, Metro, Migros, Ahold, Wal-Mart and Delhaize (Sansawat and Muliyil 2011:4). Later other retailers followed (See Table 4.2). Most major international food retailers currently support certification against one of the major food safety schemes (See Table 4.2). Retailers have a key position in these food standards as BRC, IFS, SQF and GlobalG.A.P. are owned by retail organizations. Other stakeholders such as food manufacturers, wholesalers and certification bodies do participate in technical committees and working groups of the food schemes (Fuchs et al. 2011). In the past years the GFSI also recognized some schemes that are not initiated and managed by retailers, such as the Global Red Meat Standard, CanadaGap, FSSC22000, Global Aquaculture Alliance Seafood Processing standard and Primus GFS.

Certified firms are unequally distributed over different countries and regions. Table 4.3 shows that the majority of firms that are certified against BRC, IFS and GlobalG.A.P. are European. This reflects the European origin of these standards. Third party certification against GFSI recognized schemes (particularly SQF, and also BRC) is increasing in the USA. The share of certificates in Asia, Africa, and South America is growing. Recently a Chinese food safety standard, China HACCP, has applied for recognition by the GFSI. GFSI is promoting the implementation of GFSI-recognized standards outside Europe for example by organising food safety events in China, Japan, Brazil, Chile, South Africa and India. Both GlobalG.A.P. and GFSI have initiated a program to assist small producers to implement the GlobalG.A.P. or a GFSI recognized scheme; these programs focus on developing countries.

[5] Member of the Euro-Retailer Produce Working Group (Eurep) were: Tesco, Safeways, Sainsbury's, GB Supermarkets, Continent, Delhaize, ICA Handlarna, KF, Albert Heijn, Martinavarro, APO and Promodes.

Table 4.1 Characteristics of food safety standards recognized by the Global Food Safety Initiative[a]

Standards	Current standard owner	Initiated by	Start date	Date of first recognition	Product range
BRC Global Standard for Food Safety[b]	British Retail Consortium (Association of British retailers)	British retailers (BRC)	1998	2000	Any food processing or packing operation where open food is handled, processed or packed
IFS Food Standard[c]	IFS Management GmbH (non-profit company owned by retail federations from Germany and France)[d]	German retailers (Hauptverband des Deutschen inzelhandels HDE)	2003	2003	Post-farm gate stages of food processing
SQF	Food Marketing Institute (Association of US food retailers and wholesalers)	West-Australian government	1994/ 2003	2004 or 2005	Primary production, food manufacturing and distribution
Global G.A.P.	Foodplus GmbH[e]	European retailers	1999	Between 2005 and 2009	Fruits and vegetables, meat and aquaculture fish
Global Red Meat Standard	Danish Agriculture and Food Council (non-profit association of farming and food industry)	Danish Agriculture and Food Council	2006	2009	Red Meat supply chain
Food Safety System Certification 22000	Foundation for Food Safety Certification (not-for-profit organization)	Dutch Certification Organizations (developed Dutch HACCP)	2009	2009[f]	Processing or manufacturing animal products, perishable vegetal products, products with a long shelf life, (other) food ingredients like additives, vitamins, bio-cultures and food packaging material
Global Aquaculture Alliance Seafood Processing Standard	International non-profit trade association		1997	2010	Aquaculture seafood
Canada GAP	CanAgPlus (not-for-profit corporation)	Canadian Horticultural Council	2008	2010	Fresh fruits and vegetables

(continued)

Table 4.1 (continued)

Standards	Current standard owner	Initiated by	Start date	Date of first recognition	Product range
Primus GFS	Azzule Systems (data management company)			2010 or before in benchmarking process against GFSI sixth edition	Fresh agricultural produce

Notes and sources:
[a]http://www.mygfsi.com/schemes-certification/overview.html. Accessed November 7, 2013
[b]http://www.brcglobalstandards.com/. Accessed November 14, 2013. Next to this standard covering food BRC also has three standards covering consumer products, packaging manufacture, and storage and distribution
[c]Next to the IFS Food standard other standards have been developed such as the IFS Logistics standard for transport, storage and distribution, the IFS Cash & Carry/Wholesale standard, the IFS HPC standard for Household and Personal Care, and the IFS Broker standard. All IFS standards are developed at the request of retailers, http://www.ifs-certification.com/index.php/en/. Accessed November 14, 2013
[d]The IFS Standard is managed by IFS Management GmbH, a company owned by the German retail federation (Handelsverband Deutschland (HDE) and its French counterpart (Fédération des Entreprises du Commerce et de la Distribution (FCD)). Retailers from Italy, Switzerland and Austria participated in the development of recent editions of IFS
[e]Financial and legal ownership and responsibility for FoodPLUS GmbH is held by the EHI Retail Institute via its 100 % subsidiary EHI-Verwaltungsgesellschaft mbH. EHI Retail Institute is a non-profit scientific institute of the retail industry with 550 members including international retail companies and their associations, manufacturers of consumer goods and capital goods, and various service providers, http://www.ehi.org/en/about-us/company.html. Accessed November 14, 2013
[f]Dutch HACCP is a food safety standard owned by the same foundation and can be considered the predecessor of FSSC. Dutch HACCP was already recognized by the GFSI in 2003

Table 4.2 Retailers supporting the GFSI-recognized food standards

Standards	Ownership	Supporting/demanding certification from suppliers
All schemes recognized by the Global Food Safety Initiative		24 retailers[a] Aeon, Ahold, Asda, Auchan, Carrefour, Coles, COOP, Daymon, DelHaize, Food Lion, H.E.B., ICA, Kroger, Loblaw, Metro, Migros, Pick n Pay, Publix, Raley's, ShopRite, Tesco, US Foodservice, Wal-Mart, Wegmans
BRC Global Standard for Food Safety	Association of British retailers	Website does not provide this information
IFS Food standard	Retail federations from Germany and France[b]	31 retailers[c] Auchan, Aldi, ANCD, Billa, Carrefour, Casino, Conan, Coop, Cora, Edeka, Francap, Globus, Kaufland, E.LeClerc, Lidl, Match, Metro, Migros, Monoprix, NettoPlus, Norma, Picard, Pomona, Real, Rewe, U, tegut, Wal-Mart, Tengelmann, Kaiser's, Superunie
SQF	Association of US food retailers and wholesalers	41 retailers[d] A & P Tea Company, Ahold, Albert Heijn, Big Y Foods, Bottom Dollar Foods, Carrefour, Coles, Costco, CVS Pharmacy, Daymon, Food Lion, Giant Food, Hannaford Bros, Harris-Teeter, H-E-B, Kash n' Karry Food Stores, Lund Food, Metro, Migros, Pathmark Stores, Peapod, Price Chopper Supermarkets, Publix Super Markets, Raley's Family of Fine Stores, Safeway, Sam's Club, Schnuck Markets, Schwans, Sobeys, Supervalu, The Stop & Shop Supermarket Company, Target, Tesco, Tops Markets, US Foodservice, Wakefem Food Corporation, Wal-Mart, Wawa, Wegmans Food Markets, Weis Markets, Winn-Dixie Stores
Global G.A.P.	Foodplus GmbH (scientific institute of the retail industry)	38 retailers[e] Ahold, Albert Heijn, Aldi, Asda, Carrefour, Colruyt, Conad, Coop, Delhaize, Dohle, Edeka, El Corte Inglés, Eroski, Fedis, Freshmark, Globus, Hofer, lea, Kaiser's Tengelmann, Kesko, Lidl, Marks and Spencer, Metro. Migros, Musgraves Supervalu, Norma, Pick n Pay, Rewe, Rimi Baltic, Sainsbury, Spar, Superunie, tegut, Tesco, US Foods, Wal-Mart, Wegmans food market, Wm Morrisons

Sources:
[a]http://www.mygfsi.com/schemes-certification/benchmarking/benchmarking-overview.html. Accessed 14 Nov 2012
[b]The IFS Standard is managed by IFS Management GmbH, a company owned by the German retail federation (Handelsverband Deutschland (HDE) and its French counterpart (Fédération des Entreprises du Commerce et de la Distribution (FCD))
[c]http://www.ifs-certification.com/index.php/en/ifs-certified-companies-en/introduction-to-ifs/retailers-supporting-ifs. Accessed October 29, 2012
[d]http://www.sqfi.com/buyers/sqf-buyer-supporters/. Accessed November 14, 2012
[e]http://www.globalgap.org/uk_en/who-we-are/members/retailers-food-service/. Accessed November 14, 2012

Table 4.3 Geographical distribution of certified firms in major global food standards

Standards	Number of certified firms	Proportion of certificates in Africa, Asia and South America (percentage)	Proportion of certificates in Europe (percentage)
BRC Global Standard for Food Safety	15,534 certified sites in 112 countries[a]	20 %	66 %
IFS Food standard	More than 11,000 in 96 countries[b]	No figures available (expanding in US, Brazil and China)	No figures available; majority in Europe
SQF	Approximately 4,000 certified sites in more than 22 countries[c]	6 % (mainly Asia, not Africa)	None
GlobalG.A.P.	123,115 certified suppliers in 96 countries[d]	21 %	74 %
FSSC 22000	2,956 certified companies in 109 countries[e]	39 %	37 %
Global Red Meat Standard	18 certified sites	0	100 % (predominantly Denmark)

Sources:
[a]http://www.brcdirectorv.com/Siteresults.aspx?CountrvId=0&StandardId=972f3b26-5fbd-4f2c-9159-9a50al5a9dde. Accessed October 15, 2012
[b]http://www.ifs-certification.com/index.php/en/faq-en#. Accessed October 24, 2012
[c]https://sqf.etq.com/production/reliance?ETQ$CMD=CMD_CREATE_DOC&ETO$NEW_DOCUMENT_FORM=PUBLIC_SEARCH&ETQ$APPLICATION_NAME=COMPANY_1&ETQ$SCREEN_WIDTH=1440&ETQ$USER_NAME=Anonvmous&ETQSLOGIN_USERNAME=ANONYMOUS&ETQ$USE_SETTING_NAMES=true. Accessed February 15, 2013
[d]http://www.globalgap.org/export/sites/default/.content/.galleries/documents/130124_AR12_web_en.pdf. Accessed February 22, 2012
[e]http://www.viasyst.net/fssc. Accessed November 3, 2012

Herzfeld et al. (2011) investigated the adoption of the BRC Food Technical standard and GlobalG.A.P. at cross-country level. They conclude that the adoption of these standards reflects and reinforces already existing trade relations. Countries with established trade relations with the home countries of the standards (Germany, the UK and The Netherlands), countries with better institutional quality and a high level of economic development are most likely to have high numbers of certified firms. A case study of the New Zealand kiwifruit production revealed a strong relationship with EurepGAP building on the old colonial trade relationship with the UK: New Zealand as Britain's farm (Campbell 2005). Studies of the adoption of standards at farm level suggest that producers' orientation towards exporting, their involvement in producer organizations and vertical integration via contracts are positively correlated with certification (Herzfeld et al. 2011:402).

From the 1990s onwards supermarkets are expanding in developing countries. Authors observe a rapid rise of supermarkets, first in urban areas for wealthy consumers spreading geographically and to low income and poor consumers (Neven et al. 2006; Reardon et al. 2004; Reardon and Gulati 2008). This includes both local supermarket chains as well as internationally operating chains.

The rise of supermarkets in developing countries results in changing market relations (Reardon et al. 2004; Reardon and Gulati 2008). Supermarkets often have more demanding requirements for suppliers with respect to volumes, quality, hygiene, labelling and consistency. Reardon et al. (2004) distinguish four pillars of the new procurement system: 1) Traditional wholesalers are partly replaced by specialized and dedicated wholesalers and logistic firms. 2) Procurement is centralized and regionalized. 3) Sourcing with 'preferred suppliers' to assure consistent supply. 4) Imposition of private food standards for quality and for safety on suppliers.

Food retailers are the main drivers for the emergence and dissemination of global food safety standards. However, next to retail-driven standards many other private food standards have emerged initiated by food industry, industrial associations, trading corporations, civil society organizations and alliances between these organizations. Their objectives range from securing safe food to improving animal welfare, protecting the environment, improving working conditions and ascertain labour rights and fair trade. Examples include fair trade labels (Ethical Trading Initiative, Max Havelaar), sustainability programs (Marine Stewardship Council, Carbon Trust), religious food standards[6] (Orthodox Union, OK Kosher Certification, and Ifanca, IHI Alliance), organic food labels (Ifoam, KRAV, EKO), food safety standards (FS22000, Dutch HACCP, Global red meat standard, Qualität Sicherheit, TrusQ), and vegetarian or biodynamic labels (Vegan, Demeter) (see Havinga 2010; Van der Meulen 2011; Van Amstel 2007). Retailers are involved in some of these standards, either as part of the rule-making committee or by encouraging suppliers to comply with the standard. For example the Dutch

[6] In some Islamic countries the government is involved in setting and enforcing religious food laws, such as the Malaysia's Department of Islamic Development (JAKIM).

supermarket Albert Heijn aims at selling only Marine Stewardship Council (MSC) and Aquaculture Stewardship council (ASC) certified fish in its shops in 2015.[7] In some cases retailers also compete with civil society standards, e.g. initiate an alternative standard with other, more convenient requirements (e.g. UTZ certified next to Max Havelaar fair trade).

4.3 Why Do Retailers Engage in Food Safety Regulation?

There are several drivers for retailers to be engaged in food safety regulation: a safeguard against liability claims, an instrument to assure high quality of food products, standardization of product requirements over suppliers, to avoid incidents and unfavourable media attention, confidence-building (build and maintain an image of reliable and responsible company) and outsourcing expensive quality controls.

Current legislation in the European Union explicitly postulates that food businesses are primary responsible for ensuring food safety. Henson (2008) calls this a pull factor for the promulgation of private food safety standards as this establishes a 'legal position' for private standards.

In the United Kingdom, the introduction of the principle of due diligence under the Food Safety Act 1990 is said to have stimulated firms to establish private food safety regulations (Buzby and Frenzen 1999:648; Caswell 1998:416; Henson and Caswell 1999:594; Henson and Northen 1998; Hobbs et al. 2002). British retailers have been required to take all reasonable steps to ensure that the food they sell is safe. Previously, the retailers only had to prove that the food was not compromised while under their control and the manufacturer was held liable for the rest. This shift of the legal responsibility for safe food downstream in the supply chain makes food retailers ultimately responsible for the safety of the products on their shelves. This includes the verification of technical performance at food production sites of retailer branded products. For a due diligence defense against food safety offenses a retailer has to demonstrate that all reasonable precautions are taken. In response all major British supermarket chains did develop initiatives to ensure a certain quality of retail food products by committing suppliers to a specified set of standards. In the British meat industry a quality assurance scheme was set up. The British Retail Consortium developed a set of food safety standards and retailers require their suppliers to be certified against these standards. The aims of the BRC Global Standards are to improve supplier standards and consistency and avoid product failure, and to provide concise information to assist with a due diligence defense (Havinga 2006).[8]

[7] Marine Stewardship Council (MSC) and Aquaculture Stewardship Council (ASC) http://www.wnf.nl/nl/home/bedrijven/strategische_partners/albertheijn2/ and http://www.ah.nl/vis/samenwerking (both Accessed July 11, 2012).

[8] www.brc.org.uk/standards/background.htm. Accessed June 21, 2004.

Similarly, in the Netherlands the introduction of a stricter liability regime by the European Union seems to have resulted in fear for the consequences. This new liability law stimulated the development of third party certification schemes, such as quality assurance certification in the dairy industry and retailer-led certification. The Dutch supermarkets feared possible claims and litigation and they tried to cover themselves by sharpening supplier contracts. Insurance companies raised the premiums. In these circumstances the Dutch retailing sector decided to adopt the British BRC food safety standard; this resulted in the translated CBL-BRC standard (Havinga 2006). As one supermarket quality manager said: 'Looking back I would say product liability was magnified beyond all proportion; after 10 years, there have not been serious liability cases' (Havinga 2006). In the United States liability law plays a less significant role as incentive for quality assurance according to Henson and Caswell (1999:594).

The initial initiatives by European retailers seem to have been driven—at least partly—by liability legislation. However, the moment food safety standards were in place the standards are a driving force unto itself. Although liability claims were not perceived to be a real threat after some time, food safety initiatives flourished ever since. They proved to be very useful instruments for supermarkets (and other parties). Henson (2008) observes 'emerging evidence that the experiences of the Europeans are now serving to 'demonstrate' the efficacy of collective private standards and inducing, at least in part, the evolution of similar governance structures elsewhere, for example the SQF series of standards in the US'.

Private food safety standards are an instrument for supermarkets to assure high quality of food products and to avoid incidents and the subsequent unfavourable media attention. A standard is an instrument of coordination of supply chains: by specifying and harmonising product and delivery attributes the standard may increase efficiency and lower transaction costs. In international and global supply chains this implies standardization over countries, which induces a convergence with the standards of the toughest market such as the European (Reardon et al. 2004:178).

A collective food safety standard has considerable advantages above a company quality assurance system. Maintaining and implementing a company supplier food scheme including controls on the spot is very expensive and the supermarket has to pay. Using collective food safety standards with third party certification is outsourcing of the costs of quality controls. In collective standards the auditing costs are paid by the businesses that are certified, in this case food manufacturers, farmers and slaughterhouses. Another advantage is that the supermarket can source products in the market and is not limited to preferred suppliers that are included in the company's assurance system. Competition between suppliers allows retailers to pay lower prices.

Engaging in private food safety standards might also be important for supermarkets to restore and maintain confidence of consumers. However, supermarkets do not seem to utilize this opportunity extensively. The dominant retailer-led food safety standards are business-to-business standards and conformity with those standards is not communicated to customers. The BRC, IFS and

GlobalG.A.P. logo's are not printed on product labels. However, many supermarkets do communicate to consumers on their website and in their company magazine that they assure all products in their shop are safe and of high quality.

4.4 Why Do Producers Comply with 'Voluntary' Food Safety Regulation?

Supermarkets (or their wholesalers) must have sufficient buying power to impose private standards on suppliers. A supermarket chain may have olygopolistic power or offer higher pricer or other assistance to producers (Reardon et al. 2004:178–179). Retailers use their economic power to impose food safety and quality requirements on their suppliers. As Grabosky (1994:429–432) noted in his study on environmental regulation, "Large retailers are in a position to register their product and process preferences with suppliers, and the awesome purchasing power that large retailers command often carries considerable influence." Corporate retailers are increasingly powerful in the food chain because of mergers and take-overs. A small number of large grocery retailers have gained a powerful position, both economical and political (Marsden et al. 2010:9). In the UK since 2000 the number of stores operated by the four largest grocery retailers has more than doubled (Tesco, Asda/Wal-Mart, Sainsbury's, Morrisons). This concentration enables large corporate retailers to expand their grip on the global and domestic food supply chain.

In Western countries such as the UK, the Netherlands, and the USA, supermarkets have a large majority share of the food consumers market. By 2006 in the UK, 72 % of all grocery sales took place in supermarkets (Marsden et al. 2010:10). The growing share of own branded products reinforces the strong negotiating power of the retailers (Marsden et al. 2010:134). Large retailers have enormous buying power and require suppliers to meet certain quality standards. Suppliers are dependent on supermarket chains and have to comply with their requirements (Boselie et al. 2003; Gereffi and Lee 2012; Grievink et al. 2002; Havinga 2006; Marsden et al. 2000, 2010). In countries such as the UK, Germany and the Netherlands food producers who are not certified against a GFSI recognized food safety scheme (or another scheme accepted by retailers) are excluded from a large proportion of their market.

Next to the in fact almost mandatory character of third party certification against a 'voluntary' food safety standard, participation may be useful for a producer. It might help in preventing a worst case scenario such as food poisoning or product recall. And these schemes and the certification process offer a structure to organize and manage ensuring a high level of safety and quality. IFS certified firms have reported a substantial reduction in food recalls, complaints, error rate and regulatory issues.[9]

[9] http://www.ifs-certification.com/index.php/en/consultants-en/customer-testimonials/51-global-news/1420-news-2010-08-23-newslettr-en. Accessed February 15, 2012.

Retail-driven private food safety standards are also applied in developing countries. First, because European retailers source some products from these countries and require the same safety and quality from African or Asian suppliers. So Kenyan market gardeners and Thai aquaculture farmers who deliver European (or Western) supermarkets are required to be certified against a standard such as GlobalG.A.P., just as their colleagues in Spain or Norway. Second, the supermarket revolution in some developing countries also contributed to the growing importance of private food standards in the developing world. Not only the export market but also part of the domestic market asks for certification or compliance with such standards. Interviews with vegetable growers in Kenya revealed that import and export firms and certification agencies appear to occupy a key position in the diffusion of food safety requirements worldwide. They act as go-between in the relationship retailer-producer.

For the successful implementation of private standards producers must be capable of meeting the standards. In some cases there are not enough producers that can meet the standards and supermarkets (or their wholesalers) are forced to gradually implement the standards and to increase technical or financial assistance and support programs (see Reardon et al. 2004:179 for examples from Guatemala and Costa Rica). Recently the GFSI introduced the Global Markets Programme to assist small and/or less developed businesses 'through a continuous improvement process to develop to the point where the implementation of a GFSI recognised food safety management scheme could be considered'.[10] GlobalG.A.P. has had a support program for years and recently introduced the localg.a.p. Standard that offers a stepwise approach that covers the minimum requirements for food safety and hygiene. Ideal for emerging growers.[11] The introduction of these lower standards confirms that some producers are not capable of complying with the high standards retailers are requiring. As GlobalG.A.P. writes on its website: 'Retailers around the world are rising to meet the challenge by demanding certification from their producers. But they face a tricky situation when working with emerging producers, who may not be able to achieve GLOBALG.A.P. Certification. And producers without certification for their products have difficulties accessing local and regional markets.'[12]

[10] http://www.mygfsi.com/structure-and-governance/gfsi-technical-committee/gfsi-global-markets-working-group.html. Accessed November 14, 2013.

[11] http://www.globalgap.org/uk_en/what-we-do/localg.a.p./localg.a.p.-Standard/. Accessed November 14, 2013.

[12] http://www.globalgap.org/uk_en/what-we-do/localg.a.p./. Accessed November 14, 2013.

4.5 Conclusion: The Powerful Role of Retailers in Food Safety Regulation

Retailers have become increasingly important in food regulation. Major European retailers took the lead in the establishment of private food safety standards with third party certification. Supermarket chains require their suppliers throughout the world to participate in this system of private food governance. The first of these standards were developed by national retailers associations. Later the standards crossed borders, although the distribution of the standards still reflects the geographic pattern of their origin. After a short or longer period of time other stakeholders were included in the governance structure of the schemes. The major private food safety standards are retail-driven, in two ways: retailers own the standard and retailers promote the adoption of the standards by requiring compliance from their suppliers all over the world.

The emergence of private retail-driven food regulation is a remarkable success. In a relatively short period these standards have gained a very dominant position in global food supply chains. One of the factors contributing to their success probably is that they keep developing in response to criticism and new issues that came up. In 2006 I wrote: "The future will show if food safety regulation by supermarkets is self-reflexive enough to react adequately to criticism and dysfunctioning" (Havinga 2006:529). So far the answer seems to be affirmative. Most standards have implemented integrity programs and extensive requirements to secure serious, impartial and credible certification to refute criticism of lenient controls. Standards have introduced special programs to assist small producers in upcoming markets to bring their standards up in response to criticism that farmers in developing countries were excluded from food markets (and because supermarkets were faced with problems of insufficient supply). Shortly after the horsemeat scandal was on the front pages of the newspapers, the IFS Food standard added to their requirements that checks on authenticity of food products had to be included in food safety management systems. Several standards introduced separate consultancy services (accreditation of auditors requires a strict separation between audit and advice). Standards also adapted their governance structure to allow for the participation of other stakeholders than retailers. The above examples show the flexibility of the private systems.

An issue that will be on agendas in the years to come is the relationship between private and public food regulation. The interactions between these regimes have attracted significant attention of scholars of regulatory governance recently (Levi-Faur 2010). The existence of a powerful transnational private meta regulator such as GFSI places (national) governmental agencies on the second row. The ambition of the GFSI is to further align industry and government efforts in food safety, that is to integrate with the World Trade Organization Sanitary and Phytosanitary Agreement (WTO SPS) and requirements of the Codex Alimentarius. The GFSI is currently seeking to 'actively engage governments in recognizing and accepting GFSI benchmarked schemes' (Verbruggen and Havinga 2014). What will be the responsibility of public authorities participating in hybrid or private types of food governance? National food authorities in countries such as the UK, the Netherlands

and Canada are discussing how they should and could take private certification into account (Canadian Food Inspection Agency 2012; Rouvière and Caswell 2012; Wright et al. 2013).

Will this result in co-regulation, regulatory arrangements in which both public and private actors cooperate? Hybrid forms of food governance are already emerging (Garcia Martinez et al. 2013). An alternative may be that public food authorities act as a meta-regulator for private regulations that meet certain criteria. The public authority audits the private system, including reality checks, to verify that the private system is working adequately. Food businesses that voluntary participate in such a system will not be controlled by the public authorities but by the private auditors. Most likely in the near future public authorities will get more involved in private food safety standards either as meta-regulator or as co-regulator. Some examples of both forms of cooperation are already in place (Verbruggen and Havinga 2014).

Can public authorities rely on private governance for monitoring compliance with public regulations? Will private food regulatory arrangements be responsive to requirements of public authorities? These challenging questions will be at the heart of future discussions.

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On the Emergence of Private Standards: An Industrial Organization Approach

5

Abdelhakim Hammoudi, Cristina Grazia, and Oualid Hamza

Abstract

This contribution aims at providing a focused discussion on the main economic issues associated with the emergence of private standards in agrifood chains. Public and private modes for food safety management are explored. Based on a critical review of the recent developments of Industrial Organization (IO) approaches, this contribution examines the rationale behind the emergence of private strategies for food safety governance, their effects on the food supply chain organization, and the strategic interactions between public regulator and private actors in the provision of food safety in agrifood markets. The analysis then draws the attention on the interactions between public regulatory instances (notably between the legislation and the official control system) and on their influence on the incentive for firms to develop voluntary standards. By focusing on buyer-supplier relations in international food supply chains, and based on recent theoretical developments in the IO literature, a simple formalization is finally proposed to investigate the role of public "output standards" and control imperfections in shaping buyer incentive to impose "process standards" over suppliers for import safety management purposes.

Keywords

Food safety • Liability rules • Industrial organization • Game theory • Governance • Agrifood markets

A. Hammoudi (✉) • O. Hamza
INRA, Institut National de la Recherche Agronomique, Ivry sur Seine, France
e-mail: abdelhakim.hammoudi@ivry.inra.fr; oualid.hamza@ivry.inra.fr

C. Grazia
Dipartimento di Scienze, Università di Bologna, Bologna, Italy
e-mail: c.grazia@unibo.it

A. Hammoudi et al. (eds.), *Food Safety, Market Organization, Trade and Development*, DOI 10.1007/978-3-319-15227-1_5

5.1 Introduction

Food safety standards landscape is increasingly complex and deeply dynamic. Food safety regulation results nowadays from the complex interaction between public regulatory schemes (legislations, official control systems, liability rules) and private forms of food safety governance. Public intervention in the area of food quality and safety aims at ensuring the safety of food and preventing food misbranding. In recent years, private standards have emerged, at industry and firm levels, as complements (or even substitutes) of public regulations, and have become nowadays dominant drivers of agrifood systems. Public and private forms of food safety and quality governance increasingly interact in the provision of quality and safety leading to the emergence and implementation of co-regulation as a hybrid public-private cooperative arrangement designed to ensure the social goal of safe food supply (Garcia Martinez et al. 2013).

Two main standard-setting organizations operate at the international level: i) the International Organization for Standardization (ISO) that develops standards across different areas and sectors, extending across a wide range of products, services and management systems; and ii) the Codex Alimentarius Commission (CAC) that sets standards on food quality and safety (including codes of hygienic or technological practices) and establishes limits for pesticide residues and guidelines for contaminants as well as recommendations establishing rules for the elaboration of national regulations in the area of food safety and quality. At the regional level, for example, the European food safety legislation is established on the basis of several regulatory tools from regulations establishing the maximum admitted thresholds of contaminants (aflatoxin, dioxin, heavy metals) (Reg. 1881/2006) or of pesticide residues (Reg. 396/2005) in foodstuffs to the so-called "Hygiene Package"[1] (Reg. 852/2004 on the hygiene of foodstuffs and Reg. 853/2004). Beside legislation, official control schemes are designed to verify the compliance with feed and food laws.[2]

Alongside public regulatory arrangements, a plethora of private food safety and quality management standards has developed, either 'internal' to the firm or set by large food retailers, manufacturers and service operators towards suppliers. Standards are performed to ensure food quality and safety, protect firm reputation, and develop a quality-based competitive advantage. The landscape of private standards results nowadays from the complex interaction between collective private standards with international scope and individual firm standards.

[1] Based on the Regulation (EC) No 178/2002, it sets the principles of primary responsibility of food business operators, traceability, the general implementation of procedures based on HACCP (Hazard Critical Control Points) principles, and the application of food hygiene practices.

[2] Regulation (EC) No 882/2004 "lays down general rules for the performance of official controls to verify compliance with rules aiming, in particular, at preventing, eliminating or reducing to acceptable levels risks to humans and animals, either directly or through the environment; and guaranteeing fair practices in feed and food trade and protecting consumer interests, including feed and food labelling and other forms of consumer information".

The standardization of product and process attributes over suppliers, thus coexists with "spaces" of quality-based differentiation strategies.

The proliferation of private standards has raised concerns for both economists and public authorities about their effects on market functioning, industry structure and firms' competitive repositioning. The main issue at stake is to understand the economic *rationale* behind the strategies of private actors in a context where they increasingly interact with regulations in determining the final level of food safety on the market.

Given these considerations, this chapter aims at providing a more focused discussion on a certain number of economic issues associated with the emergence of private standards: Which is the rationale behind the emergence of private standards? Are they effective in improving food safety (compared to public regulations)? How costly is a food safety risk reduction? Who bears this cost? Is the cost equally distributed along supply chain participants? Or should it be so for an enhanced effectiveness of risk control measures? To address all these questions, we mainly refer to a recent literature based on models developed in the framework of the Theory of Industrial Organization (IO). The advantage of this approach is to take into account the multitude of supply chain economic players, while analyzing their decisions in a context of strategic interdependency.

5.2 The Emergence of Private Standards in Agrifood Chains

5.2.1 A Typology of Food Standards

Regulations are the typical form of '*ex-ante*' regulatory tool designed to regulate the behavior of economic agents before an externality (e.g. food safety failure) is generated (Shavell 1984). They are legally mandatory in the sense that legal penalty arises from non-compliance. *Ex-pos*t regulatory tools (such as liability rules) are designed to sanction non-compliant behaviors (Polinsky and Shavell 2006; Hobbs 2006). According to the "top down" model (Garcia Martinez et al. 2013: 1106), public regulators "provide a legal mandate to the private sector to implement public objectives", i.e. private actors implement public objectives and are required to implement control measures that demonstrate they are managing food safety within their business. Alternatively, public authorities may recognize in their enforcement policies industry-level safety certification schemes ("bottom-up" model) (Rouvière and Caswell 2012).

The government may also set standards with which compliance is voluntary (*public voluntary standards* or 'optional laws'), such as 'Label Rouge' in France. In this case, standards are 'regulated' by a legislative framework, but the decision of private agents (whether to adhere or not) is voluntary. The EU quality schemes such as PDO (Protected Designation of Origin), PGI (Protected Geographical Indication) and TSG (Traditional Speciality Guaranteed) are included within this typology. Finally, the public authority may require compliance with private standards

(legally-mandated private standards), which are developed by the private sector and then made mandatory by public authorities.

Along with public standards, "private voluntary standards" (PVS) are developed and adopted by private actors (e.g. firms, industries, nongovernmental organizations) and are voluntary in nature. Even if PVS are not legally mandatory, they are often referred to as de facto mandatory in a commercial sense for access to important markets (as required by dominant food operators), as a consequence of their rapid spread beyond regional and national boundaries and their large diffusion at the international level (measured by the progressively increasing number of adhering firms), especially in the case of private collective Business-to-Business (B2B) standards (e.g. GlobalGap, British Retail Consortium (BRC), Safe Quality Food (SQF), Global Food Safety Initiative (GFSI), etc.). In addition, PVS are often referred to as more restrictive than public regulations. As highlighted by Henson and Humphrey (2009), PVS might 'go beyond' public regulations in two distinct ways: either they take the form of more stringent standards, or they implement controls on issues that are not covered by public regulations.

Coglianese and Lazer (2003) distinguish the following types of regulations that may be also used for the discussion of the design of private standards (Humphrey 2011). *Performance-based regulation*, where the regulatory authority specifies the outcomes that must be achieved, is restricted to products (e.g. limits for emissions of chemicals into the environment or maximum levels of pesticide residues) and no indication is given on how to achieve the outcomes. Alternatively, *technology-based regulation* indicates "technologies to be used or steps to be followed". Any set of defined rules or procedures or behaviors falls in this category. A third type is the *management-based regulation*, where firms are required to design "plans to comply with general criteria designed to promote the targeted social goal" (e.g. in the case of second generation-HACCP based on ISO 22000). While performance-based approaches concern the output stage and technology-based approach in the acting stage, the management-based approaches intervene at the planning stage to induce organizations to improve their internal management. Whilst performance standards specify the characteristics the product is expected to have when it reaches a certain point in the agrifood chain and thus specify *what* outcome has to be achieved (e.g. maximum admitted amount of pesticide residues), process standards specify the *characteristics the process is expected to have* either to achieve a given performance (e.g. "safe", "organically grown", etc.) or to create/maintain certain conditions for the environment (e.g. "environmentally friendly") (e.g. HACCP) (Reardon et al. 2001; Reardon and Farina 2002). Comparing public and private standards on the basis of the above-mentioned criteria, PVS tend to be more specific about *how* to achieve a particular goal and/or how to operationalise process-based requirements. Indeed, while public regulations are often referred to as "obligations of results" (output standards), private standards often take the form of "obligation of means" (process standards). Acting on the process, PVS may considerably influence upstream agricultural practices, when designed in the context of

buyer-supplier relations. Compliance may thus require significant changes in production practices implying an "entry cost" for suppliers.[3]

Humphrey (2011) distinguishes between two typologies of private standards or schemes: *premium (or high level) private standards and baseline standards*. Premium schemes are aimed at distinguishing specific product quality attributes (e.g. origin, animal welfare standards, etc.) by establishing superior quality (e.g. Label Rouge at the national level or the Fair trade certification at the international level). Also firms' standards communicated to consumers (B2C standards) as sub-brands (identified by a specific logo or symbol) on retailer private label products fall into this category. Examples of such standards are Plan A by Marks and Spencer (UK), Nurture (Tesco, UK), EQC-Engagement Qualité Carrefour (Carrefour, France), Gold Star (BI-LO, US), etc. Here, the communication on food safety attributes is often bundled with other process attributes, such as environmental, ethical or social attributes. In contrast, baseline schemes are *aimed at meeting the required minimum level of performance for access to particular market segments* rather than establishing the uniqueness of particular products. Collective international B2B standards such as SQF-IFS, BRC and GlobalGap are all examples of baseline standards (Humphrey 2011). Baseline standards may be also B2C (e.g. Red Tractor assurance scheme, UK). These standards are mainly designed for risk management and procurement coordination purposes to 'govern from a distance' in global supply chains to be adopted by organizations in different countries. Those standards may evolve to include non-food safety attributes (e.g. environmental or employment practices, such in the case of GlobalGap).

Given these considerations, two main criteria to classify private standards may be highlighted: i) the degree of "visibility" to consumers (signaled versus not signaled, i.e. B2B versus B2C standards) and ii) the number of agents involved in the standard-setting strategic decision (individual or collective private standards). Combining these two criteria allows for a more well-grounded overview on private standards (Fig. 5.1).

In the next section, the rationale for the development of private standards will be explored in detail, by conceptualizing the role of risk management and quality differentiation purposes, the *trait d'union* role of brand reputation and brand development, as well as the synergies or conflicts between individual and collective initiatives.

5.2.2 The Rationale for Private Food Safety Governance: An Overview

Private standards can play an important role in providing additional security and reduce the expected risks associated with food safety failures (risk management) while constituting the basis of quality differentiation strategies. These objectives

[3] E.g. upgrade handling and hygiene practices, upgrade equipment and buildings for chemical storage, hygiene and temperature controlled facilities, pesticide storage units, pesticides disposal pits, technical skills, etc.

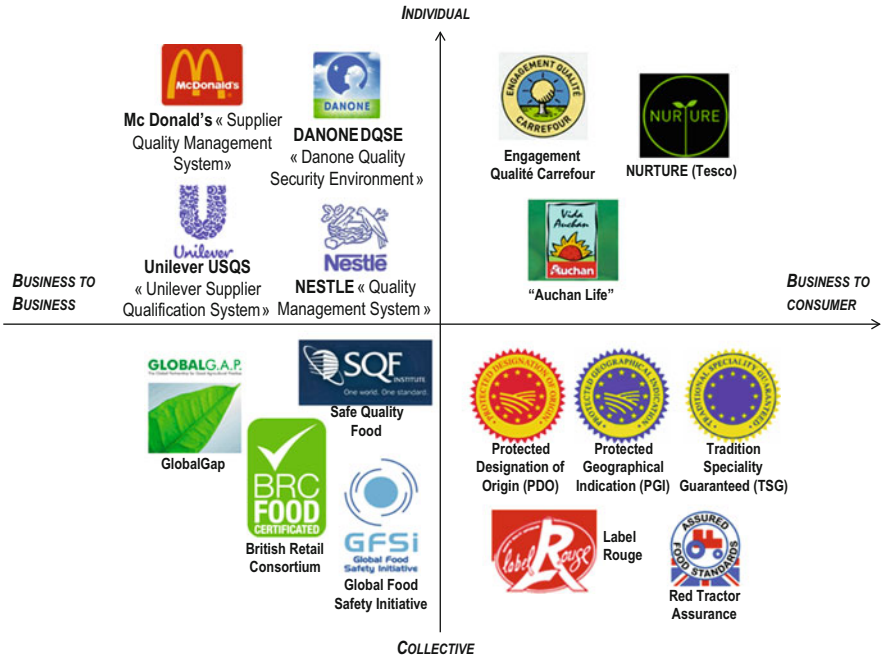

Fig. 5.1 Private standards in agrifood chain: combining risk management and quality differentiation purposes. *Source*: Giraud-Héraud and Hoffmann (2013)

essentially correspond to two dominant approaches to food safety governance by major food operators (notably retailers): Business to Business (B2B) collective private standards (e.g. GlobalGap, Safe Quality Food (SQF), etc.) and B2C individual firm standards (e.g. Nurture by Tesco). To summarize, these two approaches mainly differ in their degree of 'visibility' to consumers and in their collective or individual nature.

5.2.2.1 Private Standards and Risk Management in Agrifood Chains

Private standards perform a risk management function and "procurement regulation" in intermediary markets. This function mostly refers to B2B private (international) collective standards. The main purpose here is to provide *additional* security for firms against the risk of food safety failures and the consequent strategic costs (e.g. loss of market share, market revenue, erosion of brand capital, etc.) and operational costs (e.g. product recall, customer complaints, and penalties from enforcement authorities). A 'liability function' is then performed in the sense that standards provide additional security *vis-à-vis* the threat of civil legal actions against a firm producing unsafe food (and the resulting financial damages) (Hobbs 2004). Hence, liability rules are shown to be crucial for these standards to emerge and the risk of a market sanction (fall in demand in the case of a sanitary accident) is not always sufficient to favour the emergence of such initiatives (see

Giraud-Héraud et al. 2012a). Other authors argue that private standards afford "domain defense" (Caswell and Johnson 1991) and protect market share and reputation (Fulponi 2006). The 'risk management' function becomes increasingly important, since procurement becomes progressively broader in geographical scope and supply chains extend beyond regional and national boundaries with the emergence of multinational retailers, food service operators and manufacturers. B2B standards are collective in nature and vertical coordination is realized through *intermediate markets and third-party certification*. These standards allow standardizing over suppliers, thus reducing the costs of governing food safety along supply chains, and more specifically procurement transaction costs such as suppliers identification and approval audits, routine supplier site visits, routing end-product laboratory, chemical, biochemical or microbial testing, etc. (Holleran et al. 1999). In this context, third party certification transfers auditing costs from retailers onto suppliers, while enhancing the credibility of production practices (Hatanaka et al. 2005; Henson and Northen 1998).

5.2.2.2 Private Standards and Competitive Advantage

Private standards may allow firms to take advantage of market opportunities through a quality-based product differentiation ("domain offence"). This function mostly refers to B2C individual firm standards. Hence, food scares in a number of industrialized countries have raised consumer concerns about the safety of food and eroded confidence in prevailing mechanisms of food safety control. At the same time, consumers have increasingly focused on a broader array of food attributes when assessing product quality, many of which are experience or credence ones. Especially when credence attributes are concerned, consumers rely upon external risk indicators to infer the level of quality and safety of products (Mitchell and McGoldrick 1996). In this context, the possibility to capture a premium price based on consumers' willingness to pay (WTP) for an increased quality level may drive retailers to move beyond public regulations (Garella and Petrakis 2008; Giraud-Héraud et al. 2006) and differentiate from each other on a quality basis in order to gain market share. Taking into account direct market benefits associated with the implementation of private standards (increased consumer WTP) is crucial in the analysis and may contribute to explain the reason why firms may have incentive to reinforce the minimum quality standards (MQS) *even if* this latter is relatively strict. Since they are individual in nature, these standards mostly rely on direct (more or less contractualized) relationships with upstream suppliers.

To sum up, the two typologies of standards represent mechanisms for food safety governance differing in their main motivation, in their degree of visibility to consumers and in their nature (individual or collective). These specificities in turn affect their impact on supply chain organization (Fig. 5.2). While B2C individual firm standards mainly rely on direct relationship between suppliers and buyers, B2B collective standards rely on intermediate "spot" markets.

Given these main features and the existence of partially common objectives, the question may be addressed whether these two approaches are antagonistic or simultaneously implemented by firms in the context of mixed strategies.

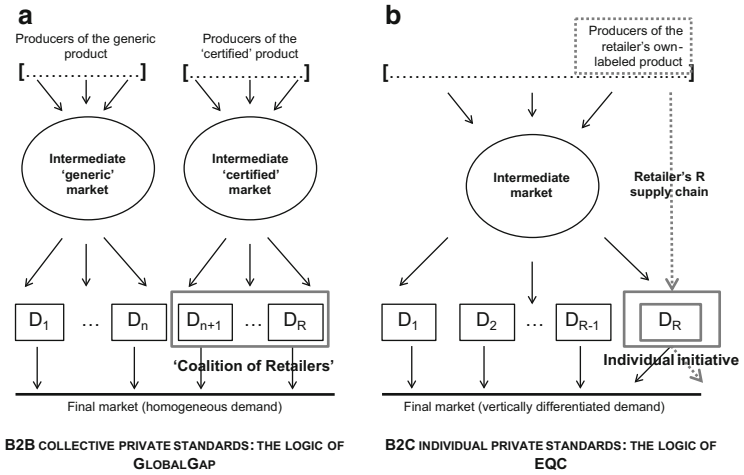

Fig. 5.2 Collective B2B and individual B2C standards: effects on supply chain organization. *Source*: authors' own elaboration

This question is linked to the more general issue of the competitive-cooperative nature of relationships among retailers. Both the trend to global retail-led food chains and the role of quality competition suggest the development of both approaches. However, the retailer individually faces a trade-off between the two strategies. While the collective standard allows standardizing over suppliers and regulating procurement as well as restricting the "rules" for market access (the higher the proportion of downstream agents involved), free riding behaviors potentially harmful to individual reputation may result in a disincentive for individual participation. Most likely, the progressive strengthening and spread of rules for market access (both public and private) have encouraged the shift of private standards to B2C solutions, where food safety is combined with labor practice criteria, environmental footprint, equity and sustainable use of natural resources, to enable firms to continue to differentiate from competitors. Indeed, many private standards have gradually evolved from B2B to B2C, becoming "as much about brand enhancement as about safeguarding food safety" (Homer 2010: 11), e.g. the evolution of Tesco Nature's Choice to Tesco Nurture or M&S Field to Fork to M&S Plan A.

Finally, the question may be raised whether (and how) these two approaches differ in creating value and how this value is distributed along the food supply chain. In the presence of a market-driven incentive (B2C standards), the creation of value mainly relies on the premium paid by consumers for an enhanced quality level. The distribution of value among supply chain participants (and namely the proportion of value transferred to suppliers) crucially depends on the nature of vertical relationship and on the bargaining power. In the absence of a market-driven incentive (B2B standards), the motivation for the retailer mainly relies on providing additional security against the consequences of product failure, standardizing over suppliers and reducing transaction/procurement costs, while a premium on the final

market does not emerge unless the strategy is combined with B2C initiatives. In this case, the question of the benefits for suppliers is even more critical, especially given the "de facto mandatory" nature of these standards. In this case, the benefits mainly consist in improved market access and increase of commercialized volumes although still depending on the nature of vertical relationships.

5.3 Private Standards, Strategic Behavior, and the Role of the Market: An Overview of Industrial Organization Approaches

A relatively recent stream of the Industrial Organization (IO) literature provides a better-focused analysis of the economic issues related to the emergence and the effects of private standards. This section provides an overview of the most recent contributions exploring the rationale for the emergence of individual and collective private normalization strategies, the main issues related to the interplay of public and private actors in the provision of food safety, and the interactions among different regulatory tools, notably legislation and control systems.

5.3.1 Exploring the Rationale for Collective Normalization Strategies

Private collective standards (see Sect. 5.2.1) result from "coalitions" of operators requiring upstream suppliers to meet specific requirements (e.g. GlobalGap). A set of contributions investigates the incentive for individual firm to adhere to a collective standard set by other firms (at the same supply chain stage, processing or retailing) or created in collaboration with them. The incentive for a firm to create an individual standard and the incentive to adhere to a collective standard are different in nature and *rely on different strategic mechanisms*. The works proposed in this area show the complexity of the question, particularly when it is about collective B2B standards (see Sect. 5.2.2). A rigorous analysis requires using a conceptual framework of game theory (the theory of endogenous coalition formation) that is rarely used in applied contexts, but allows formalizing coordination phenomena involving a large number of actors and is particularly adapted to the analysis of the emergence of private collective standards such as GlobalGap, BRC, GFSI and others. One of the characteristics of this process is that retailers commit to a certain form of cooperation (they collectively set the content of the standard and the level of requirement to impose to suppliers) while being competitors on the market. The coexistence of cooperation and non-cooperation is very complex to represent formally. In order to adequately model the specificities of the applied context, the paper by Giraud-Héraud et al. (2012a) combines models of Industrial Economics (vertical relationships and product differentiation) and the concepts of the stability of coalitions (Bloch 1995). Giraud-Héraud et al. (2012a) model the development of a private standard as a process leading to the creation of a second spot market

starting from an initial configuration, where only one intermediary spot market exists (see Fig. 5.2a with $n = R$). On this initial market, before the development of the private standard, the "generic product" (without any certification) is exchanged (Fig. 5.2a, with $n < R$). The second intermediary market, associated with the certification, emerges when a number of downstream retailers collectively set market access requirements for potential suppliers. When this coalition of retailers emerges adopting the private standards, upstream producers choose whether to continue supplying the generic spot market or to invest in the improvement of agricultural practices to supply the "secure" spot market.

