The role of different food chain actors on setting private food standards

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SUSFANS DELIVERABLES

Consumers, retailers and producers are giving increasing attention to ensure that production and processing activities are sustainable from an economic, social and environmental point of view. The goal of this task will be to analyze the role different actors in the food supply chain play in the establishment of food standards and their impact on the sustainability of the food supply chain. The analysis will consist of theoretical modelling and an empirical analysis.

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DELIVERABLE SHORT SUMMARY FOR USE IN MEDIA

The way our food is produced and brought to our stores has changed drastically over the past few decades. First of all, our food is increasingly sourced globally, including to an ever increasing extent producers from the developing world. In many cases, cross-border food value chains have taken the place of subsistence farming. Second, following several food scares in the developed world, standards with respect to the safety of the production process and the handling of food have become significantly more stringent, even for smallholder farmers in developing countries. Third, consumers along with different organizations have become increasingly vocal about the sustainability of our food. This has given rise to countless food standards focusing on one or more aspects of sustainability. Fairtrade, Rainforest Alliance and UTZ are but some of the more well-known examples in this category.

This report aims to make sense of the various, and sometimes complex, relationships that exist between these different trends. It is structured in three parts, each addressing one aspect of the issues related to food standards, value chains and sustainability.

The first part looks at the relationship between food standards and sustainability, classifying different food standards along the sustainability impact they are trying to achieve. For each category, we offer examples as well as empirical evidence.

The second part discusses, both theoretically and empirically one aspect of the debate that has been largely overlooked, namely the economic sustainability of the food value chain. It is argued that without an economically sustainable food value chain, none of the potentially beneficial impacts from part I can be attained. Through a detailed empirical and theoretical analysis, the concept of economic sustainability is explored further, establishing the need for vertical coordination in the context of stringent food standards, especially when there are market imperfections and when the standard is a private one.

Finally, the third part considers the political economy of public and private food standards. We demonstrate that public standards can be higher or lower than is socially desirable depending on producers' and consumers' characteristics and their relative lobbying strengths. We also show that retailer-set private

standards can be more stringent than public standards if retailers succeed in shifting the burden of the standard to producers.

Above all, this report wants to encourage researchers, practitioners and policy-makers to always put the food value chain at the center of the analysis. By neglecting the role of the value chain, it is impossible to gauge the many interdependencies that exist between consumers in developed countries, producers in developing countries, government, exporters, NGOs and retailers setting food standards, etc. Specifically, European consumers and policy-makers should be aware of the fact that efforts to make food production more sustainable will be in vain if the value chain in which food production occurs is not economically sustainable. Likewise, with the proliferation of food standards set to continue for some time to come, this report offers insights into which actors are set to gain and which actors stand to lose from this evolution. Lastly, we make an effort to transform sustainability from being an all-encompassing, but ultimately meaningless concept, back to the research sphere, with a useful application for policy-making.

TEASER FOR SOCIAL MEDIA

Food standards like Fairtrade, Rainforest Alliance and GlobalGAP play an increasingly important role in the way our food is produced and consumed. This report offers a complete overview of the issues surrounding food standards in three domains: sustainability, economic sustainability of the value chain and the political economy of standard-setting.

Economic sustainability of the food value chain is crucial for sustainable food. #sustainability #standards

ABSTRACT

This report aims to shed light on the three issues surrounding the topic of food standards, value chain and sustainability by bringing together past work with newly developed theoretical and empirical insights. **Part I** offers insights into the relationship between food standards and the general concept of sustainability, establishing a classification of sustainability standards and their effects. **Part II** looks more specifically at the economic sustainability of food value chains, which is defined as the ability to withstand changes and shocks to the economic environment in which the value chain is operating. Economic sustainability should be considered as a pre-condition to other types of sustainability such as environmental and social sustainability. It is shown that especially in the context of (factor) market imperfections and private standards, vertical coordination between buyers and farmers is needed to achieve economic sustainability of the value chain. Both factors are explored theoretically and substantiated with case studies. **Part III**, finally, discusses the political economy of food standards, analyzing the role of different value chain actors (both public and private) in the standard-setting process.

INTRODUCTION

Changing consumer preferences, income growth, urbanization, technological advancements in food technology and globalization have dramatically changed the industrial organization of food production. An important element in this process are *food standards*, which can be defined as requirements, set by government (public standards) or commercial organizations or NGOs (private standards), pertaining to the safety and quality of food produce and to the conditions in which food production takes place. Both public and private standards have been increasing in number, in geographic reach and in what they cover, addressing issues ranging from safety (e.g. no small toy parts, low carbon dioxide emission), health concerns (e.g. low lead or pesticide residues), nutrition requirements (e.g. low fat), to social concerns (e.g. no child labor, fair trade).

An illustration of this trend are the notifications submitted to the WTO whenever member states introduce public standards and regulations which may restrict trade. Notifications to the WTO of sanitary and phyto-sanitary (SPS) and technical barrier to trade (TBT) measures have increased exponentially over the past fifteen years. In 2014, more than 17,000 notifications have been submitted to the WTO (WTO, 2014a; b). In the past, most of these notifications originated with the US and the EU, but in recent years developing countries have caught up and now issue 60% of the SPS notifications. Systematic data on private standards are hard to find but indirect data can be used to gauge the parallel explosion of private standards, e.g. by using data on standards such as GlobalGAP, a standard used by the world's leading retailers for their suppliers of food and agricultural produce.[1] GlobalGAP is now used in more than 100 countries and the number of GlobalGAP-certified producers increased approximately ten-fold over the past decade (GlobalGAP 2016).

The rise of standards and value chains has triggered strong debates on the impacts on international trade and development (Swinnen, 2016).

A first debate is on whether standards are (non-tariff) trade barriers.[2] As international trade agreements such as the WTO have contributed to a global reduction in tariffs, countries have turned to new instruments to shield their

[1] The GlobalGAP standard implies criteria for food safety, sustainable production methods, worker and animal welfare, and responsible use of water, compound feed and plant propagation materials (www.globalgap.org).
[2] See Beghin et al. (2015) for a more elaborate review

domestic markets from foreign competition (Anderson et al., 2004; Augier et al., 2005; Brenton and Manchin, 2002; Fischer and Serra, 2000; Sturm, 2006). The second line of critique is that, even if developing and emerging countries can comply with the new standards, there are major distributional effects within these countries, mostly to the detriment of the poor. More specifically, it is argued that standards cause the exclusion of small, poorly informed, and weakly capitalized producers from participating in these "high standard value chains".[3] Moreover, even if small producers could participate, these chains are said to be dominated by large multinational companies which extract the entire surplus through their superior bargaining power within the chains (Reardon and Berdegué, 2002; Unnevehr, 2000; Warning and Key, 2002).

However, there is considerable uncertainty and debate regarding the validity of these critical arguments on the impacts of these standards, and more generally the welfare implications of high-standards trade and global value chains (Swinnen, 2007).

First, regarding trade and the protectionist effects of standards, several authors argue that the simple "standards as protectionism" argument ignores the social benefits of standards in terms of consumer welfare, for example by reducing asymmetric information, or by reducing externalities in society. Including these other effects of standards makes the impact of standards on trade and welfare much less obvious (Beghin et al., 2012; Beghin and Li, 2013; Sheldon, 2012; Swinnen and Vandemoortele, 2012).[4] Moreover, while quality and safety standards indeed make production more costly, at the same time they reduce transaction costs in trade, and can be "catalysts" for trade (Henson and Jaffee, 2007; Maertens and Swinnen, 2007). Standards can communicate the presence of desirable attributes or the absence of undesirable attributes which are otherwise difficult, costly or even impossible to verify by consumers (Roe and Sheldon, 2007).[5]

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[3] Several empirical studies indicate that small producers are excluded because of increasing standards (Reardon et al., 2003; Key and Runsten, 1999; Gibbon, 2003; Kherralah, 2000; Maertens and Swinnen, 2009; Schuster and Maertens, 2013; Subervie and Vagneron, 2013; Weatherspoon and Reardon, 2003). For example, evidence from Kenya, Zimbabwe and Cote d'Ivoire suggests that horticulture exports are increasingly grown on large industrial estate farms, thereby excluding smallholder suppliers in the export supply chain (Dolan and Humphrey, 2000; Minot and Ngigi, 2004).

[4] Several authors have determined protectionism of standard-like measures conceptually, see e.g. Baldwin (1970), or Fisher and Serra (2000), with some limitations highlighted in Marette and Beghin (2010). However, empirically determining whether a standard is a protectionist measure is a difficult empirical problem, as explained in detail in Beghin et al. (2015).

[5] In addition, minimum quality standards may increase welfare in a vertically differentiated market by reducing firms' pricing power. Standards may also solve problems related to network externalities.

In fact, despite the rapidly growing and tightening standards, global trade has increased sharply over the past three decades. Moreover, even for developing countries, the growth has been strong in sectors where standards have become (much) more restrictive and spread rapidly. This is, for example, the case in high value (and high standards) food exports – which includes fruits, vegetables, seafood, fish, meat and dairy products. In Asia and in Latin America, exports of such high-value food products increased from around 20% of agricultural exports in the 1980s to around 40% in recent years, with overall exports increasing significantly. The process is similar, albeit somewhat slower, in Africa (Swinnen and Maertens, 2014).

A second debate concerns the impact of standards on inequality and poverty inside developing and emerging countries. While quality and safety standards indeed make production more costly, at the same time they increase the value of the products, potentially yielding higher profits (Reardon and Farina, 2002; Swinnen and Vandeplas, 2011; Maertens et al., 2012). Empirical studies also show that the introduction of standards induces important changes in the industrial organization of value chains, such as the growth of vertical coordination with potentially important implications for access to technology, capital, and crucial inputs for local suppliers (Gow and Swinnen, 1998; Dries et al., 2009).[6] The empirical literature thus suggests that smallholder participation in high standards global value chains is more widespread than what was initially predicted, or feared (Reardon et al., 2009; Swinnen, 2007).[7]

Additionally, regarding the rent distribution within these value chains, recent empirical studies show quite different effects than predicted. Early empirical studies focused mostly on the exclusion issue (i.e. whether poor producers were marginalized by the introduction of standards). Only more recent studies actually measure welfare, income or poverty. The studies that do measure welfare effects find positive effects for poor households in developing countries who may participate either as smallholder producers or through wage employment on larger farming companies (Maertens and Swinnen, 2009;

[6] Minten et al. (2009) find that inclusion in a contract-farming scheme for high-standard vegetable export production in Madagascar improves farmer's access to new technologies and food security. Dries and Swinnen (2004; 2010) find that participation of small-scale farmers in contract-farming schemes in dairy value chains in Poland increases access to credit, technology and farm investment. Similar results have been documented by Gow et al. (2000), Noev et al. (2009), World Bank (2005), Negash and Swinnen (2013).