Relying on this framework of analysis, the authors highlight the trade-offs that firms face when setting a collective standard between (i) a collective interest to commit to the cooperation with respect to a *status-quo* where no standard is in force (collective rationality), and (ii) an individual interest that may generate the incentive for the firm to unilaterally deviate once the agreement is closed. These two incentives (individual and collective rationality) are not always compatible. This may explain why the process of coalition formation may not lead to include the whole set of existing firms (e.g. only a subset of retailers has adopted the GlobalGap standard)[4] and why both collective and individual actions coexist on the market.[5] The authors show that there exists a correlation between the size of the emerging coalition and the level of stringency of the standard set by the retailers. They show that, departing from an accepted idea, the reinforcement of the standard does not necessarily lead to a reduction of the average sanitary risk observed in the market.[6]

Looking more in details into the rationale for the emergence of collective standards, two types of economic questions arise. The first question concerns the long term viability of actions that, given their B2B nature, *cannot be directly "financed" by the market* (i.e. through a premium paid by consumers). How supply chains will find the financial means that are necessary to implement these costly initiatives and which actors will contribute to their financing? Another question concerns the spread of the diffusion of *private collective standards*: What is the size of the coalitions of adopting firms in the long term? Will such a coalition extend the number of participating firms? If not, which will the "obstacles" be?

[4] Since the intermediary price on the safe market partially depends on the number of adhering producers compared to the number of adhering retailers, a relatively high number of adhering retailers is needed to assure producers' participation. Nevertheless, the possible free-riding behaviors may provide a disincentive for individual adhesion. For this reason, liability may be necessary for this type of initiatives to be adopted by a number of operators high enough to reduce market risk.

[5] The progressive globalization of agrifood chains with the emergence of retail-led supply chains "standardizing" over suppliers and the increasingly quality-based competition, suggest that both collective and individual approaches will coexist on the market in the long term (even if each of these approaches may evolve towards new forms of governance).

[6] The average risk is the sum of the risk on the "safer" market and on the risk on the "generic" market.

The second question concerns, more generally, the potential substitutability between public and private interventions in the area of food safety. Is the private sector able to perform better than the public sector in reducing food safety risk? Another question concerns the risk that these initiatives lead to economic distortions through a redistribution of market power along the supply chain (McCorriston and Sheldon 2007) and/or an excessive price increase due to the increase of industry concentration (e.g. Lutz et al. 2000).

Starting from these questions, Giraud-Héraud et al. (2012a) developed a normative analysis relying on the conceptual framework of endogenous coalition formation and more precisely on the concepts of internal and external stability defined by d'Aspremont et al. (1983). These concepts are used in the framework of an Industrial Organization model representing the relations of strategic interdependencies among actors along the supply chain (vertical relationship model *à la Tirole*). From this point of view, agricultural markets are often characterized by a relatively large number of atomistic upstream producers facing a relatively concentrated downstream (processing and retailing) sector. Even if vertical relation models have been developed that take into account the strategic interdependencies along the supply chain, existing models rarely consider, at the same time, the multiplicity of actors and the differences in the structure and in the level of concentration between the upstream and the downstream stages.

Moreover, the conceptual framework of endogenous coalition formation, which is rarely used in the field of food safety economics, is particularly adapted to the specificities of the context of private collective norms, i.e. the open access to the standard adoption. The coalition of players (firms) having adhered to the private norm does not emerge on the basis of constraining commitments, but voluntary adhesions freely allowed and not contractual a priori.[7] Such a framework of analysis allows to explain the emergence of collective norms and their diffusion by identifying the motivations relying on collective rationality considerations (awareness by retailers of the "public damage" nature of an eventual food safety crisis) and individual rationality considerations (unilateral interest of a retailer to participate in, or to deviate from, the coalition). As it is above-mentioned, these two interests (collective and individual) may be compatible or opposite according to the size of the coalition and its composition at the moment of the strategic decision of the firm. The outcome of the trade-off between these two types of motivations determines the extent of the coordination, i.e. the maximum size of the standard-adopting coalition.

Another originality of the paper by Giraud-Héraud et al. (2012a) consists in considering the endogenous formation of the sanitary risk on the market.[8] Hence,

[7] This conceptual framework is part of the typology of *n*-person games. It allows dealing with a number N ($N > 2$) of players and formally representing without loss of generality agreements that may include the whole set or a subset of players.

[8] The authors consider the level of average risk as an indicator of the risk associated with all markets. The "average risk" results from the heterogeneous quality of production practices of upstream producers participating in the activity.

the sanitary risk on the markets depends on the strategic decisions of downstream firms: setting the level of requirement of the norm, adhesion or not to the set norm. These two decisions (level of the standard and number of adhesions) lead to a dynamic of changes in upstream production practices. The extent of this dynamic determines *in fine* the level of the risk on the market. Finally, the model enables to measure the effects of these decisions on competition by simultaneously considering the level of obtained risk and the level of other economic variables that are indicators of the evolution of actors' market power (intermediary and final prices, and quantities). This allows measuring the level of economic distortion induced by these private initiatives. Finally, the proposed normative approach investigates how such a coalition may emerge under the effect of a potential collective "market sanction" and of an individual liability rule (due diligence principle). The question is whether liability is substitute or complement to the market sanction (demand drops if a crisis occurs).

As it is above-mentioned, the authors show that, departing from an accepted idea, the reinforcement of the private collective standard does not mechanically imply a reduction of the average risk of the market. The reduction of the average risk may be obtained through a reinforcement of the private collective standard and/or the enlargement of the coalition (increase of the number of standard-adopting firms). They show that these two options are not neutral in terms of global market effectiveness, i.e. in terms of distortions that are generated. At given general conditions, the less costly option is the one that generates the maximal coordination among actors (the adhesion of the highest number of firms to the norm) rather that the option of standard's reinforcement. From this point of view, the market sanction in the case of a sanitary outbreak is the most important driver for the collective dynamics, but may be insufficient to orient the actors towards the maximal coordination (maximal size of the coalition). The liability rule (penalty, in case of sanitary crisis), if moderate, may be complemented by the market sanction in the sense that it allows for a "satisfactory" risk reduction, while minimizing economic distortion (minimum social cost).

5.3.2 Exploring the Rationale for Individual Normalization Strategies

Another set of contributions deals with individual private standards. As detailed in Sect. 5.2, individual private standards are shown to emerge for quality differentiation purposes (Henson and Reardon 2005), mainly in contexts of erosion of consumer confidence (i.e. food safety risk overestimation), whereby risk perception departs from the actual level of effort undertaken by firms to secure supply. In this vein, the model of Giraud-Héraud et al. (2012b) addresses the issues of the emergence of private standards in agrifood chains by taking into account both consumer behavior and the role of vertical relationships along supply chain participants, the risk of product failure being endogenously determined by both upstream production conditions and downstream strategies towards both the final

and intermediary markets. The emergence of private standards (PS) may be explained by the strategic behavior of the firm taking advantage of the food safety regulation to better positioning on the market and increase market power both downstream (towards consumers) and upstream (towards suppliers). The authors highlight that regulations may be effective in disciplining firms' strategic behavior and incentive firms to choose a level of standard compatible with the public interests.

As it will be explained in the next section (Sect. 5.3.3), the emergence of individual private standards may be explained by the imperfections of the control and inspection system. Hence, control imperfections may provide an incentive for downstream firms' suppliers to undertake "risky" behaviors in the market by under-investing in the quality of production practices. Downstream firms (retailers, processing firms, importers...) may thus require upstream suppliers to comply with private standards that are often more restrictive than public regulation. Our results suggest that control imperfections may partially explain why public regulation ("output standards" or "obligations of results") may no longer be sufficient for downstream firms to secure supply. They thus impose third-party certified "process standards" ("obligations of means") to their suppliers.

Looking more in details into the contribution by Giraud-Héraud et al. (2012b), the authors develop a model based on the Theory of Industrial Organization aimed at explaining the emergence and the effectiveness of private food standards. *On the demand side*, the authors represent consumer demand under the hypothesis of consumer risk misperception (Polinsky and Rogerson 1983; McCarthy and Henson 2005). The perceived risk does not always correspond to the actual level of risk nor reflects the actual level of effort undertaken by firms to "secure" the market. Consumer risk perception may result from the information received by public authorities or firms, the market "history" of sanitary crises, consumer confidence towards supply chain actors, etc. Hence, the authors explicitly integrate into the analysis the non-observable nature of food product safety and consumer difficulties in assessing product quality, even after purchase.[9] The more consumers overestimate the risk, the higher the improvement of consumer willingness to pay for an increased level of food safety.

On the supply side, a generic model is developed, representing the supply chain and the strategic interdependencies among upstream and downstream operators, along with a large numbers of atomistic suppliers facing a downstream concentrated sector (monopsony). A vertical relationship is considered between a downstream retailer (monopoly and monopsonist) and J upstream producers that are differentiated according to the level of risk associated with their supply. Since the retailer has monopsonistic power, the intermediary price is set *so that* the retailer can obtain the desired (and 'safe') volumes. The average risk in the market is endogenous and determined by upstream supply characteristics. The compliance

[9] This specificity of agrifood products deals with the concept of "credence goods" and implies that consumers may under- or overestimate the risk of product failure related to consumption.

with a standard (either public or private) may require investments for producers to access the intermediary market. At a given level of standard, the downstream retailing or processing firm takes several decisions towards both the upstream and the downstream stages. The firm selects suppliers among those who are initially compliant with the public standards or among a "larger" set of producers. In the latter case, the firm bears the costs that are necessary for producers to comply with the public standards. Through this selection, the firm implicitly chooses the quantity to commercialize on the market and, based on the initial characteristics of selected suppliers (equipment, processes), the quality of input. The downstream firm faces a quantity-risk trade-off: while raising the standard lowers the risk (for a given quantity), an increase of quantity increases the risk (for a given standard).

First, the authors determine the conditions for the emergence of private standards, i.e. the conditions upon which the firm has an incentive to set a private standard more constraining than public regulation. This incentive is shown to depend on the level of market benefits (increased demand for a food safety improvement, depending on consumers risk misperception) compared to the costs for the firm to ensure a 'safe' procurement (depending on the level of standard and on the nature of the vertical relationships). Taking into account the trade-off between compliance costs and market-driven incentives makes it possible to highlight, unlike most contributions in the literature, that *an environment of lax regulations is not necessarily the dominant situation in which private standards are more likely to appear*. The authors thus depart from the accepted idea that private actors arguably have the greatest incentive to implement private standards to substitute for missing/weak public standards (Henson and Reardon 2005; Reardon et al. 2001).[10] More specifically, the downstream firm may implement a private standard by "proactively" encouraging investments by upstream suppliers for food safety improvement. This strategy (denoted "proactive") is shown to be implemented when consumers highly overestimate the risk and regardless of the level of MQS, or when consumers moderately overestimate the risk and the MQS is relatively strict. The level of compliance costs is thus not sufficient to measure and interpret the strategic incentive for firms to implement private standards. Even in the presence of a high level of MQS (i.e. high compliance costs), firms may still have an incentive to implement a private standard (PS) in order to benefit from market-driven incentives (depending on the level of consumer awareness of food safety improvement). Hence, empirical evidence shows that, despite the progressive strengthening of food safety legislation and the additional compliance costs for firms, the landscape of private standards has continuously evolved towards more restrictive rules including safety, environmental, social, ethical, and sustainability

[10] As explained in Sect. 5.3.1, private standards act to protect firms' reputation against the consequences of product failures (Fulponi 2006). The "fear of consequences" may depend on product liability laws (e.g., the 1990 Food Safety Act or the 2011 Food Safety Modernization Act in the United States), from penalties set by enforcement authorities (e.g., fines, product recalls), or more generally, from the prejudicial effects of product failure on reputation.

issues. In the meanwhile, private food standards have emerged to enable firms to continue to differentiate from the more generic products that meet the MQS.

Second, the authors analyze how PSs affect the level of final risk in the market, the involvement of upstream producers and consumer surplus and interestingly show that PSs may have positive effects for both suppliers (improving market access and income for growers) and consumers (reducing risk and improving their surplus). They also show that PS does not necessarily worsen the market access for upstream producers. This result notably arises, even if the MQS is relatively high, when the retailer implements a proactive strategy under the "market-incentive" of consumer risk overestimation. In addition, the more consumers overestimate the risk, the higher the private standard's effectiveness for consumers. Hence, producer exclusion is not obvious and crucially depends on strategic interdependencies along the supply chain, and not solely on the level of standards (and compliance costs). The authors thus depart from the accepted idea that PSs determine the "exclusion" of upstream producers[11] and support a most recent stream of literature showing "inclusion effects" of private standards.[12] These results suggest that, under certain conditions, public regulation and private initiatives may be complementary to each other in the provision of food safety. The issue of public-private strategic interaction is illustrated in the following section.

5.3.3 Public-Private Interaction in the Provision of Food Safety

Public authorities and private actors are increasingly intertwined and interact in determining the level of food safety *in fine* offered to consumers. Indeed, one of the most debated issues is that of the interplay between public and private forms of food safety governance. Here the main issue is the nature of the "game" between public and private actors in a context where decision criteria and objectives may be partially conflicting. To simplify, the regulator may intervene in two different ways in the domain of food safety: either the regulator plays a 'proactive' role, being "leader" in the decisional process and thus sets public regulation by integrating the strategic response of private agents or he leaves to private agents the role of "leader" and induces the socially optimal level of food safety via the "threat" of mandatory measures.

[11] This exclusion effect has been explained in the literature as a consequence of the "entry costs" in terms of farm upgrading becoming prohibitively large for small scale growers, thus resulting in a reduction of commercialized volumes or the exclusion of (smallholder) farmers from high-value global chains (Jaffee 2003; Dolan and Humphrey 2000).

[12] Indeed, the evidence for the private standards' impact on farmers is mixed, with some studies showing smallholder "inclusion effects" (Gulati et al. 2007; Minten et al. 2009; Minot and Ngigi 2004), opportunities provided to smallholders by buyer-driven supply chains (Lee et al. 2012) and/or revenue/productivity gains for farmers who have achieved compliance (Kariuki et al. 2012; Henson et al. 2011; Maertens and Swinnen 2009; Okello and Swinton 2009) or reduced pesticide application (Asfaw et al. 2008).

5.3.3.1 The Proactive Role of the Regulator

A large body of the IO literature has addressed the effects of Minimum Quality Standard (MQS) on social welfare and average quality. Different market conditions (competition, cost structures, and consumer quality misperception) have been explored.[13] The main thesis is that the effects of public regulation depend on the strategic reaction of firms. Alongside the IO literature, insights into the management of supply chain relationships with respect to safety have been provided by operations management theory and supply chain literature.[14] However, to the best of our knowledge, no study has addressed the role of supply chain relationships in influencing the interactions among public and private forms of governance. A full investigation of the effects of public regulations requires taking into account the specificities of food markets both on the demand side (consumer behavior towards the risk) and supply side (the nature of vertical relationships along the food supply chain). Given these considerations, and starting from the results highlighted by Giraud-Héraud et al. (2012b), the issue of the complementarity between public and private regulation of food safety can be addressed.

In the public-private game where the public authority proactively sets the mandatory measure by anticipating firms' strategies and the related impact on social welfare (Fig. 5.3), the question is whether intervening or not so that firms' strategic behaviour generates an adequate level of food safety. In the model by Giraud-Héraud et al. (2012b), when consumers overestimate (but not too much) the

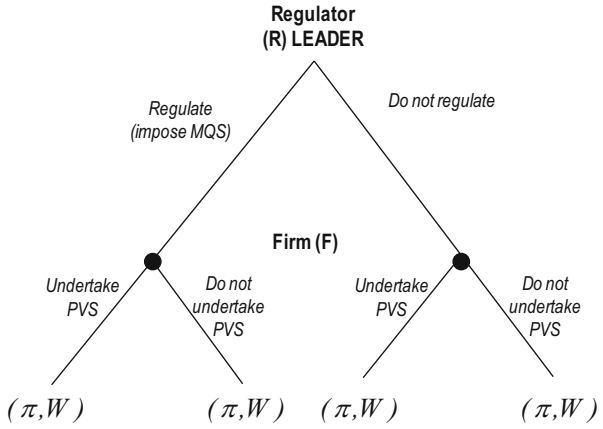

Fig. 5.3 Public-private interaction with a proactive role of the regulator. *Notes*: $W =$ Social Welfare or any other regulator's decision indicator and $\pi =$ firm's profit

[13] For example, in a competitive context, the introduction of a MQS may reduce the quality range offered to consumers and the average quality (Scarpa 1998; Crampes and Hollander 1995; Ronnen 1991). Furthermore, setting the social welfare maximizing MQS may have contrasting effects on consumer surplus at the expense of high-WTPs for consumers (Ecchia and Lambertini 1997).

[14] For example, existing works have addressed supply chain contracting (Novak and Stern 2008; Taylor and Xiao 2009) or the design of appropriate mechanisms to induce suppliers' quality efforts (Balachandran and Radhakrishnan 2005; Hwang et al. 2006).

risk, the regulator anticipates that a sufficiently (but not necessarily too) strict MQS generates the incentive for the firm to implement the risk-minimizing private standard by encouraging the upgrading of agricultural practices ("proactive strategy" as defined above).

In this case, *public and private standards are complements in the provision of food safety*. Under these conditions, the absence of regulation would imply an under-provision of food safety (i.e. the risk would not be at the minimum level), even if it would increase the output level. In this case, the trade-off for the regulator is thus whether to regulate (and thus induce the minimum risk through an improvement of upstream agricultural practices) or not (and thus favor relatively higher volumes).

However, when consumers underestimate the risk, and the MQS is relatively weak, the firm simply selects 'the best suppliers' at a zero intermediary price (monopsonistic power). This strategy implies an under-provision of food safety (i.e. the risk is not minimized). A strengthening of the regulation in this context would generate social distortions (output restriction and worsening of consumer surplus). Hence, in this case, the trade-off for the public authority is whether to regulate (and reduce the risk via volumes restriction) or not (and favor a relatively higher volumes). It is worth to note that, this situation is shown to arise even when consumers correctly perceive the risk (perfect information). Consumers' perfect information may not be sufficient for the market to work well. In this case, a 'myopic' public intervention may improve food safety to the detriment of both consumers and farmers (output restriction).

These results suggest that the regulator may induce a socially 'adequate' level of food safety by correctly anticipating firms' strategic behavior (proactive role) and choosing the level of public intervention accordingly. Namely, this analysis clearly highlights how public decisions result from a complex trade-off between strictly sanitary imperatives (risk reduction and social costs of food safety failures) and economic criteria (firm's profit, consumer surplus, upstream producers' inclusion). The main lesson is that the assessment of the effectiveness of public regulation cannot neglect the strategic response of private actors to mandatory measures.

5.3.3.2 The Emergence of Private Standards When Regulatory Standards Are Forthcoming

Another series of contributions analyzes the incentive for private actors to implement private voluntary food safety measures under the threat of forthcoming mandatory regulations (Hobbs 2004; Segerson 1999). Segerson (1999) considers a two-stage game between the firm (F) and the regulator (R) (see Fig. 5.4). At stage 1 of the game the firm implements either voluntary food safety measures or not unless forced to do so by a mandatory public policy. If the firm does not implement any initiative, there is some probability that the regulator will impose a mandatory measure (controls or standards) at stage 2. Otherwise, if the firm implements a voluntary measure, the regulator does not intervene. The reasoning behind this assumption is that the possibility is not allowed that the firm ensures a level of protection less than the target level set by the government. Being leader of the

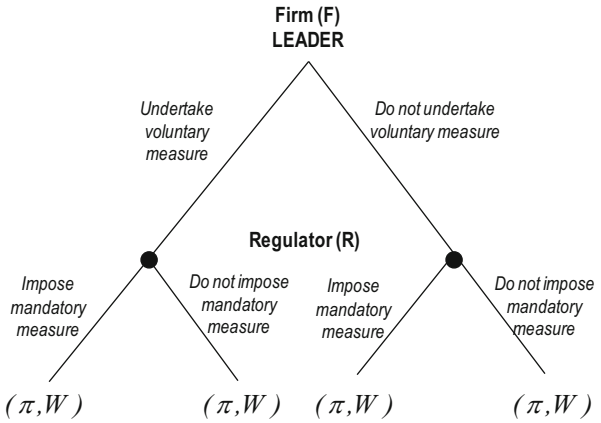

Fig. 5.4 Public-private interaction when regulatory standards are forthcoming. *Notes*: $W =$ Social Welfare or any other regulator's decision indicator and $\pi =$ firm's profit

game, the firm anticipates the effect of the regulator's strategic choice on its payoff (profit) in each possible outcome of the game and makes its choice accordingly. Segerson also shows that the decision about whether to adopt voluntary measures depends on several factors: i) the expected private costs and benefits of the voluntary measure, ii) the liability rule, iii) the availability of any direct financial incentive from the government, and iv) the likelihood of mandatory intervention. Interestingly, the mere threat of a mandatory intervention can induce voluntary adoption. Otherwise, with no threat, the incentive for the firm is shown to depend on "carrot and stick" mechanisms: market benefits (increased WTP and reputation effect) and expected losses in the case of product failure.[15] Furthermore, in the absence of market-driven incentives, anything less than full liability will lead to overproduction of the good and under-provision of food safety, with respect to the socially optimal levels.

Other contributions show that a weak threat of public intervention may generate a misrepresentation of product quality by firms. This issue relates to the present debate on food authenticity. An inadequate (or not credible) threat of enforcement and monitoring mechanisms, i.e. a threat in a strategic game that is not believable or would not be carried out if called upon (Selten 1965),[16] may be a source of "dishonest" behaviors. In the model developed by Hobbs (2004), the firm chooses, at stage 1, whether to introduce voluntary *ex-ante* verification and labelling system. This system is supposed to be subjected to third-party monitoring. The firm that has

[15] Fares and Rouvière (2010) enrich the analysis by distinguishing between "high" risk situation (a contamination episode can have strong and immediate consequences for consumers), and "low" risk situation (more silent risks). In this model, if there is no threat of public intervention, the incentive for the firm still depends on the "carrot and stick" mechanism, but firms are more likely to implement the measure voluntarily in a low risk situation than in a high risk situation (unless the legal rule is sufficiently efficient).

[16] Inversely, considering a threat to be credible is the same as saying that if the game progresses at the point where the threat is supposed to be carried out, the threat will, in fact, be acted on.

introduced the system then chooses to be "honest" or to cheat by spreading a false quality claim. If the firm does not introduce the system, the regulator is expected to introduce a mandatory verification system with some probability. The author shows that with no threat of public intervention, the firm is "dishonest" unless the market benefit is large enough to cover the costs of a voluntary system. Imperfections in the third-party monitoring system also generate dishonest behaviors.

Generalizing these results, we can conclude that the mechanism of threat (of mandatory measure) may provide sufficient incentive for firms to undertake voluntary initiatives. Otherwise, firms' strategic decision will depend on the trade-off between private costs and benefits, this latter being crucially affected by consumer risk perception.

It is worth to note that the above-mentioned models consider that the regulator intervenes with an *exogenous probability* if *no voluntary measure is set by private actors*. Implicitly, the outcome of the voluntary measure is assumed to be the same as the outcome of the mandatory measure that might be imposed. Relying on the contributions illustrated in Sects. 5.3.2 and 5.3.3.1, and notably on the assumption of endogenous risk of product failure, we might depart from this assumption. Hence, as highlighted in the introduction of Sect. 5.3.2, the level of food safety is *endogenously* determined, not only by the level of standard (either public or private), but also by firm strategies towards upstream and downstream markets. We can thus assume that the regulator, having observed the outcome of firm's choice in terms of risk (or inversely safety), intervenes *if* firm's strategy does not generate the "socially optimal" level of food safety. The firm's strategic choice will depend on the trade-off between expected costs and benefits and on the (perceived) credibility of the threat of public intervention.

5.3.4 Liability Rules, Control System and Private Standards

The question for the regulator is not only when to intervene in the decisional process (being leader or follower in the regulatory setting), but also *how to intervene* and choose the "optimal" combination of different regulatory tools. A particularly controversial issue is that of the interaction between legislation and control system. Heterogeneity and imperfections in border control systems (Whitakert et al. 1995; Willems et al. 2005) may favor opportunistic behaviors that finally jeopardize the strengthening of public regulation (e.g. maximum admitted levels of contamination) to the detriment of consumer health.

To the best of our knowledge, there exists no empirical or theoretical contribution that explicitly takes into account the relation between the food safety legislation and the control system. Most of the studies dealing with the role of the control system are developed in the context of the moral hazard (non observability of supplier quality effort by the buyer) and deal with the mechanism that the principal (buyer) may implement to induce enough quality/safety effort from the agent (supplier) and how to deter non compliant behaviors (under-investment in quality and delivering of "unsafe" food). For example, Starbird and Amanor-Boadu (2007),

and Starbird (2005) aim at characterizing the conditions for the effectiveness of a private control system in detecting non compliant products.[17] In the same spirit, a recent paper by Rouvière and Latouche (2014) analyzes how the allocation of liability for safety defects could influence coordination in the food supply chain and notably the development of a collective governance structure by importers to monitor the safety of procurement. Other papers in the supply chain literature have addressed the design of appropriate mechanisms to induce supplier quality efforts (Balachandran and Radhakrishnan 2005; Hwang et al. 2006).

In the same vein, a recent series of contributions completes the analysis and the vision on the rationale for the emergence of private standards by integrating the role of the interactions between the legislation and the control system. Grazia et al. (2012) developed an Industrial Organization approach that makes it possible to analyze the interaction between legislation (maximum admitted contamination levels) and control system in affecting the risk associated with imports, this latter being endogenously determined by the supplier strategic response (investment in the quality of production practices) to the regulatory environment.

The model starts from this main idea. The legislation most often regulates "results" without specifying the means/inputs to achieve these results. However, important investments in the quality of production practices have to be undertaken in order to comply with import safety regulations. In this model, producers choose the quality of production practices by integrating the characteristics of the regulatory environment. The upstream investments, in turn, affect the probability to comply with import requirements and finally the probability to pass the inspection at borders. Supplier reaction to regulatory environment is explained by a rational (profit-maximizing) behavior. The strategic response is determined by taking into account the competitive structure of the market, the "game" developed by partners or competitors on the market, and the leeway due to imperfections in official control systems. Hence, producers may "cheat" about their investments in good agricultural practices if this behavior is rational, i.e. preferred to the strict compliance to legislation. The rationality (profit-maximizing behavior) of producers implies that they take into account all expected sanctions (market sanction, but also public penalties in the case of merchandise rejections or sanitary accidents).

Insufficient upstream investments on production site due to this kind of behavior (risky behavior on the market) may partially explain the emergence of private standards set by retailers to their suppliers. Indeed, since liability rules most often

[17] Starbird and Amanor-Boadu (2007) use a principal-agent model in the context of adverse selection to examine how contracts that include traceability can be used to select against producers who cannot meet processor's safety specifications. The authors show that the motivation to select against unsafe producers depends on the magnitude of the failure costs and the proportion of the failure costs allocated to producers. Starbird (2005) examines the influence of inspection policies set by the principal on the efforts exerted by an agent (producer) concerning product safety. The authors show that inspection policies affect the producer's willingness to exert higher effort to ensure safety. See also Fox and Hennessy (1999) for an analysis of the effect of random and terminal inspections on the behavior of a producer afflicted with random contamination over time.

fall on downstream supply chain actors, retailers may be not satisfied with public regulations and may implement an additional system to ensure the safety of supply and additional protection against the consequences of food safety failures. In order to understand the rationale of retailers, we consider a simple formalization.

5.4 Private Standards and the Role of the Control Systems

In this section, we explore how regulations and control systems interact in favoring the emergence of private standards and notably the role of control system imperfections in influencing firms' strategies.[18] A simple IO model is developed to represent the mechanisms of interaction between the regulatory environment and the strategic decisions of supply chain actors and analyze the conditions for the emergence of private standards. The parameters and the mathematical equations are given in Table 5.1 in the Appendix and synthesized in Fig. 5.5.

Given the regulatory environment, and notably the import safety regulation consisting of an output standard (maximum admitted contamination level) and a double (border and internal) control procedure, this model makes it possible to analyze the mechanisms implemented by the buyer to ensure the safety of input.

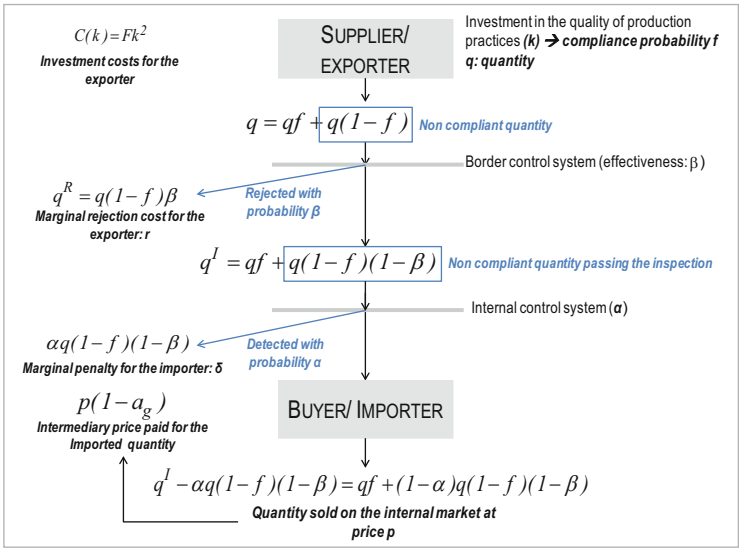

Fig. 5.5 Vertical relationship, volumes and financial flows. *Source*: authors' elaboration

[18] The simple model presented in this section is based on Grazia et al. (2012, 2014). The main mathematical details and parameters of this model are presented in the appendix of this chapter. For a more detailed description, see Hamza et al. (2015).

Namely, the strategic incentive for the buyer to implement a private standard will be analyzed. The conditions are identified, whereby the regulatory environment is complemented by a private standard regulating upstream production practices.

The model considers a vertical relationship between an upstream producer/exporter (supplier) and a downstream importer/retailer (buyer), the former located in the exporting country E and the latter in the importing country I. The producer disposes of a limited production capacity q (producer size). The importer is assumed to be *price-taker* on the final market and obtains the price p for each unit of the product sold on the market. The proportion $(1 - a_g)$ is paid to the exporter.

Let us suppose that the *import safety regulation* consists of two regulatory tools: a maximum admitted level of contamination, e.g. pesticide maximum residue limit (MRL) that we denote "sanitary norm", and a control system consisting in a border inspection system and an internal control procedure performed once the product is imported and circulated in the internal market.

The maximum admitted contamination level (s) aims at protecting consumer health from the probability of contamination at the production stage resulting in a proportion of harmful substances in the final product destined to consumption. The threshold s is a number between 0 and 1. The lower s, the more constraining the sanitary norm is. The compliance with the sanitary norm requires that the contamination rate does not exceed the threshold s. As it will be explained below, the sanitary norm will be denoted "output standard" (OS) compared with the "process standard" (PRS) eventually implemented by the retailer. While the public norm regulates the characteristics of the final product, the private standard regulates the process (in the case upstream agricultural practices).

Extending the analysis by Grazia et al. (2014), a double control procedure is designed. A first control system is performed at the importing country's border. This control procedure is supposed to be imperfect. The effectiveness of the border inspection system is measured by the parameter β indicating the probability that a contaminated sample is detected as contaminated. In the spirit of Starbird and Amanor-Boadu (2007), diagnostic errors (test sensitivity) may occur, whereby a "false negative" arises, thus implying a certain probability $(1 - \beta)$ that a contaminated quantity passes the inspection. A second control system is performed once the good has passed the inspection at borders (internal control system). As before, this system is supposed to be imperfect and its effectiveness is measured by the parameter α, $(1 - \alpha)$ representing the probability that a contaminated quantity is not detected as contaminated in the internal market.

Given the regulatory environment of the importing country, the producer chooses the level of investment k that determines the quality of production practices. The level of investment k is associated a fixed production cost $C(k)$ which is an increasing convex function of the quality of production practices.

The level of investment k and the sanitary norm s jointly determine the probability of compliance with the sanitary norm ($f(s, k)$) (see Table 5.1 in Appendix). This probability increases in the level of investment and decreases as the norm becomes more restrictive (i.e. increases in s). Given the imperfections in the border

inspection system, the probability of compliance with the sanitary norm does not equal the probability of passing the inspection at borders. Given the parameter β and the compliance probability ($f(s,k)$), we denote by $g(s,k,\beta)$ the probability of passing the inspection. This probability decreases in β (the more the control system is effective, the lower the probability of passing the inspection).

Imperfections in the border control system imply that a proportion (β) of non-compliant quantity $q(1-f)$ is rejected at the borders, while a proportion $(1-\beta)$ passes the inspection. The rejected quantity $q(1-f)\beta$ implies a unitary rejection cost (r) for the exporter. The imported quantity is made up of a proportion of compliant quantity (qf) and a proportion of non-compliant and non-detected quantity, i.e. the contaminated quantity passing the inspection, $q^C(s,k,\beta) = q(1-f)(1-\beta)$. Once the internal control procedure is performed, this contaminated quantity which is detected with probability α is equal to $\alpha q(1-f)(1-\beta)$ and is not sold by the importer, thus implying a loss corresponding to the non-realized income in the final market, while the intermediary price has been paid to the producer. In addition, the detection of a contaminated quantity on the internal market generates a penalty for the importer for each unit of detected contaminated good (δ).

Given these conditions, the strategic choice of the agents is supposed to be rational (profit-maximizing). In other words, the exporter and the importer maximize their expected profits. The importer has two options: either simply accepts the exporter's quality investment k or impose a private standard $\overline{k}$.

Following the terminology of Henson and Humphrey (2009) and emphasizing the difference in nature of public and private interventions, we denote in the reminder of the paper the public norm as "output standard" (OS) and the private standard (PS) as "process standard". In the first case, only the "output standard" (s) is in force. This configuration is denoted OS (Output standard). In the latter case, the output standard (s) coexists with a "Process Standard" (PRS) that is imposed by the buyer to the supplier in order to ensure a minimum level of investment in the quality of production practices.

The decision of the importer regarding whether to establish the process standard is taken before the strategic choice of the quality investment by exporters, according to the following two-stage game,

At stage 1, the importer chooses whether to impose or not $\overline{k}$ *a private standard regulating upstream agricultural practices,*

At stage 2, the exporter chooses the level of investment in the quality of production practices k.

In this simple two-stage game, the importer decides whether to impose or not a PS to upstream suppliers by anticipating the strategic reaction of exporters to each of his possible strategies and the respective payoff for each outcome of the game.

5.4.1 Interactions Between Public and Private Norm and Impact on the Supply Chain

We address in this section the interactions between the public and private standards. We analyze the determinants of the importer's strategic choice whether or not to impose a PS to the producer/exporter. By choosing the PS strategy, the importer imposes a level of process standard which is more restrictive than the level of investment that the producer/exporter would have chosen if only the OS were in force.

Result 1 *The importer imposes the private standard to the producer/exporter if the unitary rejection cost is sufficiently low, or the marginal penalty is relatively high or the border (internal) control effectiveness is relatively low (high).*

Interestingly, the importer's strategic choice to impose the PS to the producer/exporter is shown to be independent on the magnitude of the OS. First, it depends on the probability of detection of the contaminated quantity on the internal market (α) and on the associated level of penalty incurred by the importer (δ). Second, it depends on the unitary rejection cost (r) and on the effectiveness of the border control system (β), both parameters affecting the level of investment of the producer/exporter and thus the level of contaminated quantities passing the border inspection.

Analyzing in a more in-depth way the effects of the parameters r and β, when the unitary rejection cost is relatively low, the expected loss in the case of non-compliance for the producer/exporter is relatively low. Regardless of the effectiveness of border controls, the rejection cost for the producer/exporter is relatively low. As a consequence, the producer/exporter under-invests in the process quality on the production site. Hence, we can verify that the optimal level of investment for the producer/exporter decreases with the unitary rejection cost. This "opportunistic" behavior generates a relatively low imported quantity (the probability of passing the inspection decreasing in k for a given level of border control) and thus a relatively high rejected quantity (the higher the level of border control) or a relatively high contaminated quantity passing the inspection (if the border control is not sufficiently effective). In this context, since the importer is responsible for the contaminated quantity detected in the market, the importer has the incentive to impose the PS in order to avoid a low imported quantity and/or a high contaminated quantity on the market.

In the same vein, ineffectiveness of the border control system generates a reduction of the producer/exporter's investment effort and a high contaminated quantity passing the border inspection. In this case, only a relatively high effectiveness of the internal control system makes it possible to penalize the importer. For this reason, the importer imposes the PS in order to avoid expected losses associated with the penalty.

Regardless of the level of effectiveness of border and internal controls, a relatively high penalty always generates the incentive for the importer to impose the PS.

5.4.1.1 Effects of the Private Standard (PS) on the Contaminated Quantities and on Market Access

The PS strategy results in a higher investment in the quality of production practices with respect to the investment that the producer/exporter chooses when only the OS is in force. The higher upstream quality investment generates an increase in the compliance probability and in the quantity passing the inspection (imported quantity). Moreover, it results in a lower contamination ratio (i.e. the ratio between the contaminated quantity and the imported quantity) and in a lower total contaminated quantity.

We now analyze whether the PS strategy may be profitable or not, at the same time for the importer and the producer/exporter. The *nature of vertical relationships* between the importer and the producer/exporter crucially affects the results and the conditions for the existence of a mutually profitable "solution". More specifically, both the distribution of compliance costs and the bargaining power affect the results. The result could be summarized as follows.

Result 2 *The PS is profitable for both the importer and the producer/exporter if the importer bargaining power and the proportion of the compliance costs incurred by the importer are relatively high.*

Interestingly, this result illustrates that the development of PSs may be mutually profitable (for both the importer and the exporter), depending on the nature of vertical relationships among supply chain participants and on the relative bargaining power of actors. Public and private interests may be thus compatible. The reasoning behind this result is the following. The importer has an incentive to impose the PS if and only if this strategy improves his profit, more specifically if his participation in the compliance cost is relatively low. However, the participation of the importer in the compliance costs counteracts the increased investments for the producer/exporter if and only if it is higher than a certain threshold. The importer's participation in the compliance costs is sufficiently high (and counteracts the investments for the producer/exporter) when his bargaining power is relatively high (a_g). Hence, the PS may improve both importer's and producer/exporter's profits if both the importer bargaining power (a_g) and his participation in the compliance cost (a_k) are relatively high.

5.4.2 Internal Control System, Liability and Impact on the Supply Chain

The quality of agricultural production practices may be generally influenced by a reinforcement of the control system or a strengthening of the liability rule.

The results of the model tend to moderate these effects according to whether the importer has imposed the private standards or not.

Result 3 *A reinforcement of the internal control system or a stricter liability rule:*

Does not have any impact on the quality of production practices in the absence of the PS,
Generates an improvement of production practices, an increase of the imported quantity and a decrease of the contaminated quantity in the presence of the PS,
Generates a decrease in the importer's profit but may increase producer/exporter's profit.

The importer is solely responsible for the quality of imported quantities in the destination market. Hence, the producer/exporter determines his optimal investment in the quality of production practices without taking into account the effectiveness of internal controls and the penalty. As a consequence, in the absence of a PS, variations of these parameters (i.e. an improvement of internal control effectiveness or increase of the penalty) do not generate any incentive for the producer/exporter to improve process quality. Nor, an increase of the penalty determines a reduction of the contaminated quantities on the internal market. However, an improvement of internal control effectiveness, even if it does not affect the quantity or the quality of products passing the border inspection, makes it possible to reduce the contaminated quantity commercialized by the importer. An evolution of the two parameters (internal control and penalty), whilst they do not affect the producer/exporter profit, may penalize the importer by reducing his profit and thus generate the incentive for the importer to impose the PS.

When the PS is implemented, the optimal investment imposed by the importer increases with the effectiveness of internal control and with the level of penalty. This generates a positive effect on the commercialized quantity, a reduction of the total contaminated quantity and a reduction of the proportion of the contaminated quantity over the quantity passing the inspection. However, the effect on the importer's profit is negative. Hence, by imposing the PS the importer participates in the compliance costs. The increase in the compliance costs counterbalances (and is more proportional than) the above-mentioned effects (increase of the commercialized quantity and reduction of the contaminated quantity).

However, the increase of internal control effectiveness or of the penalty generates a positive effect on the producer/exporter profit if the importer participation in compliance costs is sufficiently high. Hence, at these conditions, the increase of compliance costs is mainly incurred by the importer. In this case, the increase of revenue due to the increase of the quantity passing the inspection is higher than the increase of the proportion of compliance costs incurred by the producer/exporter.

5.5 Conclusion

This chapter proposed a discussion on the most up-to-date economic issues associated with the development and diffusion of food safety standards. Specific attention has been given to the analysis of the interactions between public regulatory tools and private strategies. The main objective is to analyze the rationale behind the emergence of private standards and their economic and sanitary legitimacy, where the imperative of consumer health coexists with objectives related to economic effectiveness and equity of relationships between upstream and downstream actors.

An original methodological approach is needed that measures social costs of private strategies in terms of economic effectiveness and equity and the health benefits. Such a cost/benefit analysis is needed to assess the acceptability of occurring distortions relative to the anticipated health gains. In this spirit, a recent series of contributions in the field of IO highlights how the development of private standards may allow firms to achieve a better position in the market and increase their power towards both competitors and suppliers. Situations may thus arise where an under-provision of food safety and economic distortions arise. Public regulations may be designed to provide an incentive for virtuous behaviors by firms choosing a level of standard that is compatible with the collective interest. One of the conditions for the emergence of mutually profitable solutions is the "quality" of vertical relationships among supply chain participants and the *equity in the distribution of value to upstream suppliers*. Worth mentioning is a more focused and comprehensive analysis of the economic legitimacy of private standards that should clearly integrate the role of trust in disciplining vertical relationship. Indeed the development of trust-based relations, and the reliability and stability of supply may justify higher returns for upstream suppliers and a better equity of upstream-downstream relations.[19]

A good interaction between public and private modes of governance may orient firms towards decisions that not only improve the safety of products, but also contribute to a fairer distribution of compliance costs among supply chain agents and may constitute an opportunity to rebalance the power among supply chain actors.

[19] These empirical evidences clearly emerge within buyer-supplier relations in global agrifood chains (producers/exporters and importers). Preliminary results of empirical surveys on importers, conducted within the framework of the SAFEMED Project "Food safety regulations, supply chains structure, market access and international competition", coordinated by INRA-ALISS, highlight the role of trust and reliability, within the criteria for supplier selection, as one of the mechanisms to ensure the safety of procurement. For more details on the SAFEMED project, see the following website: http://www.arimnet.net/Form_website_SAFEMED_corrected2.pdf

Appendix

Given the parameters and equations presented in Table 5.1, the game is solved by backward induction.

Let us suppose that at stage 1 the importer has chosen not to implement the PS. Only the OS is in force. At the second stage of the game, the exporter chooses the quantity to commercialize (we easily verify that the optimal quantity corresponds to the total production capacity) and the level of quality investment k by maximizing the following profit function:

$$\pi^E(F,q,s,k,\beta,a_g) = (1-a_g)pq^I(s,k,\beta) - rq^R(s,k,\beta) - C(k) \tag{5.1}$$

By using (5.1) and the equations presented in Table 5.1, we easily verify that the optimal level of investment is given by:

$$k^*(F,q,s,k,\beta,a_g) = \frac{(1-s)q\beta\left[(1-a_g)p+r\right]}{2F} \tag{5.2}$$

We denote $k^*(F,q,s,k,\beta,a_g) = k^*$. Analysing expression (5.2) makes it possible to identify the factors affecting the strategic choice of the exporter. These factors pertain to the regulatory environment, to exporter size as well as to expected market benefit and losses. By using (5.2) we easily verify that the optimal level of investment increases with β and decreases with s; it increases with q and decreases with F. Moreover, the optimal level of investment increases with the intermediary price and with the marginal rejection cost.

In this case, the profit of the Importer is given by:

$$\pi^I(F,q,s,k^*,\beta,a_g,\alpha,\delta) = a_g pq^I(s,k^*) - (p+\delta)\alpha q^C(s,k^*) \tag{5.3}$$

Expression (5.3) denotes the profit of the Importer in the configuration OS (simply denoted by $\pi^I(k^*)$).

Let us now suppose that at the stage 1 the Importer has chosen to implement the PS. The cost for implementing the private standard PS is paid by the importer in a proportion a_k. The Importer chooses the level of PS by maximizing the following profit function:

$$\pi^I(F,q,s,k,\beta,a_g,\alpha,\delta,a_k) = a_g pq^I(s,k) - (p+\delta)\alpha q^C(s,k) - a_k C(k) \tag{5.4}$$

By using (5.4) and the equations presented in Table 5.1, we easily verify that the PS chosen by the Importer is given by:

$$\overline{k}(F,q,s,k,\beta,a_g,\alpha,\delta) = \frac{q(1-s)\left[a_g\beta p + (1-\beta)\alpha(\delta+p)\right]}{2a_k F} \tag{5.5}$$

We denote $\overline{k}(F,q,s,k,\beta,a_g,\alpha,\delta) = \overline{k}$. By using (5.5) we easily verify that the

Table 5.1 Parameters and equations of the model

Parameters and equations	Explanations
q	Producer/exporter production capacity
p	Price of the product on the importing country's market The price is assumed to be exogenous. The importer is a price taker in the importing country's market
a_g	Importer's bargaining power a_g *is a negotiation parameter* that reflects the bargaining power of the importer vis-à-vis the producer/exporter The importer receives the unit price p for the quantity sold in the importing country's market and pays the producer the unitary intermediary price $\boldsymbol{(1-a_g)p}$ for the imported quantity
s	Sanitary norm The importing country is characterized by a certain level of minimum quality standard on final product characteristics s (with $0 \leq s \leq 1$). (output standard OS) An increase of s on the interval [0, 1] means relaxing the food safety regulation in the importing country
B	Importing country's border control procedure The importing country is characterized by a certain degree of effectiveness of borders control $\boldsymbol{\beta}$ (with $0 \leq \boldsymbol{\beta} \leq 1$). This parameter represents the probability that a contaminated sample is correctly detected as contaminated, while $(1-\boldsymbol{\beta})$ denotes the probability of a false negative test
A	Importing country's internal control procedure The importing country's market is subjected to an internal control procedure α (with $0 < \boldsymbol{\alpha} < 1$) α is the probability that a contaminated sample is correctly detected as contaminated, while $(1-\alpha)$ denotes the probability of a false negative test
k	Producer/exporter's quality investments The producer may invest in the quality of production practices in order to reduce the level of contamination of food. We denote k the level of quality associated to production practices, with $0 \leq k \leq 1$
$C(k) = Fk^2$	Total production cost The investment in the quality of production practices implies a fixed production cost
$f(s,k) = 1-(1-s)\ (1-k)$	The compliance probability, i.e. the probability that a product unity complies with the norm s

(continued)

Table 5.1 (continued)

Parameters and equations	Explanations
	At a given level of norm s, an increase in the effort k increases the probability of compliance for each product unit. Moreover a norm reinforcement (s decreases), decreases the compliance probability, for a given level of investment k
$g(s,k,\beta) = f(s,k) + (1-\beta)[1-f(s,k)]$	The probability that an exported product unit passes the inspection at the importing country's border At a given norm s and level of investment k, the probability $g(s, k)$ that a product unit passes the inspection decreases with β
$q^R(s,k,\beta) = q[1-g(s,k)] = q(1-f)\beta$	The rejected quantity
$q^I(s,k,\beta) = qg(s,k) = qf + q(1-f)(1-\beta)$	The quantity that passes the border inspection
r	Marginal rejection cost for the producer/exporter
$q^C(s,k,\beta) = q(1-\beta)[1-f(s,k)]$	The contaminated quantity passing the border inspection, i.e. the quantity that does not comply with the norm s but is not detected by the border control system, due to imperfections
$\alpha q^C(s,\beta,k) = \alpha q(1-f)(1-\beta)$	The contaminated quantity passing the inspection and detected by the importing country's internal control procedure
δ	Marginal penalty for the importer for the contaminated quantity detected by the internal control procedure
$\delta\alpha q^C(s,\beta,k)$	Expected total penalty for the importer

optimal level of investment increases with the expected market price and with the expected losses associated with the detection of non-compliant goods on the internal market. It decreases in the proportion of costs for standard's implementation supported by the importer.