[7] For example, Minten et al. (2009) show that in Madagascar most fresh fruit and vegetable production for exports is on very small farms, often on a contract-basis with the agrifood industry, and with important positive effects on farmers' productivity. Similar results are found by studies in Asia (Gulati et al., 2007), in Eastern Europe (Dries and Swinnen, 2004; Dries et al., 2009), and in China (Wang et al., 2009).

Maertens et al., 2011; Colen et al., 2012; Minten et al., 2009; Rao and Qaim, 2011; Rao et al., 2012; Andersson et al., 2015).[8] What is remarkable is that these strong benefits occur in several of these cases despite the fact that trade is organized by monopsonistic exporting companies.

A third debate is regarding the impact on the sustainability of the food sector. Climate change, the pollution of soil and water, biodiversity losses and issues related to farmers' health are important concerns. Both governments and private actors, in particular transnational corporations and civil society organizations, have increasingly included sustainability provisions into their food standards (Fuchs and Kalfagianni, 2010). Sustainability labels have proliferated over the past decades and have become known under a host of different denominations: eco-, bio- and organic labels all feature within the sustainability trend.

The literature on sustainability effects, however, is somewhat less developed than that on trade and development impacts, which we just summarized. There are two different types of studies that are relevant here. One are studies that analyze how standards intended to improve some aspect of sustainability have the desired (or claimed) effect. These studies are obviously empirical in nature since the mechanism is (supposed to be) clear by design. Another group of studies focuses on sustainability effects that are not (necessarily) the intended outcome of the standards that are introduced. For example, Maertens and Swinnen (2009) and Minten et al. (2009) show that the introduction of high EU safety and quality standards in fruit and vegetables export chains had major impacts on incomes and food security of African farmers - an outcome which was not the direct objective of the introduction of the standards. Most of such studies are empirical as well, with some exceptions. Therefore in this report we first review the empirical literature, which is most abundant, and then develop a conceptual (theoretical) framework on aspects of sustainability effects of standards, in particular economic sustainability, which has not been studied much, either theoretically or empirically.

[8] Maertens and Swinnen (2009) find that farmers' income doubles as a result of being included in the horticultural export chain in Senegal; and Dedehouanou et al. (2013) point out that participation in such contract farming schemes increases farmers' subjective well-being or happiness. Rao and Qaim (2011), Rao et al. (2012) and Andersson et al. (2015) find that the participation of smallholder vegetable farmers in high-standard supermarket channels in Kenya increases farm productivity and income with almost 50%. Minten et al. (2009) find that inclusion in a contract-farming scheme for high-standard vegetable export production in Madagascar improves poor households' food security.

The literature on sustainability standards is quite abundant, but there is much to be desired on the front of rigorously analyzing the effects of the standards on the issues they claim to be remedying. One problem is that studies on sustainability issues are hampered by the fact that most research is conducted by the organizations setting the standards. Needless to say, these studies lack the impartiality and rigor expected from proper academic research. Moreover, possibly because of the private nature of some of these standards, adequate data is often missing or not accessible (Rotherham 2005). As a consequence, environmental effectiveness of sustainability standards, for instance, has generally been evaluated indirectly by relying on data on consumer awareness and consumer demand for the standard and on changes in production behavior (OECD, 2005). In this report we will review empirical evidence and provide a conceptual framework for a crucial aspect of sustainability that has largely been ignored, namely economic sustainability. We argue that economic sustainability is a necessary pre-condition for all other types of sustainability effects (environmental, health, welfare, …). Our analysis of the relationship between food standards, value chains and sustainability integrates specific issues that characterize this relationship by exploring them theoretically.

This report brings together past work with newly developed insights to arrive at a concise but comprehensive overview of different issues related to food standards, value chains and sustainability. The report is divided into three separate parts, each related to one aspect of the topic of food standards and sustainability.

In **Part I**, we discuss the relationship between food standards and sustainability as it is commonly understood in the literature. We provide an overview of the empirical literature in this domain and show that food standards demonstrate a potential to have sustainability-enhancing effects, but that significantly more research is needed.

In **Part II**, we shed light on food standards and their relationship with the economic sustainability of value chains, which is defined as the ability of a value chain to sustain shocks or disturbances in its economic environment and as a precondition for other sustainability outcomes. This relationship is explored both empirically and theoretically. The theoretical analysis of food value chains is extended by introducing shocks and uncertainty to the relationships between buyers, farmers, processors and exporters. So far in the literature, farmers and buyers were considered to be perfectly informed about present as well as future market conditions. This allows them to completely specify all contingencies that

might arise in the future. Naturally, in an environment as volatile as the agri-food industry (FAO, 2010a), this is not a realistic assumption. Circumstances are likely to change drastically, even during the duration of a given contract or commercial relationship. For that reason, we import the so-called 'probabilistic hold-up framework', developed by Klein (1996), and apply it to the context of agricultural markets. We show that economic sustainability of the value chain in the presence of stringent food standards can only be achieved by vertical coordination between the different actors in the chain. Furthermore, we find that more vertical coordination is needed as market imperfections increase and when the standard is a private one.

In **Part III**, finally, we discuss the political economy of food standards and value chains, both for the case of public standards and the case of private standards. After discussing some general conceptual issues related to the political economy of standards, we show that consumers and producers have an interest in lobbying the government to set a public standard at a certain level. Depending on the producer's production costs, the consumer's utility gains and their relative lobbying strengths, the government will decide on the level of the public standard, which may be higher or lower than the socially optimal one. Further, it is shown that private standards (set by a retailer) may be more stringent than public standards if retailers are able to shift the burden of the private standard to producers. Finally, we discuss some shortcomings of the literature surrounding the political economy of food standards and offer some fruitful venues for future research.

PART I – FOOD STANDARDS AND SUSTAINABILITY: CLASSIFICATION AND EMPIRICAL EVIDENCE

Sustainability is the main focus and objective of many different food standards .[9] Several have even been explicitly designed to have a sustainability impact. Of course, this is in part due to the fact that sustainability is interpreted in such a broad way. The purpose of this section is to introduce a classification of different food standards according to their sustainability effects, to offer examples of each of them and present evidence from the literature.

1.1. Defining Sustainability

Of course, before delving into such a classification, we have to carefully define the concept of sustainable agriculture. This is by no means an easy task as sustainability has over the years earned the dubious honor of belonging to the same group of words like 'globalization' and 'grassroots development': they are widely and often gratuitously used without anyone ever being able to tell you what it really means. As a starting point for our analysis, we will rely on the, admittedly broad, definition coined by the United Nations' Brundtland Commission (1987): "Sustainability implies meeting the needs of the present without compromising the ability of future generations to meet their own". Based on this definition, the World Summit on Social Development (2005) then introduced three pillars of sustainability: environmental, economic and social.

Our classification of sustainability standards in the agri-food sector will roughly follow the same lines. Specifically, we classify standards according to the type of potential sustainability impact they have: we distinguish between environmental, social, health, and food safety standards. This categorization is a theoretical

[9] Numerous private governance organizations promising to address sustainability concerns currently exist at the global level. To name but a few, in agriculture and fisheries, there is the International Federation of Organic Movements (IFOAM), the Sustainable Agriculture Network (SAN), GlobalGAP, the Marine Stewardship Council (MSC), and the Aquaculture Certification Council (ACC). Such organizations are set up either by business actors alone, such as GlobalGAP, or in the context of public-private partnerships, such as SAN. According to the website Ecolabelindex.com (2016), there are currently no less than 465 standards that have at least some sustainability requirements. Some of them are well-known by consumers and clearly serve differentiation purposes (for instance: Rainforest Alliance aims at the so-called 'green' market segment) while others feature more in a business-to-business context and are not actively marketed towards consumers (like GlobalGAP). While environmental concerns dominate the current sustainability landscape, sustainability should be considered as a much broader concept and will be treated as such throughout this report.

construct useful for our analysis as it allows us to trace the impact of different effects. In reality, however, many standards have characteristics from more than one category. Consider organic food standards for example (see e.g. Lusk and Briggeman, 2009). Consumers may consider food labeled as organic as safer because pesticides are not used in the production of organic food (a food safety standard in our classification). At the same time, society may benefit from reduced pesticide use (a social and environmental standard in our classification.[10] However, for the purpose of this report the mutually exclusive classification adopted is useful. Obviously, it is important to take these considerations into account when applying this analytical framework for empirical research.

Other food standards may also have sustainability effects (in the areas defined above) even though they are not mentioned as explicit objectives. Even if a certain food standard only specifies what a product should look like (something which does not occur very often), there will still be consequences for the way the food is produced and hence it will have sustainability effects. Moreover, food standards with an emphasis on one type of sustainability are bound to also have an impact on other areas of sustainability. For instance, an environmental standard that prohibits the use of a certain pesticide will most certainly also have social implications in the sense that the farmer's income will be affected by that requirement. Moreover, if the prohibited pesticide is harmful for farmers, this particular standard will also engender health effects. As such, we should by no means limit our attention to those standards that attach great importance to sustainability as we risk misrepresenting the impact of the entirety of food standards on sustainability.

In what follows, we will first define each category of standards, then offer some examples and finally discuss the effects in terms of the existing literature.

1.2. Environmental Food Standards

Environmental food standards are perhaps the most well-known and most straightforward category in our classification. They are geared towards protecting or restoring (parts of) nature. As such, these standards include provisions against pesticide use, stipulations for forest, marine or animal preservation and directives to combat global warming. All eco-, bio- and

[10] This classification issue is also one of the main causes for the lack of data concerning the number of food standards. Only some limited and incomplete information on the amount of different food standards is available.

organic food labels can be considered belonging to the category of environmental food standards, making it a broad and growing group of standards. Environmental food standards' aims are often twofold: in addition to urging producers (often farmers) to adopt more environmentally-friendly practices, they also try to increase awareness of certain ecological issues in order to induce consumers to alter their consumption patterns, which in turn could have an impact on government regulation. In our framework, the focus is on the former, namely the producer-level environmental impact of food standards.