In this case, the profit of the exporter is given by:

$$\pi^E\left(F,q,s,k,\beta,a_g,a_k\right) = \left(1-a_g\right)pq^I\left(s,\overline{k},\beta\right) - rq^R\left(s,\overline{k},\beta\right) - \left(1-a_k\right)C(k) \tag{5.6}$$

By substituting (5.5) into (5.4), we determine the profit of the importer in the configuration PS (simply denoted by $\pi^I\left(\overline{k}\right)$). The optimal choice of the importer at stage 1 is obtained by comparing the expected profit in the two possible configurations of the game. The Importer will implement the PS when $\pi^I\left(\overline{k}\right) > \pi^I\left(k^*\right)$.

By comparing the expected profit in the two configurations, we determine the conditions whereby the Importer implements the PS (Result 1). The conditions are

shown to depend on the degree of control system imperfections (β, α) and on the parameters measuring the extent of the respective expected losses associated with border (r) and internal (δ) control system.

Then, by using expressions (5.1)–(5.6), we compare the profit of both the importer and the exporter in the two configurations and determine the conditions (on the parameters a_g and a_k), whereby the PS is mutually profitable (Result 2).

Finally, by using expressions (5.1)–(5.6), we analyse the effect of an improvement of the internal control system (or of a stricter liability rule) on the quality of production practices (k), imported and contaminated quantities and profits of the importer and the exporter in both configurations (Result 3).

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Consumers' Behaviour Towards Food Safety: A Literature Review

6

Magda Aguiar Fontes, Eric Giraud-Héraud, and Alexandra Seabra Pinto

Abstract

This paper deals with the actual expectations of consumers on food safety and their predictable behaviour in case of foodborne outbreaks. We present an overview of the purchase process for risky products and the reason why the consumer has a specific behaviour with respect to the sanitary risk. Moreover, by taking the results of different works that focused these effects in the meat and fruit and vegetables sectors, we show how the real quality signals on the European market (organic production, designation of origin, private retail labels, etc.) could promote consumer confidence.

Keywords

Food safety • Consumers' behaviour • Risk

M.A. Fontes (✉)
CIISA – Faculdade de Medicina Veterinária, Universidade de Lisboa (Ulisboa), Lisbon, Portugal
e-mail: magdaaguiar@fmv.ulisboa.pt

E. Giraud-Héraud
INRA-ALISS and Ecole Polytechnique, 91128 Palaiseau CEDEX, France
e-mail: Eric.giraud-heraud@ivry.inra.fr

A.S. Pinto
UEIS – SAFSV, National Institute for Agrarian and Veterinarian Research I.P. (INIAV), Oeiras, Portugal
e-mail: alexandra.pinto@iniav.pt

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6.1 Introduction

Considering the last 30 years, different food scares have taken place in Europe, having different origins (such as salmonella, listeria, E. coli, dioxins in animal feed, alar pesticide, mercury poisoning in fish, nitrofuran, and bovine spongiform encephalopathy (BSE)). The recurring nature of the different food crisis has made food safety an issue of intense public concern (see for example Knowles et al. 2007). The contaminant-based "food scares" (antibiotics, hormones and pesticides) are of more concern to consumers than hygiene standards and food poisoning (Huang 1993; Miles et al. 2004). Consumers are also becoming alarmed with the "cocktail effect", that is the synergistic effects of different pesticide residues (Luijk et al. 2000).

Concerning animal disease related scares, BSE remains the main one across Europe. As Knowles et al. (2007) argued, although not being the "first food scare to affect food safety on an European scale", it was from BSE onwards that legislation and regulatory schemes suffered different reforms and new regulatory institutions were established (Reg. (CE) No 1760/2000, the EU Food Law, Reg. (CE) No 178/2002, The European Food Safety Authority). It was also with BSE that consumers became more aware of food safety issues and in the particular case of beef, by expressing the refusal to buy this type of meat and/or diversifying their options within the meat group. According to *Eurostat*,[1] in 1990, beef and veal per capita consumption in the European Union (EU) was 22.1 kg/inhabitant/year; in 1995 it fell off to 20.2 kg and in 2001 to 17.9 kg. A market survey undertaken in France by the end of 1997 (Peretti-Watel 2001) also showed that 18.5 % of the respondents had stopped eating beef after the BSE crisis (1996) and 39.3 % has stopped eating some parts. But it also revealed that some consumers after a longer period had decreased their beef consumption while others (less than 5 %), taking advantage of lower prices, increased their beef consumption. The short-term impact of the second wave of the BSE crisis (during the following 2 or 3 months of year 2000) in different European countries was studied more precisely by Angulo and Gil (2007). In all cases consumption had dropped considerably: France lost 40 %; Germany, 60 %; Italy, 42 %; and Portugal, 30 %. In France, the second wave of BSE crises created a national panic. It led to a ban of beef in school canteens and to a major drop in beef sales; beef consumption dropped by 40 %, compared to 25 % in the 1996 crisis. Other important foodborne outbreaks have occurred in Europe and USA. Arnade et al. (2009) show the impact on demand of the announcement transmitted by the Food and Drug Administration (USA), in September 2006, about the possible contamination of spinach with *E. coli* O157:H7. The short-term impact was a decrease in demand for all leafy greens, as consumers temporarily substituted other vegetables for leafy greens. The other bulk leafy greens were identified by the authors as "shock complements" because the reputation of these products was affected by the spinach problem. However, over the long term,

[1] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

consumers switched purchases among leafy greens, but total expenditures for leafy greens did not change.

Hence, consumers have been faced with different food safety problems that have major consequences on their behaviour, attitudes and preferences towards particular food products (this was particularly evident in consumers' reactions to BSE). Moreover, food outbreaks imply consequences at different levels of the food system from the production level, going through processing, to retail marketing and international trade, with particular relevance on consumer behaviour. Indeed with the world trade globalization, mass access to information and global information networks operating, consumer behaviour can never be underestimated or not taken into account. In developed economies consumers' food demand is increasingly towards higher quality, including taste, nutritional, and safety characteristics, and value added products. Food safety can be treated as a dimension of quality (Hooker and Caswell 1996) where safety attributes include foodborne pathogens, heavy metals, pesticide residues, food additives and veterinary residues. According to the expression of Grunert (2005), one of the things consumers find desirable in a food product is food safety, a "sleeping giant" that becomes highly relevant in situations of food outbreaks.

What is meant by "sleeping giant"? Following Grunert, this means that there are situations where the food outbreaks are so relevant, mainly in the short-run, that food safety issues overcome all the other attributes leading to a boycott on consumption. But, in the long-run, the food safety attribute is underneath all the other attributes in the sense that consumers do not take it into consideration, assuming that a food product to be available in the market is in accordance with the food safety minimum legal requirements. Altogether this is indeed like a "sleeping giant": present in the long-term but not directing consumer decisions, present in the short-run when outbreaks take place and highly influencing consumer decisions. In his paper, Grunert considers that there are two major ways in which food safety perceptions influence consumer behavior towards food. One role is this "sleeping giant"; the other role has to do with the way "consumers apply safety considerations to certain production technologies". And in this regard consumers, perhaps mainly due to the lack of knowledge on what can be the long-term health effects of some technologies, for example the use of genetically modified organisms (GMO) or food irradiation, might develop negative attitudes towards foods with such characteristics. The immediate consequence can be at the innovation level: firms delay the introduction of such processes due to consumers' reactions.

This explosive issue is the result of imperfect knowledge and information about foodborne risks (Smallwood and Blaylock 1991). Food safety is thus a credence quality attribute in the sense that the consumer can never ascertain by himself the presence of such attribute, having to rely on the information that is given. Due to the credence aspect of the attribute "food safety", standards and certifications may be used to provide information to consumers, legitimating health and safety regulation. First, Public Authorities establish "minimum quality standards" (MQS) of safety performance for a product characteristic. Moreover, the governments can set up certifications and standards, in the context of voluntary agreements (i.e. non

mandatory standards) which allow to certify the behaviour of producers/companies, virtuous in social or/and environmental aspects, and which can have an indirect link with food safety from a consumers' point of view. For example, the organic certification is very often interpreted as an improvement of the sanitary safety. Finally, the private strategies of standardization and the private brands can be also organized to reassure the consumers following the various sanitary crises.

Indeed, standards can help consumers to evaluate the quality of food products by increasing the transparency of the production processes and the traceability of products. With an outbreak, consumers are more willing to pay for products that provide information in comparison to products that do not (Caswell and Joseph 2006). A potential premium paid by consumers for attributes signaling more confidence to consumers might be an important incentive to develop and/or adopt private standards provided that these efforts are explicitly or implicitly communicated to consumers. Some authors argue that signaling the quality (through labels, for example) is particularly important when consumers react to the perceived rather than the objective risk that the supply chain fails to provide safe food in the final market. It is therefore essential to assess consumers' risk perception to determine their willingness to pay and to evaluate the role of specific standards. It is recognised in the scientific community, that accurately getting valid and reliable estimates of the maximum price a consumer is willing to pay for a particular product, becomes more difficult when dealing with private goods that have credence attributes associated with public good characteristics, such as beef perceived as having higher food safety. This raises the issue of ethical responsibility versus consumer demand and therefore also the possibility (or not) of market differentiation. Considering fresh meat, although having a low degree of differentiation (Grunert et al. 2004), there might be incentives for producers to differentiate beef based on credence attributes such as production method, food safety or animal welfare. Of course this food safety is, if we may say, subjective in the sense that it translates consumers' perceptions of food safety as opposed to the objective food safety proved by food scientists (Wezemael et al. 2010). And, if this is a credence attribute, what can help communicate to consumers the presence of such attribute? Very often the certification labels, either public or private, perform this role. However, with such labels a full amount of information is given, very often confusing the consumer and the main objective may be lost. Of course this is also linked with the perception that a number of credence attributes are jointly produced and given to the consumer, exacerbating this problem.

Throughout this chapter we will try to provide a literature review, giving some examples, and elaborate on the questions raised. We explain that consumers have been reacting to food outbreaks changing their preferences and behaviour. For some products there has been what we may call a boycott, with a significant decline in consumption or even a total refusal of the product. In such situations the "sleeping giant", following Grunert's designation, becomes a major food quality attribute highly influencing consumer preferences and behaviour. In other situations taste or other attributes overcome the food safety issue, since in the consumers' memory there are no recent "scary" situations. In what follows we give a literature review on

consumers' behaviour and economic interpretations towards food safety. Then in a subsequent section we go through different examples using meat and fruit and vegetables as case studies and we summarize the main results obtained, and already published, to reinterpret them in light of the above-mentioned questions. Finally the chapter ends by widening the research topics of this problem.

6.2 A Literature Review

Over the last two decades, an important economic literature has emerged on food safety risk valuation by consumers. The aim is generally to estimate the factors that affect consumers' behaviour *vis-à-vis* food safety risk. These papers focus namely on the analysis of boycott behaviour or decrease in demand and willingness to pay (WTP) for the innocuousness of food products. All these studies, though each one having different specificities, show that food safety has an expected influence on consumers' behaviour and market demand (e.g. Antle 2001).

6.2.1 Meat Safety Risk Valuation

The study of the impact of food safety information on demand for food has been a subject of important interest to economists. Several studies have been concerned with the American and European meat markets. Dahlgran and Fairchild (1987), Robenstein and Thurman (1996), Lusk and Schroeder (2000), McKenzie and Thomsen (2001), and Piggott and Marsh (2004) developed theoretical models to study the impact of food safety information on the U.S. meat demand. In Europe, authors like Burton et al. (1999), Mangen and Burrell (2001), Verbeke and Ward (2001), and Mazzocchi (2004) used an almost ideal demand system (AIDS) model to analyse the effects of BSE crisis on meat demand. Burton et al. (1999) found significant effects of BSE on the allocation of consumer expenditure among meats. In the Netherlands, Mangen and Burrell (2001) used a switching AIDS model to investigate preference shifts among Dutch consumers. They found that preference shifts caused by the BSE crisis reduced beef expenditures with offsetting gains in the shares of pork, prepared meat and fish. Verbeke and Ward (2001) analyzed meat demand in Belgium after the BSE crisis with an AIDS model that included an index of television coverage and advertising expenditures as explanatory variables. Their results showed that advertising had only a minor impact on demand compared to the negative media coverage. Pennings et al. (2002) showed that in comparison with Dutch and US consumers, Germans were extremely risk averse. At the beginning of 2001, German consumers were willing to reduce their beef consumption by 73.2–91.1 %, depending on the supposed von Creutzfeld-Jacob (vCJ) infection probability. Mazzocchi (2004) used Italian aggregate household demand of beef and chicken in a stochastic model framework for representing the time-varying impact of two BSE crises (1996 and 2000) and the dioxin crisis in between. The author showed that the impact of the first BSE crisis on Italian consumers seemed to have

quickly disappeared, but the second wave of the scare at the end of 2000 had a much stronger effect on preferences than the first one. The dioxin crisis had a strong impact on the chicken demand with a positive persisting shift after 14 months of the beginning of the crisis. It seems we can say that very often the type of reaction consumers have when facing a food safety issue, is highly dependent upon the discomfort or concern that the food crisis has originated and the time-length, again the "sleeping giant" at force. Barreira et al. (2005) evaluated the BSE and nitrofuran crisis effects in Portugal. The authors estimated an AIDS model for four groups of meat (beef, pork, poultry and other meat). Results showed that these crises have significantly altered the preferences of Portuguese consumers towards meat in the period being considered. With the BSE the proportion of expenditure in beef has significantly declined, while that of pork and poultry has significantly increased. The nitrofuran crisis was translated in a significant decline on poultry expenditure, without a significant change in the other categories of meat expenditure.

Considering measuring WTP for safety attributes, this has been an important issue in agricultural economics. Henson (1996) argues that assess the consumers' WTP for an improvement in food safety is, theoretically, the correct approach to obtain the value that consumers attach to safer food. The methods usually used to obtain these values include qualitative surveys to elicit broad indicators of food safety preferences (see for example Penner et al. 1985), and also contingent valuation surveys, choice experiments (i.e. conjoint analysis, contingent ranking or choice modelling), and experimental auctions. The vast literature that exists within this subject has focused on the assessment of consumers' WTP for risk reduction in the meat sector, others on risk reduction from the use of food safety technologies, others on pesticides risk reductions in food, amongst others.

Latouche et al. (1998) conducted a survey in France in 1997 to know if French consumers were willing to pay a premium for a beef that would not transmit the human variant of BSE. Consumers were presented with two different modalities of beef: i) medium-quality, low-priced minced steak with little risk of variant of vCJ disease, and ii) high-quality, higher-priced beef with no risk of vCJ disease . For the two meat products, the mean WTP premiums were 22 % of the original price and 14 % of the original price, respectively. The authors also found that employed and highly educated respondents as well as respondents who preferred labelled or organic products indicated higher WTP, while respondents who were involved in agricultural activities were less willing to pay a premium. McCluskey et al. (2005) used the data obtained from a consumer survey in Japan to investigate the effects of BSE on consumers' willingness to pay for and consume beef. The authors pointed out that media coverage could increase the severity of the consumer response against beef.

Several studies have assessed consumers' WTP for mandatory and voluntary beef labeling programs associated with food safety attributes (Dickinson and Bailey 2002; Alfnes and Rickertsen 2003; Enneking 2004; Loureiro and Umberger 2007; Roosen et al. 2003). Dickinson and Bailey (2002) developed experimental auctions to assess American consumers' preferences and willingness-to-pay for traceability, additional food safety assurance, and animal treatment (animals were produced

using humane treatment procedures and with no added growth hormones) in beef and ham products. Their results showed that consumers were willing to pay a positive premium for traceability assurances; however the premiums were larger for additional food safety assurances. Alfnes and Rickertsen (2003) used surveys and experimental auctions to examine Norwegian consumers' preferences for beef originating from various countries and produced with or without hormones. The results showed that hormone-treated beef was less preferred than hormone-free beef regardless of the country-of-origin. Enneking (2004) analysed the impact of food safety label applied to brand products. He concluded that WTP estimates varied considerably across food labels and that quality labelling influenced consumer's choice behaviour. The consumer research by Umberger et al. (2003), and Loureiro and Umberger (2007) found that the majority of consumers who preferred "Certified US" beef interpreted the origin-labeling programs to provide additional food safety assurances. They argue that indication of origin may only become a signal of improved quality if the source-of-origin is associated with higher food safety or quality.

The works of Shogren et al. (1999), Fox et al. (2002), and Nayga et al. (2005, 2006) have focused on consumers' WTP for irradiated meat. In the empirical study of Shogren et al. (1999) three different types of markets are defined: a retail market, an experimental auction market and a hypothetical market survey. In each market, individuals are confronted with a choice between conventional and irradiated chicken breast. They concluded that consumer choices were similar across market settings at a price premium for irradiation. Their findings also suggest that individuals are initially skeptical of irradiated food but their concerns can easily be put to rest through simple educational devices. Nayga et al. (2006) use a non-hypothetical experiment with irradiated ground beef to estimate willingness to pay for reducing risk of getting foodborne illness. Their results show that consumers are willing to pay for a reduction in the risk of foodborne illness once informed about the nature of food irradiation technology.

6.2.2 Valuation of Pesticide Reduction

Regarding the reduction of pesticide residues in food, Yiridoe et al. (2005) present an exhaustive review of different studies that focus on organic consumer demand and marketing issues. Indeed, using surveys and contingent valuation methods, many empirical studies show that consumers declare they would pay a significant premium price for both organic and certified pesticide residue-free (CPRF) produce. In these studies, the information on certification for pesticide reduction was disclosed without specifying the presence of labels that consumers faced in actual markets. Papers from Ott (1990), Misra et al. (1991), Weaver et al. (1992), Huang (1993) and Eom (1994) evaluated different alternative price premiums for American consumers. These authors show that, on average, consumers would pay 5–20 % more than current prices, and that more than half of the consumers would pay a premium for CPRF. Jolly (1991) evaluates the market diffusion of organic foods

among California consumers and shows that consumers' premiums varied with the commodity and with the reference price of the conventional product. This author points out that when the price difference between organic and conventional apples increases by 74 %, only 13 % of consumers were willing to buy the organic product. Buzby and Skees (1994) analyse the results of one national survey conducted by the University of Kentucky where food shoppers' WTP for reduced risks from pesticides were evaluated. The authors found that more than half the respondents declared a preference for both organic and CPRF over conventional products. However, only 25 % of respondents had actually purchased organic or CPRF produce on a regular basis. They verify that the respondents were willing to pay a few cents more for grapefruit free of pesticide than for grapefruit with a reduction of 50 %. More recently, Gil et al. (2000) used a contingent valuation in two Spanish regions to assess the maximum premium of several organic food products (vegetables, fruits, meat). They showed that these values ranged from 15 to 25 % over the price of conventional. In the same time, Boccaletti and Nardella (2000) observed that 70 % of Italian consumers would not pay a price premium higher than 10 % of the regular price. In Greece, Tsakiridou et al. (2006) found that the average premium for organic products may reach 35 %. In the context of their paper, these authors argued that the premium for organic products increased if confidence on organic prices increases.

Most of these studies find significant heterogeneity in price premiums for CPRF and organic products. Products' appearance and consumers' characteristics are pointed as the most influential factors to explain heterogeneity. Concerning the influence of products' appearance Ott (1990) shows that less than 40 % of shoppers would accept any cosmetic defects. Inversely, Weaver et al. (1992) do not find a significant trade-off effect between residue-free and appearance when evaluating consumers' WTP. Almost half of the respondents indicated a willingness to buy CPRF tomatoes with cosmetic defects. Along the same line, Huang (1996) analyses the extent to which consumers are willing to accept sensory defects for reduction in pesticide residues. This author uses a qualitative choice model with different explanatory variables that may affect consumers' WTP for pesticide use reduction. It appears that the majority of potential organic consumers were not willing to purchase organic products if they had sensory defects.

Concerning consumers' characteristics Jolly (1991) argues that organic food buyers are younger than non-buyers; however the results show that educational level and gross household income do not explain differences in organic buying behaviour. In Thailand, Posri et al. (2006) showed that WTP for 'pesticide residue limit compliant safe vegetables' increases with income and age. However, Thomson (1998) argued that income (and also gender) did not influence the probability of buying organic products, while age, family composition and education may affect significantly organic purchasing behaviour.

Some studies have tried to measure consumers' reaction to more specific information on pesticide use or impact. Using contingent valuation and improving consumers' information on pesticides' reduction, Buzby et al. (1995) focused on the elimination of only one specific postharvest pesticide on the production of

grapefruit. They showed that consumers' WTP could be around 40 % more for grapefruit free of the specific pesticide. Giving also greater emphasis to information about the consequences of pesticides on health (risk of developing cancers), and using a sample of married females from Taiwan, Fu et al. (1999) highlighted that WTP could be significantly related to the scope of the risk reduction. Chinnici et al. (2002) explained that all consumers knew that there was a price premium of 20–30 % for organic produce but only the consumers that had a consolidated consumption of organic produce and weree "health conscious" have stated they were willing to pay this premium.

Several papers have also investigated the possibility of a third way between conventional and organic products, namely the intermediary certifications connected with Integrated Pest Management (IPM) in the United States. The positive consumer response to this certification was reported in the works of Hollingsworth et al. (1993) and Mullen et al. (1997). Govindsamy and Italia (1998, 1999), and Govindsamy et al. (2001) empirically evaluated consumers' WTP for different production methods: organic, IPM and conventional. Following a contingent-valuation format, the survey participants reported a higher WTP for IPM produce than for organic produce. They also found that the household that is most likely to pay a premium for organic products is also willing to consider alternative agriculture, such as IPM. Cranfield and Magnusson (2003) explored on the Canadian market a new classification of environmentally friendly food products, the so-called "pesticide-free products." This system of farming lies between organic and IPM farming practices. They found that 67 % of respondents have a modest WTP of a 1–10 % premium and 5 % are willing to pay a premium of 20 % over conventional prices (see also Magnusson and Cranfield 2005).

The explicit influence of signals carrying certification information to consumers (labels, stickers or logos as mentioned by Henneberry and Mutondo 2007) in the formation of their WTP for pesticide reduction has mainly concerned the premium for organic products. Buzby and Skees (1994) stressed that more information about the use of pesticides was demanded by consumers when they took into account different levels of risk reductions from pesticide residues. Almost 90 % of their survey's respondents said that all products should be labelled with information on pesticide use. Krystallis et al. (2006) studied the influence of organic labels on the valuation of several organic food products (olive oil, raisins, bread, oranges and wine). They conducted a conjoint analysis in Greece and they studied the impact of the presence of the organic label attribute on the consumers' WTP for these products. The respective premiums varied with the foodstuff under evaluation (for example, 19.1 % for raisins and 63.7 % for wine). Anderson et al. (1996) showed that consumers would be willing to pay 10 % more for corn that was marked with an "IPM certified" sticker advertised in the media. Focusing on environmental-impact assessment (production process, use, and disposal) of the product, Blend and Van Ravenswaay (1999) measured consumers' acceptance for eco-labelled apples. Their research reported that 63 % of the respondents were willing to pay a premium for eco-labelled apples. Similarly, Loureiro et al. (2001, 2002) assessed WTP for apples with an eco-label close to a good agricultural

practices (GAP) certification. Based on the answers of apple-buying consumers to a survey conducted in two grocery stores in Portland (USA), they used a modified version of the double-bounded choice model to estimate mean WTP. They found a small mean premium for eco-labelled apples (5 %) and argued that the context of the procedure used, with conventional and organic apples as substitutes, had an influence on these results. Many consumers considered organic apples the more environmentally friendly alternative and they would be more willing to pay a higher premium for them. Recently, Tonsor and Shupp (2009) assessed consumers' WTP for products marketed with "sustainably produced" labelling claims. They concluded that U.S. consumers were not willing to pay a positive premium for tomatoes or apples labelled as "sustainably production", because this information was vague and not associated with production practices. The authors proposed the implementation of additional experiments designed to evaluate label valuations when alternative forms and levels of information are provided to consumers.

While many papers have investigated WTP for pesticide-use reduction through consumers' statements, very few have used market data to measure the actual price premium for organic or CPRF products. Based on retail price differences between organic and conventional fruits and vegetables, Hammitt (1993) estimated the price premium that consumers assigned to several organic products. The median ratio of the organic premium to the conventional price across produce types was about one-third. More recently, Monier et al. (2009) studied French organic consumer patterns, evaluating the impact of price on buying organics. Their work showed a small impact of prices on demand because price elasticities are estimated with marginal price variations that are much lower than the price gap between organic and conventional products. Their results were in line with the work of Bunte et al. (2010) who demonstrated that consumer demand for organic products in Netherlands does not changes when the price gap between organic and conventional products is deliberately reduced. These authors show that the reduction of organic price for some products, like organic milk, potatoes and rice do not shift demand much.

To control more precisely the impact of information on pesticide-use reduction, non-hypothetical experiments are increasingly popular. Using Vickrey auctions, Roosen et al. (1998) studied the impact of insecticides' elimination and cosmetic damages on consumers' WTP for apples. The results showed that appearance of apples had non-negligible effect on the WTP and that information about pesticides changes the WTP of consumers. After the disclosure of the information about the consequences of insecticide use, the consumers' WTP increases by about 50 %, while cosmetic damage decreases average WTP by 63 %. Gil and Soler (2006) analysed the Spanish consumers' decisions to pay a premium for organic olive oil. They observed that information about conventional product ("reference price") increased the perceived value of the organic product. Their results also showed that only the consumers that have already bought organic products were willing to pay a price premium and only 5 % of them would be willing to pay the correspondent market price.

Using experimental auctions, Bazoche et al. (2014) study several systems of good agricultural practices, possibly signaled to consumers, ranging from public and private IPM strategies to organic production methods. The results suggest a relatively homogeneous behavior of European consumers. These authors show how improving the information on pesticides reduction could have unexpected consequences. Results also reveal that sensory characteristics or reference to an origin of production should not be overlooked.

A last, but important issue concerns the impact of interaction between signals on consumers' WTP. Two papers investigated the effects of additional signals that are commonly used in the supply of organic products. Bernard and Bernard (2010) determined consumers' WTP for organic potatoes and sweet corn, focusing on two characteristics: pesticide-free and non-GM. They found that the premium for the organic version was not significantly different from the sum of the two components (pesticide-free and non-GM) when they are evaluated independently. This suggests that these two characteristics are what consumers are paying for when buying organic products. Tagbata and Sirieix (2008) compared French consumer's willingness to pay for organic and fair-trade chocolate products. The authors found that a large proportion of their sample (41 %) consider taste and health issues at least as much as social and environmental dimensions when choosing organic and fair trade products.

6.3 Specific Results for Perceptions of Beef Safety

A research undertaken in Portugal (project AGRO 422) in 2005, concerning beef consumption in Portugal looked at habits, attitudes and perceptions of Portuguese consumers (Aguiar Fontes et al. 2008).

This research project has shown, using a sample of approximately 800 consumers, that right after the BSE crisis different reactions occurred, though 59 % of the respondents said they did not alter their level of beef consumption (Fig. 6.1). Those who stopped eating were mainly the elderly (66–75 age group) and those who decreased were mainly in the 46–65 age group.

In the same study, when asked about their beef consumption in 2005 (10 years after the first BSE crisis), around 64 % mentioned they were consuming basically the same as prior to the crisis. This corroborates the idea that immediately in the "heat" of the food crisis, consumers are more reactive in terms of their consumption habits but as time goes by and human memory becomes more dissipated, consumption slowly tends to return to levels closer to previous ones, though often not exactly to the levels they used to have prior to the crisis, but of course differing according to products and consumers. Notice that Henson and Northen (2000) had already concluded that, on average, consumption of beef declined across the EU in years right after the first BSE crisis in 1996 and remained below the pre-BSE consumption levels in most countries. However, the authors highlighted that there were different consumers' reactions: Though the majority decreased their consumption levels, a proportion of consumers have entirely stopped beef consumption, while

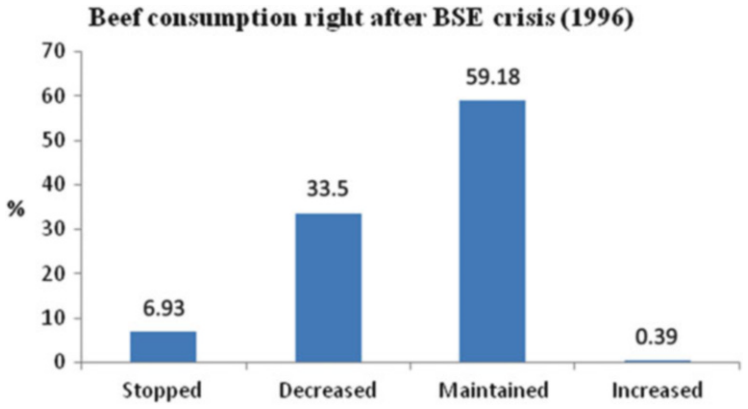

Fig. 6.1 Consumption reaction to BSE crisis. *Source*: Project Agro 422 (2004–2007)

others, taking advantage of the price decrease that took place by that time, increased beef consumption. The different types of reactions are dependent upon the way consumers perceive risk. This perception is linked to consumers' assessment of food safety, a credence attribute that cannot be ascertained by the consumer at the point of purchase. As so, extrinsic and intrinsic cues become highly relevant to turn a credence attribute into a search one (in accordance with the already mentioned work by Wezemael et al. (2010)).

More recently, six focus groups were established in two main cities of Portugal (Lisbon and Oporto) within a broader research project and full details are to be published in Viegas et al. (2013). All of the participants had to be beef consumers and at least partially responsible for household's meat shopping. One of the subjects of these focus groups was a discussion around consumers' perceptions of beef safety.

Quite interestingly the majority of participants in the focus groups established in Portugal did not seem to be particularly concerned at that time with beef food safety, indeed they considered that at that moment it was not an issue, considering that if the beef is available for shopping then it must be safe, or at least with minimum risk. This was so because minimum standards were generally perceived as guaranteed, but also because in the period focus groups were established there were no events around beef that could bring this issue to the fore front. Again, this confirms the thesis of the "sleeping giant" as argued by Grunert (2005).

Worth mentioning is the fact that these participants in general, stressed their confidence in the existing legal framework, and in the existing audits and inspections. Nevertheless, issues such as drugs and antibiotics residues, hormone administration, feed quality and slaughter hygiene were considered to be worrisome during the production stages by many participants (Viegas 2013; Viegas et al. 2013). They considered a safe beef as a domestically-produced meat, within the expiry date, with a good aspect/appearance, and looking reddish (live color). Notice that some cues are used by these focus group's participants to infer upon

beef safety such as origin, aspect, fat and color—intrinsic attributes, and expiry date, shopping location or packed beef—extrinsic cues (Viegas 2013). These findings, albeit obtained from focus groups and hence only exploratory and descriptive, were in accordance with the work by Bernués et al. (2003) where they concluded that expiry date and beef origin were also the most relevant cues for the quality and safety of beef, but close to maturation time, cut, nutritional information, amongst others.

Wezemael et al. (2010) established eight focus groups in four EU countries (France, Germany, Spain and the United Kingdom). In these authors' work, the main findings were quite similar in the countries involved in the analysis and beef safety was mainly defined as related with consumer's health. Quite interestingly, like in Portugal, beef safety was considered a "precondition that allowed for the consumption of beef products without the need of being concerned". Overall, beef safety was associated with legislation, control, experience of beef safety and safety cues such as color and certificates.

6.4 Specific Results for Pesticides' Reduction in Fruits and Vegetables

When consumers deal with fruits' food safety they usually do an assessment that confronts food safety attributes and others attributes such as appearance, cosmetic damage and taste. Do consumers "forget" the safety risks of food when sensory characteristics are assessed? Next, we present two studies that used experimental auctions to estimate consumers' WTP for food safety attributes (reduction of pesticides) of fruits (apples and pears) and for sensory attributes (appearance and taste).

The first study that we present—the work of Roosen et al. (1998)—is considered as a seminal work because it is the first one that uses experimental auctions to investigate consumers' WTP for apples produced with different types of insecticides. The possible consequences of the insecticides in the long-term due to chronic exposure to these pesticides in early childhood were confronted with the cosmetic damages of apples in the short term. The apples' evaluation was based on multiple attributes (pesticide use and appearance) and the authors assessed the impact of insecticide's elimination and cosmetic damages on consumers' WTP using a multiple round Vickrey auction method. The auction design was also original because at the beginning 54 participants from a Midwestern university town (USA) were provided with one bag of apples that were identified as the "base quality". During the auction, the participants were given the opportunity to reveal their WTP to exchange their apples for each of four alternatives of apples. These four types of apples differed according to the insecticides used in their production and also differed in terms of appearance, because some of them had some cosmetic damages (Table 6.1). Also, during the auction, the participants were informed about the pesticide intensity of damage and risk, and its consequences on brain's functions in the long term.

Table 6.1 Average bids and number of zero bids (first and final steps)

Experiment	Apple 2 No one neuroactive insecticide; no cosmetic damage	Apple 3 No one neuroactive insecticide; cosmetic damage	Apple 4 No neuroactive insecticides; no cosmetic damage	Apple 5 No neuroactive insecticides; cosmetic damage
Step 1				
Average bid	$0.22	$0.08	$0.22	$0.14
Number of zeros bids	26	39	27	37
Step 7				
Average bid	$0.34	$0.21	$0.45	$0.34
Number of zeros bids	24	37	19	26

Source: Adapted from Roosen et al. (1998)

The analysis of Roosen et al. (1998) showed that WTP for produce free from neuroactive pesticides is significantly higher than for conventional produce and that apples, not so appealing, have a significant negative (−63 %) effect on WTP. The authors also measured consumers' WTP for a partial reduction of pesticides use in apples. They found a 50 % increase of WTP between the partial pesticides reduction and the complete lack of pesticides. The results revealed that the appearance of apples had a non-negligible effect on the WTP and that information about pesticides changes the WTP of consumers. After the disclosure of the information about the consequences of insecticide use, consumers' WTP increased by about 50 %, while cosmetic damage induced a decrease in average WTP by 63 %.

Another case study focuses on consumers' WTP for fruits that carried food safety information conveyed through different food labels. Considering this topic, Combris et al. (2010) developed an experimental market for pears in Portugal and its protocol was applied to both non-certified and certified products. The non-certified pears were used to support the idea that the absence of food safety guarantees could lead to an important decrease of the WTP. For the pears that were certified for different quality assurances related to on-farm production methods, the aim was to show the role of two kinds of labels in order to transmit the information on attributes to consumers: *i*) a collective label with a protected designation of origin (namely the "Rocha do Oeste" pear) and (*ii*) a well-known premium retail label. In the experimental economic procedure of this work, the Becker-DeGroot-Marschack elicitation mechanism (Becker et al. 1964) was combined with sensory evaluation in order to evaluate the interaction between food safety and sensory attributes and to know if this interaction affects consumers' WTP.

The experiment took place in the region of Lisbon and 74 consumers were recruited from the general population of this region. Consumers participated in one of eight sessions that were held in the week of November 6–12, 2006. Four types of 'Rocha' pear were evaluated in the experiment: a conventional 'Rocha'

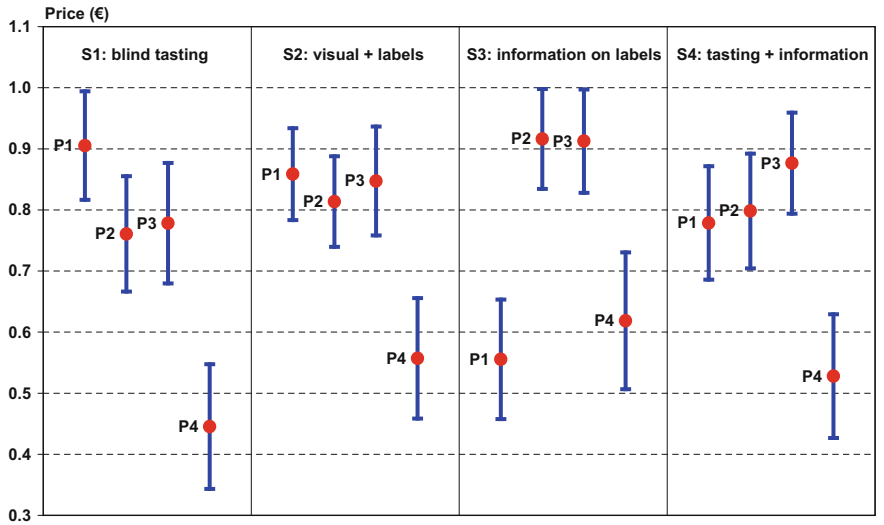

Fig. 6.2 95 % confidence intervals of mean WTP for each pear. *Source*: Combris et al. (2010)

pear without a label (P1), a pear with a premium retailer label (P2) and two pears with the Protected Designation of Origin (PDO) (P3 and P4) with two levels of maturity, expressed by different sugar contents (as measured by the Brix degrees[2]) and skin colour. During the experiment, participants had to evaluate the four types of 'Rocha' pear in four different information situations. In each of them, participants could evaluate the four types simultaneously and had to complete a small questionnaire indicating, for each type of pears, whether they want to buy 1 kilo of this pear and if "yes" at what maximum price. The experiment consisted of four steps (or information situations): i) blind tasting of the four types of pears, ii) visual labels and tactile examination, iii) additional information, and iv) tasting with all the information. A complex pattern of relationships between taste and food safety in consumers' evaluation were highlighted in the results. For this study we shall concentrate on the results linked with the transmission of information about food safety. Before presenting the results, it is important to refer that in the second step three modalities of pears were presented to the consumers with a personalized retailer/producer label. The participants had made a visual and tactile inspection of the fruits and had examined the labels, but no information was transmitted. In the third step, some information was given about food safety for each fruit.

Figure 6.2 illustrates how the absence of food safety guarantees explains the decrease of the WTP for the conventional pear (P1), from situation 2 ("visual + labels") to situation 3 ("information on labels").

In situation 2 (S2), where the guarantee of food safety is insufficiently conveyed by the labels, it is possible to estimate the difference in WTP between a safe pear

[2] Brix degrees are roughly equivalent to the percentage of sugar present in the pear.

and an unsafe one. The absence of food safety guarantees explains the decrease of the WTP for the conventional pear (P1), since the WTP for the conventional pear (P1) is smaller in situation 3 (S3) ("information on labels") than in situation 2 ("visual + labels"). Note that information on IPM increases the WTP for pears P2 and P3. Moreover, it appears that the guarantee of origin (or the absence of guarantee of origin in the case of the retail label) has no specific effects compared to the food safety guarantees.

The sequel of the experiment shows that the limited knowledge of consumers on integrated pest management is largely responsible for their relative lack of responsiveness to fruit labelling. To control for a priori beliefs of participants at this stage of the experiment, the authors asked them to complete a short questionnaire. For each pear, they had to answer three questions about the guarantee of quality, the guarantee of origin, and the food safety guarantee (associated IPM). Table 6.2 shows the distribution of responses for each pear and each guarantee. Right answers are written in bold characters and percentages showing that only a minority of consumers is well informed about one of the guarantees given by the labels are underlined. Data from Table 6.2 highlight the fact that participants are strongly uninformed on the guarantee of higher food safety standards given by labels. Indeed, from the column "Guarantee of Food Safety" in Table 6.2, it is possible to see that a minority (less than 50 %) considers that these labels take into account integrated pest management. Moreover, only 8.2 % of participants know that generic 'Rocha' pear doesn't have a specific guarantee of food safety (i.e. a higher standard compared to the public regulations).

After having completed the questionnaire and still in the situation S3, the right answers were given to the participants and again they performed another evaluation of the four pears. As a result of this new evaluation, pear P1 obtains a much lower WTP than pears P2 and P3 (−0.36 €, $P < 0.0001$). The control of participants' knowledge before this evaluation, allowed a good estimation of the effect of

Table 6.2 A priori knowledge on guarantees on pears

	Guarantee of quality			Guarantee of origin			Guarantee of safety		
Type of pear	Yes (%)	No (%)	Don't know (%)	Yes (%)	No (%)	Don't know (%)	Yes (%)	No (%)	Don't know (%)
P1 Generic Rocha pear	41.9	**16.2**	41.9	**58.9**	1.4	39.7	20.5	**8.2**	71.2
P2 Retail label Rocha pear	**51.4**	21.6	27.0	41.1	**15.1**	43.8	**49.3**	2.7	47.9
P3 PDO Rocha pear	**74.0**	6.8	19.2	**89.2**	0.0	10.8	**47.9**	2.7	49.3
P4 PDO Rocha pear ("green")	**57.5**	17.8	24.7	**86.5**	2.7	10.8	**43.8**	4.1	52.1

Source: Combris et al. (2010)

Note: The bold figures correspond to right answers and the underlined figures are the percentages that show that only a minority of consumers is well informed

information about the food safety guarantee brought by the labels. It highlights the increase in labels' reputation that more communication could bring. Nevertheless, the fact that in this situation, informed participants did not value pear P4 very much when compared to P2 and P3 (−0.30 €, $P < 0.0001$), raises the question of the trade-off between food safety guarantee and sensory quality.

Situation S4 brings some answers to this question. When fully informed on labels and after tasting all the pears, participants finally value the pears according to their sensory characteristics rather than their labels. WTP for pear P4 remains significantly lower than WTP for P1, P2 and P3, (−0.25 €, −0.27 €, −0.35 € respectively, $P = 0.0001$ or less). Moreover, WTP for pears P1, P2 and P3 is not significantly different. This could mean that the better taste of pear P1 compensates for the absence of specific guarantee on sanitary risks.

This study reveals that consumers are willing to pay significantly more for better quality assurances related to on-farm production methods such as the absence of pesticides. The results confirm that labels such as PDO improve the signaling of credence attributes to consumers. They should do so, not because the WTP is higher for goods produced with less pesticides, insecticides, etc., but because the absence of these guarantees could lead to an important decrease of the WTP. Combris et al. (2010) argue that "when the damages cannot be scientifically proved (e.g. how pesticides affect health) it seems reasonable to assume that the absence of a label guaranteeing safe food has a limited effect on demand. On the contrary, when the damages can be proved and are known to consumers (e.g. the "mad cow crisis") these may overestimate the risk. Then the decrease in demand due to inadequate food safety may be more significant."

Another important finding these authors mention is that "taste beats food safety", that is, when faced with sensorial characteristics of the product these become more important in consumer preferences than food safety issues, particularly if no recent food scares have taken place.

6.5 Conclusion

The many health crises of the past decade (BSE in 1996 and 2000, foot-and-mouth disease in 2001, avian flu in 2005, cucumber crisis in 2011), patterns of fraud relating to the authenticity of the food ("horsegate" in 2013) and the ongoing debate concerning the safety of certain processes (e.g. accusation of GMOs in 2012) led to an increasing distrust of the consumers for the quality of food products. The consequences of these concerns result in a very low level of radical innovations in this sector of the economy and in many situations these innovations are not even put forward by firms. Yet these may be the source of a substantial strengthening of safety. This is the case of the irradiation which eliminates some of the microorganisms responsible for the degradation or contamination of the food. This is also the case when certain additives can enhance the conservation or use as antibacterial and antifungal agents in foodstuffs. However, these positive effects are often contested, given secondary suspected or proven effects. Under these

conditions of widespread suspicion issues 'naturalness' and 'authentic' food products are now highlighted and demanded by the consumers, as well as the origin of production where the way the product is made.

Considering the specificity of food consumption we showed how food safety in the purchase of food products is a "non-negotiable" attribute. This review of the literature confirms that consumers in developed countries have become more demanding of food safety, which could result in a boycott in case of a suspected or proven assumed food outbreak. Elements such as social amplification of the risk or media coverage can greatly influence the purchase of food products.

It is clear that immediate health risk more easily causes a consumer rejection rather than risk distributed over time. However it is not at all clear that uncertainty (even health) causes a non-purchase decision. The consumer may not reflect this uncertainty (pretend that it does not exist) or reduce its willingness to pay (as if he considered that his health has a price. . .). In the latter case, we showed how a large number of quality parameters could largely offset this effect.

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The Role of Food Standards in Trade and Development

7

Johan Swinnen, Miet Maertens, and Liesbeth Colen

Abstract

Food standards are increasingly impacting developing countries' trade and development. Over the past two decades, both public and private standards have proliferated in global food supply chains. Standards alter the structure and governance of these supply chains and affect the in- or exclusion of smallholder farmers and the distribution of benefits along the chain. Several authors have argued that increasing standards act as barriers to developing countries' integration in global markets and lead to the exclusion or reduced bargaining power of small farmers. On the other hand, there is evidence that standards can generate important benefits for poor rural households in developing countries, either in the form of contracts with processing or exporting companies, or as employees. Hence, the rapid rise of food standards does not necessarily lead to new barriers to trade and more inequitable distribution of the gains, but can also enhance developing countries' participation in high-value global food markets and generate benefits for the poor.

J. Swinnen (✉)
LICOS – Centre for Institutions and Economic Performance, KU Leuven, Leuven, Belgium

Centre on Food Security and the Environment, Stanford University, Stanford, CA, USA
e-mail: jo.swinnen@kuleuven.be

M. Maertens
Division of Bioeconomics, Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium
e-mail: miet.maertens@kuleuven.be

L. Colen
LICOS – Centre for Institutions and Economic Performance, KU Leuven, Leuven, Belgium
e-mail: liesbeth.colen@kuleuven.be

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Standards • Global supply chains • Trade • Development • Contract farming • Employment

7.1 Introduction

Standards are increasingly dominating world agri-food trade (Aksoy and Beghin 2005). During the past decades, the requirements on product quality and food safety have increased rapidly. More recently, also standards on the ethical and environmental concerns of food production have gained importance. Food trade, especially to the European Union (EU), the United States (US) and other high-income regions, now has to satisfy a series of stringent standards imposed by public bodies. In addition, private companies such as supermarkets and food processors increasingly require their suppliers to fulfil a series of privately set requirements. The fast proliferation and tightening of food standards pose challenges for developing countries' participation in high-standards agricultural trade and there are concerns that smallholder suppliers will be increasingly excluded from the benefits that such high-standards supply chains may bring.

In this chapter we give an overview of the theoretical arguments and the empirical evidence regarding the impact of food standards on developing countries' trade and development. We start by describing the rapid proliferation of public and private standards in global agri-food trade. In Sect. 7.3 we discuss the views that standards act as barriers or catalysts to trade and we give an overview of the empirical evidence. In Sect. 7.4 we analyse how food standards affect development through their impact on the structure and governance of food supply chains. We discuss the theoretical insights and empirical evidence regarding the in- or exclusion of smallholder farmers and regarding the distribution of benefits along the supply chain. Finally, we highlight the fact that the shift towards high-standards agricultural trade raises the demand for workers and generates significant benefits for the rural poor through the employment channel.

7.2 Increasing Public and Private Food Standards

Over the past decades, international and national governments, as well as private actors have imposed new regulations and requirements on food quality, safety and increasingly also on issues such as environmental protection, animal welfare and employment conditions.

A number of food standards are set by international bodies (e.g. standards regarding food safety by the Codex Alimentarius, regarding plant health by the International Plant Protection Convention (IPPC), and regarding animal health by the World Organization for Animal Health (OIE)). The WTO Sanitary and Phytosanitary (SPS) and the Technical Barriers to Trade (TBT) agreement regulates

the use of standards by WTO member states and uses these international standards as a benchmark against which national standards are evaluated. WTO member states have the right to adapt and deviate from these international benchmarks as long as it is in the interest of human, plant and animal health and as long as the need for stricter regulation is based on scientific principles.

Over the past two decades, several national and regional governments have installed new food laws and regulations that are often much stricter than these international indicative standards. Especially in high-income countries, such as the EU and US, an extensive food safety and quality control system has been put in place. In 1997, the European Commission (EC) launched a new food safety initiative resulting in major legislative changes and to the *Basic Food Law Regulation,* including a recast of EU veterinary rules, and the creation of the European Food Safety Authority (EFSA). The EU's General Food Law or Regulation (EC) 178/2002 introduced two main new principles on food safety requirements and health issues. The precautionary principle states that the measures to protect human health are permissible on the ground of reasonable food safety concerns, even if scientific support is lacking. The principle of traceability implies the identification of the origin of feed and food in order to facilitate the withdrawal of produce in the case of food safety hazards. Therefore, the European food safety policy follows an integrated 'from farm to fork' strategy which tries to control risk in all stages of food production and distribution and includes a Rapid Alert System for Food and Feed (RASFF)[1] to ensure efficient risk management and quality control across all member states.

In addition to these public regulations at the national and international level, private standards have become increasingly important in the governance of global food markets. Many large food companies, supermarket chains and Non-Governmental organisations (NGO) have established private standards that are usually more stringent than the public ones (Fulponi 2007; Vandemoortele and Deconinck 2014). These private standards often go beyond food quality and safety, and also include specifications regarding environmental protection, employment conditions or fair trade principles. Over the past 15 years several certification schemes have been set up by private actors, including GlobalGAP,[2] the British Retail Consortium (BRC), Ethical Trading Initiative (ETI), Tesco Nature's Choice

[1] The RASFF system covers all foodstuffs and feed. It is comprised of a network of all member states, the commission and EFSA as a member. There has been an existing early warning system in place both at the member states and the Commission but the new system extended more to include both food and feed under the umbrella of the 'farm to fork' strategy. Therefore, the network jointly acts to spot unsafe food and feed. If a threat is spotted, an EU-wide notification system acts depending on the level of risk detected. Rules related to emergency, risk management measures during food scare cases and scientific uncertainties are all part of food law. For more details see OJEC (2002, L31/1).

[2] GlobalGAP is the most widespread private standard in the trade of international fresh food products. It was established (as EurepGAP) in 1997 by a group of European retailers. By 2010, more than 40 retailers (including the largest) in 15 countries—mainly in Western Europe—required their suppliers to be GlobalGAP certified.

etc. Although adoption of such private standards is voluntary, an increasing share of buyers in international agri-food markets requires compliance with these standards, and as a result, many of these private standards have become de facto mandatory (Henson and Humphrey 2010).

Not only is the number of standards rising, food standards are also becoming more stringent, especially phytosanitary and hygiene requirements such as maximum residue levels and levels of contamination. The number of SPS measures notified to the WTO has increased exponentially (Henson 2006). With its precautionary principle and traceability requirements the EU General Food Law of 2002 introduced two main new food safety requirements and health issues. Also the GlobalGAP standard has become stringent over the past years, with more and stricter compliance criteria. Moreover, private standards may be in violation with WTO requirements, e.g. on transparency and the need for scientific justification, which is currently debated in the SPS Committee.

Several factors have contributed to the accelerated use of stringent food standards in recent years. First, increased consumer demand for food safety and product quality has played a role. Rising income levels and changing dietary habits have increased the demand for high quality and safe food. A series of major food safety hazards has increased consumer and public concerns on food-borne health risks and have led to the implementation of new public and private safety standards and control mechanisms. In the EU, the BSE crisis in 1996 and the dioxin crisis in 1998 have triggered the reform of the European food regulation and have contributed to the development of the EU's General Food Law in 2002. A more recent example is China's milk scandal in 2008, which resulted in the immediate implementation of regulations on milk production, processing and marketing by the Chinese government to ensure quality and safety in the dairy supply chain (Jia et al. 2012). In addition, consumers are increasingly (made) aware of the ethical and environmental aspects related to food production and trade, which has increased the need for specific standards related to these aspects.

Second, the increased trade in fresh food products such as fruits, vegetables, fish, and meat—which are more prone to food safety risks and subject to specific quality demands by consumers—have increased the need to regulate trade through standards. Especially in developing country exports, the share of fresh food in total exports has increased very fast over the past decade (Aksoy 2005).

Third, the increased dominance of supermarkets in food chains contributes to explaining the increased importance of food standards. Large retail chains put much emphasis on freshness, product quality and food safety as a product differentiation strategy or to reduce food safety risks and the very large reputation costs that are related to the risk of selling unsafe food.

Finally, it is argued that the process of increased trade liberalization has created incentives for the implementation of new and stricter standards. Countries that see quotas removed and tariffs reduced, may be tempted to use standards in order to bar imports (Neff and Malanoski 1996). The establishment of the WTO in 1995 might thus have contributed to a reorientation in the regulation of world trade from imposing tariffs and quotas to the use of standards.

7.3 Food Standards as Barriers and Catalysts for International Trade

By providing a bridge between consumer concerns and preferences in high-income countries and producers in developing countries, food standards can be thought of as catalysts to developing countries' participation in trade. On the other hand, standards entail costs and can be used as non-tariff barriers to trade, diminishing export opportunities for developing countries. In the next sections we discuss the use of standards as a protectionist tools, and give an overview of the arguments and evidence for the views of standards as catalysts, or standards as barriers to trade (see also Maertens and Swinnen 2007).

7.3.1 Food Standards as a Protectionist Instrument?

The observation that the rapid proliferation of standards largely coincides with increased efforts of trade liberalization, has led many to argue that food standards were mainly used as protectionist tools and that they form new non-tariff barriers to trade, diminishing especially the export opportunities of developing countries (Augier et al. 2005; Brenton and Manchin 2002; Ferrantino 2006). Public standards can indeed potentially be used to bar imports and protect domestic farmers and agri-food companies. As mentioned above, the pressure to reduce the use of traditional trade protection instruments may have induced the use of standards as an instrument of 'protection in disguise' (Vogel 1995).

There are some examples where standards are set or monitored differently according to the origin of the product. For example, Mathews et al. (2003) describe that zero-tolerance levels for salmonella are monitored for products from developing countries only, but not for domestic supplies. Jaffee and Henson (2005) describe how sauces containing benzoic acid are prohibited for Philippine exports, but permitted for imports from New Zealand.

Also the rapid increase in notifications of new SPS measures and the rise in dispute settlement cases regarding such measures (Henson 2006; Neff and Malanoski 1996) are consistent with the potential protectionist nature of standards. Developing countries confronted with supposed discrimination often lack the scientific and institutional capacity for the dispute settlement of the World Trade Organization (WTO). Yet, more recently, developing countries have increasingly participated in WTO institutional processes and the number of SPS related notifications by developing countries has increased. While in 1995–1996 all complaints related to trade in horticulture products for discussion in the WTO SPS committee were raised by developed countries (mainly the EU and the US), two-thirds of the complaints were raised by Asian, Latin-American and African countries in 2001–2002 (Roberts and Krissoff 2004).

However, considering standards as protectionist tools, ignores the fact that many standards were actually introduced in response to demands by consumers, not producers. Jaffee and Henson (2005) argue that despite the fact that there are

examples of the discriminatory use of standards, there is not systematic evidence that standards are used as protectionist tools by industrial countries to bar developing country imports. They argue that many of these anecdotal cases involve at least partially legitimate food safety and agricultural health issues. Before judging standards to be protectionist, it is therefore crucial to take into account both the benefits and costs to both consumers and producers.

Swinnen and Vandemoortele (2011) provide an analytical framework to determine whether standards serve as protection in disguise, or not. They develop a formal model of the political economy of public standard setting, in which they integrate the costs and benefits that are faced by producers and consumers and that will influence the political equilibrium.[3] Standards do not only introduce higher costs to producers, but also generate benefits for consumers by guaranteeing certain characteristics of the product, by providing information and reducing transaction costs, or by generating environmental or social effects that are valued by consumers. They find that the politically optimal standard depends, among others, on the relative costs of the standards for domestic and foreign producers. Higher costs for domestic producers will lead to a lower standard, while higher costs for importers lead to higher standard. They show that either producers or consumers may gain or lose from a public standard being imposed, and that standards are therefore not necessarily driven by producer protectionism. Hence, food standards can be, but are not necessarily protectionist and call for a careful analysis of the specific effects of standards before categorising them as protectionist instruments. Yet, even when standards are not set based on protectionist objectives, they will affect developing countries by imposing new costs or by enhancing trade.

7.3.2 Costs and Benefits Related to Compliance with Food Standards

The costs of compliance with standards might be high, specifically for developing countries that generally lack the infrastructure, institutional, technical and scientific capacity for food quality and safety management, and that face a wide divergence between national food quality and safety norms and international standards. Similar concerns arise regarding certification to private standards. In several global food markets, compliance with private standards becomes increasingly important for remaining competitive, but may involve substantial costs including technology upgrading, training and infrastructure (Reardon et al. 2004; Garcia Martinez and Poole 2004). As developing countries may have more difficulties to incur these costs, the rise of private agri-food standards may undermine the competitiveness of poor countries to benefit from the opportunities associated with high-value food markets.

[3] Also the nature of standards and the role of food safety risk can be incorporated in their model (Swinnen and Vandemoortele 2009).

The empirical evidence on the costs related to food standards is limited and mixed. Some authors find evidence of high compliance costs with public standards, which are especially problematic for small producers, while other studies have estimated that the costs of compliance with SPS measures are only a small fraction (less than 5 %) of total production costs (for example Aloui and Kenny (2005) for tomato exports from Morocco, Cato et al. (2005) for shrimp exports from Nicaragua). Also with respect to the costs of compliance and certification to private standards, evidence is mixed. Asfaw et al. (2010b) measure the investment costs related to GlobalGAP to represent 30 % of annual crop income for smallholders in Kenya, while the estimates by Graffham et al. (2007) differ enormously across different firms or farmer groups. In many cases, these compliance and certification costs are largely carried by exporters or by donor support (e.g. Subervie and Vagneron 2013; Kersting and Wollni 2012). Maertens and Swinnen (2007) suggest that the compliance cost with quality and safety standards are much lower than generally assumed.

On the other hand, standards can also act as catalysts to trade and facilitate developing countries' access to international food markets. Standards and certification schemes can reduce transaction costs and enhance consumer confidence in food product safety and quality. As such they provide a bridge between consumer preferences high-income markets and producers in developing countries and increase developing countries' access to international markets. Moreover, standards can induce upgrading of the production system and supply chain modernization and allow developing countries to reposition themselves in the global market (Henson and Jaffee 2008). Several developing countries have indeed been successful in complying with standards and ensuring their competitive position in high-value international markets. Examples are Kenya, Thailand, Senegal and Madagascar for horticulture, Thailand and Nicaragua for shrimp (Jaffee 2003; Maertens and Swinnen 2009; Minten et al. 2009). Jaffee and Henson (2005) show that the most successful countries and sectors have used high quality and safety standards to (re) position themselves in global markets.

The empirical evidence shows that standards can impose very high costs, but can also provide important benefits. Which of these effects dominates is likely to depend on a case by case basis. A number of studies have empirically estimated the overall impact of food standards on trade from developing countries, and also these studies do not come to conclusive evidence as to whether the barrier or catalyst effect dominates. Several studies find that public standards lead to a reduction in trade volumes (e.g. Anders and Caswell 2009; Wilson and Otsuki 2003; Chen et al. 2006), other finds that the effect on trade differs across standards (Czubala et al. 2007), or that there is no impact on developing countries' exports (Xiong and Beghin 2012). Concerning the impact of private standards on trade volumes, the empirical evidence is even more limited. Henson et al. (2011) find that certification to the private standard GlobalGAP increases firms' export revenues for a cross-sectional sample of fresh produce exporting firms from ten African countries. Using panel data from the Peruvian asparagus export sector, Schuster and Maertens (2013b, c) find no evidence of an increase in export volumes or value

following private standard certification. Hence, overall the evidence remains mixed, and it seems that standards may hinder trade from developing countries in certain cases, but may enhance their integration in international food markets in others.

7.4 Food Standards and Development

Understanding the link between standards on the one hand, and export competitiveness and performance of developing countries on the other hand is crucial in the design of a broader development agenda as integration in global markets is generally believed to favour economic growth. However, there are concerns regarding the local development implications of high-standards agri-food trade. It is argued that standards exclude small producers from participating in high value supply chains, and that the unequal distribution of bargaining power in the chain leads to the exploitation of small farmers by large, often multinational companies (e.g. Reardon and Berdegué 2002; Warning and Key 2002; Unnevehr 2000). If this is the case, the poor may not benefit proportionally from high-value trade and standards would reinforce existing inequalities, instead of contributing to pro-poor growth.

The proliferation of public and private standards has induced important structural changes in the organization of international food supply chains (Swinnen 2007). These structural changes have important consequences for the participation of rural households in these global markets and for the distribution of rents over the supply chain. In order to analyse the local development implications of increasing high-standards food trade, it is therefore crucial to understand how standards affect the structure and governance of global food supply chains.

7.4.1 Structural Changes in International Food Supply Chains

The main structural changes in food supply chains in response to increasing food standards are increasing levels of *vertical coordination* (VC) and *consolidation* of the supply base with large companies increasingly dominating the chains.

7.4.1.1 Vertical Coordination

First, compliance with increasingly complex and stringent food standards and monitoring of this compliance throughout the supply chains require tighter VC in the chain. This can occur through different forms of contract farming or in the most extreme case through complete ownership vertical integration.

In order to ensure large and consistent volumes of high-quality and safe produce, food traders and processors in high-standards markets increasingly procure from preferred suppliers or specialized wholesale markets, often on a contract basis, and thereby push the food supply chain towards more VC. Dolan and Humphrey (2000)

document how a few large vegetable exports in Kenya dominate the sector and all have contracts with supermarket chains in the UK and other European countries.

Also upstream the supply chain VC is increasing: faced with increased standards, agro-industrial food companies and exporters are increasingly changing their procurement system towards more VC, instead of relying on traditional spot market transactions (Swinnen 2005). Swinnen and Vandeplas (2011) develop a theoretical model that explains the rise of contract farming and tighter contract coordination in response to the increased demand for product quality. The production of high-quality commodities requires extra capital investment to buy specific inputs such as fertilizer, credit, seeds, technology, which farmers in developing countries often have no access to because of credit market imperfections. When the buyer or processor does have access to capital, he can offer a contract to the supplier and provide him with inputs such that high-quality production can be achieved. Their model analyses the conditions for such contracts to arise and be sustainable. They show that higher standards, creating a higher value in the chain, make it more likely that sustainable contracts will arise.

As such, standards lead to a rise in contract farming and to tighter contract coordination with primary suppliers, including intensified farm assistance programs (e.g. the provision of inputs, credit and extension services) and closer involvement in farm management decisions (Swinnen 2007; World Bank 2005). Empirical evidence from different countries widely supports the shift to increased VC as a result of higher food standards. Gulati et al. (2007) describe a sharp increase in animal contract production in Southeast Asia, Jaffee (2003) reports intensified extension services and closer governance in supplier contracts in the horticulture export sector in Kenya, and Minten et al. (2009) document the provision of inputs and credits and investments in extensive supervision and monitoring systems in horticulture export production in Madagascar. Mo et al. (2012) describe how the increased regulation of the dairy sector in response to China's milk scandal in 2008, resulted in a drastic government-led restructuring and increased vertical coordination of dairy supply chains in China.

In addition, many food processors and traders have engaged in a more extreme form of vertical supply chain coordination and have shifted from smallholder contract-based production to vertically integrated large-scale estate production. Such integrated production facilitates the monitoring of compliance with high standards by reducing transaction costs, even though on the other hand this entails additional production risks and labour supervision costs for the agro-industry.

There are many examples of such a shift towards vertically integrated production, but it is unclear how far-reaching this shift actually is. Maertens and Swinnen (2009) and Maertens et al. (2011) document the reduction of smallholder contract farming and the rise of large estate production in the horticulture export sector in Senegal. A number of studies describe the decreasing importance of smallholder horticulture production in Kenya (e.g. Gibbon 2003; Jaffee 2003; Dolan and Humphrey 2000) and Côte d'Ivoire (Minot and Ngigi 2004; Unnevehr 2000), although they do not agree on how important this decrease is. Subervie and Vagneron (2013) describe the rise of large exporter-owned lychee plantations in

Madagascar in response to rising private standards. And a recent study by Schuster and Maertens (2013a) shows, based on a detailed panel of companies active in the Peruvian asparagus export sector, how private standard certification leads to vertical integration and reduces the share of produce sourced from external producers.

7.4.1.2 Consolidation

Second, the cost of compliance with increasing standards (although low relative to total export values) might be very high relative to the means of small agri-food businesses and poorer farmers, leading to the market exit of such small producers and traders (Reardon et al. 1999). Moreover, smaller businesses may be disadvantaged in emerging VC schemes or pushed out of the supply chain because of a shift towards vertically integrated agro-industrial production. Hence, food standards could lead to weaker players exiting profitable export markets, and hence to the consolidation of the export supply base.

Indeed, empirical studies find evidence of on-going consolidation in agricultural export production in developing countries. Colen et al. (2012) document an important increase in the share of a few large companies—which are usually also the ones having obtained private standard certification—in total exports. Dolan and Humphrey (2000) and Jaffee (2003) observe that smaller firms are more and more squeezed out of fresh vegetable export in Kenya and Zimbabwe, while the sector is increasingly dominated by a few agro-industrial companies. Also at the level of primary producers there is evidence of consolidation and of the exclusion of small farmers from high-standards supply chains, which will be discussed in detail in the next section.

7.4.2 Local Development Effects

These structural changes and increased levels of governance in response to increasing standards have important implications for the welfare of rural households in developing countries. The main concerns are that smallholder producers—and especially the poorest ones—are either excluded or exploited in high-standards food supply chains.

7.4.2.1 Are Smallholder Farmers Excluded from High-Standards Supply Chains?

The general view in the literature is that high-standards trade leads to the exclusion of poor smallholder farmers because of high compliance costs and increasing levels of vertical coordination (Gibbon 2003; Reardon and Barrett 2000; Reardon et al. 1999). VC schemes may be biased towards larger farms because of smaller transaction costs, especially for monitoring conformity with standards (Key and Runsten 1999). On the other hand, standards are themselves instruments for harmonizing product and process attributes over suppliers, and can as such also reduce transaction costs in dealing with a large number of small suppliers. Moreover, well-specified contracts include farm extension and assistance programs that

can alleviate the financial and technical constraints small farmers face in meeting stringent standards. In fact, high-standards contract-farming with tight contract-coordination and intensified farm assistance programs could provide a basis for constrained small farmers to participate in high-value export production. In addition, firms might prefer to contract with smaller farms because they might have a cost advantage—especially if it concerns labour intensive production with relatively small economies of scale, such as fresh fruit and vegetable production—or because contract enforcement might be less costly with small suppliers.

The actual evidence on smallholder participation in high-standards supply chains is very mixed. The studies from Kenya, Senegal, Côte d'Ivoire and Peru, that were mentioned earlier, document the increasing exclusion of smallholders as supply chains shift towards vertically integrated production systems. Schuster and Maertens (2013a) find that especially sourcing from small farms decreases. There are even cases of complete vertical integration with hardly any smallholder involvement (e.g. Maertens et al. 2011; Legge et al. 2006). Still, many poor and small farmers are successfully included in high-standards value chains (e.g. Minten et al. (2009) for Madagascar; Swinnen (2005) for Eastern Europe and Central Asia; Henson et al. (2005) for Zimbabwe; Handschuch et al. (2013) for Chile; and Kersting and Wollni (2012) for Thailand). Based on the analysis of five case studies, Boselie et al. (2003) conclude that small farmers can succeed in complying with high supermarket standards if they engage in new, supportive arrangements with other farmers and commercial retailers. It seems that in most cases of high-standards export production there is a mix of smallholder contract production and large-scale agro-industrial production (Maertens et al. 2012).

These different outcomes in the empirical literature raise the question on why the development of high-standards supply chains may include farmers in some cases but not in others. Vandemoortele et al. (2012) develop a formal theoretical model of the emergence of the demand for high quality and safe food and analyse which producers are most likely to be included. They show that conditional on the initial production structure in the economy, the nature of transaction costs, and the possibility of contracting between producers and processors, certain producers are included in the high quality economy, and others are not.

Their model predicts that in a mixed production structure, with both smallholder farms and larger farm enterprises, smallholders are more likely to be excluded. When the farm sector is more homogeneous and dominated by small farms, it is likely that the emergence of high value production will be slower but more inclusive. Note that these findings correspond to the conclusions by Reardon et al. (2009) who, based on the existing empirical studies, find that smallholders are especially excluded if sourcing from large farms is an option. The model also shows that reducing specific transaction costs (for example by investments in infrastructure, producer associations, third party quality control) can enhance the integration of small and less efficient producers in high-value supply chains. Finally, the model shows that contracting arrangements between producers and processors that provide access to capital or inputs can play an important role in facilitating the inclusion of smaller farmers.

7.4.2.2 Do Smallholder Farmers Benefit from Inclusion in High-Standards Production?

Participation of small enterprises and poorer farmers in high-standards export production and trade is a pre-requisite for high-standards agricultural trade to contribute to smallholder farmers' welfare, but they also need to effectively benefit from this participation. It has repeatedly been argued that the gains from high-standards agricultural trade are captured by foreign investors, large food companies and developing country elites (e.g. Dolan and Humphrey 2000; Reardon et al. 1999). On the one hand, consolidation of the export supply base and VC in the supply chain are said to amplify the bargaining power of large agro-industrial firms and food multinationals, displace decision-making authority from the farmers to these downstream companies, and strengthen the capacity of these companies to extract rents from the chain to the disadvantage of poor farmers and local households (Warning and Key 2002).

On the other hand, VC schemes provide a basis for farmers to access the credit, inputs, and technology they need for upgrading their production in terms of productivity and quality and to increase their incomes. As already mentioned above, the theoretical model by Swinnen and Vandeplas (2011) shows how the increased demand for higher quality products requires buyers to assist farmers in order to improve the quality of production, for example by providing the farmer with inputs on credit. In a context of weak contract enforcement, which is likely in many developing countries, this creates holdup opportunities for the farmer, who can decide to use the inputs but sell the high-value product to another buyer without paying back the credit that the first buyer offered him. In order to prevent this, buyers are forced to offer attractive contract terms in order to secure their returns to investment, for example by offering the farmer a price premium. Hence, poor suppliers can benefit from the introduction of quality standards in a weak contract enforcement context, even if all bargaining power lies with the buyer.

Indeed, several empirical studies have found that once farmers overcome the barrier of inclusion into high-value supply chains, they benefit significantly. Dries and Swinnen (2004) and Gulati et al. (2007) find improvements in small farmers' productivity and quality of produce when contracting with large processors for the dairy sector in Poland and for animal production in South-East Asia, respectively. In the Senegalese horticulture sector it is found that contract-farming leads to important increases in farmers' household income (Maertens and Swinnen 2009) and farmers' subjective wellbeing (Dedehouanou et al. 2013). Minten et al. (2009) show that high-standards vegetable export production in Madagascar leads to more income stability and a reduction in the number of 'hungry' months' for local farm households. They also find that the better technology and management practices related to contract farming spill over to other crops, generating large productivity increases in rice production. With respect to the implementation of and certification to private standards, Handschuch et al. (2013), Asfaw et al. (2009), and Subervie and Vagneron (2013) find that smallholders' certification to GlobalGAP results in improved quality, increased volumes, higher prices and a higher net-income from fruit or vegetable production for respectively Chile, Kenya and Madagascar.

Moreover, Asfaw et al. (2010a) finds improved health outcomes among farmers as a result of the use of less toxic pesticides and improved farmers' pesticide management. These studies suggest that there are several mechanisms through which rural producers can benefit from the increase in the demand for high-value products.

Based on Chinese data, Xiang et al. (2012) analyse the general equilibrium effects of the growth in high standards food on household welfare. Their simulation results show that an increase in the worldwide or domestic demand for high standard food, leads to an increase in the production of high standard products and to a reduction of poverty and inequality. But the study especially illustrates the importance of taking into account that the growth and equity effects of high standards are determined by a complex set of factors and mechanisms that are often ignored in the empirical literature.

7.4.2.3 The Benefits from Employment in High-Standard Supply Chains

Finally, an important—and much overlooked—argument in the welfare analyses of high-standards trade is that poor households may benefit through employment effects. High-standards trade creates new employment opportunities in processing and handling of produce, and on vertically integrated estate farms and large contracted farms. Some recent empirical studies show that the development of high value agro-industrial supply chains creates substantial employment that is well-accessible for the poor, leading to increased rural incomes and reduced poverty rates (for example, Maertens and Swinnen (2009) and Maertens et al. (2012) for the horticulture export sector in Senegal; Barron and Rello (2000) for the tomato agroindustry in Mexico; Mano et al. (2011) for the cut flower industry in Ethiopia). They find that rural households, and especially the poorer ones, benefit importantly from employment. Moreover, the high demand for female labour in these sectors may contribute significantly to female incomes and empowerment (Maertens and Swinnen 2012), leading to indirect effects such as increased child schooling (Maertens and Verhofstadt 2013) and investment spillovers (Maertens 2009). The increase in standards may also create improved employment conditions for workers. Ethical or fair trade standards may generate positive effects on working conditions. For example, Barrientos et al. (2003) find that labour standards and codes of conduct can improve workers' well-being, although not in all cases. Yet, even food quality and safety standards may generate benefits for workers. By increasing the need for companies to invest in training, standards may result in higher wages through an efficiency premium paid to trained workers in order to stimulate them to keep working at that same company. Colen et al. (2012) find evidence of increased employment periods and higher wages for workers, following companies' certification to private standards in the horticulture export sector in Senegal.

7.5 Conclusion

Over the past decades, food standards have proliferated in global food supply chains. Many authors have raised the concern that rising standards pose barriers to developing countries' integration in international food markets and to the participation of small farmers in global value chains. Yet, the overview of the existing empirical studies and the theoretical frameworks provided in this chapter show that developing countries can benefit from high-standards trade and that high standard global supply chains can bring important benefits for poor rural households, either in the form of contracts with processing or exporting firms, or as employees. Hence, the rapid rise of food standards does not necessarily lead to new barriers to trade and to a more inequitable distribution of the gains, but can also enhance developing countries' participation in high-value international food markets and contribute to development in these countries.

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Food Safety Standards and International Trade: The Impact on Developing Countries' Export Performance

8

Honda Keiichiro, Tsunehiro Otsuki, and John S. Wilson

Abstract

The expansion of food safety standards in regulations has introduced new complexity in trade policy dialogues and efforts to expand trade in agricultural products. A loss of competitiveness due to the costs required to comply with these standards has arisen concern among exporting firms, particularly those in developing countries. This chapter reviews and synthesizes existing studies that quantify the impact of food safety standards with particular attention to developing countries' access to international markets. Based on the empirical studies using country-level data such as those using the gravity models, food safety standards have an adverse effect on trade in general. Furthermore, this adverse trade effect is likely to be greater for developing countries than developed countries. The firm-level studies generally demonstrate the adverse effect of food safety standards to impose direct/indirect and one-time/recurring costs on exporting firms in developing countries. In contrast, some of the country- and firm-level studies suggest the presence of the demand-enhancing effect of standards. However, the net effect of tightened food safety standards on developing countries appears to be generally negative according to the studies to assess the demand and supply impact of food safety standards because the trade-cost effect tends to outweigh the demand-enhancing effect. Given this extensive literature review, this chapter highlights the importance of a concerted effort

H. Keiichiro
Prefectural University of Kumamoto, Kumamoto, Japan
e-mail: khonda@pu-kumamoto.ac.jp

T. Otsuki (✉)
School of International Public Policy, Osaka University, Osaka, Japan
e-mail: otsuki@osipp.osaka-u.ac.jp

J.S. Wilson
The Center for Global Enterprise, New York, USA
e-mail: jwilson@thecge.net

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between developed and developing countries to reduce the trade-cost effect and to leverage the demand-enhancing effect. Such an effort would include setting reasonable level of food safety standards as well as raising the capacity of exporting firms in meeting the consumer's demand for reasonable level of quality and safety of food products.

Keywords
Food safety standards • Compliance costs • Developing countries • Econometric modeling

8.1 Introduction

The expansion of food safety standards in regulations has introduced new complexity in trade policy dialogues and efforts to expand trade in agricultural products. Unlike tariffs, policies on food safety standards and regulations need to consider diverse and sometimes conflicting social objectives. Promoting global economic prosperity through trade liberalization, and protection of the health of consumers, plants and animals is a complex endeavor.

The World Trade Organization's Agreement on Sanitary and Phytosanitary (SPS) Measures sets out international rules for the appropriate use of standards with the goal of protecting human as well as plant and animal health. The Agreement also seeks to prevent unnecessary present barriers to trade. However, many countries continue to maintain restrictive food safety standards. The costs required to comply with these standards can weaken the competitiveness of exporters, particularly those in developing countries (Henson and Jaffe 2008). Food safety standards are likely to be more stringent than or dissimilar from exporting countries' standards and these discrepancies often require costly investment from producers (Maskus and Wilson 2001). The lack of information on the size of the potential adverse effects of standards and technical regulations is problematic. Despite the importance of this issue, until recently studies that quantify the impact of food safety standards on trade have been limited.

The last decade, however, has witnessed an increasing number of studies to examine this relationship using contemporary estimation techniques. Whilst most existing studies have found negative associations between tightened food safety standards and food and agricultural exports, other studies reported an insignificant or even a trade-creating effect of these standards. It is important to examine the literature on standards systematically, according to the focus of the studies, including the types of products, types of regulations, and characteristics of countries such as income levels. Moreover, empirical studies differ in terms of methodologies and focus. Therefore, it is of particular importance to assess whether trade loss due to standards is more prominent for developing countries, and what products and types of regulation need careful attention. It is also important to consider the methodology in reviewing these studies as the results are dependent on the approach used.

For example, recent gravity model studies that control for zero trade flows found that standard gravity models tend to overestimate the effect of standards.

This chapter will review and synthesize existing studies that quantify the impact of food safety standards with particular attention to developing countries' access to international markets. Section 8.2 reviews the empirical studies that use country-level data. The results of such studies are applicable across countries, and in predicting trade losses resulting from tightened standards at a country or global level. Section 8.3 reviews the empirical studies that use micro data such as firm-level data, which allows us to identify better specific hindrances that developing-country firms confront in meeting food safety requirements. The comparison of developed and developing countries tells us whether developing countries face greater technological and financial difficulty in complying with foreign or international standards. Section 8.4 discusses the lessons learned from the existing studies and proposes possible policy prescriptions for developing country governments and firms that are currently exporting or intending to export.

8.2 Empirical Studies Using Country-Level Data

Analysis using country-level data is common among the empirical studies assessing the trade impact of food safety standards. The first subsection reviews studies that apply gravity models to the analysis of the impact of food safety regulations on bilateral trade flows with a particular focus on developing countries as exporters. The second subsection uses these studies to investigate the demand and supply effects of food safety standards, and the welfare implications of food safety standards. Empirical studies of this kind consider countries' performance in terms of the amount of exports, diversification of export destinations, and welfare, but they typically focus on particular products partly because of the heterogeneity of the effect of food safety standards across products and partly because of the limited availability of data on food safety regulations. The third subsection reviews the studies that used alternative approaches.

8.2.1 Trade Flows and Food Safety Regulations

Gravity models have been commonly used in empirical studies to assess the sectoral and countrywide aggregate impact of food safety standards on bilateral trade. Gravity models can effectively isolate the variation in bilateral trade flows due to regulations and that due to other importer- or exporter-specific factors based on panel-data econometric estimation methods. Measurements of food safety standards are incorporated in standard gravity models using extra explanatory variables. In gravity models, bilateral trade flows are regressed on both importers' and exporters' degree of economies of scale and the distance between importers and exporters as follows:

$$\ln y_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j - \beta_3 \ln Dist_{ij} + \mathbf{x}\boldsymbol{\beta} + \varepsilon_{ij},$$

Where y_{ij} is the value of bilateral trade between countries i and j, GDP proxies the economies of scale in each country, $Dist_{ij}$ is the distance between two countries, and ε_{ij} is the error term. In many cases, researchers employ other regressors that are elements of the matrix $\mathbf{X}$, for example, variables for colonial relationships, common language usage, common borders and regional trade agreements. Regulation variables such as those on food safety standards are also included as additional explanatory variables to estimate the magnitude and sign of their impact.

The earlier studies that applied gravity models to assess the impact of food safety standards employed the above standard specification of the gravity model. Otsuki et al. (2001a) analyzed the effect of the European Union (EU) aflatoxin standards on imports of groundnuts from 15 major groundnut exporting African countries. The aim of the study was to investigate the impact of the European Union's harmonization of the maximum aflatoxin limit in imported foodstuffs in 2002. This study was motivated by serious concerns about potential export loss among exporters of food and agricultural products because of tightened developed-country food safety standards. For example, a representative of Gambia claimed that "the proposed standard would effectively restrict entry of Gambia's groundnuts and essentially the groundnuts from producer countries in the developing world to the EU" (WTO 1998). The EU's maximum residue limit was set at a very stringent level (2 parts per billion (ppb)) compared with the Codex international standard (16 ppb). Otsuki et al. (2001a) aimed to demonstrate the existence of potential trade-offs between trade and food safety. Their gravity model was designed to examine whether a tightened food safety standard really reduced food and agricultural exports from developing countries by focusing on groundnuts and groundnut oil.

In the estimation of their gravity model, Otsuki et al. (2001a) used bilateral trade flow data from 1990 to 2000 from the United Nations COMTRADE Database, and data on the maximum residue limit (MRL) of aflatoxin in each importing country obtained from the Food and Agriculture Organization's survey of mycotoxin standards in 1994. They found the elasticity of EU imports with respect to the aflatoxin standard is 1.1 for edible groundnuts. As data on aflatoxin standards are unavailable for most African countries, they included exporting country dummies to control for the unobserved exporter's standards as well as other factors specific to the exporting countries.

Otsuki et al. (2001b) expanded the product coverage in their earlier gravity model analysis to include cereals, dried fruits and nuts in the same set of importing and exporting countries. They found the elasticities to be 1.1 (cereals and cereal preparations), 0.74 (coconuts, Brazil and cashew nuts), 1.3 (groundnuts, and other edible nuts), and 0.77 (dried or preserved fruits). Wilson and Otsuki (2003) estimated the same gravity model for a wider set of importing and exporting countries. Their result indicates the same elasticity value for cereal products, but a smaller elasticity for nuts product (0.34), and statistically insignificant elasticity for dried and preserved fruits. This creates uncertainty regarding the order and

statistical significance of the elasticity parameters for aflatoxin standards depending on the country coverage. These studies need further investigation as an elasticity value of around one may be unrealistically high, and it implies that drastic changes in trade flows are possible because a small change in the standards (e.g. from 2 ppb to 1 ppb) reduces trade flows substantially, given the fact that the aflatoxin standards are in the order of 1–30 ppb.

Wilson et al. (2003) investigated the effect of residue limit standards on tetracycline, as an antibiotic veterinary drug, on beef exports from the major beef exporting countries using the standard gravity model. The estimated elasticity of beef exports with respect to the tetracycline standards in maximum residue limit (MRL) was 0.59. Wilson and Otsuki (2003) examined the effect of residue limit standards on *chlorpyrifos*, as a pesticide, on banana exports from the major banana exporting countries using the standard gravity model, and estimated the elasticity to be 1.63, which is high. Chen et al. (2008a) estimated the impact of pesticide residue limits for *chlorpyrifos* on China's food and agricultural products, and found a significant and negative effect on China's food and agricultural exports. The elasticity of MRL is 0.28 for vegetables as a whole, and varies from 0.21 for onions to 1.0 for spinach.

Furthermore, Wei et al. (2012) studied the impact of pesticide residue limits in the export markets for China's tea using a standard gravity model, and found a significant negative effect of pesticide residue standards on China's tea exports. Anders and Caswell (2009) studied the impact of US hazard analysis and critical control points (HACCP) standards on food and agricultural exports from the top 37 suppliers of seafood using the standard gravity model. They found that HACCP had a negative impact on exports from developing countries whereas it promoted exports from developed countries. Thus, empirical studies of the impact of food safety standards based on standard gravity models have largely found a negative impact on food and agricultural exports, particularly from developing countries.

However, some recent gravity model studies point to critical caveats of the standard gravity models (Bergstrand 1985; Anderson and van Wincoop 2003; Santos Silva and Tenreyro 2006). Among other factors, the lack of theoretical orientation and the failure to consider samples with zero trade values, have frequently been subject to criticism. The former problem leads to a misspecification of the econometric models because of their disconnection from economic theory, and thus researchers have been motivated to use theory-oriented gravity models as first developed by Bergstrand (1985), and made econometrically tractable by Anderson and van Wincoop (2003). Anderson and van Wincoop (2003) introduced multilateral resistance terms that measure the average barrier between two countries that affects prices, which can be controlled for by exporter- and importer-fixed effects. In the context of food safety standards, ignoring multilateral resistance is also expected to create omitted variable bias.

The remaining major caveat of the standard gravity model is that it ignores the potential bias caused by the presence of zero trade values. The gravity model takes a log-linear form, and the reduction in sample size because of zero trade values (which makes taking logarithms impossible) may create sample selection bias.

The widely used approaches to address the issue of zero trade values include a sample selection model using two-step estimation as proposed by Heckman (1979), and models that allow zero values in the dependent variable, such as the Poisson pseudo-maximum likelihood (PPML) method proposed by Santos Silva and Tenreyro (2006), and its variants.[1]

With these caveats of gravity models in mind, Xiong and Beghin (2012) reexamined the gravity model analysis of Otsuki et al. (2001a) incorporating multilateral resistance and zero trade values. They found no significant negative effect of the EU MRL on aflatoxins in 2002 on African groundnut exports. Instead, they found that domestic supply issues could have constrained African groundnut exports.[2] Consequently, the robustness of the results of Otsuki et al. (2001a) is uncertain. Munasib and Roy (2011) estimated the impact of aflatoxin standards on maize trade using a sample selection gravity model to accommodate zero trade values, and found a significant negative effect of the standards based on the global sample (−0.080), the low-income country sample (−0.12) and the African country sample (excluding South Africa) (−0.22). The negative effect is greater for the low-income countries, particularly for the African countries suggesting greater compliance difficulty for developing countries.

Concerning other or more general sets of food and agricultural products, Disdier et al. (2008) applied the theory-oriented gravity model to examine the effect of SPS standards on food and agricultural imports from the OECD countries. They also compared the effect of a 1 % increase in the tariff equivalent of SPS/TBT[3] on trade values between the cases of developing and OECD countries as exporters, and found that tightening of SPS/TBT leads to a decrease (0.14 %) in trade. They also found that this negative impact of nontariff barriers is significant and large (0.14 % for a 1 % increase of AVE) when developing countries are exporters. Disdier and Marette (2010) applied the sample-selection gravity model to estimate the impact of MRL on antibiotics on the export of crustaceans to the US, the EU, Canada and Japan. The gravity model coefficient for the MRL variable (in terms of the marginal effect) is 0.13 (smaller than that for the standard gravity specification (0.15)).

Drogué and DeMaria (2012) examined the impact of pesticide residue limits of importing countries on apple and pear exports worldwide using PPML-type gravity

[1] Counterparts of the PPML include, for example, the negative binomial pseudo-maximum-likelihood model (NBPML), the zero-inflated Poisson pseudo-maximum-likelihood model (ZIPPML), the zero-inflated negative binomial pseudo-maximum-likelihood model (ZINBPML) and the generalized negative binomial model (GNB). See, for example, Martínez-Zarzoso (2013) for discussion of the economic performance of this class of estimation methods (categorized as a part of generalized linear models (GLM)) relative to the widely-used least-squares methods with the log-linear specification.

[2] Xiong and Beghin (2012) examined a wide range of variants of the standard gravity model including the sample selection gravity model, as well as models that accommodate zero trade values. Their sample selection gravity model modified the Heckman procedure following the Helpman et al. (2008) specification that allows control for heterogeneity of firm-level productivity by including a firm heterogeneity term in the second stage equation.

[3] Technical barriers to trade.

models. They found that the more similar are the regulations of importing and exporting countries, the greater the trade flows. Chile, South Africa and Brazil follow this pattern (trade promoting) although it was statistically insignificant. Winchester et al. (2012) used PPML-type gravity models to analyze the impact of pesticide residue standards on all plant products, and found that the heterogeneity (reflecting stringency of an importer's standards over those of an exporter) of the regulations can deter the trade of both developing and developed countries. Winchester et al. (2012) may be useful for obtaining the overall tendency of the impact of standards for all the plant products, because HS (harmonized system) four digit products are pooled in the sample observations. Furthermore, it is useful to note that they developed a heterogeneity index of trade regulations (HIT) which varies across bilateral pairs of countries.

Ferro et al. (2013) examined the impact of importer's food safety standards on exports to 61 importing countries using the sample-selection gravity model, and the highly disaggregated and complete dataset on the MRLs of pesticides. They developed a standards restrictiveness index that varies across importer-product-pesticide-time pairs; this index has the advantage in effectively isolating the effect of standards from other confluent factors unlike those in other studies. They also found a negative marginal effect of tightening standards on trade in plant products. Furthermore, their regional comparisons indicated that, the marginal effect of standards of emerging middle-income countries such as the BRIC countries—Brazil, Russia, India, China, and South Africa—tends to be greater than that of others although their standards are not the most stringent. It also suggested that exports from low-income countries are more sensitive to tightened importer's standards than those from higher-income countries.

While it is not a case-oriented analysis, it is also worth noting that Li and Beghin (2012) performed a unique meta-analysis of the quantitative estimates of the impact of technical regulations in 27 previous studies, with a total of 618 observations. They also found that technical measures such as food safety standards tend to have a greater negative effect on trade for developing country exporters than for developed countries.

It is also useful to note that the sample-selection gravity models also produce an important complementary result based on the selection equation. These models allow a separate investigation of the impact of regulations on the relationship between the volume of trade flows and entry to a particular import market. The impact of food safety standards can also be addressed by examining entry to import markets, which is often referred to as the extensive margin in contrast to the intensive margin measured in terms of the volume of trade flows.

8.2.2 The Effect of Standards on Demand, Supply, and Welfare

While the gravity model, including its variants, only allows us to estimate the impact of regulations on trade flows and trade regimes, some studies of this kind conveniently extended the methodology to allow the distinction between the

Table 8.1 Estimates of intensive and extensive margins from Xiong and Beghin (2013)

Exporter–importers	Demand enhancing	Trade cost	Net effect
Trade volume (intensive margin)			
All	0.707*	−0.250*	Positive (p = 0.000)
South-to-North	0.745*	−0.421*	Positive (p = 0.000)
North-to-North	0.928*	−0.259*	Positive (p = 0.000)
Trade regime (extensive margin)			
All	0.315	0.028	Positive (p = 0.000)
South-to-North	0.344	−0.020	Positive (p = 0.000)
North-to-North	0.473	−0.078	Positive (p = 0.000)

Notes: "*" denotes statistical significance at the 1 % level. "p" denotes p-value

demand and supply impact of standards, or to conduct welfare analysis. Unfortunately, the studies reviewed here do not address the implications specifically for developing countries. However, the review is still useful for obtaining general implications.

Xiong and Beghin (2013) decomposed the impact of standards into the demand-enhancing effect (demand effect) and the trade-cost effect (supply effect), and estimated these effects for both the intensive and extensive margins as shown in Table 8.1. For the intensive margin, they found that the demand enhancing effect is greater than the trade cost effect. This implies that, from the viewpoint of exporters, food safety standards are likely to discourage trade. From the viewpoint of consumers, however, tighter standards are favorable since they lead to greater food safety. For the extensive margins, the net effect of standards is also significant and positive although each of the demand enhancing and the trade cost effects are statistically insignificant. Table 8.1 also shows that these results hold for the south-to-north trade as well as north-to-north trade. It is still important to note that the smaller demand enhancing effect and the greater trade-cost effect for south-to-north trade imply that developing countries face a greater disadvantage in meeting food safety standards compared to developed countries.

Disdier and Marette (2010) conducted an *ex post* simulation analysis of the impact of standards on each country's welfare. They found that tightening of regulation (lowered MRL) during the period 2001–2006 would have reduced the welfare of foreign exporters, but the total welfare of all countries, including Canada and the EU, would have increased. The relative magnitude of the demand-enhancing effect and the trade cost effect of the standards varied across product groups. Under the scenario of zero MRLs, the welfare of all countries except Japan would have increased. In the case of dairy products, they found that the trade cost effect of the standards would outweigh the demand-enhancing effect. In the case of cereal preparations, it was found that the demand-enhancing effect outweighed the trade cost effect. The welfare implications can complement the results regarding the impact of standards on trade flows, which is negative in most cases, and thus, enriches the discussion of the impact of food safety standards.