Prominent examples of food standards that focus specifically on environmental impact are abundant. We offer but a few examples here. Rainforest Alliance was, as the name suggests, originally dedicated to the conservation of (rain)forests, but has since then expanded to also combat other environmental issues such as declining biodiversity, climate change and water pollution (Rainforest Alliance 2016). The Carbon Trust Standard, which is independently managed by the Carbon Trust organization, offers certification to companies around the world (and not only in agriculture) that have undertaken action to reduce their environmental impact, especially in terms of their carbon footprint (Carbon Trust 2016). Another well-known environmental standard is the ISO 14000 family of standards, developed by the non-governmental International Organization for Standardization (ISO). It encourages companies to set up an environmental management system (ISO 2016). Other environmental standards are more focused on the agricultural sector.[11]

Quite surprisingly, especially given the number of specialized environmental standards, few studies have so far rigorously analyzed the environmental effects of those and other food standards. As mentioned in the introduction, most analyses on environmentally focused standards originate from the standard-setting organizations themselves, which is an issue in itself but they also offer little more than descriptive evidence. One reason could be that much of the attention in the field has gone to Fairtrade, a standard which is geared more towards social and economic issues. Or, it might also be the case that

[11] For instance, the International Federation of Organic Agricultural Movements (IFOAM) is an organization that brings together many organic initiatives in the field of agriculture. The way they define organic agriculture is not entirely dissimilar to our general notion of the concept of sustainability. In fact, one could argue the term organic simply refers to sustainability applied to the agricultural sector (IFOAM 2016): "*Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.*"

environmental concerns have simply not found its way into the debates on food standards. Nevertheless, a review paper by the International Trade Center (ITC 2011) has identified five studies that investigate the impact of food standards on the environment (focusing on soil erosion, biodiversity, deforestation and water quality). Three of those studies report positive impacts while the evidence in the other two is considered mixed or even negative. This mixed picture has been confirmed by Blackman and Rivera (2011), who provide an overview of 11 credible studies (they considered a total of 46) and find limited evidence for enhanced environmental (and also economic) benefits. On the other hand, Blackman and Naranjo (2012), one of the only rigorous studies that looks at the environmental impact of eco-certification, find more positive effects. Using cross-sectional data combined with propensity score matching, they demonstrate that eco-certification caused farmers to use less harmful pesticides. Clearly, more research on the environmental effects of food standards is warranted.

1.3. Social Food Standards

The second category we consider are social food standards. While they often share many of the same aims with environmental food standards, the two categories can be separated by the fact that social standards aim to improve the actual livelihoods of food producers and not just the environment in which they operate. Improving farmers' incomes is perhaps the most important aim of any social food standard, but other social problems such as gender issues and children's rights are also often included in such a standard.

Perhaps the most well-known among consumers and most widely discussed private standard in this category is the Fairtrade standard. Even though it also stipulates requirements regarding the environment, its primary aim is to ensure that farmers (mainly in developing countries) are paid a fair price for their goods. If a farmer (or farmer organization) manages to comply with the Fairtrade standard, they are guaranteed to be paid a certain price floor for their produce. Generally in line with Fairtrade is UTZ certification, which focuses mainly on coffee, tea and cocoa. While UTZ is said to aim at sustainable agriculture in general (and could thus potentially be classified in any of our categories), the organization clearly focuses most on farmer profitability (UTZ 2016).

The literature on the effects of food standards on the welfare of farmers is considerably more expansive than what has been written on environmental effects.[12] Most studies find that the welfare of small producers succeed at meeting a food standard typically improves. Some empirical studies even find very large effects. Maertens and Swinnen (2009) show that farmers' incomes double as a result of being included in the horticultural export chain in Senegal, and Dedehouanou et al. (2013) point out that such inclusion increases farmers' subjective well-being or happiness. Rao and Qaim (2011) and Rao et al. (2012) find that the participation of smallholder vegetable farmers in high-standard supermarket channels in Kenya increases farm productivity by 45% and farmers' incomes by 48% and that this income gain results in poverty reduction. Minten et al. (2009) find that inclusion in a contract-farming scheme for high-standard vegetable export production in Madagascar increases farmers' incomes and their income stability, improves farm technologies, and reduces the number of hungry months. Dries and Swinnen (2004, 2010) find that participation of small-scale farmers in contract-farming schemes in dairy value chains in Poland increases access to credit, technology, and farm investment. Similar results are documented by Gow et al. (2000), Negash and Swinnen (2013), Noev et al. (2009), and World Bank (2005).

Important channels of the effects of and reasons for (significant) increases in farmers' incomes are technology transfers and access to more and better inputs through vertical coordination in value chains. A second factor is that the enforcement of standard-induced vertical coordination schemes induces efficiency premia for farmers in the distribution of rents in the value chains, leading to increases in income beyond suppliers' reservation incomes (Swinnen and Vandeplas, 2011).

Although these empirical studies provide important insights into the welfare effects of inclusion in high-standard value chains, they are less informative about the pure impact of specific standards on the welfare of farmers in developing countries. The empirical studies are based on samples including a mixture of farmers in high-standard value chains and farmers in low-standard local chains. The estimated effects are confounded when one assesses the joint impacts of inclusion in export or supermarket chains, of inclusion in specific chains and contract-farming schemes, and of the use of standards.

Other studies look at the impact of specific standard adoption on the welfare of smallholders in a more direct and unconfounded way. These studies use various

[12] For a more complete overview, see Beghin et al. (2015)

econometric methods to compare adopters and nonadopters of standards within a sample of smallholders that are included in contract-farming schemes and export chains. This approach allows the effect of standard adoption to be disentangled from other confounding effects. The results of these studies point mainly to positive (monetary as well as nonmonetary) welfare effects of the adoption of GlobalGAP and a few other private standards, albeit not for all farmers. Asfaw and coauthors (2009; 2010a,b) find that GlobalGAP adoption among smallholder horticultural export farmers in Kenya increases farm revenue and farm income and improves farmers' health (through better pesticide use). Handschuch et al. (2013) find that certification to GlobalGAP or US GAP standards among Chilean raspberry farmers doubles their incomes. Hansen and Trifković (2014) find that the adoption of private standards, including GlobalGAP, BAP, and SQF1000, has significant positive effects on the income of medium-scale pangasius farmers in Vietnam but find no effect for small-scale farmers. Holzapfel and Wollni (2014) find that GlobalGAP certification in horticulture in Thailand has a significant positive income effect for farmers in producer-managed groups and for the largest farms, but not for farmers in exporter-managed groups or for the smallest farms.

All these studies focus on one single standard and use instrumental variable or propensity score matching methods with cross-sectional data. Only a few studies so far distinguish between standards. They find differences among standards, but there are no consistent results for specific standards. Chiputwa et al. (2015) conclude that Fairtrade standards reduce poverty among smallholder coffee farmers in Uganda and that UTZ standards have no impact. Beuchelt and Zeller (2011) and Ruben and Zuniga (2011) find that Fairtrade coffee certification has no impact on poverty in Nicaragua but that Rainforest Alliance certification does enhance incomes. Nowhere does organic certification impact poverty.

1.4. Health Standards

As a third category of sustainability standards, we discuss health standards. When we talk about health standards, we refer to the farmer's health, not the consumer's (standards that address consumer's health are food safety standards in our classification). Like the other categories we have described, health is again a broad concept. It refers not only to farmers' well-being, but also to their working conditions for example.

Food standards focusing specifically on farmers' health or working conditions are scarce. Generally, such provisions are considered an addendum to the more essential demands such as food safety of environmental friendliness. In fact, the organization most concerned with labor rights is undoubtedly the United Nations' International Labour Organization (ILO) which bundles most international labor standards and thus also those for rural workers (ILO 2014). Yet, the Ethical Trading Initiative (ETI), which brings together global companies, trade unions, international organizations and NGOs, is one of the few independent organizations that have developed standards aimed specifically at workers' rights (ETI 2016). Another, less well-known, example is the SA8000 Standard for Decent Work, developed by Social Accountability International (SAI), an international NGO. In a similar way as ETI, they cooperate with all the different actors in the value chain and have granted certification to companies in 69 countries (SAI 2016).

In spite of the limited number of standards focusing almost exclusively on farmers' or workers' health, many other types of food standards include at least some provisions about it. Moreover, as will become clear from the empirical evidence, high-standard production has enormous implications for farmers' and workers' well-being, even if the standard itself does not explicitly specify any related requirements. As such, several studies have been conducted on the effects of those food standards on the health of farmers, particularly smallholder farmers, and of employees in large-scale agricultural operations in developing countries.[13]

The increased reliance of value chains on large-scale plantations and vertically integrated farms instead of smallholder farms implies that more of the gains from trade in agriculture emerge through labor market effects (hired labor on large-scale farms) instead of through product market effects. In addition, standards increase the need for labor-intensive postharvest handling (e.g. for washing, sorting, labeling), which further increases the importance of labor market effects.

Empirical studies of these labor market effects in high-standard trade show significant implications for rural households in developing countries. Maertens and Swinnen (2009) and Maertens et al. (2011) find that employment in large-scale horticultural export companies in Senegal (which emerged as a response to increasing standards) is well accessible for the poor and for rural women and that this employment creates substantial income gains for rural households and

[13] Again, for a more complete overview, see Beghin et al. (2015)

results in substantial poverty reduction. Nonmonetary welfare benefits of female employment include increased child schooling and reduced fertility rates (Maertens and Verhofstadt, 2013; Van den Broeck and Maertens, 2015). Mano et al. (2011) show that employment in the cut flower export industry in Ethiopia significantly reduces poverty. Rao and Qaim (2013) point out that among smallholder vegetable farmers the demand for hired labor, especially that for female labor, increases as a result of inclusion in high-standard supermarket chains in Kenya. Other recent papers are more doubtful. For example, Trifkovic (2014), using per capita consumption expenditures as a measure of welfare, finds no effect of employment in pangasius estate farms in Vietnam on the welfare of workers.