Wieck et al. (2012) developed a calibrated spatial simulation model (combined with a gravity model) to examine the effect on welfare of demand and supply curve shifts following a change in import bans to control avian influenza. They used data for the major poultry meat exporting countries, namely, Brazil, China, France, Germany, Netherland, and the United States (US). They found that exports of uncooked poultry were reduced by the bans. The results of the gravity model for uncooked meat show that a ban has a nearly prohibitive trade impact, whereas permission to export uncooked meat to the non-infected regions of the infected country is trade enhancing. The simulation model demonstrated the trade diversion effects among countries conditional on the infection status. A major effect was that banned exporting countries redirected much of their original exports toward their own market and began to trade among each other, crowding out imports from countries not directly targeted by the ban.

Cororaton and Peterson (2012) assessed the effect of the import ban imposed by the US against Argentine lemons under three scenarios (full access), regional restricted access (entry allowed only in the non-citrus-producing states), and limited access (entry allowed only in the non-citrus-producing region during the off-season of lemon production). The reduction in U.S. wholesale prices from granting access to Argentine lemons increases U.S. consumer welfare, measured by equivalent variation from $9.1 million for limited access to $16.8 million for full access. Losses in producer surplus for U.S. lemon producers were calculated to be $5.3 million for limited access and $10.9 million loss for full access, thus net US welfare increased from $3.8 million to $5.9 million between limited and full access. Because of increases in wholesale prices in the EU and the Rest of World (ROW), consumer welfare decreased, while increases in producer prices in those regions lead to an increase in producer surplus. Overall, the losses in consumer welfare because of the import ban are larger than the gains in producer surplus.

8.2.3 Tariff Equivalents and Prohibitive Standards

There are a few country-level studies that use approaches other than gravity models to evaluate the impact of standards on trade. Tariff equivalent is another popular measure of the extent of nontariff barriers. Calvin and Krissoff (1998) estimated the impact of the Japanese phytosanitary measures on the apple imports from the US in terms of tariff equivalents. When SPS/TBT measures are prohibitive and thus bilateral trade flows are not observed, tariff equivalent cannot be used. To consider this problem and quantify it correctly, Yue and Beghin (2009) econometrically estimated tariff equivalents of technical regulations assuming that prohibitive technical barriers to trade can reduce trade. They applied this method to the case of prohibitive phytosanitary regulations by Australia against apple exports from New Zealand. Honda (2012) applied Yue and Beghin's method to estimate the tariff equivalents of phytosanitary regulations by Japan for US exports of apples.

8.2.4 Summary

In summary, the studies reviewed so far using country-level data provide several lessons. The results vary across products and countries, but in general, a negative impact of food safety standards on food and agricultural exports is observed. Winchester et al. (2012) which is probably the most inclusive study in terms of product coverage (all plant products) and standards (captured by the heterogeneity index) confirmed the adverse effect of food safety standards on plant product trade. Based on product-level studies, the adverse effect may be robust for cereals, and fruits and vegetable, whereas the signs of the effect are mixed for other products such as nuts. There is limited empirical evidence for meat products, and therefore, more studies are required for this product category.

It is also observed that the negative effect is more prominent for developing country exporters. The negative effect is still found even when zero trade values and multilateral resistance are incorporated, but the size of the effect tends to become smaller.

When the effect of the standards is disentangled into demand and supply effects, as was done in Xiong and Beghin (2013), they are found to be positive and negative, respectively. Although the net effect is positive for both developed and developing countries, it is smaller for developing countries. This implies that developing countries face greater difficulty to export than developed countries when food safety standards exist in export markets. The effect of standards on welfare is complex, but it can be generally said that food-exporting developing countries are likely to suffer from welfare loss when food safety standards are tightened.

8.3 Firm-Level Analysis of the Impact of Food Safety Standards

Country-level studies can illustrate how food safety standards affect total exports of a particular country/product. It is likely that, if a standard is trade limiting, it imposes barriers for firms to export the regulated products to that country. However, heterogeneity in the production and export capacity of firms exists even within a specific product sector of a country, and it may prevent us from finding the hypothesized relationships. Thus, studies using firm-level data would be helpful in understanding how each firm reacts to the food safety standards, and what factors affect their reaction. Chapters 9 and 10 in this volume discuss this line of studies in an in-depth way and provide case studies. Few have been done until recently, however, because of the lack of firm-level data that contain information on the food safety regulations that the firm faces as well as information on export and production performance.

Capacity constraints that producers in developing countries have in complying with food safety and quality standards, typically in developed countries, may be significant as several case studies have descriptively demonstrated (see, for example, Wilson and Abiola (2003), and Aloui and Kenny (2005)). Firm-level

quantitative studies on technical regulations are very limited, and even more so when it comes to developing countries. Thus, we try to obtain some useful insights from findings in firm-level studies.

The World Bank's Technical Barriers to Trade (TBT) Survey Database contains samples from 689 agricultural and manufacturing firms in 17 developing countries for the period 2000–2001. The database includes information on the firms' response to various technical barriers in their domestic and export markets as well as data on other attributes and performance. Wilson and Otsuki (2003) summarized some of the key observations from the TBT database. While the database mainly contains manufacturing firms, approximately 30 % of the samples are from food producers or food processing firms.

Data in the World Bank's TBT Database suggest that for approximately 70 % of the surveyed developing country firms, the cost of testing and certification prevented them from exporting to major developed country markets. Furthermore, about 80 % of the surveyed firms reported that ensuring product quality is important for expanding their exports. In addition, the survey revealed that a higher proportion of firms are subject to foreign technical regulations (70 %) than to domestic technical regulations (49 %). The firms tried to comply with the technical requirements by expanding their plant or equipment, re-designing products, and hiring labor for production/testing. The actual total compliance costs incurred by the firms were found to be approximately 4.4 % of total sales on average. The compliance cost seems to be not prohibitively high, but it still reduces the firm's ability to export, thereby constituting a barrier to trade.

Ragasa et al. (2011) assessed the magnitude and sign of the effect of firms' compliance to food safety regulations using survey data from seafood production firms in the Philippines. They calculated the expenditure to comply with the HACCP standards. Furthermore, using a translog cost function, they estimated the impact of compliance with HACCP standards on the firms' operational cost net of the HACCP-related expenditure, which was approximately 1.6 % of the total value of output if it was to comply with the HACCP standard.

They also found that the cost was under-estimated by US$1.1 per US$1 spent if the compliance to food safety regulations was not taken into account. Blandon et al. (2009) investigated transaction costs in the supermarket supply chain for fruits and vegetables and the efficiency gain from collective action, although they were concerned mainly with domestic standards. If the transaction costs were high enough, firms exited the supply chain. While this study does not deal with food safety standards, the findings imply that, if the transaction cost increases because of the introduction of food safety standards, firms tend to exit the supply chain.

Maertens and Swinnen (2008) pointed out that developed countries' stringent food safety standards do not always discourage developing country firms. Maertens and Swinnen (2009) and Maertens et al. (2011) demonstrated through a case study of Senegal's fresh and processed fruit and vegetables, that stringent food safety standards in developed countries can increase developing country exports to developed countries through increased employment of poor rural farmers in the export sector aiming at high-standards markets. However, the success of the Senegalese

tomato sector, is perhaps backed up by the multinational enterprises (MNEs), which are leaders in the supply chain of food products through their ability to ensure product quality meets developed country's requirements in terms of product quality and safety. Their analytical approach combines the regression and the propensity score matching methods to examine the impact of participation in the export sector.

Maskus et al. (2013) and Chen et al. (2008b) also provided useful firm-level empirical analyses of technical regulations, although their focus was on manufacturing firms rather than agricultural producers. Using a translog cost function, Maskus et al. (2013) estimated that a 1 % increase in the direct cost of compliance results in a 0.06–0.13 % increase in firms' operational cost (net of the compliance cost) depending on the industry. This estimate seems much smaller than that of Ragasa et al. (2011), possibly because the latter focused on the seafood sector whose assurance of food safety (under the requirement for the HACCP) would be by far more costly. Chen et al. (2008b) estimated firm-level export functions of intensive and extensive margins. They identified the factors that increase the amount of exports in a firm's total sales (intensive margin), and the number of export markets and products that are exported (extensive margin). Compliance with quality standards is found to increase the export volumes, as well as the number of export markets and products exported. On the contrary, standard certification procedures, are found to reduce the number of export markets and products exported.

Fontagné et al. (2013) examined the effect of SPS standards on firm's probability to export (extensive margin), value of exports (intensive margin) and export prices using the firm-level data for French agricultural and manufacturing firms. They found that SPS concerns reduce the presence of French farms in the SPS-imposing export markets. Furthermore, they found a negative effect of SPS imposition on the value of exports. Although the analysis is about French firms, it seems natural to expect that the result also applies to the developing country firms.

Finally, some of the representative descriptive studies on the impact of food safety standards on developing country producers, will be briefly mentioned. Wilson and Abiola (2003) provided case studies with descriptive approaches on how food safety standards in developed countries could affect the export and production performance of farmers, and fishermen in various sectors in Sub-Saharan African countries. Alavi (2009) used a descriptive approach based on a survey, and found that there was a significant effect of the EU food safety regulations on fishery operations in Malaysia. Aloui and Kenny (2005) also used the descriptive approach supported by a survey, and estimated the compliance costs for citrus and tomatoes in complying with food safety standards in the EU and US.

In summary, studies on the impact of food safety standards using firm-level data indicate that developing country firms bear some additional costs when they are required to comply with foreign food safety standards. The firms do not only need to incur initial one-time costs, but also recurring costs. Furthermore, certification requirements are found to discourage exports perhaps because the trade cost effect is greater than the demand-enhancing effect. On the contrary, types of standards such as quality standards can facilitate trade, perhaps because of the demand-

enhancing effect as was discussed in Sect. 8.2. Other studies on food safety standards have found that certified firms may increase exports and profits. Furthermore, Colen et al. (2012) found in their study of the Senegalese horticulture industry, that firms certified with GlobalGAP can pay 30 % higher wage rates than uncertified firms possibly through improved quality assurance through their export-oriented supply chains. If the same applies to the (public) food safety standards, standards compliance can possibly lead to a rise in firms' profit margins and hence salary payments. Generalization of the findings of those studies to firms in various industries and countries needs careful attention, but they are at least useful in complementing the findings in studies using cross-country data as presented in Sect. 8.2.

8.4 Conclusions and Policy Implications

We reviewed both cross-country and firm-level analyses on the impact of food safety standards. Cross-country studies have the advantage of providing generalized analytical results, as a wide range of countries and products are considered collectively. Firm-level studies have the advantage of dealing with firm-level behavior and observed heterogeneities. They also allow us to analyze directly the impact of standards on firms' behavior. Thus, it is useful to combine both types of analysis to develop useful policy implications.

Based on the empirical studies using country-level data such as those using the gravity models, food safety standards are likely to have an adverse effect on trade whilst the impact may vary across products. Also, this adverse trade effect is likely to be greater for developing countries than developed countries. This seems to reflect the technological difficulties developing countries face in complying with more stringent food safety standards. The firm-level studies generally confirm this view by demonstrating that food safety standards impose direct/indirect and one-time/recurring costs on exporting firms in developing countries.

On the other hand, the demand-enhancing outcome of compliance with food safety standards may counteract negative supply-side effects. The firm-level studies also demonstrated that improved product quality and safety will increase export volumes, as well as provide access to a greater number of export markets and product varieties to be exported. The reputation effect of private food safety and quality standards are also of great interest to developing country firms, and global supply chains appear to have an important role in facilitating compliance of firms to foreign food safety and quality standards. The studies to assess the welfare impact of food safety standards generally predict that food-exporter developing countries tend to lose from tightened food safety standards because the trade-cost effect tends to outweigh the demand-enhancing effect.

Developing countries consequently continue striving for lowering compliance and other trade-related costs associated with food safety standards by providing testing and certification, and technical assistance to firms. Henson and Jaffe (2008) emphasize that, rather than degrading the competitiveness of developing countries,

the enhancement of capacity to meet stricter food safety standards can potentially create new forms of competitive advantage. This is because the compliance costs may be offset by an array of benefits from the improvement of food safety management capacity. Peterson et al. (2013) also demonstrated that accumulation of export experience tends to counteract the trade-restricting effects of SPS requirements.

In the domain of international policy coordination, it is important to seek a well-balanced regulatory framework for food safety regulations to reflect both producer and consumer benefits. Since the SPS and TBT Agreements permit countries' deviation from the internationally recognized standards, global harmonization of the standards may not be the most efficient solution when consumers' demand for safety, justifiably vary across countries. Still, it is important to make sure that food safety regulations should not be used as protectionist measures, by importing countries, nor should they be set at levels that are excessively stringent for the degree of the associated safety risks. Research to identify to what extent the observed stringency of standards of a country is accounted for by the consumer demand of food/plants/animal safety and the protectionist measures would significantly benefit policy coordination.

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Food Safety Regulation and Private Standards in China

9

Helen H. Jensen and Jiehong Zhou

Abstract

Both global and domestic markets place increasing importance on the quality and safety of food products produced in China. The presence of microbial agents, toxic animal or plant products, and chemical contamination are major food safety problems. Suppliers to export markets face relatively high refusal rates for Chinese food products. We provide an overview of food safety problems in China and the changes and efforts made by the government and private sector to meet the needs for improved food safety. Evidence from the vegetables and vegetable processing sector illustrate the challenges in developing a coordinated quality and food safety system and the advantages that larger scale firms and integrated supply chains hold in competing in high quality markets. Both the lack of testing and inability to control hazards as they enter the food distribution system lead to systemic failures in the food production system. Current efforts are directed to developing supply networks to assure safe production practices among suppliers, and investing in greater control of products and traceability in the supply system. Challenges center on problems of (1) coordination and enforcement of food safety regulations, (2) implementing traceability in the agricultural and food product system, (3) lack of public confidence in the safety of the food supply, and (4) the high cost of implementing food safety controls. Improving technical standards at each stage throughout the supply chain and integrating the entire process requires attention to

H.H. Jensen (✉)
Department of Economics and Center for Agricultural and Rural Development, Iowa State University, Ames, Iowa, USA

Center for Agricultural and Rural Development, Iowa State University, Ames, IA, USA
e-mail: hhjensen@iastate.edu

J. Zhou
Center for Agricultural and Rural Development, Zhejiang University, Hangzhou, PR China
e-mail: runzhou@zju.edu.cn

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demonstration, training and consultative services, as well as investment in infrastructure, testing, and systems of tracking ingredients and product. Establishing and comprehensively enforcing a unified legal and regulatory food safety system in China would provide the foundation to maintaining quality and food safety in both domestic and export markets.

Keywords
Food safety • China • Food quality • Fresh and processed vegetables • Supply chains

9.1 Introduction

China's rapid urbanization and modernization that accompanied rapid economic development, major demographic shifts of population from rural to urban areas, and growing importance in international markets for food and agricultural products have had major effects on its food supply and food safety. Along with the growth in income, per capita consumption of meat, fish, and oil products have increased rapidly. At the same time, China has become a leading exporter of vegetables, fruit, livestock and poultry products, and fish and shrimp products. As shown in Figs. 9.1 and 9.2, vegetables and aquatic products lead other agricultural products in export volume and value and both have risen rapidly since 2000.

The increased demand for food and agricultural products from China has put pressure on the food supply networks to meet demand, through both local supply and increasingly industrialized supply chains. Both global and domestic Chinese markets place increasing importance on the quality and safety of food products produced in China, in part due to experiences with major food safety problems. Recent examples include the melamine contamination of infant milk powder in 2008; toxic pesticide residues detected in cowpeas in Hainan Province in 2010; and the 2009 discovery of the use of ractopamine, a prohibited substance in China, in pig production (Wang et al. 2008; Zhou and Yue 2010; Jia et al. 2012; Lam et al. 2013). The presence of heavy metals, poor sanitation, overuse and misuse of fertilizers and pesticides, and use of illegal chemicals and food additives have affected the water supply and safety of food products, and has led to mistrust among consumers (Calvin et al. 2006; Dong and Jensen 2007; Lam et al. 2013).

In this chapter we provide an overview of food safety problems in China and the regulatory changes and efforts of private suppliers to meet the needs for improved food safety. We provide several examples from recent case studies to illustrate the increased efforts in private supply chains to maintain tighter control of products and traceability in the supply system. Finally, we summarize the types of changes required by public and private agents to enhance the food system and respond to the potential for food safety failures.

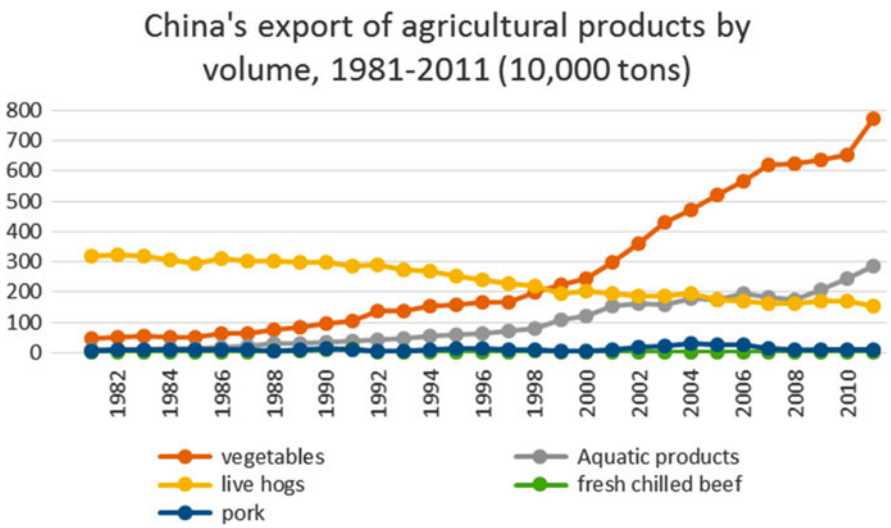

Fig. 9.1 China's export of agricultural products by volume, 1981–2011. *Source*: National Bureau of Statistics of China (2012), Department of Rural and Social Economic Survey of National Bureau of Statistics of China (2012), Ministry of Agriculture (2011, 2012)

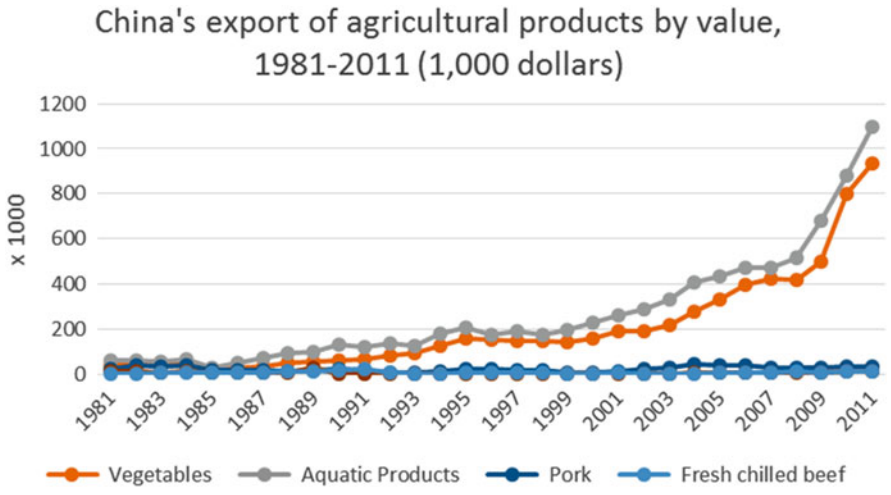

Fig. 9.2 China's export of agricultural products by value, 1981–2011. *Source*: National Bureau of Statistics of China (2012), Department of Rural and Social Economic Survey of National Bureau of Statistics of China (2012), Ministry of Agriculture (2011, 2012)

9.2 Food Safety Issues in China

China's food system has emerged from one focused on problems of famine and insufficient supply, to one that now produces large quantities of processed foods destined for export markets, as well as dairy, pork, poultry, and aquaculture to meet the growing demand for animal source foods. China's growing middle class—expected to grow from 247 million in 2012 to 607 million in 2020—has fueled demand for increased meat and dairy products, as well as readily available fresh produce in urban markets. Along with the increase in production, rapid urbanization and new food marketing networks have disrupted traditional institutions and trade and introduced the potential for greater spread of contamination and food safety problems in the system. Despite government efforts, food safety in marketed foods is a growing problem, and the potential for failures has outpaced the government's ability to control the problems, especially in domestic markets. Consumers, therefore, lack confidence in the safety of domestically produced food.

Recent reports of food safety problems in China list microbial agents, toxic animal or plant products, and chemical contamination as the three major types of food safety problems, with microbial contamination most frequently reported (Lam et al. 2013). In addition, food safety issues pose problems for China's increasing exports of food products as importing regions in the European Union, Japan, and the United States have relatively high refusal rates for Chinese food products (Dong and Jensen 2007; Zhou et al. 2013b).

One of China's major challenges to providing safer food is the sheer number of farmers and food producers in the agricultural sector. Many operate as small-scale producers, and some farmers lack training in the safe use of chemical fertilizers, pesticides, and food production practices (Calvin et al. 2006; Dong and Jensen 2007; Zhou and Yue 2010; Zhou et al. 2013a). Without adequate training and use of safe practices, and without adequate tracking systems to link problems to specific farm producers, some farmers can send products to food distribution channels with high residue levels of feed additives, toxic chemicals and other contaminants, and microbial contamination. However, the ability to detect and control food safety problems is limited by the fragmented marketing system, the number of small-volume cash exchanges that occur, and limited testing of product quality (Calvin et al. 2006; Huang et al. 2009; Gale and Hu 2012).

A lack of testing and an inability to control hazards as they enter the food distribution system lead to systemic failures in the food production system. The failures arise from the inherent nature of the untraced contamination and mixing that can occur as food and food ingredients are processed and distributed within the food system (Hennessy et al. 2003). In response, the Chinese government and food industry have promoted vertically coordinated supply channels, improved traceability, and improved testing and auditing, which offer greater control of products and reduce the potential for losses that might spread through the food system without greater controls.

Since the 1980s, various supply network models have emerged, including relatively tightly controlled vertically integrated farming organizations that may

lease land and hire labor, "company plus farmer" models that involve production contracting with farmers and may include specifications for inputs and other variations that strengthen backward linkages between retailers and producers (Gale and Hu 2012). Government and industry have encouraged increased control of supply networks in order to enhance available information about production, processing, and handling of products that enter retail and export channels. However, in practice, the control of food safety problems in the widely diverse and fragmented production, processing, and handling systems remains a significant problem. Efforts to better organize the supply networks and contracting offer some prospects for standardization of production practices among the large number of small producers.

9.3 Regulatory Context and Government Initiatives

In the last 25 years, China has introduced various product certification standards, test methods, and measures that are aligned with international practice and in compliance with the requirements of the World Trade Organization (WTO) rules. In addition to improving food safety in domestic markets, the standards and regulations are designed to promote safety of products that enter export markets. Since the late 1980s, the major food safety legislation has included the implementation of the *Standardization Law of the People's Republic of China* (1988), a major revision to the *Food Hygiene Ordinance* (1995), the new *Agricultural Product Quality Safety Law of the People's Republic of China* (2006) that regulates agricultural products, the comprehensive *Food Safety Law of the People's Republic of China*, and the *Implementation Rules of Food Safety Law* (2009) (Lam et al. 2013). These laws form the basis of China's technical trading and measurement system, and are designed to harmonize China's food safety system with international standards. The 2009 Food Safety Law establishes that food safety is both a public and private responsibility.

Recent efforts have focused on institutional reforms to better integrate regulations on food safety across the food supply system. This effort has involved merging the oversight of food safety from state administration for industry and commerce in various governmental offices and bureaus (e.g., food safety office, food and drug supervision bureau, production stage of quality inspection bureau, distribution stage in market regulation) into the China Food and Drug Administration (CFDA), in order to better coordinate and lead in the government regulation of food safety throughout the whole food supply system. Among its main responsibilities, the CDFA charts laws, regulations and rules coordinated with efforts by food companies and local governments ("integrated responsibility"). The CFDA also has responsibility for coordinating food safety information, standards and risk monitoring. Although it is still early, the new efforts to coordinate food safety control in a single agency has introduced a new era of safety and quality inspection and supervision for agricultural products and foods for both domestic and international markets.

Table 9.1 Traceability demonstration cities in meat and vegetable production

Year	Number	Cities
2010	10	Shanghai, Chongqing, Dalian, Qingdao, Ningbo, Nanjing, Hangzhou, Chengdu, Kunming, Wuxi
2011	10	Tianjin, Shijiazhuang, Harbin, Hefei, Nanchuang, Qinan, Haikou, Lanzhou, Yinchuan, Urumqi
2012	15	Beijing, Taiyuan, Hohhot, Changchun, Zhengzhou, Changsha, Nanning, Guiyang, Xi'an, Xining, Suzhou, Wuhu, Weifang, Yichuan, Mianyang

Among other changes, the Chinese government initiated programs for traceability in the agricultural supply chain from farm gate to retail in several relatively well-developed areas (e.g., across China's developed coastal areas, especially Zhejiang Province and Shanghai City).[1] These programs, initiated in 2002, were designed to support the safety and quality of agricultural products in international and domestic markets. Efforts include the introduction of improved documentation of production methods, building effective traceability systems, monitoring and providing information on product qualities, supporting local systems in marketing management for vegetable and livestock production, and construction of national agricultural standardization demonstration gardens to cover all sectors in agriculture. In 2012, there were more than 4,000 demonstration gardens throughout the country. In addition, since 2010, the government has introduced traceability demonstration systems that provide traceability information to consumers in meat and vegetables markets in the selected demonstration cities (Table 9.1).

These changes have led to significant progress in improved food product quality and reduced food safety problems. As an example, over 40 agricultural products from Zhejiang Province were authenticated and included in the first batch certifications of pollution-free agricultural products in the country (Ministry of Agriculture 2003). Today, nearly 4,000 products have been certified, with pollution-free quality verified through spot-checks in Zhejiang Province to meet the national levels for certification (Hangzhou Center for Inspection and Testing for Quality and Safety of Agricultural and GM Products 2013). Although evidence from other areas suggests continuing problems for certification and testing (Huang et al. 2009), the progress in Zhejiang Province indicates progress in achieving product certifications on production practices.

[1] Several of China's laws, legislations, and rules related to food traceability are summarized in Law of the People's Republic of China on Quality and Safety of Agricultural Products (2006), The Administrative measures for the Packaging and Marking of Agricultural Products (2006), Food Safety Law (2009), and Management Regulations on Live Pig Slaughter (2010).

9.4 Challenges for Food Safety Control

Despite the country's progress, problems persist in making China's current agricultural product-quality traceability system consistent with the requirements for achieving comprehensive food safety standards. The current challenges center on problems of (1) coordination and enforcement of food safety regulations, (2) implementing traceability in the agricultural and food product system, (3) lack of public confidence in the safety of the food supply, and (4) the cost of implementing food safety controls. First, the coordination and enforcement of food safety regulations are inadequate to meet the needs for integrating food safety regulations across governmental departments and within a system of many widely dispersed agricultural producers. The sector includes over 200 million farmer-households producing on 1–2 acres of land on often non-contiguous plots (Calvin et al. 2006; Jia and Huang 2011). Efficiency of the entire supervision of food safety is relatively low, and the legal and regulatory enforcement is not sufficient to hold producers and processor accountable for food safety failures (Li 2011). Greater attention to a more unified agricultural product certification would support better integration of the standards throughout the food system and emphasize the importance of private sector involvement and coordination with public efforts to manage food safety risks.

Second, efforts to implement a system of traceability in the food system are limited by the fact that production documents and distribution marks are not well integrated within the agricultural and food supply chain. The large number of small-sized agricultural producers and widely dispersed farmer-suppliers have little training related to adhering to food safety controls (Zhou and Jiang 2007; Huang et al. 2009; Li and Kou 2010). Although the process for tracing products and ingredients back to the farm or supplier is available, the lack of universally recognized barcodes or quick response (QR) codes causes difficulties when trying to trace the source of food safety or quality problems. The ability to trace and recall products is especially important for high-risk foods (such as dairy products, infant formula, etc.). Furthermore, non-food raw materials and additives used in food production are not well monitored.

Third, public confidence in food safety is low. Lack of public access to information about product sources and processing (as through adequate information on product traceability) (Gu and An 2012) and about failures in government testing has led to low public trust in the food industry, despite government involvement and oversight.

Fourth, because of the traceability and information problems, the market system does not "reward" (provide the needed premiums) for the higher costs of taking more cautions and supervising food quality/safety by producers, processors, and other suppliers in the food system (Shi and Zhou 2012), although certifications may provide access to export markets. Based on results from a survey of food exporting enterprises, Chen and Song (2009) report that following the adoption of the new food safety law, the firms faced increased inspections, higher costs of inspections, training, record-keeping and recall costs. Costs for improving infrastructure required for implementing various quality management programs (including

HACCP, GMP, GAP ISO9001, ISO14001 and ISO22000[2]) increased significantly from 2006 and 2007. They estimated that the overall costs of compliance for the surveyed export-oriented firms by 2008 were 4.7 % of total sales and 6.2 % of the total export costs. Zheng et al. (2013) report that ISO 22000 is the most widely used of Third Party Certifications (TPC) in China and find that TPC would lead to positive gains in trade by China's exporting firms with trade to the United States. China's ISO 22000 standards for food safety management have increased rapidly, from 369 certificates in 2008 to 8,228 certificates in 2012.

The relatively high costs of implementing traceability systems along the supply chain due to labor required for documentation and capital for information systems may be the main reason that the firms with traceability systems do not benefit from the market through higher prices, especially in domestic markets. Without adequate premiums for caretaking, the domestic market does not reward the higher costs of supervision of these food market activities. However, the firms may gain access to export markets.

Key to assuring the quality and safety of agricultural products is the ability to control food safety and quality throughout the food supply system. Important tools in the process are achieving some degree of agricultural standardization, supporting existing agri-product voluntary certification programs (pollution-free, green, and organic certifications), and further development of the agricultural product traceability system. Certification of pollution-free agricultural products, products containing only limited artificial fertilizers or chemicals, is issued by the Ministry of Agriculture and the national Certification and Accreditation Administration, and is the first level of product certification. It is used widely across China. In 2007, about 10 % of agricultural products available were certified as pollution-free, and another 4 % had either green or organic certification.

By 2012, these figures had increased to nearly 76,000 agri-products certified as pollution-free, 16,929 certified as green, 1,916 certified as organic, and 1,001 certified as Geographically Identified (GI). These products accounted for the production from over 47 % of China's total arable land (Xinhua.net 2012). Although pollution-free certification is voluntary, government subsidies encourage the certification, and the intent is that all agri-food from China will reach the status of pollution-free product in the next several years.

Certification of quality and safety standards, including input usage or production practices, has been a successful method of improving quality control in the food supply chain in many countries. Although the application and enforcement of food safety and quality standards has limited ability to *guarantee* that products on the market are safe and of high quality, the standards serve as a mechanism for communicating information in trade and reducing uncertainty about products and process attributes between buyers and sellers.

[2] Hazard Analysis Critical Control Point (HACCP) systems, Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP); ISO standards are set by the International Organization for Standards as guidelines for quality assurance by suppliers (ISO9001), for environmental management systems (ISO14001), and for food safety management (ISO22000).

Efforts to develop supply networks, agricultural cooperatives, and contractual arrangements offer some prospects for facilitating the adoption of food safety and quality standards to improve the quality of foods offered to domestic and export markets.

9.5 China's Agricultural Cooperatives and Contractual Arrangements

Despite the extensive regulatory reforms, the assurance of a safe and high quality food market is difficult to achieve due to a lack of standardized production practices and relatively little vertical coordination. Most small-scale farmers cannot afford the costs of implementing the standardized practices. In addition, some farmers are not well educated and do not understand the requirements for standardized production practices that can assure safer foods (Jin and Zhou 2011). This leads to problems of improper and excessive use of pesticides and fertilizers, use of illegal chemicals and food additives, and poor sanitation practices.

Farmer cooperatives in China offer a structure through which formal and informal agreements can be made between farmers and buyers. These arrangements support vertical coordination that can better address food safety and quality concerns. A recent study by Jia and Huang (2011) investigated the contractual arrangements of farmer cooperatives through a national survey (conducted in 2003 and 2009) and found that over half of the farmer cooperatives used contracted marketing in their primary marketing channel. The basis of the contracts was, more often than not, commitment for market delivery, and much less often quality and farming practices. The contracts were of both written and oral form, with written ones occurring more often in the more modern supply chains and when the farmer cooperatives had their private brand. Most of the farmer cooperatives were in the sectors for cash crops and livestock products. However, commitment to meet *public* food safety and quality standards was not an important component of contracting arrangements between farmer cooperatives and buyers (Jia and Huang 2011), and control of products throughout the food supply system remained a challenge.

Improved standardization of production practices used by farmers is important to achieving safer foods. Agricultural cooperatives provide both a larger scale of "production base" to share related costs as well providing a way to organize production practices. Jin and Zhou (2011) found that among the vegetable cooperatives in Zhejiang Province studied, larger cooperatives (approximated by land area), those with a more positive attitude about food quality and safety standards, and those owning a brand name were more likely to adopt standards. At the same time, an agricultural cooperative's access to destination markets—both supermarkets and foreign markets—is enhanced by adoption of food quality and safety standards. As the development of supermarkets and chain store retailers improves, farmer cooperatives will be encouraged to adopt food quality and safety standards.

Some examples drawn from the vegetable industries illustrate the challenges of assuring food safety and quality in the food supply chain, and factors that influence the adoption of standards and practices related to food market systems today. Both government and industry are making efforts to address the problems.

9.6 Case Example: Vegetables

The Chinese vegetable industry is a major supplier to both the large domestic market and increasingly to the world vegetable market. The value of exports of vegetables ranks second behind aquatic products today, and has risen dramatically since 1990—nearly twice the rate of aquatic products (Fig. 9.2). Much of China's vegetable production comes from Zhejiang Province, located on the southeast coast of China. The vegetable production and processing industry is one of the most important agricultural industries in Zhejiang Province. During the last decade, the Chinese government has identified priority enterprises likely to survive market competition in export. Many of these "flagship firms" in the vegetable sector are located in Zhejiang Province, which is ranked third in the export value of vegetables. Hence, compared with vegetable processing firms in other provinces, those in Zhejiang are relatively more export-oriented and oriented to producing products with a higher level of food safety. Thus, examples from Zhejiang Province provide insight into the ways in which private and public efforts can work to meet the needs for food safety.

China's vegetable industry faces increased scrutiny on food safety and quality standards in its export markets. As the vegetable sector has grown, so too have related food safety issues associated with increased application of agricultural chemicals, heavy metals, and other hazards introduced through fertilizers or water supplies. The presence of residues from highly toxic pesticides are a particular problem as pesticide residues pose a risk to both the health of China's consumers as well as in export markets. Exporting firms have faced relatively high refusal rates in exports to major destinations such Japan, the European Union, and the United States.

A recent survey of 507 vegetable farmers found that almost one-quarter of farmers interviewed (23.0 %) used highly toxic pesticides compared to those using less toxic methods (Zhou and Jin 2009). Almost all of the farmers (91.7 %) farmed plots of land less than 1 ha. Those using highly toxic pesticides were older and less educated farmers. In addition, those who were not specialized in any vegetable crop and those who tended to have higher rates of self-consumption were more likely to use highly toxic pesticides. Over 60 % (62 %) of farmers who did not apply highly toxic chemicals were members of an agricultural cooperative, compared to the 37 % cooperative membership rate of those that did. Farmers who were not using toxic chemicals were more likely to sell their produce in wholesale markets or to agricultural processing firms instead of directly to handlers. Both the wholesale markets and processing firms are more likely to test for pesticides. The results suggest that basic knowledge about pesticide use and market orientation is

an important factor in the choice of methods at the farm level. In addition, better training and market organization (cooperative membership) are shown to support safer practices. Also, buyer testing of products was associated with safer production practices.

A survey of vegetable processing firms in Zhejiang Province was conducted at about the same time (2006–2007) (Zhou and Yue 2010; Zhou et al. 2011a). About 130 firms were ultimately used in the analyses. Pollution-free certification of products, and following ISO 9000 standards in processing—both voluntary practices—were the most common certifications. Among the processing firms, 47 % indicated they followed ISO 9000 standards (voluntary); about a third (35 %) used a HACCP system to control food safety risks (mandatory for frozen vegetables and voluntary for other products); and 36 % used quality control (QC) standards (mandatory for several categories of processing products) to assure quality and tests on food safety (Zhou et al. 2011a).

Zhou and Yue (2010) found that most firms adopt food safety and quality controls in order to improve product reputation and popularity (76.5 % of firms). Also, firms made investments in food safety and quality controls in order to enhance brand image and reputation and gain market access. However, for many of the firms, meeting government regulations provided the main incentive. In contrast, firms that sold into export markets were more likely to face requirements for production and processing records, and certification of the origin of the product; and also faced requirements for inspection of the production environment. Overall, only 28 % of the surveyed firms had product recall systems in place. Some of the other firms had staff in place to help in handling product traceability. The formal recall systems were more common among urban and export-oriented firms. Firms indicated that they were most confident in raw-materials traceability when they sourced from a firm or cooperative, and least confident when sourcing raw-materials from individual farmers or from pooled raw-materials markets (spot markets or common procurement). Verification of the production environment and monitoring would be required for pollution-free or green certification.

Lack of timely delivery of product, inconsistent raw material quality, and low technical skills all limited the processing firms' ability to achieve control of product quality and safety. Firms identified out-of-date control technologies and lack of ability to take advantage of economies of scale as the major obstacles to achieving higher levels of product or management system certifications (e.g., HACCP). Firms targeting export markets were the larger-scale firms—firms able to gain from economies of scale in food quality and safety control.

Wholesale markets are a key link in the distribution of vegetables for the domestic market, and provide a good example of the difficulties of implementing controls for vegetable quality and safety through traceability systems. A recent study in cities in Zhejiang Province in 2009 highlights difficulties in incorporating traceability in the distribution channel at this key exchange point, and the need for coordination between the markets and government in managing the risks (Zhou et al. 2011b). Traceability is assured with information obtained as vegetables enter or leave the market. However, by this measure, the survey found that in the

city markets, only about one-third of the product is traceable (forward and backward). The markets suffer from structural and coordination issues. Regulatory authority is not well coordinated between public and private market management. Because of competitive pressures and lack of customer demand for tighter control, there is a relatively low level of compliance on quality and safety controls. The markets themselves do not generally enforce a registration system for admission to the market or registry for products leaving the market; do not regularly conduct product sampling of suppliers; and are lax in enforcement mechanisms for out-of-compliance sellers. However, more frequent government inspection was associated with suppliers implementing traceability systems.

Despite recent efforts to improve training of upstream producers in the areas of accountability and product safety management, these efforts have not been successful in helping suppliers understand the need for traceability and the need for quality and safety assurance. The lack of customer interest and awareness about food quality and safety traceability systems also limits incentives for maintaining tighter control of the distribution system. Incentives for suppliers implementing traceability systems were greatest for large-scale suppliers, who are likely to be able to achieve the economies of scale in implementation of the capital and data investment required, as well to see the longer term benefits of better management.

In efforts of shared responsibility for food safety control, the government of Zhejiang province has worked to support food safety-related infrastructure for agricultural and food firms. This includes the construction of a distribution traceability system to cover hog procurement and processing (including district markets), 3 wholesale markets, 30 fresh and chilled meat wholesaler, over 150 wet markets, 1,380 meat retailers, 50 supermarkets and nearly 2,000 restaurants and food service companies. The traceability system is designed to ensure effective transmission of information flow along whole supply chain and establish responsibility for food safety failures along the traceability system.

In further efforts, in 2012 Zhejiang province established an office of agricultural product quality and safety to supervise the product certifications. Under this supervision, 11 cities in Zhejiang province set up Green Food Offices for inspection and regulation of pollution-free and green products. These efforts were designed to provide more efficient certification for the private sector, including retail firms, processors, distributors and large farmers.

Other public and private support has come in the form of subsidies and support to the private sector for assistance in meeting standards, worker training, constructing demonstration sites and related social services to meet the agricultural and market standards. In addition to the special fund from the central government, Hangzhou city has provided nearly 50 million RMB ($8.23 million) to support the efforts for establishing the meat and vegetable traceability system, and additional resources to encourage private enterprises, firms and farmer's cooperatives to produce products certified as green food products (Farm Administration Bureau and Agricultural Quality and Safety Center of Zhejiang Province 2013).

9.7 Challenges Ahead and Recommendations

The food safety challenges that China faces today in both export and domestic markets reflect the need to improve technical standards throughout the food supply system. Although costs of production may seem to be low, the additional costs of assuring safe products and compliance for meeting international SPS and quality requirements are likely to be high. Evidence from the vegetables and vegetable processing sector illustrate the challenges in developing a coordinated food quality and safety system and the advantages that the larger scale firms and integrated supply chains hold in competing in high quality markets. Improving technical standards at each stage throughout the supply chain, and integrating the entire process will require attention to demonstrations, training, and consultative services, as well as investment in infrastructure, testing, and systems for tracking ingredients and products. Priority needs to be given to changes that limit market access to producers of quality and safe products through inspection of food products and non-food raw materials and documentation of additives used in food production. In addition, developing a legal and regulatory system to address food safety risks and clarify the laws, administrative regulations and rules, local regulations, and normative documents that delineate the responsibilities and purview of the associated regulatory bodies and private firms in meeting food safety objectives would help to address the challenges of China's relatively disperse food control system. Establishing and comprehensively enforcing such a system in China would provide the foundation to maintaining the quality and food safety in both domestic and export markets.

China is now making efforts to enact and strengthen laws aimed at monitoring high-risk foods through traceability systems, and to establish a recall process for unsafe food. Chinese regulators have built the relevant quality and safety management systems with early warning and rapid response mechanisms ensuring quality and safety for both export and import markets. However, more attention needs to be paid to the food and agricultural product certifications (pollution-free, green, and organic) that establish the quality of production, handling, processing, and distribution in the market. Agricultural firms and enterprises will be the major bodies to adopt or implement the certification systems, and in doing so, realize increased control in the area of food safety. The pollution-free, green, and organic product certifications have achieved important results to date.

China continues to make efforts to improve services and provide support to farms and distribution and transportation channels, and to establish competitive markets for quality agricultural products. Having a modern agricultural standards system constructed in a scientific and unified way, and in compliance with international standards, is especially important for major agricultural and food products.

China's lawmakers will need to encourage local governments and associations to establish local agricultural standards that are reasonably structured and consistent with national industry standards. In doing so, it will be important that the central and local government work together to establish agricultural product testing and inspection systems, including support for HACCP programs. These efforts should

be designed to strengthen quality control on food production through agricultural standardization. This may occur through a two-tiered approach, with increased incentives and monitoring supporting agricultural flagship firms and farmer cooperatives. In this way, the system encourages high-level firms and cooperatives with core competitive power and assigns other resources and regulatory activities to help bridge the gap between the market demands and the scattered and unskilled Chinese farmers.

Recent progress in food safety traceability has been limited by the high cost of establishing a traceability system in China. The high costs make it difficult to incentivize producers like farmers' cooperatives to adopt a voluntary traceability system without sufficient support from government and guidelines from associations. Firms seek quick returns and to maximize profits, which has several important implications.

First, in the process of agricultural modernization, the newly organized producers, such as farmer cooperatives and leadership firms, are in the best position to initiate the extension and demonstration program on methods for tracking back to scattered farmers. Such systems would document production, record the purchase and use of agricultural inputs, and provide quality tests for purchased agricultural products. The systems would require product barcodes, QR codes, product labels, and standardize recording at all stages to strengthen the monitoring of food safety. Such systems encourage producers to manage in a unified manner and provide uniform service to farmers, and can establish confidence in supply networks and achieve access to downstream markets. The challenge for this process is developing ways to coordinate the many small-scale producers and handlers in such a system. Agricultural cooperatives are likely to play an important role in achieving the scale needed for implementing the quality and safety control systems.

Second, industry support to policies that links modern farming methods with vertical integration operation of processors can allow achieving economies of scale required for food quality and safety traceability. The costs for establishing traceability systems could be shared with support from the local government via research and development (R&D) investment, financial subsidies, and technical consulting services.

Third, it will be necessary to strengthen communication and collaboration among governmental departments and better unify management by agencies for food safety under a single control. A unified agency function can better monitor incoming trade to the agricultural wholesale markets, and standardize common testing, certification, and other documents designed to safeguard food safety.

In these efforts, it will be important for the relevant agricultural regulatory bodies and industry associations to strengthen and promote the knowledge of quality and safety traceability in production, distribution, and consumption, and to actively participate in implementation of a traceability system throughout the food system. Increasing information about food safety traceability among the public will increase consumer awareness and encourage consumers to request certificates or invoices that document the food source. Such interest may translate into increased willingness to pay and willingness to purchase products with

traceability attributes, and thus encourage the traceability system implementation in China's agricultural product supply chain.

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The Impact of Private Food Standards on Trade and Development: Evidence from Peru

10

Monica Schuster and Miet Maertens

Abstract

Private food standards are increasingly governing international agricultural trade and thereby affect developing countries. With this chapter we contribute to two ongoing debates on this issue for which the empirical evidence is still mixed. The first is on the trade effects, and whether standards act as barriers or catalysts for developing countries' export. The second one is on the welfare effects, and whether standards have an excluding or including effect on small-scale farmers in export supply chains. We address both the trade effects for firms and welfare effects for small-scale farmers in the Peruvian asparagus export sector, using company-level data for the period 1993–2011. While we find no evidence for a trade-enhancing effect of certification to private standards, we document that adoption of standards leads to more vertical integration and significantly reduces the share of produce that is sourced from external producers, with a larger effect for small-scale producers.

Keywords

Private standards • Global supply chains • Export performance • Inclusive supply chains • Horticulture • Peru

10.1 Introduction

Standards are increasingly governing international food production and trade. While public standards, set by public authorities, mainly focus on food quality and safety issues, private standards, set by private companies and non-state actors

M. Schuster (✉) • M. Maertens
Division of Bioeconomics, Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium
e-mail: monica.schuster@ees.kuleuven.be; miet.maertens@kuleuven.be

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often add other aspects such as ethical or environmental concerns. Private standards started to emerge at the end of the 1990s, mainly in response to consumer concerns in high-income countries about food safety and quality. The spread of private standards has been intensively documented in the literature (e.g. Henson and Reardon 2005; Humphrey 2008; Jaffee 2003). Due to the expansion of agricultural trade between industrialized and developing countries, private standards have quickly become a global phenomenon, influencing developing countries' markets and producers (Jaffee and Masakure 2005; Reardon et al. 2001; Unnevehr 2000). Understanding the impact of private food standards on developing countries is imperative, as agricultural and food exports are a fundamental component of developing countries' growth and entail the potential to reduce rural poverty (Jaud and Kukenova 2011).