The increasing importance of labor market effects in high-standard value chains also implies a role for labor standards and for labor requirements incorporated into public and private food standards. Barrientos et al. (2003) find that the adoption of labor standards and codes of conduct (including ETI and SA8000, as well as more general food standards such as GlobalGAP) among African food-exporting companies improves the welfare of workers, although effects are less pronounced for temporary and female workers. Nelson et al. (2007) point to similar findings for the adoption of social codes of conduct in the South African wine and the Kenyan cut flower industries. Ehlert et al. (2014) find that workers in GlobalGAP certified vegetable export companies in Kenya are better trained.

Other papers are less positive about the contribution that labor requirements in food standards make in improving the welfare of workers in food export companies. Riisgaard and Gibbon (2014) are skeptical about the contribution of labor standards (such as ETI, FLO, and HEBI) in the East African cut flower sector to the empowerment of labor organizations and trade unions. Schuster and Maertens (2016) find that standards with a main focus on labor conditions (including SA8000, OHSAS18000, SEDEX, ETI, and BSCI, among others) do improve the labor conditions of workers in the Peruvian horticultural export industry to some extent—for example, by lowering the probability of receiving a wage below the minimum wage—but not beyond national labor laws. Schuster and Maertens find that other food standards that include some requirements for labor and working conditions (including GlobalGAP and Tesco's Nurture, among others) hardly have an impact on the conditions of workers.

1.5. Food Safety Standards

The final category of sustainability standards we consider are food safety standards. In the spectrum of food standards, these can be seen as the default category. After all, every food standard's primary aim is ensuring that the product in question is safe to be consumed. Arguably, food safety is the main reason why food standards have been called into existence in the first place (Henson and Humphrey, 2010). Moreover, most retailer-initiated food standards are first and foremost aimed at food safety as they want to avoid the reputational and other costs associated with the sale of unsafe food. In that sense, standards such GlobalGAP, BRC (British Retail Consortium) and most individual retailer standards should be classified in this category.

Food safety is still in many ways the domain of governments. Especially since the major food safety scares in the 1990s, governments across the (mainly developed) world have tightened their grip and defined strict rules for food safety management. The *Codex Alimentarius*, which is jointly managed by the Food and Agriculture Organization (FAO) of the United Nations and the World Health Organization (WHO), brings together and at the same time represents the point of departure for most public food safety regulations. Yet, this does not mean that private actors do not have a role to play in the management and the development of food safety standards. After all, public institutions have often ceded the administration and the enforcement of these rules to private actors. A prime example of this is the HACCP (Hazard Analysis and Critical Control Points) food safety system. While the system itself is part of the *Codex Alimentarius* and is thus managed by the different (inter)national food agencies, it is mostly adopted and enforced by private institutions in their standards. Moreover, public regulations on food safety are often the product of compromise between many different actors and as such represent a lower bound on food safety for private institutions. As we will see in Section 6, retailers and processors have for a number of reasons decided to go beyond the public requirements and imposed stricter food safety standards on their suppliers (Fulponi 2006). Consequently, the rise of private food standards has most certainly had an impact on the level of food safety.

Unfortunately, it is quite difficult to disentangle the effects of food standards on food safety from the concurrent evolutions taking place in the agricultural and economic landscape. In any case, there is no doubt private food standards have helped to promulgate strict food safety requirements across the globe (FAO,

2010b), especially in regions where governments do not have the capacity to set or enforce their own standards (Henson and Reardon, 2005).

PART II – FOOD STANDARDS, VALUE CHAINS AND ECONOMIC SUSTAINABILITY: CLASSIFICATION AND THEORY

2.1. Economic sustainability and smallholder inclusion

From the analysis presented in the previous section, it is clear that there is at least a potential for food standards to have positive sustainability effects. Yet, a crucial element that is missing from the analysis above and in the theoretical and empirical literature on the topic of food standards and agricultural economics more broadly, is a consideration for the role of the food value chain. Our concern is shared by Reardon and Zilberman (2016), who maintain that the literature on Climate Smart Agriculture, an approach developed by the FAO that aims at sustainably increasing agricultural productivity, has neglected the growing complexity of food supply chains. They posit that analyzing these complex supply chains has become essential when considering sustainability, both from a food security perspective (with 100% of rural households in Asia and 98% in Africa depending to some degree on purchased food) and in terms of farmer welfare as they are increasingly involved with supply chains, either through contracting or through employment.

We argue that none of the sustainability-enhancing effects described above can materialize in the context of stringent food standards without economic sustainability of the value chain. If no farmer or too few farmers are unable or unwilling to meet the sustainability requirements included in a food standard, the potentially positive effects of those requirements will not come about. In other words, it does not matter how big the potential sustainability-enhancing effects of a certain standard are, if contracting between the different actors in the value chain cannot occur or breaks down constantly, the effects will not matter. In that sense, economic sustainability of the value chain should be considered as a necessary (but not sufficient) pre-condition for other sustainability effects.

As such, economic sustainability of the value chain should be interpreted as the ability of a value chain to sustain shocks or disturbances in its (economic) environment. Or, a more economically sustainable value chain is one that is more resistant to changing circumstances. There are two elements implicit in this definition: one ex ante and one ex post. Ex ante, contracts or other forms of

agreement between the different actors in the value chain should be feasible. This means that each party has to benefit from entering into an agreement with the others. If this were not the case, high-standard production would not take place and sustainability effects would never materialize. Ex post, even after contracting has occurred, situations (shocks or disturbances in the economic environment) might arise in which the agreement between the relevant parties breaks down. In that case, the value chain also cannot be considered economically sustainable. Such shocks or disturbances could come in a number of forms. The first category that comes to mind are shocks to the market price of the good that is being traded in the value chain. Additionally, one can think of heavy rainfall or droughts, climate change (see Reardon and Zilberman, 2016), demand collapses or booms, changes in government regulation, conflicts and so on.

The importance of economic sustainability is also illustrated by the large literature on the inclusion or exclusion of smallholder farmers in high-standard value chains. This strand of literature investigates whether high-standard production is a possibility for smallholder farmers in developing countries. Or, in terms of our framework, whether high-standard value chains can be made economically sustainable when the actual food producers are small in size. This is an important empirical question since such value chains would offer the most opportunities to achieve sustainability in the different domains we have identified (social, health, food safety and environmental).[14]

Most of the studies in this field focus on a specific sector. Some studies look at one specific value chain related to one company or supermarket, whereas others use a sector-wide approach. Much- discussed cases are the fruit and vegetable export sectors in Kenya and Senegal, where large shifts from smallholder to large-scale (vertically integrated) farming have been documented (Dolan and Humphrey, 2000; Gibbon, 2003; Jaffee and Masakure, 2005; Maertens and Swinnen, 2009; Ouma, 2010). The share of export produce from smallholders decreased from almost 100% to less than 50% with standards becoming more important. Similar changes are observed in Latin America (Berdegué et al., 2005; Reardon and Berdegué, 2002), other African countries (Gibbon, 2003; Subervie and Vagneron, 2013; Unnevehr, 2000; Weatherspoon and Reardon, 2003), Asia (Belton et al., 2011), and Russia (Dries et al., 2009). In most of these cases, there is only a partial shift toward large suppliers, and sourcing remains partially from smallholders. Henson et al. (2013) and World Bank (2005) point to a

[14] Again, for a more complete overview, see Beghin et al. (2015)

complementary rather than a competitive relationship between company own-farm production and sourcing from smallholder farmers. An exception is Senegal's tomato export sector, which is completely based on exporter-owned agro-industrial production (Maertens et al., 2012).

Yet, there are also cases in which specific contract-farming schemes for high-standard export or supermarket retail include a large number of smallholder farms. This is documented, for example, for the horticulture sector in Africa (Henson et al., 2005; Minten et al., 2009), for the horticulture sector and for animal production in Asia (Gulati et al., 2007; Roy and Thorat 2008; Wang et al., 2009), and for the dairy sector in Eastern Europe (Dries et al., 2009; Noev et al., 2009). Among smallholders, those supplying to high-standard value chains are often those who are somewhat larger, more capitalized, and more commercially oriented, as documented by Asfaw et al. (2010b), Handschuch et al. (2013), Hernández et al. (2007), Kersting and Wollni (2012), Maertens and Swinnen (2009), and Neven et al. (2009).

The studies have limitations and shortcomings. First, there are obvious causality issues deriving from the cross-sectional data sets that are often used, and there are questions as to whether other factors are sufficiently accounted for. Second, many studies either look at standards in general, pooling different types of standards without differentiating, or look at specific individual standard and certification schemes. But standards are heterogeneous, and the type of standard may matter (Henson and Humphrey, 2010). A few studies use panel data methods and/or distinguish between standards. For example, Schuster and Maertens (2013) use panel data methods to analyze the impact of different types of private standards on the sourcing behavior of asparagus export companies in Peru. They find that in particular pre-farm-gate or production standards, such as GlobalGAP, decrease the share of produce that export firms source from smallholders. Van Herck and Swinnen (2015) use panel data on dairy value chains in Bulgaria and find that the dramatic reduction in smallholder supplies is not due to standards but is due to other economic factors.

In summary, the evidence suggests that the effects of standards on the supplier base of the value chains are sector, country, and standard specific. Despite the methodological shortcomings and difficulty of causal identification, evidence suggests that in several sectors and countries, standards increase large-scale and vertically integrated production, but in other countries and sectors, small farms remain dominant. To explain these different patterns of smallholder

inclusion, Vandemoortele et al. (2012) develop a formal theoretical model of the emergence of the demand for high-quality and safe food and analyze which small producers are most likely to be included. They show that—conditional on the initial production structure in the economy, on the nature of transaction costs, and on 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 is dominated by small farms, the emergence of high-standard production is likely to be slower but more inclusive. These predictions/arguments correspond to the conclusions by Reardon et al. (2009), who, on the basis of 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, and third-party quality control) can enhance the integration of small and less efficient producers in high-value chains. However, this finding seems inconsistent with findings of other sector studies that point to a high degree of smallholder inclusion in sectors without external support. A crucial component here is private sector-driven vertical coordination. Some empirical studies point out that the inclusion of smallholder farms in high-standard trade and the adoption of private standards by smallholders are possible only with external support from development programs or from public-private partnerships, or with collective action (e.g. Boselie et al., 2003; Henson et al., 2011; Kersting and Wollni, 2012; Narrod et al., 2009; Okello et al., 2011).

So, as these studies already indicate, there are quite a number of reasons why a value chain might not be economically sustainable. In fact, the literature on food standards is riddled with examples of badly functioning food value chains which have caused contracting to either not occur or break down in spite of good sustainability intentions. We offer some examples of these in the following section together with the innovative ways in which value chain actors have tried to alleviate them. Particularly, we will identify two main drivers that have caused value chains to be economically unsustainable and have required actors in the value chain to be more creative in finding solutions: (factor) market imperfections and private standards. These two factors, and their consequences, will then be theoretically explored for the case of one buyer and one farmer in Section 5.

2.2. Institutional Organization of Value Chains and Economic Sustainability[15]

Before embarking on a theoretical analysis of the concept of economic sustainability, we offer some examples of economically unsustainable food value chains and the ways in which the different actors have tried to make them sustainable. Unsurprisingly, most of the examples stem from periods of uncertainty and drastic change. This confirms our presumption that the concept of economic sustainability is inextricably linked with the presence of shocks and disturbances.

Several of the examples come from the period in the wake of liberalization process in Eastern European and the former Soviet Union (FSU). The liberalization of markets and the privatization of firms in Eastern Europe and FSU in the 1990s and 2000s created a natural experiment where suddenly existing (state-controlled) value chain systems were abandoned. In the pre-liberalization-era, the technology applied at different stages of the value chain was primarily directed by the state. The shift to a market-led economy led to new competitive pressures, and created incentives for firms to improve quality and meet new consumer demand. Improving product quality in a context of failing capital and technology markets and imperfect contract enforcement, meant that the private sector was forced to come up with innovative contractual solutions to meet the new standards in the chain. This unique natural experiment provided a series of very interesting case studies with rich implications.

We increasingly observe other – poorer – parts of the world (Sub-Sahara Africa, Asia and Latin America) entering a phase comparable to Eastern Europe and FSU in the 1990s. Increasing urbanization and consumer purchasing power, increasing FDI in agri-food companies, the rise of supermarkets, and an increase in exports of high value crops, give rise to high quality and safety standards, also in these areas (Henson and Reardon, 2005; Reardon and Timmer, 2014). Similarly as in Eastern Europe in the 1990s, complying with these standards requires significant upgrading of production, transport and storage technology in a context of failing markets and weak governance, which induces private-sector-led institutional innovations for value chain technology transfer. Hence,

[15] This section is based on a LICOS Discussion Paper (376/2016) by Johan Swinnen and Rob Kuijpers. More examples and references can be found therein.

the insights from value chain innovations in Eastern Europe and FSU are highly relevant to understand and to inform policy makers in countries that are currently experiencing similar developments.

2.2.1. Value Chain Organization and Market Imperfections

We start by considering a simplified value chain (Figure 1). With perfect markets, decisions to invest in high-quality production are made independently at each stage of the chain. Demand and supply for a product with certain qualities determines the price level and thereby the incentive to invest. A change in consumer demand for higher quality food, will in this way translate into a demand for high quality farm output and an incentive to invest for the farmer if profitable.

Notice that parallel to the flow of goods and inputs in the value chain there is a flow of finance (in the opposite direction). Access to finance (in the form of own liquidity or loans) at each stage of this chain is crucial as production costs and quality investments are carried in full by the individual actors. Moreover, costs of standard-related investments are incurred at the start of the production cycle, while payment occurs at the end, making access to capital essential to bridge this gap. This is especially the case in the agricultural sector where the duration of the production process is relatively long.

It is not difficult to see why this form of high-standard production might not materialize and thus be economically unsustainable in the context of imperfect credit and input markets. It is well known that financial markets are often not working well in developing and emerging countries (Banerjee and Duflo, 2014; Bardhan and Udry, 1999). Poor farmers may simply not have the financial means to make the investment out of own savings and may not get loans from banks or other lenders. As a result, credit market imperfections and financial constraints will cause output market imperfections, and the failure to upgrade to high-standard production processes.

In addition to credit markets not functioning properly, developing and emerging countries' economies are also often characterized by other failing factor markets. In many instances, farmers are unable to acquire the fertilizer, seeds, technology, know-how and the labor that would allow them to engage in high-standard production. Dillon and Barrett (2014), for instance, study five countries and find strong evidence of factor market failure in each of them.

2.2.2. Other Factors

It was already pointed out that (factor) market imperfections play a fundamental role as a motivating element for value chain innovations. There are more factors which influence the specific value chain innovation to engage in high-standard production, including the financial and technical capability of the firms downstream in the value chain, the risk of holdup (contract enforcement problems), the value in the chain, and the type of standard (public or private).

Imperfect enforcement of contracts necessitates private enforcement mechanisms, such as third party enforcement or self-enforcing contracts. These solutions are only feasible when sufficient value can be created by the value chain (Swinnen and Vandeplas, 2011). This is because a contract can only be self-enforcing when it pays each party at least as much as their respective outside option (taking into account reputational costs). This might not be possible if too little value is created by the upgrading of quality.

Another important factor affecting the risk of hold up, and therefore economic sustainability is the type of quality or sustainability standard that is being adhered to. It seems that especially the specificity of the standard (i.e. whether it is a public or a private standard) seems to be important here (Klein et al., 1978; Williamson, 1985). If the standard is 100% private (e.g. farmers are required to install a company-specific traceability system), it will be difficult to sell the agricultural goods outside of the contract; if the standard is public (and thus mandatory for everyone), on the other hand, goods can be diverted much easier. Obviously, this distinction has ramifications for the economic sustainability of the value chain, which means that the various actors will design their value chain differently according to the type of standard chosen.

In summary, we have identified various factors (market imperfections and the type of standard chief among them) affecting the economic sustainability of the value chain and thus inducing actors to come up with different value chain innovations. This means there is no one-size-fits-all solution, but that instead, we can expect a wide diversity in value chain designs – which is what we observe.

2.2.3. Institutional Innovations in Value Chains

Economic unsustainability of the high-standard value chain not only affects the farm, but also all other agents in the chain. Input providers have lower profits since they cannot sell their inputs; processors do not get the raw material they need for producing high-standard consumer products; and consumers do not get the products they desire. All these agents have an incentive to make the farm meet the standard. Moreover, some of these agents (usually downstream) may have better access to finance than the farms, because they have more liquidity, are more likely to get loans, or because they can draw on other commercial activities. These agents can then consider whether it is profitable to set up different types of exchange systems (rather than the spot-market model) to help or induce farms to meet the standard, such that they can benefit from the functioning of the value chain with high-quality and/or highly sustainable production at the farm level.

The most straightforward model is that of "interlinked contracting" between farm and processor or retailer. The processor or retailer offers the farm either direct access to the inputs or the technology needed to meet the standard, or to credit to be able to make the investment, as part of a supply contract with payment conditions. Such interlinked contracts are well known in the traditional development literature for input provisions (e.g. Bardhan, 1989; Bell and Srinivasan, 1989).[16] In the next section, we provide examples of some of these interlinked contracts.

However, they are far from the only model. In some cases it is not the processor or the retailer, but other agents in the chain that set up the contract systems – such as input providers. In other cases more than two agents may get involved in joint institutions. In some cases it may even require merging different agents into one organization. In the next section, a typology is provided of different value chain innovations and empirical illustrations.

[16] Bell and Srinivasan (1989) define interlinked market transactions as a transaction in which the parties trade in at least two markets on the conditions that the terms of all trade between them are jointly determined. Interlinked market transactions always include an element of credit as they involve exchange of current for future claims. Apart from interlinked credit and output transactions, interlinked transactions also exists in land markets (landlord who provide tenants working capital) and in labor market (employers who give advances to laborers in return for a claim on their labor in peak labor demand periods).

Innovation 1: Farm - Processor/Retailer Contracting

Figure 2 illustrates the first value chain innovation. This is the case where the company that buys the farm product (be it a processing, a retailing, or a trading company) finances the investment needed to meet the standard and then provides inputs (technology, fertilizer, seed, know-how, ...) to the farm as part of a contract.

The rationale behind such schemes is that the downstream firm may have better access to credit than farms, because it has more collateral or more cash flow for financing the investment, and faces lower transaction costs. The latter can be the case when the lead firm makes the investment for multiple suppliers (e.g. as part of an outgrower scheme) and benefits from economies of scale. Another reason why a downstream firm may be in the position to assist its upstream suppliers is because they are closer positioned to the final consumer and therefore might have better knowledge on consumer preferences concerning quality and sustainability.

The contract typically specifies an obligation to comply with buyer standards (which could be public or private) and a transfer of inputs (or credit, to make quality upgrading possible), linked to a purchasing agreement. Payment for these services is generally accounted for at the time of product delivery. The inputs that are provided can be rather simple such as specific seeds, fertilizer or animal feed. However, much more complex forms of technology transfer are also observed, especially in areas where product quality becomes more important and long term investments are required. More advanced forms of contract-farming can include the provision of long-term technological improvements through extension services, technical and managerial assistance, quality control, specialized transport and storage services, investment loans, and investment assistance programs.

Studies on horticultural export chains in Africa document the provision of specific inputs (as seeds and specific fertilizer) as well as elaborate systems of technical advice and extension services to contracted farmers (Henson et al., 2005). For example, Minten et al. (2009) show that access to technological inputs was a major reason why poor farmers decided to sign up for the contracts with horticultural export companies.

There are several studies on Eastern Europe and Central Asia which document complex and elaborate value chain contracting systems in the 1990s and 2000s in various sectors including sugar, dairy, barley, cotton etc. Cotton gins in

Kazakhstan, for example, not only provided seeds and fertilizer, but also water to the cotton farms, with water irrigation systems being a crucial technological input for farms (Sadler, 2006). Dries et al. (2009) summarize evidence on dairy contracting systems from various countries showing extensive input and technology transfers. Important components are credit, animal feed, and technical advice, as well as investment loans for improved dairy cows and milk cooling tanks. Dries and Swinnen (2004; 2010) show, for the case of Poland, that interlinked contracting had a major impact on milk quality, both for small and larger farms.