There are two main issues in understanding how developing countries are affected by the spread of private food standards. First, there is a debate on whether food standards act as non-tariff barriers to trade or as catalysts to trade for developing countries (Jaffee and Henson 2004; Maertens and Swinnen 2007). On the one hand, compliance with standards requires one-time investments, e.g. to update facilities, and recurrent fixed costs, e.g. for certification procedures (Maskus et al. 2005). For exporters and farmers in developing countries these costs may be high relative to their operational size and financial means. By increasing the cost of trade, standards may act as barriers to trade and especially limit exports from developing countries. On the other hand, standards can solve information asymmetries between trading partners and reduce transaction costs, and act as catalysts to trade (Jaffee and Masakure 2005; Hudson and Jones 2003). This might be true especially for exports from developing to industrialized countries, as this is where information asymmetries are largest. The empirical evidence on this issue is still weak. A number of studies use gravity models to analyze the trade effects of standards and find that standards limit trade (see Honda et al. (2014) for a review of these studies). Such studies are very informative to capture country level effects but fail to detect microeconomic outcomes. Other studies use cross-sectional firm-level analyses—often combining data from different sectors and countries—and find that standards improve firms' export performance (e.g. Chen et al. 2006; Maskus et al. 2005; Henson et al. 2011). While such cross-sectional studies point to important differences between complying and non-complying companies, they fail to capture dynamic effects and to control for country, sector and company heterogeneity. Especially in the analysis of private standards this might be problematic because not all companies adhere to the standards and the decision to do so might depend on unobserved heterogeneity and past export performance, which might lead to an overestimation of the trade impact of private standards from cross-sectional data. In this debate on the trade effects of standards, there is a need for more and more convincing micro-economic evidence.

Second, a major concern is that private standards engender an unequal distribution of the gains from trade because they lead to the exclusion of the poorest farmers, who are unable to comply with stringent requirements due to a lack of technical and financial capacity (Graffham et al. 2009; Maertens and Swinnen

2007; Reardon et al. 2001; Swinnen and Vandeplas 2011; Vandemoortele et al. 2012). Several studies have documented that with increasing standards, a decreasing share of export produce is sourced from small farmers. For example, Maertens and Swinnen (2009) document a recent shift from smallholder contract farming to vertically integrated farming on large-scale plantations in the vegetable export sector in Senegal and attribute this shift to the increased importance of standards. Gibbon (2003) observes that increased exports of fresh produce from developing countries are generally accompanied by a decline in the proportion of this produce accounted for by smaller-scale producers. On the other hand, a recent study on African exporters by Henson et al. (2013) points to a complementary rather than a competitive relationship between company own-farm production and sourcing from smallholder farmers. Maertens et al. (2012) provide a review of the literature on smallholder inclusion/exclusion in high-standards horticultural export chains in Africa. They conclude that the evidence is mixed, and that in some sectors and countries standards have led to increased exclusion of smallholder farms while in other sectors and countries high-standards exports are largely realized by smallholder farmers.

In this chapter we contribute to both debates and report research results on the trade and development implications of the spread of private standards in the Peruvian fresh asparagus export sector. First, we describe the evolution of asparagus exports in Peru (Sect. 10.2) and the spread of private standards in the sector (Sect. 10.3). Second, we look at how certification to private standards affects firms' export performance, measured as individual firms' yearly export volumes and values (Sect. 10.4). Third, we investigate the impact of certification to private standards on the strategy of export companies to source from external producers and small-scale farmers[1] or to integrate vertically (Sect. 10.5). We rely on a micro-economic firm level analysis and on results from econometric estimations, described in Schuster and Maertens (2013a–c). Due to the size of the industry with around 100 firms actively exporting each year, its long history, the availability of firm longitudinal data for the period 1993–2011, as well as the diversity of adopted private standards, the Peruvian asparagus export sector represents a unique case to study the trade and welfare effects of private standards. The availability of panel data for a large set of companies and years allows us to hold country and sector specific aspects constant, to take into account time trends and to correct for unobserved heterogeneity and company self-selection into private standard schemes.

[1] We define small farmers as producers with 10 hectares (ha) of land or less.

10.2 Case-Study Background

10.2.1 Data

We use a unique firm level dataset on Peruvian fresh asparagus exports constructed from secondary sources and own original data collection. Secondary data include transaction-level custom data and tax administration data on 567 asparagus export firms for the period 1993–2011. Primary data include survey data from a stratified random sample of 94 export firms. This includes recall information on certification to private food standards, production and processing procedures, management structure, ownership, etc. The sample includes both firms that are operative in 2011, the survey year, as well as firms that ceased operations by then, which ensures its representativeness not only for the current situation but for the whole period. In subsequent analysis we use a total number of 87 export firms, which are regularly exporting[2] and for which we have complete information on certification behavior and other firm characteristics over 18 years. This represents 66.5 % of the overall fresh asparagus export volume during that period. The dataset is described in more detail in Schuster and Maertens (2013a, b).

10.2.2 The Asparagus Export Sector

Peru is the largest exporter of fresh asparagus worldwide. The sector currently accounts for about 25 % of the country's total agricultural exports. More than 220,000 tons of asparagus are produced yearly. Production zones range from 400 km south to 800 km north of Lima along the desert coast (Fig. 10.1). There is no domestic market for asparagus and 99 % of the whole production is exported, of which 70 % as fresh produce (SUNAT, custom data 2011). The main destination markets for fresh asparagus exports are the US (United States) and the EU (European Union).

Figure 10.2 shows the evolution of the total exported volume and value (Fig. 10.2a), and the number of firms exporting each year (Fig. 10.2b). Asparagus exports increased tremendously in the period 1993–2011, from 4,590 metric tons (mt) and US$6,413,000 in 1993 to 134,992 mt and US$286,534,000 in 2011 (Fig. 10.2a). Export growth was steady during the 1990s, accelerated in the late 1990s, and slowed down again from 2009 onwards. The accelerated growth in the late 1990s might be due to the introduction of several new neo-liberal land policies and laws promoting private investment in agriculture at the end of the 1990s and year 2000 (Shimizu 2006; Diaz 2007). The growth slowdown in 2009 is likely

[2] We exclude firms with less than five shipments over the entire period, declaring to only extraordinary export fresh asparagus or which only shipped export trial.

Fig. 10.1 Asparagus production areas in Peru, by type of exports. *Source*: "Instituto Peruano de Esparrago y Hortalizas" (IPEH), adapted by authors

related to increasing USD/Peruvian Nuevo Sol exchange rate fluctuations[3] and to overall international demand shocks, e.g., the global economic crisis that badly hit all Peruvian exports. The number of firms exporting each year show a similar trend (Fig. 10.2b). The number has tripled from around 40 firms at the end of the 1990s to almost 120 firms in 2006, and stabilized at around 100 active export firms each year since 2006. Given a total number of 567 firms that ever exported fresh asparagus since 1993, these figures point to an absence of consolidation and a large transition in and out of exporting.[4]

[3] The USD was historically weak as compared to the Peruvian Nuevo Sol at the end of the year 2007/beginning of 2008.

[4] This is in line with observations from other studies, e.g., Freund and Pierola (2010), Eaton et al. (2008).

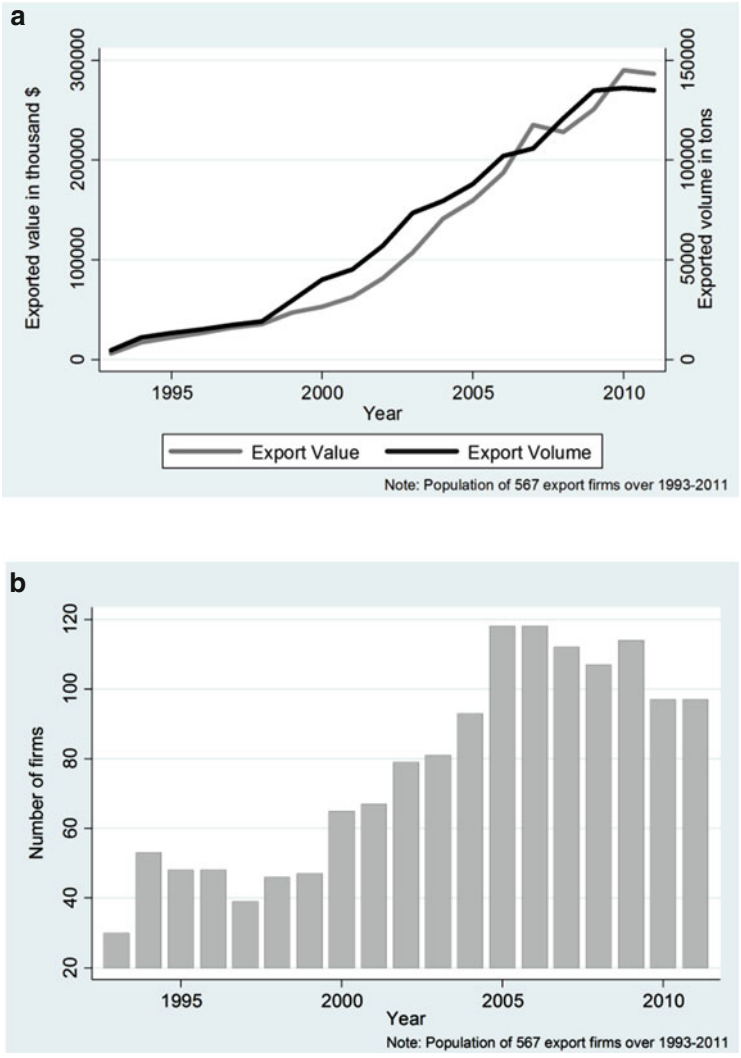


Fig. 10.2 Evolution of fresh asparagus export volumes (tons) and values (thousand US$) and of the number of export firms, 1993–2011. (**a**) Export volumes and values. (**b**) Number of export firms. *Source:* Author's calculation based on SUNAT Custom data, Peru

10.3 Certification to Private Standards

Private standards started to gain importance in the fresh asparagus export sector in the year 2000 and certification to these standards has spread rapidly in the sector from then onwards. Figure 10.3 describes, for our sample, the evolution of export volumes and values for certified and non-certified firms (Fig. 10.3a) and the

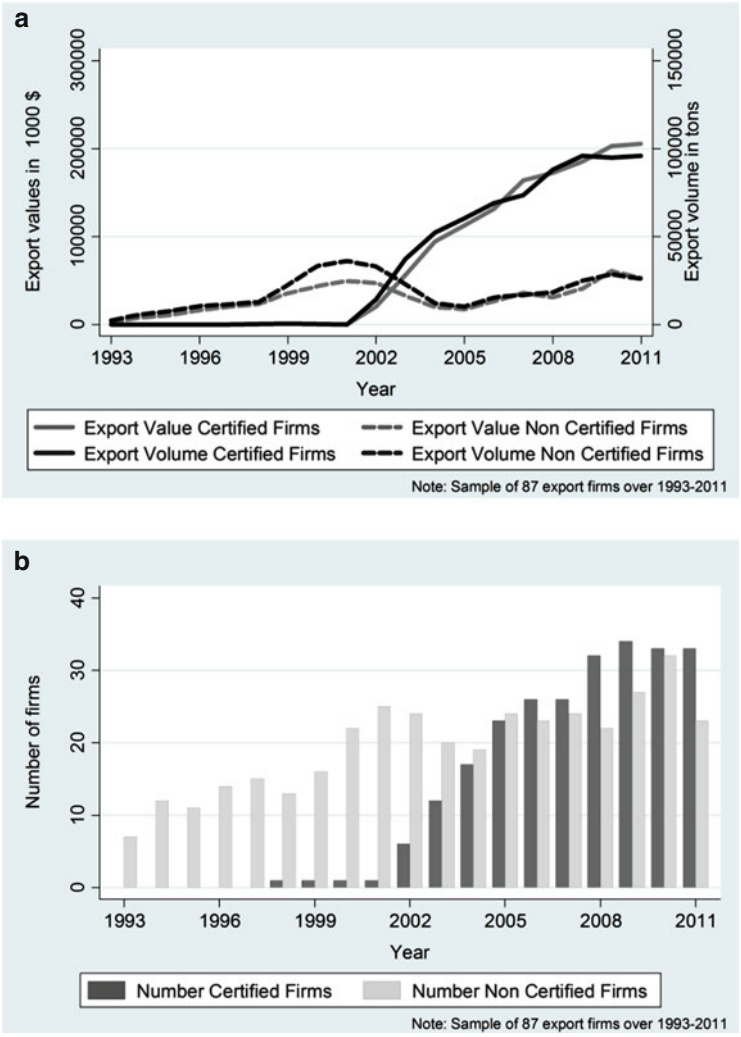


Fig. 10.3 Evolution of certified and non-certified fresh asparagus export volumes (tons) and values (thousand US$) and of the number of certified and non-certified export firms, 1993–2011. (**a**) Certified and non-certified export volumes and values. (**b**) Number of certified and non-certified export firms. *Source:* Author's calculation based on SUNAT Custom data, Peru

evolution of the number of certified and non-certified firms (Fig. 10.3b). The spread of certification was most rapid in the early years 2000. Until 2001 only one firm was certified. The number of certified firms surpassed the number of non-certified firms by 2006 but remained stable from the year 2007/2008 onwards. Similarly, also the certified export volume and value increased rapidly from 2000 onwards. Almost no produce was certified until the year 2000 but by 2003 the export volume of certified firms already exceeded that of non-certified firms. The volume of non-certified

asparagus decreased sharply between 2000 and 2005, but increased slightly again after 2005.

In 2011, 37 % of the export companies are certified to one or several private standards and the average number of certificates held by certified companies is 2.5 (Schuster and Maertens 2013c). This indicates that there is a divide between the type of exporters, with some investing in multiple types of certifications and others not seeking certification at all. Table 10.1 reports the type of private standards that are present in the Peruvian asparagus export sector. GlobalGAP is the most important private standard in the sector, with slightly more than one-third of the

Table 10.1 The type of prevalent private standards

Certification type	Full name	Type of standard, according to firms' statements	Further reference	Percentage of certified firms in 2011 (N = 56)
Global Gap	Global Good Agricultural Practice	Production, high-level	www.globalgap.org	34.6
HACCP	Hazard Analysis and Critical Control Point	Processing, low-level	www.haccpalliance.org/	14.1
BRC	British Retail Consortium	Processing, high-level	www.brc.org.uk	15.4
BASC	Business Alliance for Secure Commerce	Other type	www.wbasco.org/	15.2
GMP	Good Manufacturing Practices	Processing, low-level	www.gmp.com.pe/	7.5
SQF2000	Safe Quality Food Institute 2000	Production, low-level	www.sqfi.com/	7.7
SQF1000	Safe Quality Food Institute 1000	Processing, low-level	www.sqfi.com/	1.1
TESCO	Tesco Nurture (Supermarket standard)	Production, high-level	www.tesco.com/nurture/	6.4
LEAF	Linking Environment and Farming	Production, high-level	www.leafuk.org/	4.3
GAP	Good Agricultural Practice	Production, low-level	www.ipeh.org/	2.1
IFS	International Food Standard	Processing, high-level	www.ifs-certification.com	2.4

Source: Author's calculation based on survey data

export firms being GlobalGAP certified by 2011. Other important private standards, for which about 15 % of the firms are certified, include HACCP, BRC and BASC. Other standards, such as TESCO, LEAF, IFS, GMP, SQF2000 and SQF1000, are taken up by less than 10 % of firms. The existing literature on standards (e.g., Codron et al. 2005; Henson and Humphrey 2010) categorizes private standards according to the vertical scope or the extension along the value chain and subdivides the prevalent standards into pre-farm gate or production standards and post-farm gate or processing standards, as well as into low and high level standards. Low-level standards are designed to establish superior attributes and differentiate products, while the high-level standards are not designed to establish the uniqueness of particular products but aimed at meeting required minimum levels of performance.

We slightly adapt the existing classification to better fit the standards landscape and classify low- and high-level standards according to the stringency of the requirements, as stated by the surveyed companies. As summarized in Table 10.1, export companies perceive GAP, SQF, HACCP and GMP as low-level standards because they entail lower requirements and demand less company investments. Global Gap, TESCO, LEAF, BRC and IFS are perceived as high-level standards due to the larger time, physical, as well as human capital (e.g., training) investments they need. BASC certification, mainly required by the US, is classified as a separate standard, due to its intrinsic aim of promoting safe international trade and protecting from bioterrorism and drug trafficking.

Table 10.2 summarizes the reasons for companies to seek certification to one or several of the above mentioned standards, as reported by certified companies themselves. Half of all certified firms in 2011, indicate that they are responding to an external demand coming from the overall asparagus export market (mentioned by 47.6 % of all firms), from the European import market (8.3 %) or from specific buyers (45 %). 13.7 % of all firms also feel that certification to standards represents their only possibility to remain in the export market, while 15.7 % define themselves as trend-setters in the sector and to voluntarily seek certification as part of their firm's innovation strategy. A smaller percentage of all firms feels that

Table 10.2 Reasons for certified export firms to seek certification (N = 56)

Reasons for certification	Percentage of firms mentioning this reason[a]
Overall market requirement	47.6
Buyers' requirement	45.0
Trend-setters in sector	15.7
Only alternative to stay in the market	13.7
European market asks for it	8.3
Adds value to company	5
Grants quality	1.3
Opportunity to improve own internal operations	1.3

Source: Author's calculation based on survey data
[a]Multiple answers per firm are possible

certification to standards are necessary to add value to their company, improve their own internal operations and guarantee standardized production quality.

In Table 10.3 we compare the characteristics of firms that are certified to one or several standards with those of non-certified firms. Out of all firms, 53.4 % own agricultural land and 49 % own a processing plant, but certified firms are more likely to own both agricultural land (96.4 %) and a processing plant (84.6 %) than non-certified firms (32 % and 28.2 % respectively). The average landholdings are substantially larger for certified firms (52.9 ha) than for non-certified firms (3.6 ha). On average in 2011, asparagus export firms existed for more than 8 years and had almost 7 years of export experience. Certified firms are older (~13 years) and have more years of export experience (~10 years) than non-certified firms (~5 and 4 years), which could indicate that there is less entry and exit among certified firms. Indeed, 59.3 % of the currently certified firms are pioneers who were already in the market before 2003 while this is barely 5 % for non-certified firms. 40.1 % of all firms rely on foreign capital; this is slightly larger among certified firms (44.3 %)

Table 10.3 Characteristics of certified and non-certified firms

Firm characteristics	All firms, exporting in 2011 (N = 56)	Certified firms, exporting in 2011 (N = 34)	Non certified firms, exporting in 2011 (N = 22)
Asparagus land ownership	53.4 %	96.4 %	32.0 %
Hectares of owned asparagus land	20.2 ha	52.9 ha	3.6 ha
Processing plant ownership	48.6 %	84.6 %	28.2 %
Years since foundation of firm	8 years[a]	13.1 years	5 years
Years actively exporting	6.6 years[a]	10.5 years	3.6 years
Pioneer in sector—in the market before 2003[a]	24.4 %	59.3 %	5.1 %
Owned by foreign capital	40.1 %	44.3 %	38.1 %
Exporting green, instead of white, asparagus	94.5 %	86.31 %	99 %
Production departments			
Ancash	2.1 %	5.7 %	0.0
Ica	58.8 %	64.1 %	55.6 %
La Libertad	30.1 %	24.6 %	32.9 %
Lima	8.0 %	2.8 %	11.5 %
Lambayeque	1 %	2.8 %	0.0

Source: Author's calculation based on survey data

[a]Data from entire population of 96 export firms in 2011, instead of export sample of 56 firms

than among non-certified firms (38.1 %). The large majority of all firms grows green asparagus (94.5 % of all firms) and the cultivation of white asparagus is concentrated in the hands of few large, mostly certified, export companies in northern Peru. The location of certified and non-certified firms differs slightly, with certified firms being concentrated in the department of Ica (see Fig. 10.1).

The variation in certification is likely partially due to the diverging expectations that firms have of certification (Table 10.4). On the one hand, almost 70 % of all firms in our sample, independently of their own certification status, have at least one positive expectation about certification. Even though the improvement of the firms' internal organization was mentioned only by a few firms as a reason for certification (Table 10.2), one fourth of all companies expect to improve their internal management and efficiency with the adoption of private standards. Another 23.7 % expects to get access to more and larger markets, while 8.9 % and 6.4 % awaits to respectively improve the quality and the traceability of the produced goods. 5 % of all firms explicitly mention that they do not feel that private standards represent a

Table 10.4 Expectations of firms about the benefits of certification (N = 87)

Expectations of certification	Percentage of firms[a]
Positive expectations	***69.6***
Improves internal organization/efficiency	25.0
Opens up markets	23.7
Improves quality	8.9
Better traceability	6.4
Does not represent a barrier for export, not even for small producers	5
Improves profitability, through different channels	3.2
Better prices	2.5
Reputational values	2.2
More competitive	1.7
Compliance with legislations/norms	0.7
Negative or no expectations	***60.9***
No price difference	32.1
Does represent a barrier for export, especially for small and medium producers and firms	9.5
Does not see any advantage	8.2
Big additional cost	5.9
Profitable for some markets only and if you have clients that prioritize certification	5.7
Annoying and time consuming, without direct benefits	4.7
Not needed for export	3.4
Need for homologation to decrease costs	2.1
Not profitable, only commercial objective	0.9

Source: Author's calculation based on survey data

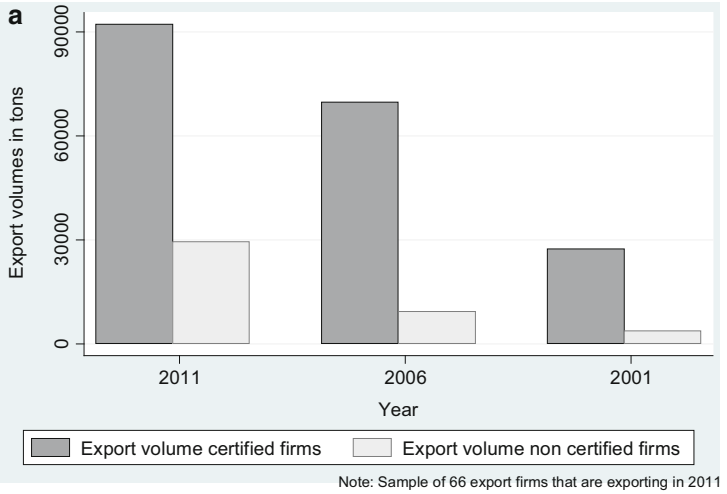
[a]Multiple answers per firm are possible. Values in bold and italics indicate supersets of the below listed expectations

barrier to export and others feel that it improves profitability through several different unspecified channels (3.2 %) or through specific channels such as better prices (2.5 %), reputation (2.2 %), competitive advantages (1.7 %) and the compliance with the national legislation (0.7 %). On the other hand, almost 61 % of all firms indicate that they have no expectations or even negative expectations. By far, the main concern relates to the lacking monetary compensation for certification, which is mentioned by almost one third of all surveyed firms. Another 9.5 % see standards as an export barrier for medium and small firms, while almost 8 % of all firms cannot identify any advantage or declares that compliance to standards is not needed for exporting (3.4 %). Almost 17 % of all firms either criticize the large additional costs, the limited profitability (only in some markets and with some clients) or define standards as time consuming. Finally 2 % of all firms suggest a harmonization of standards in order to bring down investment costs.

10.4 Certification and Export Performance

In this section we look at whether certification to private standards affects firms' export performance, in terms of their export volumes and values. In the previous section we saw that firms' expectations of the effects of certification are ambiguous, and that positive and negative or no expectations almost outweigh each other. Indeed, a large number of Peruvian firms expect enhanced market access through certification, while others expect private standards to be barriers to export and do not expect any benefits on prices.

In Fig. 10.4 we compare the export volumes (Fig. 10.4a) and export values (Fig. 10.4b) of firms that were certified in 2011 and of firms that were not certified in 2011. We look at three representative years: 2001, which is the year in which standards started to emerge in the Peruvian asparagus export sector; 2006, when the share of certified companies reached a peak with almost 50 % of all export companies being certified; and 2011, which is the last year of observation in our dataset. There is a very similar trend for both export volumes and export values, which shows that certified firms perform better in terms of export volume and value, and that exports have increased tremendously over the past decade for both currently certified and non-certified firms. In 2011, the quantity and the value of exports for certified companies is more than three times that of non-certified companies. However, this difference in export performance between currently certified and non-certified firms was already there in 2006 and in 2001, and was relatively larger in those years. This shows that certified firms were initially, before they became certified, already exporting larger volumes and values than firms that did not become certified. Between 2001 and 2011, the average export volume and value of currently certified companies increased with 237 % and 420 % respectively, while for non-certified companies these growth figures are 637 % and 1,237 %. Given that currently certified companies already had larger exports than non-certified companies before they became certified and that non-certified companies have been growing faster, it is difficult to attribute observed differences



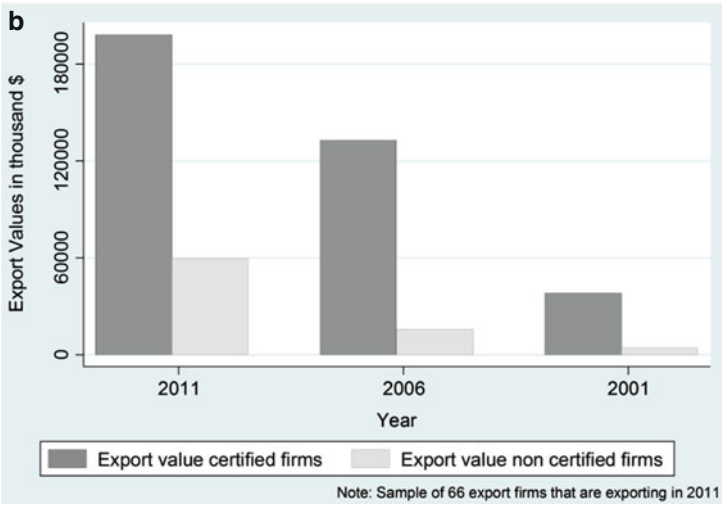


Fig. 10.4 Export performance of firms in 2011, 2006 and 2001—by certification in 2011. (**a**) Average export volumes. (**b**) Average export values. *Source:* Author's calculation based on SUNAT Custom data, Peru

in the export performance between certified and non-certified firms to the impact of certification.

An important question is whether certification to private standards has a causal impact on the export performance of companies or whether the observed differences in export performance between certified and non-certified companies relates to export persistence and underlying firm characteristics. If firms self-select into certification in a non-random way, this question is difficult to answer. Certification may be related to current or past export performance and certified and

non-certified companies may differ in their underlying observable (as seen from Table 10.3) and unobservable characteristics (e.g., innovativeness of the firm, overall working environment, adaptation capacities, etc.) that could determine both the export capacity of a company and the likelihood of certification. Failing to control for these aspects would lead to wrongly attributing differences in export performance to the impact of certification or an overestimation of the trade effects of standards. We addressed this question in a formal econometric way in Schuster and Maertens (2013b), using fixed effects and GMM methods.[5] The richness and large size of our dataset, including detailed information on exports and certification for 87 firms over 18 years, allow us to hold country and sector specific aspects constant, and to control for export persistence and dynamic effects, and for observed as well as unobserved heterogeneity in underlying firm characteristics. Our main result from this analysis is that we do not find any evidence that certification has a significant impact on companies' export performance, neither at the extensive margin—or on the propensity to export—nor at the intensive margin—or on the export volumes and values. When we are not controlling for export persistence and unobserved firm heterogeneity, we find a significant positive effect of certification on the propensity to export and on export volumes and values. As soon as we take time trends and firms' unobservable characteristics into account, the significant effects disappear. We looked at whether this effect differs across standards but find very similar effects for different types of standards (production versus processing standards, and low-level versus high-level standards) and for individual standards. This makes us conclude that certification does not have a causal impact on the export performance of firms. This conclusion challenges the point of view that standards can act as catalyst to trade and contradicts some previous empirical findings.

10.5 Certification and Sourcing Strategies

In this section we look at the relationship between certification and the firms' individual sourcing strategy. From Table 10.4 in the previous section, we know that 9.45 % of all export firms in Peru feel that the spread of standards represent a threat to small firms and producers, while another 4.98 % feels that this concern is not justified and food standard certification does not necessarily lead to the exclusion of smaller producers and firms.

In Fig. 10.5 we compare, for the three representative years 2001, 2006 and 2011, the average share of exported produce that is sourced from external producers (Fig. 10.5a) and from small producers (Fig. 10.5b) for firms that were certified in 2011 and non-certified firms. We notice that there is a large difference between currently certified and non-certified firms and that the share of produce sourced

[5] GMM stands for "Generalized Method of Moments". The econometric techniques are described in more detail in Schuster and Maertens (2013b).

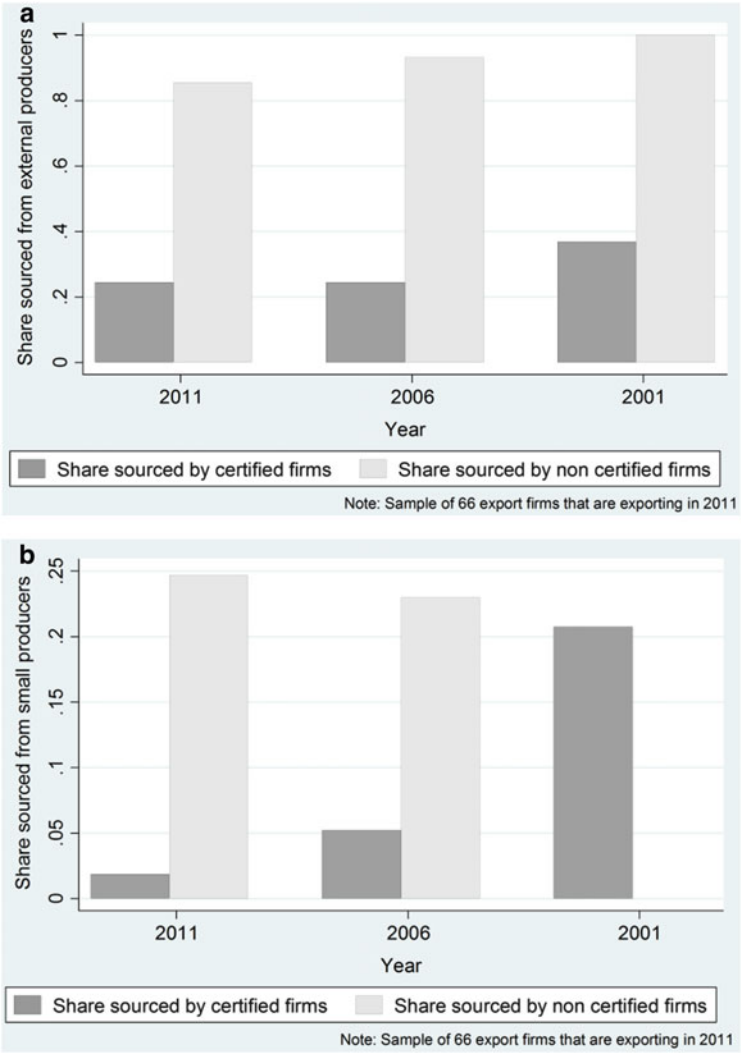


Fig. 10.5 Average share sourced from external and small producers—by certification in 2011. (**a**) Share sourced from all external producers. (**b**) Share sourced from small producers. *Source:* Author's calculation based on SUNAT Custom data, Peru

from external producers in general, and from small producers in particular, has decreased over time for both currently certified and non-certified firms. In 2011 certified companies were sourcing on average 24 % of export produce from external producers and relying for 76 % on own vertically integrated production, while non-certified companies sourced on average 83 % of produce from external producers (Fig. 10.5a). Already in 2006 and also in 2001, when firms were not certified yet, currently certified firms sourced on average smaller shares from

external produces than non-certified firms. Yet, the relative gap between currently certified and non-certified firms in terms of external sourcing, increased over time. When looking at sourcing from small producers (Fig. 10.5b) the difference between certified and non-certified firms is more pronounced. In 2011 only 1.5 % of export produce of certified firms came from small producers, while this was around 20 % in 2001. For non-certified firms the trend is reversed: while they did not source at all from small producers in 2001,[6] this increased to 25 % in 2011.

In Fig. 10.6 we compare, for the three representative years 2001, 2006 and 2011, the average share of exported produce that is sourced from external producers for firms that were in 2011 certified to production standards and firms not certified to production standards (Fig. 10.6a), and for firms that were in 2011 certified to processing standards and firms not certified to processing standards (Fig. 10.6b). For both firms currently certified to production standards and for firms currently certified to processing standards, the share of produce sourced from external producers decreased over time. But the relative decrease of sourcing from external producers is slightly smaller for firms that are certified to processing standards as compared to firms that are certified to production standards (48 % and 58 % respectively). The sourcing behavior of firms that are currently not certified to production standards also differs from those firms not certified to processing standards. While the share of produce sourced from external producers decreased for firms currently not certified to production standards, there is an increase in external sourcing for firms not certified to processing standards.

The above tables and figures show that, since the year 2001 and the raise of private standards in Peru, there have been important time trends, not only in the nature of export companies, but also in their sourcing strategies. An important question again is whether the observed difference in sourcing behavior between certified and non-certified companies can be attributed to the causal effect of certification to private standards. As firms likely self-select into certification in a non-random way, underlying observed and unobserved firm characteristics may influence both the decision to become certified and the decision to source from external and small producers. We addressed this question in a formal econometric way in Schuster and Maertens (2013c) using GLM, fixed effects and GMM methods[7] to deal with endogeneity and simultaneity issues. The main result from this analysis is that certification to private standards changes companies sourcing behavior, and significantly reduces the share of produce they source from external suppliers in general and from small-scale suppliers in particular. The negative effects of certification on small-scale sourcing are almost twice the magnitude than for all types of producers. When analyzing the impact of certification to

[6] In 2001 the share of product sourced from small producers by firms that are not certified in 2011 is zero, as all export firms that were sourcing from small producers in 2001 and are exporting in both 2001 and 2011 are certified in 2011.

[7] GLM stands for "Generalized Linear Model". The econometric techniques are described in more detail in Schuster and Maertens (2013b).

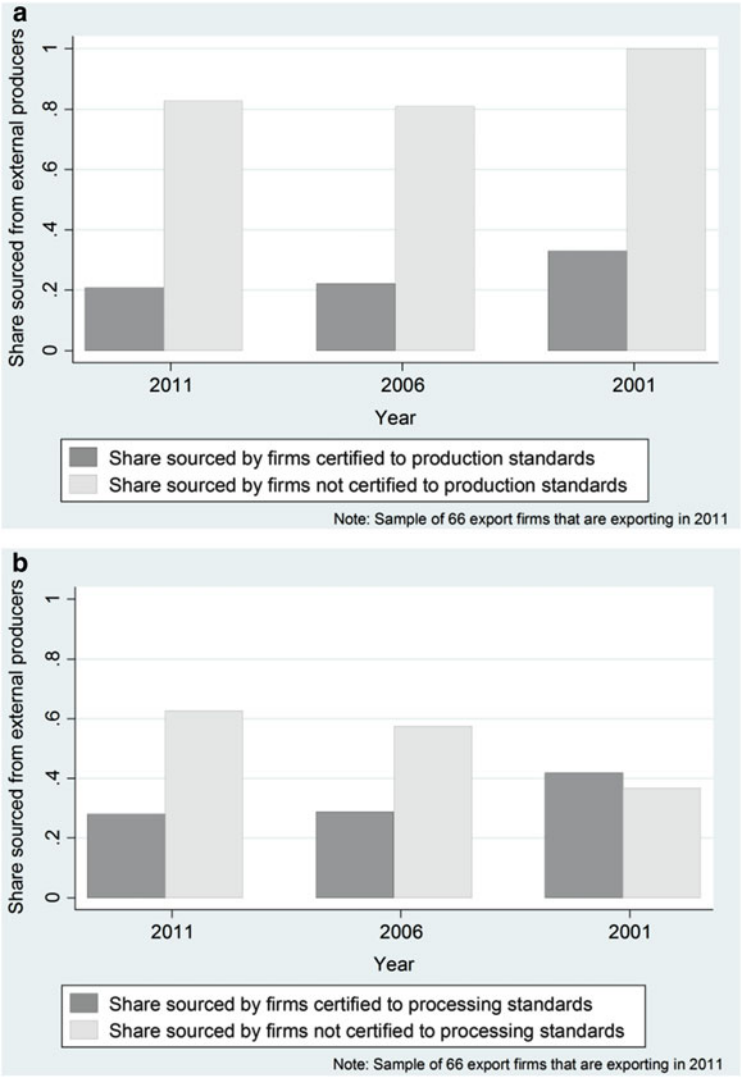


Fig. 10.6 Average share sourced from external producers—by type of certification in 2011. (**a**) Share sourced, by production certification. (**b**) Share sourced, by processing certification. *Source:* Author's calculation based on SUNAT Custom data, Peru

different types of private standards, we find that the negative effect of certification on external sourcing only holds for production standards and not for processing standards. In particular, certification to production standards has a significant negative effect on external sourcing and on sourcing from small producers, while certification to processing standards has a positive effect on external sourcing and a negative effect on small-scale sourcing.

Our results are in line with the existing descriptive and qualitative evidence in the literature, that with increasing standards, a decreasing share of export products is sourced from small farmers (e.g. Gibbon 2003; Maertens and Swinnen 2009). It is likely that the small, informal and scattered nature of small producers makes supervision by export companies even more complex and costly, which explains the larger negative effect of certification on sourcing from small-scale farmers. The heterogeneous effects of different types of standards can be explained by the nature of certification schemes. Production standards impose restrictions on the pre-farm gate treatment of a product and thus on the cultivation and harvesting procedures which are typically managed by producers themselves. The origin of a raw product and the control over the production stage therefore matters in this case, which explains the negative effect on external sourcing. Companies reduce their external sourcing to more easily control the compliance with the quality and traceability requirements of the production standards. Processing standards impose restrictions on product handling, but do not interfere with the origin of the raw product. In order to amortize the costs related to the certification process, firms need large volumes and reliable supply of raw produce and might therefore increase sourcing from external producers. As compared to sourcing from medium and large producers, sourcing from small producers only provides limited volumes in more informal business relationships, which is likely less cost effective for creating a guaranteed supply; it is therefore not affected by processing standards.

10.6 Conclusion and Policy Implications

This chapter documents how private food standard can affect developing country export sectors. We have analyzed how certification to private standards affects the export performance and the sourcing strategies of asparagus export companies in Peru. This analysis entails important conclusions. First, we do not find evidence that certification to private standards has an effect on firms' export performance, neither at the extensive margin nor at the intensive margin, and neither on export volumes nor on export values. This contradicts earlier empirical findings on the trade effect of private food standards and does not support the view that standards could act as catalysts to trade. We believe that these contradicting findings are related to methodological issues. By focusing on one country and one export sector, and due to the availability of panel data for a large number of firms in many years, we are able to control for export persistency and for self-selection of companies into certification.

Second, our results show that private standards lead to increased vertical integration and reduce the share of produce that export companies source from external and small-scale producers. We believe that this is an important finding. While many studies have described a tendency towards increased vertical integration and exclusion of smallholders from export chains, little quantitative evidence is available on the causal impact of private standards on the structure of export supply chains. While most studies looked at the issue of exclusive supply chains from the

perspective of family farmers, we looked at the issue from the perspective of export companies. This perspective brings some important nuances in the debate. A first nuance is in relative versus absolute numbers. In the Peruvian asparagus export sector, the relative importance of smallholder suppliers has decreased over time (which can be attributed to the impact of private standards) but in absolute terms the export volumes sourced from smallholder suppliers has continued to increase. A second nuance is in the form of vertical integration that private standards induce. This could be forward or downstream vertical integration by exporters into primary production but could also be backward or upstream vertical integration by farmers into export activities. We have only analyzed the sourcing behavior of companies after they started involving in export activities and find evidence of backward integration.

We recognize that our case-study approach has limitations and that our findings do not necessarily hold in other cases. We need to be careful with generalizing results. The availability of land in arid coastal areas in Peru, public investment in large irrigation schemes, favorable tax regimes for export companies and favorable labor laws for agro-export companies might be important factors in the trend towards increased vertical integration in the asparagus sector. Also, the long history of the asparagus export sector and the fact that Peru already had an important market share for asparagus in the international market before private standards started to emerge and spread, might play a role. Effects of private standards on supply chains and the inclusion of small producers might be different in more recent sectors, such as African horticulture exports that boomed along with the rise in private standards. In addition, Peru is a middle-income country. The effects of private standards might be different in the case of middle-income countries with well-established export sectors than in the case of low-income countries and emerging export sectors. It might well be that export persistence plays a less important role in the latter case, and that private standards do have an impact on the export performance of companies in emerging export sectors. More in depth research on private standards and its trade and development effects in different developing countries and contexts is still needed. Moreover, in this paper we have not looked at standards addressing issues of broader social accountability, which are increasingly being adopted by export firms in developing countries. There is thus room for future research to focus on the emerging role of social-issue standards, especially in terms of labor market or environmental behavior effects.

Based on our results, we cannot support the view that private standards act as a catalyst to trade nor that certification leads to a price premium in the export market. However, our results do support the point of view that private standards result in exclusion of smallholder farmers from export chains. The combination of these two findings has important policy implications. Many NGOs and development agencies invest in supporting developing country exporters to comply with private standards and seek certification. Initiatives such as the *Pesticide Initiative Program* in ACP[8]

[8] ACP stands for "African, Caribbean and Pacific group of states".

countries (Jaud and Cadot 2012) and MCA or BAMEX[9] in Madagascar (Bignebat and Vagneron 2011; Subervie and Vagneron 2013) assist private firms to comply with the requirements of overseas buyers, based on the assumption that this will benefit trade and development in the country. Some studies have indicated that such donor support is necessary for the inclusion of family-type farms in high-standards trade because the adoption of high standards by smallholder farms is only possible through external interventions, e.g. development programs, public-private partnerships or collective action support (e.g. Boselie et al. 2003; Kersting and Wollni 2012; Narrod et al. 2009; Okello et al. 2011). Certain studies measure the impact of development programs that assist developing country exporters and producers to become certified, and point to positive effects on firms' export performance (e.g. Jaud and Cadot 2012). Yet, our results imply that the return to such development programs, especially in middle-income countries and in well-established export sectors, is questionable. If the adoption of private food standard by developing country exporters does not improve their export performance but does result in reduced sourcing from smallholder producers—as we have shown is the case in the Peruvian asparagus export sector—then programs that support certification to private standards will not benefit smallholder producers. Given that development agencies are often concerned specifically with the inclusion of smallholder farmers in export chains, development programs to assist export firms with standards compliance might even defeat those agencies' development goals.

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[9] MCA and BAMEX stand for "Millennium Challenge and "Business and Market Expansion", respectively.

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Food Standards, Smallholder Farmers and Participation in High Value Fresh Export Markets

11

Julius J. Okello

Abstract

The last two decades have witnessed many developing countries diversify exports into non traditional fresh exports (NTFE), especially fresh fruits and vegetable. The diversification has been driven by globalization and changing consumer lifestyle among others. The NTFE are grown mainly by smallholder farmers in developing countries. As the trade with developing countries has expanded, so have been the demands for compliance with very stringent food safety standards. What has been the effect of these standards on smallholder farmer participation in the NTFE value chain? Where in the value chain are smallholder farmers most affected? And how have such farmers adjusted to these effects? This study uses green bean value chains in three African countries to address these questions. It identifies six critical points at which smallholder farmers face the greatest risk of being marginalized by the standards and the strategies used by farmers to respond these threats in order to maintain their participation in the high-end export markets. Of the six critical control points, smallholders farmers are most threatened with exclusion from green bean value chain at the pre-harvest farm-level and collection centre control points. Farmers have had to use two non-market strategies namely, collective action and public-private partnerships to avoid being marginalized at these points of the value chain. These findings imply that the market, if left on its own, could adopt solutions that exclude smallholder farmers from NTFE value chain.

Keywords

Food standards • Critical control points • Farmer exclusion • Collective action • Public-private partnerships • Africa

J.J. Okello (✉)
Department of Agricultural Economics, University of Nairobi, Nairobi, Kenya
e-mail: jjokello@gmail.com

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11.1 Introduction

The commercialization of smallholder agriculture has been a major theme of the debate on strategies that pursue pro-poor growth in developing countries (Kirsten et al. 2013). Past and current development strategies of these countries emphasize the need for smallholder farmers to be integrated into high value markets. Part of this strategy targets the diversification of smallholder agriculture into the better-paying export markets. The markets often targeted in this diversification strategy are the developed-country export markets for the non-traditional high value fresh vegetables (Okello and Swinton 2007). Consequently, the last two decades have witnessed a major shift in developing-country agricultural exports from traditional exports (e.g., coffee, tea, pineapples) to non-traditional fresh exports (e.g., green beans, peas, Asian[1] vegetables, fruits and flowers) (Singh 2002). The trade in non-traditional fresh exports (NTFE) has boomed over the last two decades aided by, among others, i) inexpensive labor in the developing countries, and ii) the highland altitudes that enable the growth of cool season crops year-round, thus making it possible for developing countries to meet year-round demands for produce by major European retailers (Dolan and Humphrey 2000; Okello 2011). In Africa, Zambia, South Africa, Côte d'Ivoire, Morocco, Egypt, Kenya, Ethiopia, Uganda, Madagascar and Zimbabwe have all targeted NTFE, with many achieving rapid growth in the exports of these commodities at one point.

To participate in the non-traditional fresh export markets, farmers and exporters usually are required to meet a number of food quality and safety standards relating to pesticide residues, hygiene and phytosanitary requirements. Indeed, as the number of developing-country suppliers of the NTFE has increased so has been the increase in attention by consumers and governments in Europe on the safety of food grown and exported from developing countries (Narrod et al. 2009). Okello (2011) argue that this heightened attention on food safety and quality has resulted from at least four factors. First, globalization has led to sourcing of fresh produce from countries where systems of food safety control are weak. Second, as incomes have increased, the demand for safe food has also risen with consumers willing to pay more for lower risk of microbial and pesticide contamination, and also contamination with other disease-causing substances. Third, improvements in technology have made it easier to measure contaminants in food and to document their impact on human health. Fourth, international food scares, including Salmonella and Listeria in other products, has made consumers and food industry regulators more aware of the risks associated with food safety problems (Freidberg 2004).

The food safety scandals and the ensuing scares were especially potent in transforming food sector regulations in developed countries. The scandals resulted in major consumer backlash on governments as consumers felt that their governments had not done enough to protect them from the hands of uncaring profit-driven traders/retailers. Jaffee (2003), for instance, indicates that consumer

[1] These include okra, dudhi, chillies and brinjals.

response to the scandals was so intense in some cases that it brought down the government in Belgium. The pressure from consumers led most developed-country governments to revise food safety laws by transferring responsibility for exercising due diligence into the hands of the private traders/retailers (including supermarkets) as a way of protecting consumers and farm-workers.

In Europe, the main destination market for NTFE from Africa, retailers responded to tighter government regulations by developing very stringent food safety protocols[2] that they, in turn, imposed on their developing country suppliers (i.e., exporters and farmers). This effectively made access by developing-country farmers to high value European retail markets (especially the supermarkets) contingent upon compliance with diverse sets of food quality and safety standards. It was no longer sufficient to comply with public regulations alone; the supplier needed to also meet a number of private food safety protocols developed by the retailers and the food industry players in addition to public standards set by individual European governments and the European Commission.