Innovation 2: Farm – Input Company Contracting and Leasing

Input companies can also be initiators of innovations aimed at making the high-standard value chain economically sustainable. Like food processing companies, input companies also have problems because financially constrained farms cannot afford to purchase the appropriate inputs or technology. To assist farms in purchasing the inputs (and ensure payments), input suppliers have engaged in a variety of, sometimes quite unconventional, forms of contracting. Institutional innovations have focused on reducing financial constraints of farms by introducing credit schemes, leasing arrangements, and by assisting farms in selling their products to improve their cash flow and liquidity.

One common initiative is finance provision by the input company (i.e. another form of interlinked contracting), sometimes in combination with output purchasing, as illustrated by Figure 3. Foster (1999) describes how a multinational farm equipment manufacturer partnered with local farm equipment distributors to sell combines and tractors to farms in Ukraine in the 1990s. Farmers could buy equipment from the distributor using a payment scheme. Initially they had to fulfil 25 percent down payment (in cash or kind). After three additional payments they received full ownership. To overcome financial constraints of the farms and to ensure payment to the tractor company, the equipment dealer received the rights to a certain grain area as part of the payment by the farm. In addition, the equipment dealer was given the rights to harvest, transport, store and sell the grain. Hence, while the interlinked contracting by the food processing companies in Innovation 1 made the food company enter the input market (vertically coordinating in the upstream part of the value chain), here the input company entered in buying and selling the farms' products (vertically coordinating in the downstream part of the value chain).

Other value chain innovations where input companies were part of, included more complex forms of contracting where they were part of an institutional design involving multiple partners. This is discussed next.

Innovation 3: Triangular Structures

Many processors or retailers are reluctant to provide loans to farms for significant quality investments. The reasons are obvious: they require substantial amounts of finance and with the increase in the size of the outstanding loans, the risk of delayed re-payment or default increases too. Processing companies have therefore reached out to financial institutions to see if they could collaborate in providing loans to farmers to make the necessary investments to meet the standard.

We refer to such institutional designs and collaborations as triangular structures (illustrated by Figure 4). The downstream company typically offers a guarantee to the financial institution if it provides a loan to a farm which has a supplier contract with the company. The guarantee is basically a promise by the buyer company that it will assume the debt obligation of the supplier in case of default. The underwriting is for specific loans for quality upgrading, related to the contract, and restricted for contracting farms. Triangular structures require a smaller financial commitment from the processor or retailer as the financing (loans) is now (at least partially) covered by the financial institution. The guarantee is also likely to reduce the interest rate for the farmer, as the guarantee lowers the risk for the financial institution.

So far the "triangular structure" has been discussed as between the farm, the buyer and a financial institution. However the third party can also be an input provider. In this case the buyer provides a payment guarantee directly to the company that sells the inputs. The logic is very similar to the case with the financial institution.

In practice both models have been observed. Guarantee programs within triangular contracting structures were implemented, for example, by sugar processors in Slovakia (Gow et al., 2000), by retailers in Croatia for fruit and vegetable supplier investments in greenhouses and irrigation (Reardon et al., 2003), and by dairy processors in several East European countries (Dries et al., 2009).

Innovation 4: Special Purpose Vehicles

An even more complex way of improving economic sustainability, is the use of so-called "special purpose vehicles" (SPVs). A SPV is a stand-alone company jointly owned by, for example, a processor, an input provider and a bank (see Figure 5). Typically, the SPV will then contract with the farms. The contract can include provisions on output, inputs, and credit.

An important advantage of such institutional solution is that the partners in the SPV now share the risk of contract breach. When a downstream company by itself implements input provision programs, it carries the entire risk of farms' breaching contracts, although both the input provider and the financial institution benefit from these contract innovations. Institutions such as SPVs allow sharing of the risk between various agents, and hence, will stimulate investments by companies who otherwise may be deterred by the risk.[17]

An example described in the literature is the case of the collaboration between the Russian dairy processor Wimm Bill Dann (WBD) and the Swedish dairy equipment seller De Laval (Top Agrar, 2004). The goal of the joint project "Milk Rivers" was to upgrade the quality of production in Russian farms. They created a jointly owned "project", an SPV, which leased combine harvesters, milking and cooling equipment. The farmers had to cover about 20% to 30% of the costs themselves and received the equipment (provided by De Laval) based on a three to five year leasing basis. The leasing costs were being paid off by the farmers by delivering raw milk to WBD. The main condition for suppliers to take part in the program was compliance with WBD private quality standards and motivation to improve quality and productivity.

Although the project was considered a success, at times the enforcement of the contracts proved difficult, as some of the supported farms started to supply their milk to competitors who offered a higher price. These holdups endangered the sustainability of the scheme (World Bank, 2005).

Also with these innovations there were horizontal spill-over effects. Serova and Karlova (2010) found that a few years after the WBD-DeLaval project took off, competitors of WBD, started copying the scheme to stimulate dairy farm investments. They used a similar construction (also with DeLaval), whereby farms

[17] In some cases such structures have developed with farmer participation. For example, Gow and Swinnen (2001) report that in Eastern Hungary a group of sheep farmers set up a producers' co-operative through which they participated in an SPV-like joint company.

received milking equipment under a leasing contract as part of a one- to five-year instalment plan, as well as calf milk replacers (CMRs) and feed additives.

Innovation 5: Vertical Integration

In some cases companies have gone as far as taking over the farming activities, i.e. by "vertically integrating" the supply of raw materials in their company. There are several motivations to do so. One is high transaction costs of market exchanges or high risks of hold-ups in contracting (Klein et al., 1978; Williamson, 1985). Increasing quality and sustainability standards, especially private, may increase these transaction costs, in particular when monitoring is costly (e.g. restrictions on the use of pesticides and child labor). These costs of input transfer and monitoring are amplified when the capability of farmers is low and when standards are complex (as is often the case for private standards) (Gereffi et al., 2005).

There are several studies which show how the rise of standards in high value chains and the associated requirement for farmers to invest in quality upgrading, has led towards vertically integrated production systems. Several studies have documented this for Africa. For example, Maertens and Swinnen (2009) and Maertens et al. (2011) document how, in the Senegalese horticulture sector, the combination of available land and a tightening of public and private standards (such as HACCP and GlobalGAP) induced exporters to move from smallholder contracting to integrated estate production. Similar shifts to vertical integration and large estate sourcing have been observed in other parts of Africa as well, such as in Ghana (Suzuki et al., 2011), Zimbabwe (Henson et al., 2005) and Kenya (Dolan and Humphrey, 2000).

Note, however, that in almost all of those cases, the shift towards vertical integration has only been partial, as processing companies maintained a mixture of sourcing channels. There are several motivations for this strategy. First, it might simply be difficult to acquire land, due to practical (e.g. high population and farm density in fertile areas) or legal constraints (e.g. foreign ownership of land not being allowed). Second, social pressures (e.g. from surrounding communities or international civil society) might induce large reputational costs from being associated with "land grabbing". Third, maintaining multiple and diverse types of suppliers is part of a risk management strategy (Swinnen, 2007). Suzuki et al. (2011) explain why Ghanaian pineapple exporters combine own-estate production with smallholder-sourcing to anticipate unexpected fluctuations in demand.

2.2.4. Implications for Conceptual Models

The analysis above contains some useful takeaways for the further development of the concept of economic sustainability. While we by no means ignore the important differences between the different examples discussed, we believe there are three key messages that can be discerned from this section.

First, from the type of innovations and all the examples, it is clear that food companies have gone through great lengths to make high-quality, high-standard value chains economically sustainable. It seems that those companies have understood that they can only reap the benefits of selling high-quality produce if they can rely on a consistent supply from farmers.

Second, when considering the different innovations together, one can discern a striking pattern: they all represent varying degrees of vertical coordination. Indeed, while innovations 1 and 2 can be considered the most basic forms of vertical coordination (upstream and downstream contracting respectively), innovations 3 and 4 are slightly more complex, but still nothing more than vertical coordination with the assistance of a bank or an input provider (innovation 3), or a self-created third party (innovation 4). Finally, innovation 5 represents the most far-reaching form of vertical coordination: vertical integration. As such, it seems to be an empirically established fact that in order to achieve economic sustainability of the value chain in the presence of high-quality food standards, there needs to be at least some degree of vertical coordination between the different actors in the chain.

Finally, we can identify two main underlying reasons why high-standard value chains are economically unsustainable and require more vertical coordination in the first place. First, almost all examples in this section are characterized by (factor) market imperfections, which prevent farmers from making the necessary investments to meet the quality or sustainability standards. Hence, if other actors in the chain want to make the chain sustainable, they have no choice but to engage in some form of vertical coordination by helping farmers to make the investment. Second, it seems that vertical coordination was even more pronounced in those value chains under private standards. In particular, innovations 4 and 5 almost exclusively took place in the context of private standards. For instance, the example of Wimm Bill Dann (WBD) required a complex construction with far-reaching vertical coordination to make the value chain economically sustainable. Further, economic sustainability in the Senegalese horticultural sector, where quality upgrading was mainly driven by

the private EurepGAP standard (GlobalGAP's predecessor), could only be achieved through vertical integration. In the following section, we will theoretically flesh out these two findings separately. More specifically, Section 5.1 will demonstrate why vertical coordination is needed to make a value chain economically sustainable in the presence of (factor) market imperfections while Section 5.2 will show why even more vertical coordination is needed in the presence of private standards (compared to public standards).

2.3. A Theoretical Model of Economic Sustainability of the Value Chain

In this section and the following, we will theoretically substantiate the concept of economic sustainability for two agents: a buyer (denoted with subscript or superscript B) and a farmer (denoted with subscript or superscript f). In our context, the buyer can be used to refer to a number of different intermediate actors in the food value chain. It could be a processer who buys directly from the farmer, an exporter who is responsible for getting agricultural produce from a developing country to the developed world or a retailer or a retailer consortium. The same applies to the farmer in our model: it might refer to a single farmer or to a farmer cooperative. Further, we assume that there is only one way in which the farmer can sell to the buyer and that is through a contract with a pre-specified price, quantity and standard (which specifies the level of quality and might include a number of other sustainability requirements).

2.3.1. Economic Sustainability and Market Imperfections[18]

In this section the first condition that might make a value chain economically unsustainable is discussed: (factor) market imperfections. Simply put, because of these imperfections, farmers are unable to make the necessary investments to meet the requirements stipulated in the food standard. Consequently, they will not enter into an agreement with the buyer and the value chain will be economically unsustainable. We also assume that both farmer and buyer are perfectly informed about any complications that might arise in the future. For now, we do not yet distinguish between a public and a private standard, this will be dealt with extensively in Section 5.2.

Economic Sustainability and Perfect Markets

We begin by analyzing a reference case in which factor markets function perfectly. The farmer in this framework has a fixed allocation of labor and land and produces a quantity q_L of a low quality product (without a standard) that can be sold in the local market for a price p_L. The farmer's alternative is to sell to the buyer, who sells the product (possibly after processing) to urban consumers

[18] For more details, see chapters 11 through 16 in Swinnen et al. (2015) and Kuijpers and Swinnen (2016,)

for a price p_H. To keep the model simple, we assume processing or marketing costs are zero.

The buyer requires the goods meeting a specific standard from the farm. To comply with the standard, the farmer therefore needs to make an investment I^f. This investment could take many forms, depending on the standard: it could be an investment in a more advanced technology or in a sophisticated accounting system, but it could also refer to having to buy specialized inputs such as seeds, fertilizer or credit.

We assume this investment allows the farmer to comply with the buyer's chosen standard, reflected in a higher quantity produced q_H (with $q_H \geq q_L$) and/or a higher consumer price ($p_H \geq p_L$), given fixed land and labor inputs.[19] The total value generated by complying with the standard is defined as $V = p_H q_H$. Defining $l = p_L q_L$ as the farmer's opportunity cost, the net surplus created by adopting the technology is $S = V - l - I^f$. This is the total surplus in the value chain from standardization. The farmer's net surplus is $S^f = V^f - l - I^f$ with $V^f = \theta p_H q_H = \theta V$ and θ representing the farmer's share of the consumer price for the high value product. The farmer will decide to comply with the standard and enter into a contract with the buyer if his net surplus S^f is positive, i.e. if:

$$V \geq \frac{(I^f + l)}{\theta} \qquad (1)$$

This result is illustrated in panel (a) of Figure 6.

This general condition captures both the quantity and quality effects of standardization. All else equal, standardization is more likely if its quantity effect on productivity ($q_H - q_L$) is larger, if the quality effect ($p_H - p_L$) is stronger, if the farmer's share of the consumer price θ is larger, if the required investment I^f is lower, and if the opportunity costs of the farmer l are lower.

[19] We ignore the possibility that there is a trade-off between quantity and quality. Such trade off may well exist for given standards and for some technological innovations. However, many of the standards that are relevant in the analysis increase both quantity and quality, or at least one without reducing the other.

Standards and Market Imperfections

However, this story clearly represents a simplified version of reality. As shown in Section 4, many farmers, especially in developing and emerging countries, face considerable factor market imperfections (with often no access to credit, inputs, technology, know-how, labor force or information), making it difficult and sometimes impossible for them to make the investment and comply with the standard (Croppenstedt et al., 2003; Feder et al., 1985; Morris, 2007; Rozelle and Swinnen, 2004). Buyers are typically far less constrained than the farmer because they have more access to credit or liquidity; or lower transaction costs due to economies of scale; or lower information asymmetries if they have better knowledge of consumer preferences. To increase the economic sustainability of the value chain, the buyer can then offer the farmer a contract, which includes the transfer of inputs, technology or even information and conditions for purchasing the product (time, amount and price). As such, if the farmer is unable to make the investment, the buyer will have to step in and engage in more vertical coordination.

The buyer's opportunity cost of the investment is referred to as $I < I^f$ (we assume here that the buyer bears the entire standard-related investment, but this need not be the case). This opportunity cost will depend on the cost of transfer, as well as on the buyer's potential return to alternative investments (including alternative sourcing contracts). This means that in the absence of a contract, the buyer's "disagreement payoff" is equal to I. For simplicity, we assume the farmer's "disagreement payoff" is equal to $l = p_L q_L$.[20] The buyer's and farmer's participation constraints are then defined as $\Pi^B \geq I$ and $\Pi^f \geq l$, with Π^B and Π^f denoting the buyer's and farmer's contract payoff, respectively. The total (net) surplus created by the value chain and the contract is $S = V - l - I$.

The division of the contract surplus can be modeled as a Nash bargaining problem, where each party receives his or her disagreement payoff and a share of the contract surplus (see Swinnen and Vandeplas, 2011, for more details). We denote the share that accrues to the farmer as β, with $0 \leq \beta \leq 1$. To start, we assume that this sharing rule β is determined through ex-ante bargaining.

[20] Implying that standard compliance against an investment I^f is not profitable and the farmer keeps producing the low-standard good when not involved in the contract. This applies to the domain where $V < (I^f + l)/\theta$ in Figure 6.

Consider first, as a benchmark, the case that contracts are always perfectly enforced. In this case, given the disagreement payoffs of both parties, the contract payoffs are

$$\Pi^{f^*} = l + \beta S = l + \beta(V - l - I) \quad (2)$$

$$\Pi^{B^*} = I + (1 - \beta)S = I + (1 - \beta)(V - l - I) \quad (3)$$

where superscript * denotes the payoffs with perfect enforcement. Under these assumptions, high-standard production will take place if the net surplus is positive, i.e. if

$$V \geq I + l \quad (4)$$

The value created (V) should be larger than the opportunity costs of labor (l) and of the investment (I). This result is illustrated in panel (b) of Figure 6. High-standard production is more likely if the effect on the value of the farmer's product ($p_H - p_L$) or on the production efficiency ($q_H - q_L$) is higher, if the buyer's opportunity cost of investing I is lower, and if the opportunity costs of labor l are lower. In any case, it is clear that, in the presence of market imperfections, for contracting to be economically sustainable between farmer and buyer, buyers will often have to engage in increased vertical coordination by providing the farmer with inputs, technology, credit or information.

Standards in the Presence of Hold-up

While the previous section is already considerably more realistic than the base case, a crucial element is still missing: hold-up. Hold-up, as is clear from the examples in Section 4, in a contractual environment occurs when one of the parties to an agreement decides to go against the original intent of a contract. In that sense, it is a much broader concept than contract breach. In the setting considered here, we distinguish between four types of hold-up, two on the farmer's side, one on the buyer's side and one applying to both. First, the farmer could decide to divert the investment provided by the buyer by using it for different purposes or by selling the provided inputs to other buyers. Secondly, the farmer could default on the contract by selling the product to an alternative buyer, after using the buyer's investment to upgrade the quality. Such "side-selling" can be profitable as the alternative buyer did not have to make the investment, but can reap its benefits. Third, relevant types of buyer holdup in value chains include late payments, renegotiation of prices at product delivery and the absence of transparent and reliable quality evaluation procedures (which could lead to inappropriately rejecting produce). Finally,

counterintuitively, hold-up could also arise from abiding by the contract. This implies that hold-up should by no means be considered as a phenomenon specific to developing countries. In fact, a well-functioning legal system might even be conducive to hold-up.

Klein (1996), for instance, uses the example of General Motors (GM) and Fisher Body (FB) in the beginning of the 20th century. At that time, the latter made an investment to be able to supply the former. Because of this, the contract specified, along with a price which came down to a mark-up over variable cost, an exclusivity clause which meant that GM had to buy all its car bodies from FB for a period of ten years. The combination of these two contract terms ensured that FB was able to hold up GM by driving up its variable costs and making sure the contract was enforced. Even though this clearly violated the original intent of the contract, GM would not have been able to challenge FB's behavior in front of the court. So, in this case, as in many other cases, the probability of this particular kind of hold-up would not have been as high in a situation without perfect court enforcement. There is much empirical evidence that hold-up problems are important and widespread in agri-food value chains in developing and transition countries (e.g. Cungu et al., 2008; Barrett et al., 2012; Saenger et al., 2014).

Here we focus on farmer holdup through diversion of the buyer's investment and buyer holdup through contract renegotiation, ignoring the possibility of side-selling, to simplify the analysis.[21] If the farmer diverts the investment (for instance, the inputs or the technology provided by the buyer), we assume the benefit equals the cost of the investment for the buyer I. In addition, the farmer can still realize his opportunity cost of labor l. By going against the intent of the contract, the farmer suffers a reputation cost $\phi \geq 0$. Hence, with diversion of the buyer's investment, the farmer's payoff is $\Pi_d^f = l + I - \phi$ and the buyer's payoff is $\Pi_d^B = 0$.[22]

In case there is no external contract enforcement (beyond what is captured in the reputation costs) the partners can try to design the contract to be "self-enforcing" (Klein 1996) to avoid hold-ups and make contracting in the value chain economically sustainable. For the contract to be self-enforcing, the

[21] While conceptually similar to input diversion, side-selling is more relevant in the context of the next section and will be discusses in detail there. The same applies to hold-up through honoring the terms of the agreement.

[22] Note that in our model I and l are "sunk" costs, which is why they do not directly show up in the buyer's and farmer's payoffs. These costs will be reflected in the buyer's and farmer's participation constraints.

farmer's contract payoff must at least equal his holdup payoff Π_d^f, while the buyer's payoff must at least equal his disagreement payoff I. In other words, the contract should satisfy the farmer's incentive compatibility constraint ($\Pi^f \geq \Pi_d^f = l + I - \phi$) and the buyer's participation constraint ($\Pi^B \geq I$). Combining these, the value generated by quality upgrading should satisfy the following condition for the contract to be sustainable:

$$V \geq l + 2I - \phi \qquad (5)$$

in addition to the condition $V \geq l + I$, determined earlier (equation 4). This implies that high-standard production is possible when

$$V \geq V^{min} = \max\{l + I;\ l + 2I - \phi\} \qquad (6)$$

If V is sufficiently high, it is possible to adjust the contract terms to satisfy the farmer's incentive compatibility constraint without violating the buyer's participation constraint, making the contract, in principle, sustainable. A low V, however, might be insufficient to pay the farmer at least his hold-up payoff and prevent contract breach. In this case, contracting will not be economically sustainable. Obviously, hold-up is only profitable for the farmer if the benefit of diverting the buyer's investment is bigger than his reputation cost, i.e. if $I > \phi$. If $I \leq \phi$, the farmer has no incentive to hold up the buyer and the "efficiency" condition (equation 4) remains binding. These results are illustrated in panel (c) of Figure 6.