Typically, the production of NTFE—especially fresh export vegetables—in developing countries is dominated by poor smallholder households that either work independently or are aligned to multinational supply chains (Dolan and Humphrey 2000). Majority of these suppliers have small plots of land averaging 0.5 acres and mostly rely on family labor for most of the farm operations (Okello and Swinton 2007). These producers face four distinct problems namely, 1) how to meet the standards needed to produce safe food, 2) how to be recognized as producing safe food, 3) how to be competitive with larger producers that enjoy economies of scale in compliance with food safety requirements, and 4) and how to identify cost-effective technologies for reducing risk (Rich and Narrod 2005).

Studies suggest that developed country food safety standards entail high transaction costs which work against smallholder farmers (Okello and Swinton 2007; Narrod et al. 2009). Other studies have found that compliance with food safety standards can be hindered by the high capital/asset requirements of the standards (Neven and Reardon 2004; Graffham et al. 2009; Asfaw et al. 2010). These past studies suggest that many smallholder farmers might find it difficult to maintain their participation in the NTFE high-value chains (HVC). Indeed Graffham et al. (ibid), in particular, predict continued exit by smallholder farmers due to the screening effect of developed-country food safety standards (DCFSS). This chapter examines: i) the critical food safety control points along the NTFE value chains where produce quality and safety are of utmost concern to the export/buyer, ii) the points along the value chains where farmers are most at risk of being screened out by the standards, and iii) the role collective action and public-private partnership can play in overcoming the exclusionary effect of DCFSS at these critical control points.

[2] The protocols included those outlined in the Tesco supermarket's *Nature's Choice* and Mark and Spencer's *Farm to Folk* standards. The requirements of these standards often exceeded the official (public) regulations (Jaffee 2003).

This chapter focuses on smallholder green bean growers in Kenya, Zambia and Ethiopia that supply European Union (EU) retail supermarkets. Green beans are among the most important fresh vegetables exported from developing countries and are predominantly grown by smallholder farmers in the three countries (Okello and Swinton 2007). The EU is the major importer of fresh vegetables from Africa (Diop and Jaffee 2005).

There are important variations among the three countries studied with regard to the impact of DCFSS on smallholder farmers. Part of this variation can be attributed to their time of entry in the high value export market. Kenya entered the green bean export business way ahead of Zambia and Ethiopia. Jaffee (2003) suggests that Kenya's export of fresh vegetables (including green beans) dates back to 1960s. Kenya therefore started developing some of the institutions that later became useful in complying with DCFSS before the onset of the standards. To the contrary, Zambia and Ethiopia entered NTFE markets when the European food safety standards had taken root and therefore had to invest heavily in both "catching up" with Kenya and at the same time evolving with the standards. Throughout this chapter we adopt Kimenye's (1993) and Okello and Swinton's (2010) definition of smallholder farmers as those having up to 2 acres in Ethiopia and Kenya and up to 5 acres in Zambia.

The rest of this chapter is organized as follows: Sect. 11.2 lays out the conceptual and empirical foundations of the study. In Sect. 11.3 we present the changes that smallholder farmers had to make to meet the DCFSS and the initial impact it had on farmers. Section 11.4 highlights the food safety standards African countries are subject to and identifies the critical control points. In Sect. 11.5, we discuss how farmers used collective action and PPP to change avoid being marginalized by the standards and finally, Sect. 11.6 concludes and discusses the policy implications.

11.2 Conceptual and Empirical Methods

11.2.1 Conceptual Framework

This chapter draws from the transaction cost theory to assess the challenges DCFSS pose on continued participation of smallholder farmers in the green bean value chain. The emergence of DCFSS resulted in the development of networks of relationships aimed at coordinating procurement of beans from developing country sources (Fulponi 2005). The consequence of these networks was the development more tightly coordinated/monitored value chains linking developing-country suppliers with European buyers (Dolan and Humphrey 2000; Freidberg 2004). The development of closely coordinated value chains can result in transaction dependency and opportunism, especially where the transaction can only be completed using specific assets or is characterized by uncertainty (Okello and Swinton 2007).

Martinez (2002) identifies four types of asset specificity that can occur in a commodity value chain. These are: i) physical specificity—such as a

non-deployable investment in physical facilities needed to complete the exchange process, ii) site specificity—where there is a need to locate processing/manufacturing plants close to raw material sources usually aimed at reducing transportation costs, iii) temporal specificity—where timing of the delivery of traded goods/services affects their value, and iv) knowledge/skill specificity—in which a party to exchange has to acquire certain skills/knowledge to expedite the transaction. Asset specificity can lead to market failure following *ex-post* opportunism from the party not investing in such assets and has also been associated with price "hold-up" by buyers. Smallholders are especially disadvantaged where assets are lumpy/specific because of diseconomies of scale (Poulton et al. 2005; Okello and Swinton 2007).

Uncertainty in a value chain can further exacerbate the problem of high transaction costs. Uncertainty arises from various sources in a value chain namely, i) the tendency of some actors to behave strategically through nondisclosure, disguise or distortion of information, ii) an environment characterized by volatile demand, lack of timely communication and inability of some actors to determine timely plans/decisions made by others, iii) changes in the technology needed to complete the transaction, and iv) inability to verify at low cost quality of the produce at the time of product delivery.

The combination of asset specificity and uncertainty presents a major challenge of high transaction costs to smallholder producers. It presents an opportunity for one party (especially the more informed) to take advantage of another by using exclusively available information to benefit itself, a situation known as opportunism (North 1990; Okello and Swinton 2007). This challenge is exacerbated by the poor public infrastructure (e.g., poor roads that make access to information even more difficult) that fuel the problem of information asymmetry. Geographical dispersion of farmers can further drive up costs of enforcing buyer requirements, hence screening out some farmers.

High transaction costs affect both buyers (i.e., exporters) and suppliers (i.e., farmers). For the exporter of NTFE, high transaction costs can arise from, among others, the costs of: i) searching and identifying suppliers that are committed to meeting market requirements, ii) negotiating the terms of exchange with the widely scattered farmers, iii) monitoring and/or supervising suppliers to ensure compliance with market requirements, and iv) adapting to environmental and market changes relating to standards. Geographical dispersion of farmers and the small volumes traded exacerbate buyer's transaction costs, making smallholder farmers less attractive sources of produce compared to larger farmers. For the farmer, meeting buyer requirements requires investing in physical, human and other assets that are specific to the transaction. The need to invest in such specific assets increases the farmer's transaction costs because of likelihood of hold-up.

Theoretically, there are a number of institutional mechanisms for integrating smallholder farmers into the NTFE value chains. First, smallholder farmers could re-orient their products to target markets that are less demanding in terms of quality and safety. This way, the farmers can avoid having to invest in costly facilities and skills needed to meet the DCFSS. Second, smallholders can, through collective

action, invest jointly in lumpy/costly assets, hence take advantage of economies of scale and reduce the per farmer costs of such investment. Past studies indicate that collective action helps farmers get access to technical information that could help in meeting buyer requirements (Rehber 1998; Key and Runsten 1999). Such arrangements, when combined with some form of agreements (i.e., contracts), whether formal or informal, also allow farmers access to reliable markets, thus reducing marketing risks (Key and Runsten 1999). Third, the public sector could partner with the private sector to help smallholders overcome the most challenging market requirements by investing on the infrastructure/facilities that are lumpy or have public good characteristics (e.g., training and extension, road, supply of safe water). Indeed, the literature identifies lack of access to infrastructure needed to access better-paying markets as one of the main hindrances to smallholder commercialization (Barrett 2006).

11.2.2 Empirical Methods and Data

The information and data used in this study were obtained through detailed interviews with various participants in the green bean value chain conducted between January and February 2006 in Zambia, Kenya and Ethiopia. The interviewees included smallholder farmers, farmer organization leaders, horticultural industry association leaders, exporters, domestic green bean buyers, EU importers, EU supermarkets and certification companies. In Ethiopia, industry participants interviewed included three export companies, two domestic supermarkets, the Ethiopia Horticultural Produce Exporters Association, smallholder farmers, farmer group leaders, and the Ministry of Agriculture. In Zambia, the industry members interviewed included York Farms,[3] Lubulima Agricultural and Commercial Cooperative Union (LACCU) members, packhouse managers, former workers of *Agriflora Ltd*, Zambia Export Growers Association (ZEGA), farmer societies belonging to LACCU, ZEGA Training Trust, and Agribusiness Forum, a private business offering services to the horticultural industry. A similar list of fresh export industry actors was interviewed in Kenya. They included Fresh Produce Exporters Association of Kenya, farmer groups, representative smallholder farmers, certification companies, several export companies (e.g., Kenya Horticultural Exporters, Homegrown, Sunripe, etc.), among others. The Kenya interviews were supplemented with secondary information and data from an household survey conducted in 2004 by the author. The data was collected through personal interviews from 180 green bean farmers, stratified by compliance with DCFSS, using a pre-tested questionnaire. Additional interviews were also conducted in the export market and involved Flamingo Holdings in the United Kingdom (UK) and Mark and Spencer's fresh produce retail division manager.

[3] York Farms did not buy green beans from smallholder farmers, but instead grow its own beans.

The interviews focused on a number of aspects relating to compliance with DCFSS. These included physical facilities needed to comply, the cost of implementing the facilities, the establishment of traceability system, third-party certification of compliance with various kinds of DCFSS, sources of capital used to meet the standards and the institutional arrangements for compliance. Evidence about these aspects was synthesized after detailed personal interviews with the various actors above.

11.3 The Standards and the Early Exclusion

Compliance with DCFSS requires making changes in production and post-harvest handling practices. In addition to meeting the cosmetic[4] requirements of the developed-country consumers, DCFSS-compliant beans have to meet specific requirements[5] relating to: i) wearing of full protective gear during pesticide application by the spray operators, ii) judicious use and handling of pesticides by the mixers and applicators, iii) bathing immediately after spraying or when pesticides accidentally come into contact with the skin of the mixers and applicators, iv) storage of pesticides away from foodstuffs and in a fully secured, labelled and well-ventilated pesticide storage units, v) proper disposal of pesticide containers and leftover pesticides (This is supposed to be done in ways that do not threaten the health of humans or animals.), vi) discontinuation of the use of unapproved pesticides (especially those with long postharvest intervals) and, vii) the need to ensure that residues of approved pesticides on the harvested beans remain below the maximum residue level (MRL) specified by the destination country governments. In addition, green beans are required to meet a number of postharvest handling requirements. In particular, grading is supposed to be done hygienically to minimize contamination with microbes or foreign objects (e.g., dirt, stones and human hair) while, at the same time, shielding the beans from the tropical heat. Lastly, each farmer is required to meticulously document pesticide usage (including trade name, date used and dosage applied) for each plot of beans owned and the record of pesticide usage has to accompany each consignment of green beans to the exporters packhouse to ensure traceability.

In order to become DCFSS-compliant, a farmer therefore needs to change a number of production practices and make significant investments. The changes and investments encompass: i) the purchase of full protective gear, including long-sleeved overcoat, gumboots, rubber gloves, nose mask, goggles, and hat; ii) construction of a shower room for use by the spray operators; a well ventilated, labelled

[4] These requirements related to size, spotlessness, straightness and length of the green bean pods.

[5] These requirements that are usually imposed by exporters are normally based on different EU public and private standards. Some may not be directly specified by any of the DCFSS, but are designed to meet the standards. The case in point is the use of protective gear which is intended to protect farmers/farmworkers from exposure to pesticides.

and secured pesticide storage unit; a pesticide disposal pit and an incinerator; iii) applying only the approved pesticides, typically more costly but safer than those they replace; iv) implementing an integrated approach to managing pest and disease problems, and using pesticides only when absolutely necessary (i.e., upon approval by the exporter's agronomist or technical assistant following pest scouting); v) constructing a grading shed (with cement floor, washable tables, and a device for washing hands) and a pit latrine adjacent to the shed; vi) building a hessian cooler (in the field) and charcoal cooler (at the grading shed/collection center) for holding beans prior to pickup by the exporter; and vii) observing personal hygiene at all times during grading of green beans. The personal hygiene measures that must be followed include the use of headscarves by women and hats by men, barring children from the grading area, and barring the wearing of perfumes, loose earrings and loose finger rings from sorting and grading areas.

In order to ensure compliance with these standards, most supermarket retailers in Europe require that exporters produce evidence, in the form of third-party certification, that the food safety protocols are being strictly adhered to. In many instances, the exporters had their farms and facilities certified for compliance but expected the farmers meet their certification costs. Some exporters however included the smallholder farmers under their certification plans but subjected them to tight monitoring and supervision. Hence the value chain for NTFE became highly coordinated. Such tightly coordinated value chain however works against the smallholder due to: i) information asymmetry and transaction costs, ii) organizational constraints, and iii) regulatory failure (Rich and Narrod 2005). Information asymmetry makes it harder for smallholders to guarantee food safety without the costly third-party certification or close monitoring. Monitoring smallholders entails costs, making them less attractive to work with. Geographically dispersed small holdings, common among unorganized farmers, imply that it is not economically viable to establish the quality management systems essential in assuring food safety.

As expected, DCFSS had a very strong screening effect on smallholder farmers. Evidence from Kenya indicated that the immediate response by some of the exporters to stricter enforcement of DCFSS by European retailers was to drop more than one-half of the small outgrowers (Okello 2011). Such exporters reorganized their procurement and, in the process, reduced the number of smallholders, replacing them with medium to large scale farmers. Consequently, while over 60 % of green beans were produced by smallholders in Kenya in 1980s (Kimenye 1993) their share had dropped to about 30 % by 2003 (Jaffee 2003).

The Kenya case is best illustrated by the changes experienced by the leading fresh export firm in response to the implementation of DCFSS by its buyers. Prior to DCFSS (i.e., 1991), the firm worked with more than 2,000 farmers in just two districts (i.e., Machakos and Meru). However, upon the onset of the standards in mid 1990s, it gave farmers 6 months to implement the changes needed to comply with the standards or find a different buyer.[6] Figure 11.1 presents the changes in the

[6] At the time, this exporter was the only buyer in the two districts. Hence farmers who failed to comply after the 6 month automatically exited green bean export industry.

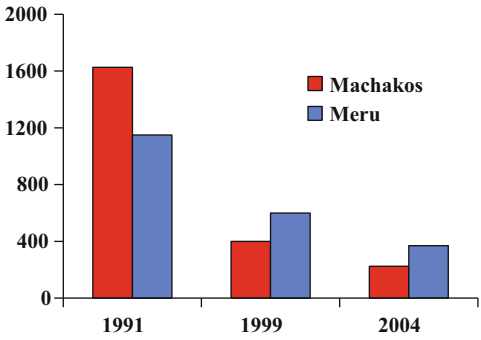

Fig. 11.1 Trends in the number of smallholder farmers supplying a leading green bean exporter in Kenya, 1991, 1999, and 2004. *Source*: Okello (2011)

number of smallholder farmers in the two districts that were still supplying the leading exporter in 1999 and 2004. As shown, the number of green bean growers dropped significantly between 1991 and 2004.

In Zambia, the story was a little different but with a similar ending. The first exporter (York Farms) initially sourced green beans exclusively from own estate farms or from larger better-off outgrowers because it doubted the ability of smallholder farmers to meet the DCFSS. Small farmers began participating in the Zambian green bean business when *Agriflora Ltd*, a fresh export vegetable exporter, entered the green bean export business. Agriflora built a smallholder fresh vegetable scheme based on the Kenyan model. However, it had to undertake some of the activities that were critical for compliance with DCFSS to assure its EU buyers that it was safe to work with smallholder farmers. Such activities included application of pesticides (done by team of pesticide applicators), dispensing the pesticides as needed (to ensure compliance with maximum residue limits), and keeping records (for traceability). Agriflora collapsed in 2004 (for reasons unrelated to the enforcement of the standards) leaving York Farms as the only green bean exporter. However, York Farms would not buy beans produced by the smallholders for fear of violation of hygiene and pesticide residue standards (Narrod et al. 2009). Consequently smallholder farmers in Zambia were forced to abandon the production of green beans for European markets. Thus in the case of this latter country. The DCFSS therefore screened 100 % of the smallholder farmers from green bean export value chain in this case.

In Ethiopia where smallholders grew 20 % of green beans, the exporters undertook pesticide handling and application for the farmers just as Agriflora did in Zambia. The farmers' roles were limited to planting, weeding and harvesting the beans. These activities have no implications on the safety of beans, hence posed no risk of pesticide residue or hygiene violations. However, the exporters working with smallholders still faced significant challenges in enforcing hygiene standards at the collection centres.

The degree of exclusion of smallholder farmers in all these countries certainly depended on the type of investments they were required to make.[7] A number of these investments were lumpy and capital intensive, hence smallholder farmers faced considerable difficulties undertaking them. There are at three reasons why lumpy investments work against smallholder farmers. First, most smallholder farmers do not have access to debt and equity capital (Okello and Swinton 2007). Consequently, the majority didn't have the cash to implement the standards.[8] Second, some farmers were not sure of continued market access after implementing the standards and were therefore afraid of losing their investments if the buyer ceased buying from them (Okello 2011). Third, the farmers were afraid of losing their investments due to marketing risks (especially uncertain demand and hence price). In general, the tight control aimed at preventing produce contamination with pathogens and pesticides worked against their continued participation in the high value chains. In all the three countries exporters shunned working with smallholder farmers, often keeping a few for ethical reasons (Dolan and Humphrey 2000). In Kenya, the enforcement of food safety standards led major supermarket suppliers to abandon sourcing from smallholder farmers, instead integrating backwards to start up own estate farms (Dolan and Humphrey 2000). A similar case was witnessed in the case of York Farms in Zambia which would not trust smallholder sources.

11.4 The Critical Control Points in the Export Green Bean Production Business

The section above has demonstrated that DCFSS can have a significant exclusionary effect on smallholder farmers. So where along the value chain are smallholder farmers most at risk of being screened out of the lucrative fresh export value chains? In addressing this question, this study identified three value chains through which smallholder farmers marketed their beans in the three study countries. These were the supermarket chain, the continental European wholesale chain, and the domestic value chain.[9] The focus of this chapter however is on supermarket chain since it is within this chain that DCFSS are strictly enforced through a tight system of monitoring (Singh 2002; Jaffee 2003). The requirements of the supermarket chain include changes in type and quality of inputs used in production beans and the absence of pests and diseases prohibited by the importing countries. Green beans marketed through this chain must be third-party certified for compliance with the standards (e.g., GlobalGAP, Tesco supermarket's Nature's Choice or Sainsburrys'

[7] See Okello (2011) for a discussion on smallholder farmers struggle to meet the standards and the various types of responses as well as their outcomes.

[8] Okello and Swinton (2007) provide an excellent and detailed discussion of this issue.

[9] In Kenya and Zambia, the supermarket chain was dominant while in Ethiopia the European wholesale market chain dominated although the Ethiopian green bean industry was at the time of this study setting up the mechanisms needed to strengthen its share of the supermarket chain.

supermarket's Farm to Fork). Which standard the farmer(s) obtain certification against depends on the market supplied. In addition, the beans must be accompanied by a phytosanitary certificate issued by a competent authority guaranteeing the absence of prohibited pests and more importantly should have a credible traceability system. Below, we examine the various stages of interest to upstream actors of the supermarket value chain in order to identify points at which DCFSS pose the greatest threat of exclusion to smallholder farmers.

Production of agricultural commodities commences with the use of inputs. Hence, as expected, the input sources and supplies are critical in the production of NTFE. Indeed the food safety protocols for the public, industry, and the private retailers typically specify the inputs that can be used and, for pesticides, the dosage and residue limits that must not be exceeded. In both Kenya and Zambia, and increasingly in Ethiopia, input supply, quality and usage as well as technical advice to the growers were all very closely monitored and coordinated by the exporters. Specifically, the amount (i.e. dosage) and kind of pesticide used, and the growth stage of the beans at which the pesticides are used were closely supervised by the exporters through their well trained field staff usually referred to as technical assistant (TA). The TA allowed only the use of pesticides authorized by the destination market. Consequently, farmers that formerly used toxic pesticides had to shift from them to safer pesticides (Okello and Swinton 2007). The shift to safer pesticides usually implied higher costs of pest and disease control since the new safer pesticides tended to be more expensive. The new safer pesticides were also often less effective/efficacious in controlling pests and diseases.

There was also close monitoring of the labor, irrigation water and manure used in the production of beans. Some of the retailers demanded compliance with ethical trading initiative which not only required fair compensation for labor but also that child labor should not be used. Relatedly, the exporters required that applicators of pesticides undergo routine blood tests to determine pesticide residue levels in the blood as a way of ensuring that the levels of harmful pesticides do not exceed those permitted by the World Health Organization. In addition, the type of water and manure used were required to meet the new protocols of the good agricultural practices (GAPs). Hence, farmers needed to routinely carry out tests on water for heavy metals, pesticide residues, industrial pollutants and pathogens (especially the Coli forms and Salmonella). Manure used should also be routinely tested for pathogens and heavy metals. These tests have now been extended to include the soils used in growing beans.

Contamination of food with contaminants such as pesticides and pathogens has been a major concern of developed-country consumers following the food safety scandals of the 1990s. Indeed, the UK, along with other major EU importers of beans, requires that retailers exercise due diligence in avoiding violations of food safety. Such violations include exceeding the set of pesticide residue limits and pathogen loads in food. At the same time, some EU governments (e.g., the UK) routinely conduct random tests on imported food and require a phytosanitary certificate issued by a responsible authority in the exporting country as evidence of absence of dangerous pests. Consequently, the handling and hygiene practices

during the harvesting, grading and packaging of green beans sold through the supermarket chain were also closely monitored. In both Kenya and Zambia, exporters adopted the developed-country process standards such as the hazard analysis and critical control points (HACCP), good manufacturing practices (GMP) in addition to the GAPs. Implementation of the GAPs is mandatory, in Kenya and Zambia, for a farmer to supply leading exporters that sell to EU supermarket chains. Such exporters carefully monitor their farmers under tightly coordinated contracts. Meeting the GAPs requires that growers have clearly labelled toilets, pesticide storage units, pesticide disposal pits, designated waste disposal points and a device for washing hands on the farm and/or at the grading shed. For the majority of smallholder farmers these investments are often too expensive owing to the large capital outlays involved.

Traceability of the produce marketed through the supermarket is also a major requirement for supplying EU retailers. The exporters therefore require that farmers keep records of the type and quantity of inputs used. Each farmer must keep records relating to crop movement, pesticide stock movement and pesticide applicator's spraying records. These records accompany green beans to the exporter's pack-house with duplicate copies, which are available to the exporter, kept at the grading shed. Keeping the majority of these records requires special skills and functional literacy, and is therefore a significant hurdle to the illiterate and low-skilled smallholder farmers.

The harvesting practices that were closely monitored by the exporter mainly relate to the hygiene and aesthetic qualities. The farmers were required to wash their hands before the start of harvesting while women were required to have a headscarf when harvesting and not to wear a perfume. Other requirements included: keeping small children out of the plot being harvested and using clean crates specifically designated for this exercise. Harvesting beans into specific crates was intended to help avoid cross-contamination of beans with pathogens. Farmers were therefore required to buy several crates. The other major requirements during harvesting stage was the possession of a hessian cooler where crates that are filled with beans can be temporarily kept to protect them from the harsh tropical heat. The hessian cooler needed to be situated far from toilets, manure/compost pits, and dusty roads or open grounds in order to reduce the risk of contamination with dirt. These field-level postharvest handling practices were standard procedures in both Kenya and Zambia, but were less strictly enforced in Ethiopia. In this latter country, farmers were allowed to keep the beans under a tree shade. However, this happened mostly for the beans sold through the wholesale market chain.

The transportation of beans from the field to the collection point/centre was also very tightly controlled, with control being tightest in Zambia. The most common means of transportation were bicycles and ox-carts in Kenya and trucks in Zambia. The food safety (hygiene) requirements during the transportation stage included covering the crates with clean dry material (i.e., cloth or paper) to keep off dust and dirt, and also to screen off the direct sunlight. Farmers also had to ensure that the transport medium (especially the ox-cart or truck) was clean.

Once at the collection point, the beans were sorted/graded and arranged into labelled crates inside a grading shed. The grading shed was required to have a cement floor, washable tables, crate store, device for washing hands and an office for filing and storing records. The crates had to be labelled for traceability purposes. The system used for storing beans at the collection points differed among the study countries. In Kenya, the beans were kept inside a charcoal cooler (with moist charcoal) while farmers in Zambia used electricity-powered cold storage rooms. In Ethiopia, farmers used makeshift collection points and had neither charcoal coolers nor cold rooms.

Beans were transported from the collection centre to the exporter's pack-house in exporters' trucks in Kenya or farmers' trucks in Zambia. In both countries the trucks were non-refrigerated but clean and covered, and usually took a short time from the grading shed to the exporters' pack-house. The trucks used by farmers in Zambia to transport beans to exporters' pack-house also had to be clean and covered.

The most careful attention to the control of contamination of beans occurred in the exporters' processing facilities (i.e., pack-houses). Leading exporters in both Zambia and Kenya invested in state-of-the-art equipments that wash (with chlorinated water) and chill the beans before processing and/or packing. The workers wore special clothing in the pack-house and were required to wash hands at regular intervals or whenever changing a shift to avoid cross contamination of beans with pathogens. A leading export company in Kenya randomly took swabs from workers' hands and tested them for pathogens. When the swab tested positive, that worker was penalized. All containers used at various stages of the processing were colour-coded to avoid mixing and hence cross-contamination with pathogens. In addition to requiring strict adherence to hygiene standards during processing (i.e., sorting, chopping, and arranging into trays and pallets) in the pack-house, packing and bar coding (in the case of high-care pre-packed beans) were done under temperature-controlled conditions. Similar situation existed in the European importers' warehouses except that the main activities undertaken in warehouse were repackaging and bar coding. While farmers were not typically involved at the pack-house stage, rejection of their produce for failure to meet physical or hygiene standards had a direct effect on their continued participation in the market.

There were clear differences in the way exporters in three countries treated beans sourced from smallholders. In Zambia, a major focus was on reducing chances of produce contamination in the field, and the exporters and farmers were clearly aware that pathogens originating from the farm could be carried over to the markets. In Kenya, on the other hand, most of the efforts at controlling pathogen contamination were concentrated at the pack-house.

The above discussion indicates that there are, in total, at least six critical control points in the supermarket chain. These are: i) preharvest field level activities, ii) the harvest, iii) transport from field to collection/grading centre, iv) the collection/grading centre, v) transportation from collection centre to pack-house, and vi) the pack-house. The extent of the threat to smallholders at each of these points varies, depending on the nature and cost of investment required to meet the hygiene and

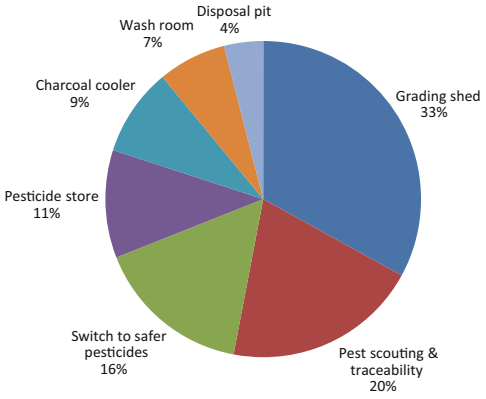

Fig. 11.2 Magnitude of the costs of complying with standards in smallholder farms (%). *Source*: Adapted from Okello and Swinton (2005)

pesticide residue standards. Figure 11.2 summarizes some of these costs and their magnitude for smallholder farmers in Kenya. Clearly, the grading shed (including the charcoal cooler) and the pre-harvest field level activities (such as pest scouting[10] and the establishment of traceability systems, and the switch to new approved pesticides) are the two most costly critical control points to comply with. At these points, smallholder farmers face a very strong likelihood of being excluded by the standards, especially due to lack of equity and debt capital. Indeed, Okello (2011) finds that the implementation of these requirements by a leading exporter in Kenya led to mass exit by smallholder farmers from green bean production.

Apart from the stages discussed above, farmers faced one other overreaching hurdle in the compliance with DCFSS, namely the need to demonstrate compliance. The demonstration of compliance required that farmers (and/or their buyers) obtain third-party certificate guaranteeing that they have implemented all the food safety requirements. Compliance costs in this case include the costs of building the quality assurance system, training farmers on GAPs and undertaking pre- and final audits, and certification. Okello et al. (2009) estimate that the combined cost of demonstrating compliance is greater than the cost of meeting the requirements at the collection/grading centre (i.e., constructing grading shed and charcoal cooler combined). Throughout the three study countries, no individual smallholder farmer had implemented these requirements alone. Indeed, the fear of exclusion of smallholder farmers from the NTFE value chain was, to a large extent, fuelled by demands by EU retailers that smallholder farmers need to obtain the third-party certification for them to continue supplying this high end market (Mungai 2004; Murimi 2004).

[10] The high cost of pest scouting related to the need to employ a technical assistant (TA) that has training in entomology and plant pathology to assist farmers with pest/disease control.

11.5 Changing the Tide of Exclusion: Role of Collective Action and Public-Private Partnerships

Sections 11.3 and 11.4 have demonstrated that DCFSS are very demanding and can have a very strong screening effect on smallholder farmers. These effects are most intense at the pre-harvest farm level and the collection/grading shed critical control points. Figure 11.3 illustrates the initial effect[11] of these standards on the volume of green bean exports by Kenya. Green beans are predominantly grown by smallholder farmers in Kenya. Hence, the changes in exports reflect changes in the participation of smallholder farmers.

Exports of green beans increased from 6,000 tons in the early 1980s to more 27,000 tons in 2003. However, the rate of expansion of trade in green beans slowed down in the 1990s as the industry adjusted to the challenges created by the DCFSS and competition from other African producers (Dolan and Humphrey 2000). This period coincided with the strict enforcement of DCFSS by EU retailers, and hence the Kenya buyers (Okello 2011). The drop in exports reflected, to a great extent, the decline in the sourcing of beans from smallholder farmers as Kenyan exporters shifted to other sources. It also resulted from the massive exit by smallholder farmers unable to make the investments required to comply with DCFSS. The decline in exports was however followed by a very strong recovery in green bean exports. In this section we discuss the role that collective action and public-private partnership played in reversing the decline in exports and maintaining the participation of smallholder farmers in this NTFE value chain.

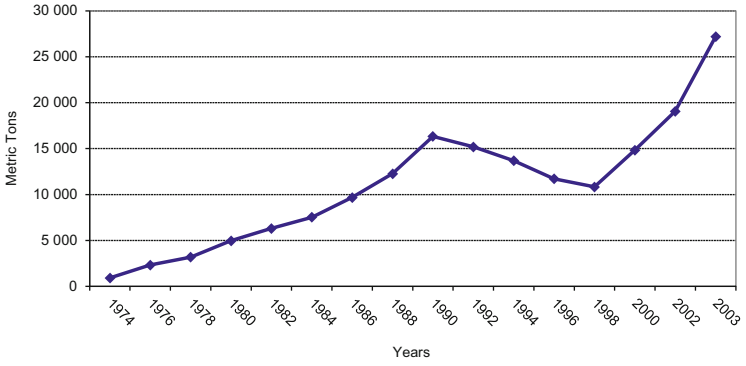

Fig. 11.3 Volume of Kenya's green beans exports, 1974–2003 (metric tons). *Source*: Okello and Swinton (2007)

[11] Jaffee (2003) provides a detailed analysis of the fresh produce industry in Kenya and also suggests a similar trend for fresh vegetable exports. He attributes the upward trend to an increase in fresh prepacked (i.e., processed ready-to-stir-fry) vegetable exports during the period, a business pioneered by Kenyan exporters in response to standards and competition from whole (i.e., unprocessed) green bean exports from North African countries.

11.5.1 Collective Action

Smallholder farmers in the study countries responded to the screening effect of DCFSS by adopting institutional innovations in the form of collective action. Farmers formed horizontal alliances that enabled them to jointly invest in facilities needed to comply with DCFSS. These alliances included producer marketing groups in Kenya and Ethiopia, and producer cooperatives in Ethiopia and Zambia. Through these organizations, farmers jointly invested in the costly facilities such as toilets, cold storage (i.e., cooler), the grading facilities/shed and employed a grading shed clerk[12] required at the collection/grading shed critical control point. The organizations also enabled farmers to construct joint pesticide storage facilities and to employ technical assistants to advise them on how to meet DCFSS requirements at the pre-harvest field level critical control point. In addition, the smallholders jointly raised larger volumes of green beans, thus enabling them to spread the per unit costs of fixed/lumpy investments. Farmer organizations also enabled smallholders to lower the transaction costs, to buyers, of sourcing green beans from a large number of widely dispersed smallholder farmers (Okello and Swinton 2007).

The farmer organizations also conducted training for members and facilitated farmer-to-farmer monitoring in the absence of the exporter's field technical assistant and/or to reinforce exporter's training. In Kenya and Zambia, the farmer organizations invited trainers of good agricultural practices (GAP) to train members on the practices relating to the observance of interval between pesticide application and produce harvesting (i.e., pre-harvest interval), the use of integrated pest management—especially pest scouting, and the establishment of functional traceability system. In addition, the farmer organizations invited experts to train members on packer hygiene and the establishment of quality assurance system.

There are high transaction costs involved in the formation of cohesive farmer organizations (Okello and Swinton 2007). Specifically, forming a producer organization entails initial *ex ante* transaction costs related to search and screening of members. In addition, reaching consensus over the group size, membership fee, leadership, mode of punishment and sharing of benefits further increase the costs of group formation. So how were the organizations used by farmers to meet the DCFSS formed? In the three study countries, these organizations were formed by farmers (with common interest and need) mobilizing themselves, electing temporary officials and then registering with the relevant government authority. However, in some cases, the formation of smallholder organizations was facilitated by the government, exporters, non governmental organizations and donors. In Kenya, most of the farmer organizations were formed through farmers' own initiative with only a few being supported by Ministry of Agriculture's field extension officers. In Ethiopia, the Ministry of Cooperatives and exporters facilitated the formation of farmer organizations while in Zambia, the formation of farmer

[12] The clerk kept records needed to meet the traceability requirement.

cooperatives that comprised Agriflora Smallscale Scheme was an effort by the exporter (Agriflora Ltd) with some financial support from donors.

Once formed, membership in the producer organizations was strictly controlled and new members had to undergo screening before becoming eligible to join. Most groups had on average 25 members. The capping of membership was partly to enable stricter control of farmer practices relating to pesticide use and hygiene. Typically, exporters required that their technical assistants visit the farmers alongside the group-employed technical assistant regularly as part of monitoring, hence producer groups had to kept relatively small.

The leading exporters in all the three study countries preferred working with farmer organizations because it was cheaper to train and then monitor the farmers as a group rather than individually. The exporters monitored the farmer organization leaders who in turn were responsible for monitoring the members. Violations of DCFSS requirements were penalized by punishing the whole group, including the leaders, by suspension or expulsion of the group (i.e., temporary cessation or stoppage of buying from the group) (Okello and Swinton 2007). In order to more closely coordinate the operations of these organizations, the exporters signed contracts with group leaders specifying the responsibilities of each party. In other cases, the contract were in form of informal agreements.

Some of the farmer organizations in Kenya used other strategies to ensure that members do not violate the pesticide residue requirements. First, they hired a team of pesticide applicators that sprayed the green bean plots for farmers under interlinked credit arrangements with the group. The group's technical assistant (TA) had to approve the spraying and authorized the usage of only the right kind and quantity of pesticide based on the growth stage of the crop and outcome of pest scouting. Second, some of the producer organizations had their own pesticide stores that stocked chemicals used by members. The advantage of this system was that it made recordkeeping by the TA easier and more accurate since the stores had records of the pesticide used by the farmer, the date it was used and the amount applied.

The farmer organizations used the clerk to maintain hygiene at the collection/grading centre and maintain the records required to meet the traceability requirements. The clerk kept crop and produce movement records as well as pesticide stock movement records. To make the records of each farmer unique, the exporter allocated a unique number to each farmer organization. Within each organization, every individual farmer was then allocated a unique number that must accompany all her/his produce. A farmer was in turn required to allocate different numbers/identities to each plot of beans. The plot was typically labeled with a number, date of planting, name of crop and variety of the crop. Thus beans received at the collection centre is allocated a unique plot number, farmer number and the group number prior to being kept in the cold storage awaiting collection by the exporter.

The upshot is that collective action helped maintain the participation of smallholder farmers in the green bean value chain by reducing the transaction costs for both the farmer and the buyer. It made investment by the farmer in specific

assets required for compliance with DCFSS possible. At the same time, collective action reduced the costs of screening and monitoring farmers and the enforcement of food safety standards among farmers to the buyer. A recent study by Asfaw et al. (2010) indicates that smallholder farmers that are able complying with the standards are necessarily those endowed with capital and labor, have access to services (e.g., extension/technical information) and have the needed skills. Ondieki-Mwaura et al. (2012) report the results of a study conducted in 2009 among smallholder green bean growers in Kirinyaga district of Central Kenya, the main green bean growing area in Kenya. The study examined the institutional arrangements that are currently being used by smallholder farmers to sell their produce to European markets. They find that the dominant arrangement in use is selling to a broker who then sells, through an exporter, to wholesale markets in Europe. As in our case, their study finds that farmers who sell to European supermarkets (i.e., the high value fresh markets) predominantly work as groups and sell their produce via an exporter under formal and/or informal contracts. These studies support our argument above that farmers who participate in collective action get access to the means of acquiring the facilities and skills needed to comply with DCFSS.

11.5.2 Public-Private Partnerships (PPP)

Alongside the horizontal alliances, a number of PPPs were formed to help smallholder farmers meet the requirements of the DCFSS. The partnerships focused on provision of information, financial support for the establishment of quality management system, the audits and certifications, and capacity building (i.e., training for group leaders) to facilitate the monitoring of members. In some cases, the partnerships met the costs of lumpy investments. Private-private partnerships (i.e., between donors and non-governmental organisations (NGO) or export firms) also facilitated investment in other needed facilities and service. A point in case was the establishment of Africa's only indigenous certification company whose aim was to make third-party certification cheaper and hence accessible to smallholders. PPPs were also instrumental in lobbying for the recognition of the ability of smallholders to meet DCFSS standards. We discuss these partnerships, by country, below.

11.5.2.1 Kenya

Kenya had the most extensive list of public-private partnerships in the green bean industry among the three countries, covering: i) compliance with DCFSS, in particular, the GlobalGAP, and ii) the provision of technical and financial support. Most of the PPPs were aimed at incorporating and maintaining the participation of smallholders in the green bean's supermarket value chain. First, the Government of Kenya (GOK) in partnership with the Japanese International Cooperation Agency (JICA) established the Fresh Produce Handling Company which constructed cold storage facilities throughout horticulture-producing regions of Kenya for use by

farmers and exporters. The partnership also: i) mobilized smallholder green bean growers into farmer groups, ii) trained the farmers on good agricultural practices and other export market requirements, and iii) trained technical officers to act as internal auditors of smallholder groups.

Second, GOK, through the Kenya Plant Health Inspectorate Service (KEPHIS), the responsible authority for issuing phytosanitary certificates, and United States Agency for International Development (USAID) through the Kenya Horticulture Development Project (also known as Fintrac), partnered to develop regulatory and pest control mechanisms. The funding allowed KEPHIS to conduct pest surveillance inspections in smallholder farms and support such farmers in meeting the phytosanitary standards. USAID also funded the certification KEPHIS laboratory in meeting the Good Laboratory Practices, thus reducing the cost of testing for notifiable pests and pathogens and also chemical contaminants in beans and other fresh vegetables destined for export markets. In addition, USAID in partnership with German International Cooperation (GIZ) funded International Centre for Insect Physiology and Ecology (ICIPE) to develop *Africert Ltd*, the only local third-party certifier in Africa at the time. *Africert Ltd* has since grown to be a regional company offering third-party certification services throughout Africa at reduced cost. Lastly, USAID through a local NGO, funded training of smallholder farmers on management and business skills, market advisory services and strategies for developing new business opportunities.

Third, the UK's Department for International Development (DFID) through its Business Management Services Development Project (BMSDP) partnered with the Horticultural Crops Development Authority (HCDA), a public agency, to train a pool of horticultural industry service providers to, in turn, provide training and extension services to smallholders at reduced cost and at the same time replace costly expatriates often hired by international donor agencies as consultants. BMSDP also worked with other private partners to promote the formation of smallholder producer marketing organizations which were then trained on GAPs and later audited and certified.

Fourth, three NGOs (namely, Care International (Kenya), Reach the Children Inc, and ICIPE) partnered with the private firms to train, audit and/or financially help smallholder green bean farmers obtain third-party certification. These NGOs were in turn supported by donor agencies. *Reach the Children Inc*, for instance, had activities that involved ten smallholder farmer groups in the Machakos district. The activities included training on good agricultural practices, certification, microcredit services and a market linkage program. Another NGO, Pride Africa, created linkages between various actors in the horticultural industry aimed at: i) training on good agricultural practices and access to technical information, ii) access to credit and, iii) access to export market. It facilitated linkages between farmer groups and GAP trainers, input sellers, banks, and exporters.

Fifth, the Pesticide Initiative Program (PIP), a EU-funded project run by the Europe-Africa-Caribbean-Pacific Liaison Committee (COLEACP), supported capacity building among green bean exporters. The project especially supported efforts by exporters to develop innovative ways of adapting the EU pesticide use

and handling requirements to local conditions. It also helped in the revision of crop protocols and the setting of maximum residue level tolerances for minor crops such as green beans which, until then, did not have such tolerance levels. It further financed farmers with demonstrated needs related to compliance with residue limits. A number of major exporters in Kenya used PIP funds to finance pesticide use training for their smallholder outgrowers.

11.5.2.2 Zambia

Zambia's green bean industry benefitted from public-private partnerships from the outset. York Farms and Agriflora Ltd were set up using venture capital that involved donors, the government of Zambia and private entrepreneurs (Freidberg 2004). The Agriflora Smallscale Scheme (ASS), comprising hundreds of smallholder green bean farmers, was largely run through partnerships with the government, donors and input suppliers. The government provided extension personnel who were retrained by Agriflora on GAPs to make them more effective in advising farmers. The training of ASS smallholder outgrowers was through partnership between the Zambia Export Growers Association (ZEGA) Training Trust and Agriflora with funding from donors. Hence, through the scheme, hundreds of smallholder farmers were incorporated into the green bean export business. The Agribusiness Forum (a local private business consultancy firm funded by donors in partnership with the government of Zambia) partnered with Agriflora to provide training/capacity building to the ASS outgrowers. It provided training on business development and group management skills.

The government of Zambia and JICA partnered to build green bean collection depots with cold facilities that also enabled ASS members to meet the EU hygiene quality requirements. The cold storage facilities were used by smallholders for grading the beans and holding them while awaiting delivery to the exporter. Agriflora Ltd also obtained inputs from suppliers through loans involving a major Zambian Bank, the government and the input distributors. The arrangement aided smallholder farmers during the transition to less toxic, but often more expensive, pesticides by providing access to the approved pesticides through interlinked credit scheme.

11.5.2.3 Ethiopia

In order to comply with the pesticide residue limits and the phytosanitary requirements set by the European Commission (EC) Ethiopian exporters and their growers worked closely with the Ethiopian Plant Quarantine Department (EPQD), a public body servicing the export industry. The department was the competent/responsible authority with the mandate to issue the phytosanitary certificates to exporters. It trained farmers on integrated pest management (IPM) and safe use and handling of pesticides, conducted routine inspection of green beans, both in the field and at the point of exit for pests, and also monitored the green bean crop at various growth stages for the presence of eggs, larvae, or insect pests. EPQD especially partnered with Ethioflora, a private fresh export firm, to train smallholder groups supplying the latter on IPM and safe pesticide usage. Also, the Ethiopian Export

Promotion Agency, through a partnership with the Dutch Centre for Promotion of Trade from Developing Country (CBI), facilitated compliance with EU food safety requirements by disseminating updated technical and market information to smallholder farmers and their buyers.

The other important PPP initiative that facilitated smallholder farmer compliance with DCFSS in Ethiopia was the partnership between USAID and ACDI/VOCA, an international NGO. The partnership funded the development of smallholder horticultural growers including those in green beans. In addition, The World Bank funded the promotion of farmer associations. The government of Ethiopia played a role in a number of these interventions. It set up an investment fund that was available through the Ethiopian Development Bank with substantial sums of money available to the horticultural industry. The government also allocated land with developed irrigation infrastructure for horticultural investments and also provided easier access to key inputs including streamlining the procedure for proper usage, storage and disposal of pesticides. At the same time, the government embarked on the expansion and modernization of Addis Ababa Bole international airport to facilitate cheaper direct shipments of fresh produce to Europe.

11.6 Conclusions and Policy Implications

This chapter examined the exclusionary effects of DCFSS on smallholder farmers in three countries in Africa. It identifies six critical points along the green bean value chain at which exporters enforce strict compliance with DCFSS to avoid contamination of the beans with pathogens and pesticide residues. These points are pre-harvest field level activities, harvest stage, transportation from field to collection centre, the collection/grading centre, transportation from collection centre to the packhouse, and, lastly, the packhouse. Among these, the points at which smallholder farmers are most threatened with exclusion from lucrative green bean value chain by the standards are the pre-harvest field level and the collection/grading centre control points. At these points the costs of investing in facilities and skills needed to meet DCFSS are too high for most smallholder farmers. Indeed, the inability of smallholder farmers to invest in the facilities and skills needed at these points caused a significant drop in the number of Kenyan smallholder farmers supplying the EU retailers following the initial enforcement of the standards. That is, the market solutions at these critical control points, while optimal, is undesirable. Therefore the smallholder farmers, if left on their own, cannot survive the screening effect of the DCFSS at these control points.

The three study countries used two non-market institutional innovations to overcome the screening effect of DCFSS at these control points namely, collective action and private-public partnerships. Through collective action, smallholders were able to jointly invest in costly facilities and skills and also reduce the buyers' transactions costs of sourcing from them, thus making them attractive to do business with. At the same time, by helping farmers invest in the lumpy capital requirements and acquire third-party certification, public-private partnership

enabled farmers to overcome some of their greatest challenge while at the same helping them demonstrate compliance with DCFSS.

The implication of this study is that government, private sector and donor interventions aimed at keeping smallholder farmers in the value chain should not ignore the field and collection centre control points. Although a number of investments at these levels are private, they involve lumpy investments that are too costly for smallholders. The study findings also imply that, at the two most challenging control points, the market, if left on its own, could adopt solutions that marginalize smallholder farmers. Thus countries seeking to diversify exports by shifting to production of fresh export vegetable (usually produced by smallholder farmers), should be ready, on their own or jointly with the private sector, to invest in supporting smallholder farmers at the two critical control points at which DCFSS pose greatest challenge to such farmers. In addition, the findings of the study imply that governments should facilitate and, where necessary, support farmers to form producer organizations through which they can overcome the screening effect of DCFSS. Obstacles such as the long process of registering such organizations and the payment of registration fees should be removed to expedite the process of forming such farmer organizations.

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Fresh Produce Regulation and Private Standards in Turkey: Implications for Export Markets

12

Burçak Müge Tunaer Vural and Sedef Akgüngör

Abstract

During the last several decades, increased concerns on food contaminants urged policy makers to take precautionary measures in order to protect domestic markets from imported foods with unwanted residues and additives, and ensure food safety. Given their potential importance to impede international trade, it is much debated whether the standards are imposed on health protection grounds or may be abused to serve as non-tariff trade barriers, especially against the exports of developing countries. Introduction of ISO 22000, besides public and private standards, may be considered as a strategic step towards solidification of diverse international food safety regulations on a voluntary basis for producers. ISO 22000 also stands as a rather less expensive and more attainable alternative for most smallholders of developing countries in agricultural production. Using a gravity model, this research aims to assess the effect of ISO 22000 diffusion on fresh produce exports by developing countries with a specific focus on the Turkish case. A panel dataset is constructed for 22 importing and 24 exporting countries over the period 2007–2011. Exporting countries are selected from the class of developing countries that has more than 10 % of their GDP value added from agricultural sector and on the basis of data availability. Within the exporting countries, there are major exporters of fresh produce as well as those that are listed at the bottom of the world exporters of fresh produce, but all countries are assumed to have a potential for agriculture since they have at least 10 % of their GDP from agricultural sector. Findings reveal that ISO 22000 certification in developing countries has a profound impact on their export performance of vegetables and fruits. Diffusion of ISO 22000 certification in developing countries tends to increase their exports of vegetables and fruits by 37 % and 53 %, respectively.

B.M. Tunaer Vural (✉) • S. Akgüngör
Faculty of Business, Department of Economics, Dokuz Eylül University, İzmir, Turkey
e-mail: muge.tunaer@deu.edu.tr; sedef.akgungor@deu.edu.tr

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Fresh produce • International standards • Food safety • Trade • Gravity model • Turkey

12.1 Introduction

Emerging and modern technologies in the food system as well as real and perceived food safety problems heightened consumer concerns for food safety in both developed and developing countries. Response to such concerns is through regulation of food safety and setting safety standards. A traditional method in applying food safety standards is market regulation by government-set policies. Market regulation requires monitoring and enforcement practices in the supply chain. An alternative to mandatory standards are private standards where self- or third-party certification is voluntary.

Both mandatory and voluntary regulations stem from the economic principle of market failure. Lack of or high cost of information about the safety of food is a major justification for public intervention to improve food safety (Garcia Martinez and Poole 2004). In addition to government standards, private standards are increasingly popular as a response to regulatory and consumer concerns on the safety of food.

Private standards provide assurance for the compliance of the product or process with minimum safety requirements. The standard certification schemes serve as a mechanism of product differentiation as well. Product differentiation through certification aims at changing the attitudes of consumers by assuring them with safe agricultural, manufacturing, retailing and distribution practices (Hobbs 2010). However, masses of standards inspected by a variety of private entities soon urged a trend toward harmonization in standards.

The governance over food safety and quality issues is promulgated by both public and private hands. Public institutions set mandatory/regulatory standards that require legal obligations for compliance. These are referred to as technical barriers to trade under the World Trade Organisation (WTO) Agreement. Private initiatives in standard setting in both the production process and end-testing in the food sectors also pervaded as consumer concerns over the issue spurred. Private standards include: (1) proprietary company-specific codes of practices, (2) - industry-wide conducted voluntary consensus standards, and (3) third-party standards set and inspected by independent entities. “Nature’s Choice” established by the British food retailer TESCO PLC, and “Farm to Fork” developed by another British retailer Marks and Spencer are the specific cases of proprietary standard setting and implementation. There are well known national examples of industry-wide certification schemes such as German Q&S, French Label Rouge, Belgian Certus, British ABM, Danish DS, Dutch IKB, and their transnational counterparts EUREPGAP by the Euro Retailer Produce Working Group, and GFSI by The Food Business Forum. Finally, ISO (International Organisation for Standardization)

certification practice is an example of third-party standards with a global focus. ISO standards are often classified under the quasi-public international voluntary standards category (Henson and Humphrey 2010). The scope of ISO certification schemes ranges from sing le stage to covering a whole supply chain. In particular, ISO 22000 specifies requirements for a food safety management system which rests on five main elements of (1) interactive communication, (2) system management, (3) prerequisite programs, and HACCP[1] principles. Regardless of its type and scope, private standards on imported goods are tools for assuring quality in the domestic market.

Food safety standards are imposed on health protection grounds, but often serve as non-tariff barriers, especially against the exports of developing countries. It has been argued that standards act as barriers to trade for developing countries that do not have financial and technical capabilities and fail to meet the strict requirements of standards imposed by developed countries. Others have proposed that standards may become catalysts to trade by inducing developing countries' production systems to be modernized and more efficient. Debates on the effects of food safety standards attract much academic interest on the quantification of the trade effects of food standards. Yet, there is a growing body of literature that aims to provide empirical evidence on the issue.

One strand of literature explores the impact of regulatory standards on the imports of developing countries. Within this strand, Otsuki et al. (2001), Wilson et al. (2003), Wilson and Otsuki (2003), and Czubala et al. (2009) provide empirical evidence that regulatory standards reduce imports from developing countries. Another strand of the literature focuses on the trade effects of private standards. This part of the literature mainly comes from case studies of private standards implemented by developing countries. For example, Henson et al. (2011) investigate the impact of GLOBAL GAP certification on export revenue of fresh produce exports in ten African countries, and find that certification increased export revenues of certified companies. Another research conducted by Schuster and Maertens (2015) focuses on Peruvian fresh asparagus export sector as a case study, and reveals that export volumes of certified companies are 4–5 times those of noncertified companies.

Besides public and private standards, the introduction of ISO 22000 food safety standards opens another strand for study in the literature. ISO 22000 may be considered as a strategic step towards solidification of diverse international food safety regulations on a voluntary basis for producers. ISO 22000 covering HACCP principles and the main requirements of private food retailers in conjunction with its tight cooperation with Codex may be expected to play a crucial role in the harmonization of international food standards. Despite their increasing popularity among the developing countries, there exists a very limited amount of literature on the effects of international voluntary standards. Review of literature by Honda et al. (2015) in this volume demonstrates the results of empirical studies using

[1] HACCP stands for hazard analysis and critical points.

country-level data and firm-level data. The review reveals that food safety standards have significant effects on trade flows, while the effect may be different across different products.

This research aims to contribute to the existing literature by providing empirical evidence to the edited volume with a specific focus on the fresh fruit and vegetable exports and ISO 22000 as a universal standard. Given the significance of agricultural production in Turkish economy, this research is expected to reveal important policy implications for Turkey as well as many developing countries that are traditionally agricultural product exporting countries.

The remainder of the paper is organized as follows; Sect. 12.2 presents a brief survey of literature, Sect. 12.3 summarizes current voluntary and mandatory standards on use in Turkey, Sect. 12.4 displays econometric model and data, Sect. 12.5 illustrates the empirical results. Finally, Sect. 12.6 provides the discussion of results and present conclusion.

12.2 Survey of Literature

Increasing competitiveness in the food industry causes fresh fruit and vegetable producers to apply production methods that require use of several physical, chemical, biological and non-conventional transmissible agents for the purpose of increased efficiency. In order to extend the shelf life of fresh produce, actors in the marketing chain use chemicals. Additionally, cost concerns of producers sometimes result in hazardous food production when producers refrain from employing processes that increase the hygiene and quality of foodstuff which is cost increasing. Hence, the fresh produce sector deserves special attention due to its importance for human health as well as concerns for the environment. Socially desirable level of protection is achieved through standardization of good practices of agriculture, manufacturing, hygiene, distribution, and HACCP systems.

Domination of private standards renders standardization issues to be strongly influential on international trade. Even though compliance with private standards relies on suppliers' own incentives in principle, in many markets, commercial imperatives render voluntary standards facto mandatory (Henson and Northen 1998). While bilateral standards, working as a form of common language, accelerate international trade among trading partners, national standards often work as barriers, and inhibit market penetration of imports from trading partners (Moenius 2004).

Blind's (2004) approach to the categorization of standards is based on their economic effects and classified under four dimensions: (1) compatibility, (2) quality, (3) variety reducing and (4) information standards. Even though standards in general are designed to serve for one of these purposes, they often perform several of these functions. In order to understand the potential effects of standards, it is appropriate to classify standards according to the problems they solve. Hence, the approach adopted in this section to analyze the economic effects of standards is based on a functional classification of standards. Among the functions of standards

identified above, fresh produce safety and quality standards serve to reduce information asymmetry in the food system by providing consumers information they need regarding quality. It is therefore evident that the functioning of fresh produce standards in general is related to ensuring quality, reducing variability and providing information.

Minimum quality and safety standards are socially desirable, especially when the markets are exposed to information asymmetries (Leland 1979). Under the existence of information asymmetries among suppliers and consumers regarding the quality characteristics of the products, consumers may become unwilling to pay a price premium for high quality products. In this case, if the cost of high quality producers exceeds the cost of low quality producers, high quality producers are dropped out of the market. Minimum quality and safety standards are considered to be an important instrument to avoid this kind of a market failure (Blind 2004).

Variety-reducing standards impose restrictions on the product regarding the range of characteristics concerning size and quality. This type of standardization leads to a reduction in product diversity, and help increasing scale economies (Blind and Jungmittag 2008). Economies of scale achieved with variety-reducing standards make the costs of larger volumes of production lower than average costs, providing cost advantages to the producers.

High technology industries are exposed to a range of information and measurement of standards, providing scientific and engineering information concerning the product attributes. With measurement tests and dissemination of the information, producers confirm the product attributes, providing enhanced consumer confidence. Therefore, information and measurement standards primarily reduce transaction costs among consumers and producers (Tassey 2000). Standards working through several channels affect both innovation/technology diffusion and industry structure which may produce pull and push factors for both the domestic and international producers of the industry. Increased product quality imposed by country-specific standards may impose varied effects on both home and host countries. First, it may increase the competitiveness of the exporting country and increase the marketing power of the exporters of the home country in international markets. However, if the standards are highly idiosyncratic and unique to the exporting country, it may create a competitive disadvantage for domestic producers by imposing additional bureaucratic and administrative cost burden on domestic producers, and making them uncompetitive against their competitors in foreign markets.

Standards may have either a positive or negative impact on international trade. Country-specific standards reduce transaction costs by making the information on market access requirements available for the exporters of the host countries. However, compliance with country-specific standards often imposes high adoption costs for the exports of the host countries. The existence of standards in the host country at first hand may increase the compliance costs of meeting the minimum requirements of entering the market. Hence, acting in a protectionist manner, trade diversion takes place from high standard markets to low and medium standard markets. However, once harmonization of standards takes place between the exporting and importing agents, crucial information flow is assured regarding the

product and the process of production. Harmonized international standards facilitate international trade through a mechanism acting as a common language among trade partners. Bilaterally shared standards have a positive effect on trade through trade creation. Hence, there exists a possibility that the dominating effect will result in either increased or decreased international trade. The net effect depends on the opposing factors, and may result in trade creation or diversion.

International standards are also influential on international trade to the extent that they promote intra-industry trade. The existence of common compatibility and minimum quality standards also increase intra-industry trade by promoting scale economies. Various potential effects on the impact of standards on international trade are ambiguous until empirically investigated. Net effect depends on the relative dominance of opposing information and compliance cost effects on trade diversion and trade creation. Since quantification of both trade and economic effects of private standards involves considerable complexity, there exist a limited number of studies in the field. Empirical literature mainly employs different versions of the gravity model to predict the trade effects of standards. Honda et al. (2015) in this volume present a thorough literature review on empirical work that use the gravity model as a widely used model to explore the trade effect of standards. The gravity model proposes that bilateral trade flows may be explained by demographic and geographical factors (Shepherd 2010). Bilateral flows are assumed to be proportional to the economic masses of trade partners, and inversely proportional to distance and barriers to trade between parties. The baseline gravity model employs GDP, population and geographical distance. The literature suggests (extended) augmented versions of the baseline model in order to account for further factors such as colonial history, free trade areas, common language, and a common border (De Benedictis and Taglioni 2011). In addition, there is a limited literature which comes from case studies on the trade effects of standards based on firm-level micro analyses (Henson et al. 2011; Schuster and Maertens 2015). One example in this volume is the study by Schuster and Maertens (2015). The authors find no evidence of trade enhancing effect of certification while they argue that standards lead to vertical integration which ultimately benefits small producers.

Empirical evidence on the effects of standards on international trade provides mixed results. There seems to be an important distinction in terms of the trade effects of standards on developed country to developed country trade, and developing country to developed country trade. Evidence suggests that both country specific and shared standards tend to increase trade among developed countries (Swann 2010). The study by Swann et al. (1996) reveals that UK standards tend to increase trade in the United Kingdom (UK) and Germany. Particularly UK country-specific standards impose stronger positive effect on both imports and exports of UK. Stronger national standards provide domestic producers with stronger marketing power abroad, hence increasing the UK exports. The same idiosyncratic UK standards also, by stimulating scale economies and increasing intra-industry trade, positively affect UK imports. Other research by Blind (2001) taking France, Germany, Switzerland and UK into consideration, concludes that standards have

trade creating effect. However, in the case of trade between developed and developing countries, while country-specific standards of an importing developed country act as a barrier to the exporting developing country, an increase in the standards of exporting developing country promotes exports to the developed countries. Clougherty and Grajek (2008) conclude that enhanced standards in developed countries results with a positive effect on imports from other developed countries, while inhibiting imports from developing countries. Furthermore, increased standards in developing countries stimulate their exports to developed countries. In line with the previous findings, Czubala et al. (2009) analyzing the effect of standards on the EU-African trade, find that EU standards reduce African exports of clothing and textiles. Reardon et al. (1999) further argue that the shift from product standards towards process standards tend to exclude small firms and farms of developing countries from participating export markets.

Concerning the specific case of agricultural trade, empirical evidence largely supports the standards as barriers view. Otsuki et al. (2001) find that the standards on minimum requirement limits on aflatoxin implemented by the EU reduced groundnut exports from African countries. Similarly, Czubala et al. (2009) highlighted that the non-harmonized (peculiar to EU) private food and agricultural standards in the EU tend to have negative trade effect on the lightly processed exports of developing countries. Anders and Caswell (2009) also conduct an empirical analysis on the impact of mandatory HACCP implementation on U.S. seafood imports, which is based on a macroeconomic trade model. Their findings support the standards as a barrier hypothesis for developing countries. In addition, however, regardless of development status standards act as catalysts for larger trade partners. To the best of authors' knowledge, there exist few papers concerning the impact of standards on agriculture in Turkey. Alpay et al. (2001) conducted an empirical test on the effect of European standards on Turkish agricultural production for the years 1997, 1998, 1999. Telllioğlu (2011) studied the implications of food safety standards for specifically for tomato sector where she finds that Turkish tomato exporters are likely to be more cautious in compliance in markets with high standards than the ones with lower standards.

There are two main contributions of this work reported in this chapter to the empirical research summarized above. The first is that it focuses on developing countries exports with specific emphasis on fruit and vegetable exports where there is a high demand for harmonization of technical standards and treatments (FAO 2003). The findings would help us understand the value that the developing country exporters will get if they comply with international standards set for fruit and vegetable production. The second contribution is that the study uses ISO 22000 compliance as a universal standard that is considered as a step towards solidification of diverse international food safety standards. ISO 22000 is considered to be a less expensive and more attainable standard for smallholders of developing country agricultural producers.

12.3 Current Mandatory and Voluntary Standards in Turkey

Turkey is a member of the Food and Agriculture Organization (FAO) since 1948 and actively participates in Codex Alimentarius. Policies on food safety and quality in Turkey started to build up and further developed after Turkey established a Customs Union (CU) with the European Union (EU) in 1995. Under the legislative framework, total quality management systems provide food safety and quality assurance from "farm to fork". Under Turkish Food Codex, HACCP principles were first introduced to Turkish legislation in 1997. Demand from European customers as well as penetration of supermarkets into the Turkish domestic retail markets in the 2000s, increased demand for further food safety and quality assurance schemes in agricultural production. Increasing demand for quality assurance and safety standards in the fresh produce sector heightened the implementation of organic production and good agricultural practices in Turkey (Koç et al. 2011).

GLOBALGAP is a private standard implemented the most widely all around the world in safety assurance of fresh produce. However, implementation of GLOBALGAP in Turkey remains limited due to the small scale farmers. In Turkey, nearly 65 % of all farms are below 5 ha, whereas 94 % of all farms are smaller than 20 ha (Sayın et al. 2004). This poses a huge obstacle for small-scale Turkish farmers to meet the huge certification costs of GLOBALGAP. More recently introduced ISO 22000 certification scheme, in contrast attracted more interest among agricultural producers. Turkey ranked among top ten countries of ISO 22000 certification.

Implementation of fresh produce quality and safety assurance system in Turkey relies heavily on public initiatives. Legally mandated private standards dominate food quality and safety assurance system in Turkey. "Regulation on Good Agricultural Practices" promulgated in 2004 was a legal framework for implementation of GLOBALGAP in Turkey. Thus, to be certified as a "Good Agricultural Product", it is mandatory to comply with the government-set rules which are equivalent to the GLOBALGAP. In addition, food manufacturing firms use a variety of quality assurance systems which are inspected and certificated by private agencies authorized to control and certification. These private standards include Total Quality Management series (ISO 22000, ISO 9001, ISO 14001), HACCP—TS 13001, IFS, OHSAS 18001, BRC, SQF 2004, FDA Registrar Crop, USDA Organic. By the end of 2012, there are in Turkey 27 and 33 private agencies authorized for the control and certification of Good Agricultural Practices and Organic Agriculture, respectively. Table 12.1 shows the main institutions and their responsibilities in the Turkish food quality and safety assurance system.

Five public institutions and a semi-public one are responsible for food safety and quality in Turkey. The Turkish Ministry of Agriculture and Rural Affairs, the Turkish Ministry of Health, the Republic of Turkey Prime Ministry Undersecretariat of Foreign Trade, Turkish Standards Institute, and Turkish Patent Institute are the standard setting and assessment entities. The Ministries of Agriculture and Rural Affairs, and Health are the two main government bodies that are responsible for legislation and enforcement. However, attempts to harmonize with the EU legislation require a new division of responsibility among two Ministries.

Table 12.1 Current institutions in Turkey responsible for food safety

Institution	Main related laws	Issue date and number	Role in food quality	Harmonization status with EU legislation	Status
Ministry of Agriculture and Rural Affairs	Veterinarian Services, Crop Health, Food and Feed Law No. 5996	13.06.2010 No. 27610	Mainly responsible for food safety, animal welfare and agricultural production	– Food Law does not include feed and veterinary concepts – Not harmonized with the latest law released in the EU – Idem for requirements of GlobalGAP	Public
	Food Law No. 5179	05.06.2004 No. 25483			
	Organic Farm Law No. 5256	01.12.2004			
	Good Agriculture Application Regulation	08.09.2004 No. 25577			
Turkish Standards Institution	Law No. 132	18.11.1960	Responsible for the preparation of Turkish food standards	– Harmonize some food product standards with Codex	Public
Turkish Patent Institute	Geographical Identification Law No. 555	27.06.1995 No. 22326	Trademarks and geographical identification Certification Institute	There is yet no "Traditional Specialty Guaranteed" concept	Public
Under-Secretary for Foreign Trade	Foreign Trade Technical Inspection Law No. 4703	11.07.2001 No. 24459	Responsible for the inspection of product standards in foreign trade		Public
	Communiqué about Turkquality support	24.05.2006 No. 26177	Regulating incentives for the quality of exported products		
Under-Secretary of State Planning Organization	Law No. 4004	16.06.1994	Responsible for the preparation of Development Plans and Annual Programmes of the Government, including investment for improving food safety and quality infrastructure		Public
Turkish Accreditation Agency	Law No. 4457	27.10.1999	Responsible for accessibility of standards and quality audits worldwide		Autonomous

(continued)

Table 12.1 (continued)

Institution	Main related laws	Issue date and number	Role in food quality	Harmonization status with EU legislation	Status
Ministry of Health	Law No. 1593	24.04.1930	Responsible for inspection, safely and quality of drinking and usage water		Public
Municipalities	Law No. 5216 Law No. 5393 Law No. 5302	10.07.2004 03.07.2005 22.02.2005	Responsible for food safety inspections at food selling points and the food service sector		Public
Ministry of Industry and Commerce	Law on SMEs Development and Support	12.04.1990 No. 3624	Responsible for SMEs organization and supporting their requirements		Public

Source: Koç et al. (2011)
Note: SME stands for small and medium size enterprises

Since the approval of "Veterinarian Services, Crop Health, Food and Feed Law No. 5179" in June 2010, the Ministry of Agriculture and Rural Affairs became the competent authority for inspecting all food stages from production to consumption, and inspection of drinking water quality and safety remains the responsibility of the Ministry of Health. The Under-Secretary of Foreign Trade is the responsible institution for the inspection of product standards in international trade. Turkish Food Standards are prepared by the Turkish Standards Institute and the Turkish Patent Institute is the main institution for certification and auditing of trademarks and patents. Furthermore, the Turkish Accreditation Agency provides accreditation for national and international entities rendering laboratory, certification and inspection services, ensures the conformity with national and intern laboratory, certification and inspection services, ensures the conformity with national and international standards, hence facilitates international recognition (Koç et al. 2011).

12.4 Econometric Modeling and Data

Theoretical propositions on the argument of whether international private standards act as barriers versus catalysts for developing countries are being tested in this section. The agricultural sector has attached much importance to its being very strategic as a subsistence sector. Besides, developing countries often possess comparative advantages in agriculture in accordance with the factor endowments theory in their trade with industrial countries. Thus, it is worthwhile to investigate the empirical evidence on the issue in order to be able to draw policy implications. Results are expected to reveal important policy implications for Turkey as well as for other developing countries.

Farms are, on average, operating at a very small scale in developing countries. Many smallholder farmers of the developing countries fail to get *standardized* through expensive programs like EUREPGAP. However, in order to maintain their competitiveness, they get certified with another well-known international standard ISO 22000. Thus, it would make sense to explore empirically whether ISO 22000 certification helps to maintain the developing countries' competitiveness or not. Since, ISO 22000 is applied throughout the whole supply chain of food from farm to distribution; its diffusion in a country necessitates its diffusion in fresh produce as well. Thus, it is presumed that there exists a complete correlation among the ISO diffusion within the country and certification of fresh produce that will be exported.

Annual cross-country data from 2007 to 2011 are compiled from various sources, including the International Organisation for Standardization (ISO) Certification Surveys, the International Trade Centre, World Development Indicators (WDI) from the World Bank, ICOW Colonial History, and World Bank's World Integrated Trade Solution (WITS) database on ISO 22000 certification, bilateral international trade flows, cross-country macroeconomic aggregations, colonial ties,

and tariffs.[2] A panel dataset is constructed for 22 importing and 24 exporting countries over 5 years.[3] Since the aim is to investigate the effect of standards on developing country's agricultural exports, exporting countries are selected from the class of developing countries that has more than 10 % of their GDP value added from the agricultural sector and on the basis of data availability. Within the exporting countries, there are major exporters of fresh produce as well as those that are listed at the bottom of the world exporters of fresh produce, but all countries are assumed to have a potential for agriculture since they have at least 10 % of their GDP from the agricultural sector. Importing countries are on the other hand, major importers of world fresh produce and are all classified under the developed country category according to the World Bank. This approach is similar to Clougherty and Grajek (2008). A fairly large cross section data dimension allows investigation of trade without selection bias.

The econometric model is specified at the macro level. The majority of empirical evidence comes from macro data and gravity models. There are few case studies investigating firm-level data, but lack of data often induces macro analyses. It would be possible to identify specific issues such as compliance abilities of firms with the specific standards and captures microeconomic effects better. Macro analyses, on the other hand, are very informative in the sense that they provide general conclusions. To the extent that there is some homogeneity among the individuals and aggregates reflect individual tendencies, one can expect reliable conclusions from such analyses. Concerning the Turkish agricultural structure, a large portion of the total product comes from smallholder farms which export upon contract. 91.5 % of utilized agricultural area belongs to farms of small classes which possess an economic size of less than 13,000 Turkish Lira (TL), that is approximately 5,000 euros by exchange rate adjustment (TUIK 2006). By contrast, across EU-28, 60.4 % of utilized agricultural area belongs to farms of economic size less than 4,000 euros, and 1.9 % of holdings that had standard output in excess of 250,000 euros accounted for 47.8 % of all agricultural economic output (EUROSTAT 2010). The huge gap between Turkey and EU in terms of agricultural holdings by economic size gives an idea of how it would be difficult for an average Turkish farmer to implement GLOBALGAP. Furthermore, since the case is applicable to more than 90 % of Turkish farmers, it would make sense to assume heterogeneity and implement a macro level analysis based on the gravity equation.

The original application of gravity model to international trade was by Tinbergen (1962). Analogous to Newton's gravity law, the bilateral trade between two countries is proportional to the product of each country's "economic mass",

[2] See Table 12.2 for more details on the data sources.

[3] Exporting countries are Algeria, Argentina, Bangladesh, Bolivia, Bosnia, China, Egypt, El Salvador, Fiji, Georgia, Ghana, Kazakhstan, Kenya, Kyrgyz Republic, Moldova, Pakistan, Paraguay, Philippines, Syria, Tajikistan, Tunisia, Turkey, Ukraine, and Uruguay. Importing countries are Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

often measured by GDP, and indirectly proportional to the distance between the countries' "respective economic centres of gravity", often capital cities. This model is referred to as the standard gravity model, and formulated as

$$Exp_{xm} = \left(\prod\nolimits_k X_k^{\alpha_k}\right) \frac{GDP_x^{\beta_1} GDP_m^{\beta_2} POP_x^{\beta_3} POP_m^{\beta_4}}{DIST_{xm}^{\theta}} \tag{12.1}$$

where

Exp_{xm}	Export flows from exporting country x to importing country m
GDP	Economic size of the home countries and the trade partner
POP	Population of the home and host countries
X	set of k observable variables to which bilateral trade barriers are related, such as trade cost associated with exports from country x to country m
$DIST$	physical distance between trading countries.

By taking natural logarithm, the equation becomes

$$\begin{aligned} lnExp_{xmt} &= \beta_1 lnGDP_{xt} + \beta_2 lnGDP_{mt} + \beta_3 lnPOP_{xt} + \beta_4 lnPOP_{mt} \\ &\quad + \theta lnDIST_{xm} + \sum\nolimits_k X_k \alpha_k + \varepsilon_{xm} \end{aligned} \tag{12.2}$$

where X_k is a set of other regressors including home and host nation ISO 22000 diffusion variables, a dummy variable for colonial ties, and the level of effective tariffs reflecting other bilateral costs of trade, and ε is the stochastic error term. Estimation of the standard gravity model yields results that are restricted to the examination of bilateral costs among trading partners assuming a structure isolated from the rest of the world. However, trade between the two partners increases as the bilateral trade cost *relative* to the average trade cost between each of the trading partners and the rest of the world decreases. Not only the bilateral trade resistance between country pairs, but multilateral trade resistance that the trading country faces with all its trading partners should be addressed in estimating the gravity model of international trade. Hence, the standard form of the gravity equation lacks an underpinning of economic theory that is, the fact that the volume of trade from country x to country m would be influenced by comparative economic density and trade costs between the two countries relative to those of the rest of the world. This lack of theoretical foundations of the empirical model results in two important implications. First, the fact that there are omitted variables leads to biased estimations. Second, it is impossible to correctly calculate comparative statistics exercises of international trade flows (Anderson and van Wincoop 2003).

In order to circumvent the problem, Anderson and van Wincoop (2003) developed an augmented version of the traditional gravity model by controlling for "multilateral trade resistance" terms. Multilateral trade resistance term referring to the trade barriers that each trading partner faces in trade with all its trade partners, the theory-consistent gravity model is based on constant elasticity of substitution preferences of consumers in a general equilibrium structure. Once Eq. (12.2) is

transformed into a theory-consistent gravity model, the corresponding empirical equation becomes:

$$\begin{aligned} lnExp_{xmt} &= \beta_1 lnGDP_{xt} + \beta_2 lnGDP_{mt} + \beta_3 lnPOP_{xt} + \beta_4 lnPOP_{mt} \\ &\quad + \theta lnDIST_{xm} + \sum\nolimits_k X_k \alpha_k - (1-\sigma) ln(P_m) - (1-\sigma) \ln(P_x) + \varepsilon_i \end{aligned} \tag{12.3}$$

where for two trade partners m and x,

$$P_x = \sum\nolimits_{m=1}^{N} \left[\left(\frac{\theta_m}{t_{mx}^{\sigma-1}} \right) \pi_m^{\sigma-1} \right]^{1/1-\sigma} \tag{12.4}$$

$$\pi_m = \sum\nolimits_{x=1}^{N} \left[\left(\frac{\theta_x}{t_{mx}^{\sigma-1}} \right) P_m^{\sigma-1} \right]^{1/1-\sigma} \tag{12.5}$$

θ_m and θ_x denoting GDP share of country m and x, respectively, and t designates theory-motivated exogenous trade costs, π_{mt} and P_{xt} represent inward multilateral resistance and outward multilateral resistance terms, respectively. Inward (outward) multilateral resistance defines the dependence of country m (x)'s imports (exports) on multilateral trade costs across all trade regions of the rest of the world. Finally, σ refers to the elasticity of substitution.

A widely used procedure to estimate the theoretical gravity Eq. (12.3) with unobservable π_{mt} and P_{xt} is to replace inward and outward multilateral resistance indices with inward and outward region specific dummies. This approach earlier adopted by Anderson and van Wincoop (2003), Eaton and Kortum (2002), and Rose and van Wincoop (2001), yields unbiased estimates for the gravity equation. Allowing for country-pair and time fixed effect dummies across the sample, the empirical specification for estimation is:

$$\begin{aligned} lnExp_{xmt} &= \beta_1 lnGDP_{xt} + \beta_2 lnGDP_{mt} + \beta_3 lnPOP_{xt} + \beta_4 lnPOP_{mt} \\ &\quad + \theta lnDIST_{xm} + X'_{xmt} \alpha + \lambda_{xmt} + \varepsilon_{xmt} \end{aligned} \tag{12.6}$$

where λ_{xmt} refers for country-pair specific effects. Multilateral resistance terms are therefore proxied and replaced by a vector of country pair-specific indicator variables (λ_{xm}) for trade flows from exporting country x to importing country m taking the value of 1 or 0 otherwise. The associated coefficient measures the common elements of exporting country's trade with all its trading partners, which is also called as a multilateral resistance term. Note that λ_{xmt} is also a time-varying individual effect that takes into account a period of 5 years. Therefore the fact that the multilateral resistance term may change over time is then taken into consideration.

The sample used for this research is a panel data with bilateral trade data for pairs of developed and developing countries all over the world with various peculiar characteristics, hence is exposed to country pair heterogeneity. Country-pair

heterogeneity brings the question of whether it is appropriate to implement empirical analysis based on pooled data from a variety of countries. Different types of country pairs—in terms of developed and developing countries—cause a systematic variation in the level and direction of trade. Use of country-pair fixed effects in estimating the model would help minimizing the problems of heterogeneity.

Another important problem of endogeneity, on the other hand, may arise from: (1) unobserved common factors, and (2) two-way causality. First, small and medium farmers often confront several obstacles in successful implementation of ISO 22000 standards as well as other certification standards. It is, on the other hand, easier for large farms to fulfill the requirements of ISO 22000 standards and become certified. Therefore, the industrial organization of agriculture and food probably matters for ISO diffusion. Exclusion of an industrial organization variable may cause an unobserved (omitted) variable bias of endogeneity. Second, ISO diffusion may affect the trade performance, as well as it may increase due to the changing requirements of already trading partners. Thus, trade orientation becomes the driver of ISO certification.

Country-fixed effect estimates, accounting for these omitted variables overcome the endogeneity problem to a large extent. Even though use of fixed effects can help to overcome the endogeneity due to unobserved common factors, time-varying omitted variables remain a problem. Hence, an instrumental variable estimation method is also used to circumvent the potential problem of this kind of endogeneity problem.

Under the theoretical and empirical framework suggested in this research, two main hypotheses are to be tested. The first hypothesis is concerned with the impact of adopting ISO 22000 standards in the exporter country on its exports. ISO 22000 standards in the exporting country would act as a facilitator of export flows from exporter to importer. We therefore propose hypothesis 1:

Hypothesis 1 (H1) International standards adopted by the exporter country have a positive impact on exporting country's exports.

The second hypothesis is concerned with the effect of ISO 22000 international standards adopted by the importer country. Standards practiced by the importer may either exert pull or push effects on the exports of the exporting countries. Net effect depends on the domination of opposing effects through various channels explained under the theoretical framework of this paper. If both the importing and exporting countries have parallel standards, the net effect would likely be a positive impact on exporting country's exports. As ISO 22000 being a universal standard, it is likely that the ISO 22000 standards in importing countries would act as a trade facilitating factor. We therefore propose the following hypothesis:

Hypothesis 2 (H2) International standards adopted by export destinations (importer) have a positive impact on exporting country's exports.

12.5 Econometric Results

The specified empirical regression (expression (12.6)) is estimated for a panel covering agricultural exports of edible vegetables and fruits from developing countries to developed countries over the period 2007–2011. Table 12.2 summarizes the sources of data and definitions of variables employed in the model.

Variables are transformed into their logarithmic form and zero trade flows would be dropped out of the estimation as the log of zero is not defined. In order to handle the zero trade issue and refrain from any biased results, we added a small constant ($1) to the value of exports before taking logarithms. Regressions are estimated for the exports of fresh fruit and fresh vegetables separately. Estimation results of the pooled ordinary least squares (POLS) allowing for fixed effect regressions and instrumental variable (IV) estimation techniques are reported in Table 12.3.

The R^2 indicates that more than 40 % of the variation in fresh produce exports of developing countries can be explained by the explanatory variables included in the model. The Hausman test provides evidence for model specification. The p-values for Hausman test on model IV versus POLS are 0.54 and 0.49 for both vegetables and fruits. The POLS model is favored therefore over the IV model. Results of the Hausman test reject endogeneity of international standardization (diffusion of ISO 22000) variables.

Table 12.2 Data sources and variables' definitions

Variable designation	Definitions and sources
$Vege_{xmt}$	Exports of fresh vegetables from exporting country x to importing country m in millions of current US$ in year t (International Trade Statistics by International Trade Centre TRADEMAP)
$Fruit_{xmt}$	Exports of fresh fruits from exporting country x to importing country m in current US$ in year t (International Trade Statistics by International Trade Centre TRADEMAP)
GDP_{xt}	Real GDP of exporting country x in year t in constant billions of 2005 US$ (WDI database)
GDP_{mt}	Real GDP of importing country m in year t in constant billions of 2005 US$ (WDI database)
POP_{xt}	Population of exporting country x in year t (World Bank's WDI database)
POP_{mt}	Population of importing country m in year t (World Bank's WDI database)
$DIST_{xm}$	Direct line distance between exporting country x and importing country m measured in kilometers
$ISO22000_{xt}$	Number of ISO 22000 Certifications in exporting country x in year t (ISO Survey of Certification)
$ISO22000_{mt}$	Number of ISO 22000 certifications in importing country m in year t (ISO Survey of Certification)
$Colony_{xmt}$	Dummy variable for presence of any colonial ties between exporting country x and importing country m (ICOW Colonial History Data Set; Hensel 2009)
$Tariff_{xmt}$	Effective Tariff Rates applied by importing country m on exports of vegetables and fruits of exporting country x (World Bank's WITS database)

Table 12.3 Econometric results of the gravity model for fresh produce

	Fresh vegetables		Fresh fruits	
Explanatory variables	POLS	IV	POLS	IV
$lnGDP_{mt}$	2.59 (4.113)	2.94 (4.323)	2.53 (4.63)	2.65 (5.07)
$lnGDP_{xt}$	0.62** (0.145)	0.63** (0.155)	1.80** (0.163)	1.72** (0.187)
$lnPOP_{mt}$	−1.733 (10.09)	−1.93 (13.65)	−1.03 (11.21)	−1.30 (16.157)
$lnPOP_{xt}$	1.18** (0.138)	1.12** (0.146)	−0.73** (0.155)	−0.68** (0.171)
$lnDIST_{xm}$	−0.99** (0.158)	−1.03** (0.177)	−1.60** (0.179)	−1.84** (0.184)
$ISO22000_{xt}$	0.37** (0.141)	0.44** (0.166)	0.53** (0.148)	0.64** (0.176)
$ISO22000_{mt}$	−0.13* (0.152)	−0.11 (0.171)	−0.24 (0.158)	−0.26 (0.182)
$lnTariff_{xmt}$	−0.39** (0.121)	−0.24** (0.141)	0.01 (0.139)	0.02 (0.149)
$Colony_{xmt}$	3.40** (0.808)	3.49** (0.954)	2.31** (0.876)	2.25* (1.03)
R^2	0.48	0.50	0.43	0.45
Hausman statistic		1.12 [0.54]		1.78 [0.49]
Number of observations	2,151	1,714	2,037	1,610

Notes: Cluster–robust standard errors are within parentheses while the figures in square brackets are the p-values associated with the Hausman statistics
POLS and IV stand respectively for "pooled ordinary least squares" and "instrumental variable estimation procedures"
* and ** indicate 0.05 and 0.01 significance levels, respectively

Results are generally in accordance with the pre-existing empirical trade literature. Most of the typical gravity model coefficients are statistically significant and have the correct sign for both export categories. The estimated coefficient on the importing country's GDP appears to have the correct sign, but has insignificant effect on exports of vegetables and fruits from developing countries. Importing country's *POP* variable has an insignificant value with its sign being negative. Opposing signs and insignificant coefficients are likely the result of multicollinearity between *GDP* and *POP* variables in the importing country.

Exporting country's *GDP* variable has a positive and statistically significant coefficient. The coefficients estimates which are equal to 0.62 and 1.80 for vegetables and fruits respectively indicate that as the developing countries grow in their economic terms (aggregate production), their exports of fresh produce increase as well; however exports of fruits increase to a much larger extent.

Exporting country's *POP* variable has a positive and significant coefficient value for vegetable exports while the reverse is true for fruit exports. The expected sign would be positive, implying that as the country's population grows, there would be

more production and more exports. The expectation is true for vegetables. However, with regards to fruits, domestic demand due to population growth may be larger than the positive impact of population on fruit production and therefore population and fruit exports are inversely related.

POLS and IV stand respectively for "pooled ordinary least squares" and "instrumental variable estimation procedures".

A distance variable with a negative and statistically significant coefficient both for fruits and vegetables provides statistical evidence that greater distance deters market entrance. The obtained results concerning distance are a typical result of trade regressions, since longer distance is reflected in increased trade costs. In addition, physical distance combined with lack of quality and efficiency of transportation infrastructure affects the end quality of food products which increases the possibility of import detention. Distance coefficients for fruit and vegetables can be interpreted such that doubling distance between the trade partners decreases exports of vegetables and fruits by 50 % and 67 % respectively.

The coefficient estimate for the tariff variable on vegetable exports is negative and statistically significant, which is consistent with prior expectations. A 1 % increase in tariffs by importing countries decrease their imports by 0.39 % that may be interpreted as an indication of inelasticity in international trade of vegetables. The tariff variable has an insignificant and positive coefficient for fruit exports, which may indicate that high tariff barriers on fruit exports do not have a significant effect on trade flows. The findings need to be explored further to find out why tariff variable is significant and has the expected impact on vegetable exports but opposite is true for fruit exports. It might be that the impact of ISO 22000 adoption by exporter country on fruit exports is larger than the vegetable exports (0.37 for vegetables and 0.53 for fruits). Therefore exporters of fruit may benefit more by complying with the standards which decreases the possible negative impact of tariffs.

A positive sign and a statistically significant coefficient of the dummy variable of colonial ties (colony) indicate that the presence of colonial ties tends to increase vegetables and fruit exports of developing countries, which is in line with the findings of Otsuki et al. (2001). For instance, Egypt, Ghana, Kenya and Pakistan have tendency to export to the United Kingdom. In contrast, Bolivia and Paraguay have tendency to export to Spain. Otsuki et al. (2001) suggest that historical trade relationships with ex-colonies may have created a strong export dependency of these developing countries.

To test hypotheses 1 (H1) and 2 (H2), ISO 22000 diffusion variables are integrated into the typical gravity model. Hypothesis 1 is tested with $ISO22000_{xt}$ variable. If the hypothesis is true, the coefficient associated with $ISO22000_{xt}$ variable would be positive and significant. The findings imply that we accept Hypothesis 1. Diffusion of ISO 22000 in developing countries tends to increase their exports of vegetables and fruits by 37 % and 53 %, respectively. Therefore, ISO 22000 certification lowers information asymmetries and transaction costs between sellers and buyers and increase trade providing support for standards as catalysts argument.

Hypothesis 2 is tested with the $ISO22000_{mt}$ variable. If hypothesis 2 is true, we would see that the coefficient estimate would be positive indicating that the pull effect of the importing country's standards. The findings do not show any evidence and all estimated coefficients associated with the $ISO22000_{mt}$ variable are negative and insignificant. The study confirms that Hypothesis 1 is fulfilled but there is no statistical support for hypothesis 2.

12.6 Conclusion

This chapter examines the effect of international private standards on developing countries' export performance of fruits and vegetables using the gravity model. Most of the coefficients for typical gravity model are statistically significant and have the expected sign in line with the relevant literature.

Based on the above arguments, the international standards adopted by the exporter country have a boosting impact on its exports of fruits and vegetables. However, the findings do not show any statistical evidence that the exports of fruits and vegetables decline when the importer country imposes standards. The ISO 22000 standards adopted by the import destinations have no impact on the export performance of the exporting countries, implying that the standards do not act as barrier for the exporting countries. The results confirm that the standards may work as enhancing demand rather than suppressing supply.

This finding is consistent with the arguments presented by Honda et al. in this book whereby they suggest that demand-enhancing outcome of compliance with standards may work against negative supply effects of standards. Here, ISO 22000 standards act as a trade facilitator rather than as a non tariff barrier. The implication of this finding is significant for Turkey as well as developing countries with large export volume of fruits and vegetables. Complying with universal standards has a significant impact on exports with no significant negative outcomes.

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Conclusion

13

Abdelhakim Hammoudi, Cristina Grazia, Yves Surry, and Jean Baptiste Traversac

The role of standards as trade barriers is most often explained by a prohibitive increase in production and commercialisation costs for producers in developing countries (Henson and Loader 2001; Horton 1998). Moreover, these costs are increasing with the proliferation of standards, including private standards, characterized by non-harmonized compliance process and proper certification schemes (Chap. 3). However, the compliance with quality standards may induce a diversification of export market and increase of the demand. To assess the impact of the standard on developing countries, it is necessary to assess the outcome of the arbitration between costs (additional) compliance (negative effects) and effects (potentially positive) changes of export demand in developing countries (Chap. 8). On other hand, the capacity to comply with norms does not systematically depend on the requirement level of standards and associated costs. In practice, it may be facilitated, or impeded, by the type of regulations set by public authorities in developing countries or by the forms of supply chain organisation (Chaps. 5 and 8). The supply chain structure, according to its level of integration or networking may significantly affect operators' capacity to comply with import market requirements. The supply chain structure may favour compliance through scale economies in the compliance process, more effective foodborne disease risk management via better coordination among agents, or an improvement of suppliers' bargaining power towards importers from the North.

A. Hammoudi (✉) • J.B. Traversac
INRA, Institut National de la Recherche Agronomique, Ivry sur Seine, France
e-mail: abdelhakim.hammoudi@yahoo.fr; jean-baptiste.traversac@agroparistech.fr

C. Grazia
Dipartimento di Scienze, Università di Bologna, Bologna, Italy
e-mail: c.grazia@unibo.it

Y. Surry
Swedish University of Agricultural Sciences, Uppsala, Sweden
e-mail: yves.surry@slu.se

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As shown by a number of contributors to this book, the supply chain organisation plays a crucial role in the development of compliance capacities. The Peruvian export asparagus case (Chap. 10) is particularly representative of this organisational issue. Another important point is the role of the intermediate sector and international supply chains in improving food safety (Chaps. 4 and 7). In fact, agricultural markets are most often characterised by an atomised upstream sector and, in contrast, a highly concentrated downstream sector (processing/retailing). When the market access for producers is constrained to a limited number of buyers (retailers or processing firms), downstream firms have a *leading* role and 'drive' the supply chain by selecting suppliers, imposing procurement requirements (e.g. quality specifications) and setting prices. Downstream players are key actors in the upgrading of upstream production practices and leaders in cost and risk sharing. These actors may favour the implementation of public regulations by preventing foodborne disease incidents, the direct consequences of food safety failures, depending on the liability rules and, at the same time, firm- and country-level reputational losses for third country suppliers (Chap. 5).

As a result of their significant strategic power, these actors play a crucial role in the inclusion of developing country producers in international markets (Chap. 7). The question of whether the strategic behaviour of these actors can lead to the exclusion of producers in developing countries has been widely debated (Lee et al. 2012; Kalaitzis et al. 2007). As a result of the heterogeneity of downstream firms strategies, the success of producers/exporters depends on the type of supply chain relating them to international markets (Chaps. 11 and 12). Empirical studies show that with increasing levels of requirement standards, the share of exports from small producers tends to decrease (Chap. 10). However, there are still a number of exporters who are constrained by production conditions to choose less safety-discerning target markets, most often those governed by public norms. They may also take advantage of the heterogeneity of control system procedures at European level. It is noteworthy that under-investment in the quality of production practices is actually rational behaviour for producers that do not have the means or the assurance of commercial outlets to compensate them for their compliance efforts.

Despite these niche markets decreasing, they will survive as long as there exists a category of less exigent customers/importers less concerned about the quality of production practices or less exigent markets. These in turn will exist as long as the control of the production means on production sites is mainly dependent on private strategies and is not clearly and systematically regulated by public norms.

Although public interventions for compliance with international norms were not addressed by all the contributors to this book, the complexity of strategies reveals the complexity of public decisions in this domain. Support for suppliers from the South to increase their compliance capacity is a good example of this strategic issue. Should individual capacity or organisational dynamics be supported? Should support be designed to encourage compliance with local or international norms? Should the regulator set mandatory or voluntary systems? If individuals (small producers) are supported without taking into account the type of supply chain relating them to international markets, short-term inclusion may be favoured

without facilitating long-term inclusion (Grazia et al. 2013). Normalisation and support policies should take into account the expected changes in the international environment, in public regulations and in the proliferation of private standards. Should a strategic vision support the inclusion of small farmers in high-value chains? This option has been selected by a number of countries in Africa and South-America (Kenya with KenyaGAP, Chili with ChiliGAP, etc.; for more details see Otieno and Knorringa (2012)). These engage a combination of public rules and private norms by explicitly incorporating criteria inspired by private standards into their national normalisation process. Such business strategies are defined in the economic literature as "proactive strategies" (Jaffee et al. 2011; Hammoudi et al. 2010). They transform threats into opportunities. Developing countries will thus not be affected by external constraints, but will take advantage of opportunities provided by sustainable development and high value markets (Bolwing et al. 2013; Jaffee 2003). The most exigent norms would ensure safe and lucrative commercial outlets in the long term (Kariuki et al. 2012; Henson et al. 2011). A pro-active development scheme, associated with effective support, would progressively provide incentives for operators not to engage in the 'one-on-one' opportunities offered by less exigent markets.

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