The buyer may refuse to pay the farmer the agreed share of the value at product delivery and, instead, offer to pay only as much as the farmer's best alternative at that moment V_s (e.g. the value of the produce when sold on the local market). Doing this will result in a reputation cost $\omega \geq 0$ for the buyer. In this case, the contract payoffs become $\Pi_r^B = V - V_s - \omega$ for the buyer and $\Pi_r^f = V_s$ for the farmer. For a contract to be sustainable, it should satisfy both the farmer's participation constraint ($\Pi^f \geq l$) and the buyer's incentive compatibility constraint ($\Pi^B \geq \Pi_r^B = V - V_s - \omega$). Combining these implies the following condition for which high-standard production remains economically sustainable under the threat of buyer hold-up:

$$l \leq V_s + \omega \qquad (7)$$

in addition to the condition $V \geq l + I$, determined earlier. This result implies that the effect of buyer hold-up on the economic sustainability of the value chain does not necessarily depend on the value generated by standard compliance V. It does depend on the reputation costs of the buyer (ω) and the alternatives for

the farmer (V_s). The latter may be a function of the value V or not, depending on the high value market structure and local demand.

Since the buyer's reputation cost ω is non-negative, $V_s \geq I$ is a sufficient condition for the farmer to agree with this contract. This is the case when the farmer is able to sell the "high-standard" product for at least the value of the "low-standard" equivalent to others than the buyer (e.g. on the local spot-market). In summary, high-standard production through value chain contracting is more likely when the value generated by standard compliance (V), the farmer's best alternative to the buyer's offer (V_s), and reputation costs (ϕ and ω) are higher, and when the farmer's and buyer's opportunity costs (l and I) are lower.

In conclusion, we have shown, for various settings, that buyers wishing to take part in economically sustainable high-standard production, will have to engage in increased vertical coordination with farmers when there are factor market imperfections that do not allow the farmers to make the necessary investments themselves.

2.3.2. Private versus Public Standards and Economic Sustainability

In this section, we introduce a second reason, specific to private food standards, why buyers may wish to engage in increased vertical coordination with farmers to make economically sustainable high-standard food production possible. Even in the presence of perfect (factor) markets when the farmer would be able to make the necessary investment to comply with the food standard (and thus would not require an investment from the buyer), the buyer's insistence on a private standard might create a situation in which the farmer is unwilling to invest. So, even contracting is achievable in principle, a buyer may still have to engage in vertical coordination to signal its willingness to commit to the contract.

To show this, we now introduce shocks and uncertainty into our framework. We build upon the work of Klein (1996) who developed a theory of 'probabilistic hold-up'. His work in turn is heavily based on the literature on transaction-cost economics (Williamson, 1979; 1981; 1991) and the literature concerning economic institutions (see, for instance, North, 1991). The framework has already been applied in the context of agricultural markets by Gow et al. (2000), Mazé (2005) and Kunte et al. (2016).

The idea is simple, yet quite comprehensive: as reality is complex and contract terms cannot possibly account for every contingency that might arise in the future, contractual relationships are deliberately incomplete. In other words, buyers and farmers know there is a chance they might be held up in the future, but, in contrast with the previous section, they do not know how big this probability is (they only know the probability distribution). In normal circumstances, i.e. when market conditions remain more or less constant across periods, neither party will have an incentive to deviate from their arrangement. However, in an environment as volatile as the agri-food industry (FAO, 2010a), circumstances are likely to change drastically, even during the duration of the contract. Consequently, unforeseen situations might arise in which one or both parties have an incentive to go against the intent of the original agreement, resulting in poor economic sustainability of the value chain.

There are still only two actors in our model: one buyer and one farmer. The contractual relationship between them can be governed in one of two ways: by a public or a private food standard.[23] The public standard is set by a government entity and is mandatory for all actors in its jurisdiction while the private standard is voluntary and set by a private actor (which could be the buyer, but does not have to be). It is assumed that there is either a public standard or a private standard in any given context and not both at the same time. In other words, there is a public standard world and private standard world and it is a priori and exogenously determined in which world both farmer and buyer operate. While this seems like an important simplification of reality, this is not true from the farmer's point of view. Often, the farmer has no say in which type of standard the buyer decides to abide by, but, as we will demonstrate, the

[23] Even though private food standards are often treated as such, they cannot be considered as an all-encompassing category. More specifically, they differ in 'scope, objective and ownership' (von Hagen and Alvarez, 2011). For now, we do not concern ourselves too much with ownership as this will be the object of discussion in Chapter 6. Throughout the report, we simply consider the standards as given, set by either a public (in the case of a public standard) or a private actor (in the case of a private standard) even though it has been noted that the dichotomy between private and public standards is not as strict as sometimes portrayed. More specifically, it is not entirely true that all public standards are mandatory and all private standards are voluntary (Henson and Reardon, 2005). For instance, *Label Rouge*, a public quality standard for poultry producers, was developed by the French government, but is not mandatory. Conversely, many private standards become *de facto* mandatory when they are introduced by dominant market players. Nevertheless, we opt to maintain the rather strict distinction between public and private standards in our framework as the cases in which the dichotomy is not as clear are few and far between. So, public standards are set by the government and have to be adhered to by all actors in the food value chain while private standards are set by private actors which producers only have to comply with if they want to enter into business with those private actors. As such, in a private standard environment, farmer always have an outside option whereas farmers in a public standard environment can only choose between adhering to the standard or not producing at all (except maybe for private use).

buyer's decision does have important implications for the farmer as well. Moreover, we assume that both the public and the private standards require the same level of quality and/or sustainability and thus require the same investment I^f from the farmer (or I from the buyer in case of vertical coordination, as in the previous section). Transaction is limited to one item of the agricultural good and we again abstract from all marketing and production costs. As such, the only notation that remains is that for pricing. The price for a high-standard good is p_H while the price for a low-standard good is p_L.

Public Standard

In case of a public standard, the farmer has no outside option. As such, he faces a choice between complying with the standard, in which case he receives p_H, and not producing at all, in which case he earns zero (the public standard is mandatory for all food producers). Ex post, after the farmer has decided to comply with the standard and entered into a contract with the buyer, circumstances might change such that the farmer is incentivized to hold up the buyer by side-selling the agricultural product to a third party (another buyer or on the local market). The price the farmer will receive in this instance will still be p_H since everyone has to abide by the same public standard and all buyers value the good equally. Conversely, for the buyer, hold-up opportunities are considerably more limited. He will be unable to renegotiate the price to a lower level than p_H as the buyer knows that the farmer would just sell his goods elsewhere at the same price.

This is summarized graphically in panel (a) of Figure 7. We define $f(H_i)$ as the expected probability distribution of the hold-up benefits of contracting party i (the buyer or the farmer), which in turn results from an underlying expected probability distribution of shocks and disturbances in the economic environment (Gow, Streeter, and Swinnen 2000). With initial hold-up costs of K_f^0 and K_B^0 for the farmer and the buyer respectively, the probability of the buyer holding up the farmer is represented by the area under the graph left of K_B^0 while the probability of the farmer holding up the buyer is represented by the area under the graph right of K_f^0. As we can see, in the case of a public standard, the probability of the buyer being held up by the farmer is greater than the probability of the farmer being held up by the buyer.

Faced with the prospect of being held up, the buyer will not likely be tempted to engage in vertical coordination in the case of a public standard unless the farmer is truly unable to make the investment (see Section 5.1). After all, the

buyer runs the risk of investing time and resources while not reaping the benefits when the farmer decides to side-sell. However, even if the farmer decides to side-sell and holds up the buyer, it will still be possible to get the produce on the market as everyone has to adhere to the same public standard. The food supply itself will not be jeopardized. As such, according to our definition, value chains under public standards will be economically sustainable in general.

Private Standard

Now, in a world where there is only a private standard, the situation is slightly different. In that case, the farmer can choose between producing the low-standard good and sell it at a price p_L on the market or making an investment to be able to sell high-standard goods to the buyer at price p_H (the private standard is voluntary). Crucially, since the standard is private, part of this investment is buyer-specific and will not be valorized outside the contractual agreement between buyer and supplier. The buyer-specific investment could take the form of special packaging or labeling, learning how to use specific equipment, a traceability system, fertilizer required by the buyer or even adapting to the buyer's marketing preferences.

By means of example, we briefly discuss Tesco's main private standard, the Tesco Food Manufacturing Standard (TFMS), which specifies about 90 pages worth of requirements for current and potential Tesco food suppliers. Most of those requirements cover rather general stipulations related to hygiene and product characteristics which can also be found in most public food standards (for example: HACCP). In addition to these general requirements, the TFMS also includes some Tesco-specific demands which clearly have value within the contractual relationship between Tesco and the supplier, but would not be valorized outside of those agreements. For instance, almost every change in practices or product has to be communicated to and approved by a so-called Tesco Technical Contact in addition to regular audits (Kingdon, 2015). Clearly, this requirement is time-consuming but will not be valuable outside of the Tesco contract. Moreover, all product characteristics have to be specified using a special Tesco format coming from the Tesco Technical Library (Kingdon, 2015, p. 13). Again, getting used to such a system constitutes an investment other buyers (or the market in general) are not necessarily interested in. So, while Tesco is willing to pay the farmer more (p_H) for meeting those specific requirements, this will not be true for other buyers in the market (who will pay p_L).

Now, ex post, if the farmer has decided to make the investment (assuming he is able to do so), he will have the possibility to hold-up the buyer. However, in comparison with the public standard case, the farmer only receives p_L in the event of side-selling since the private standard is not mandatory and (part of) the investment done by the farmer is not compensated by the market. The only way for the farmer to earn p_H is through the contract with the buyer. As such, unless big shocks or disturbances occur, the farmer will not easily be tempted to engage in side-selling. The opposite is true for the buyer. After the farmer has made the investment, the buyer knows the farmer can only earn p_L outside of the contract and will be incentivized to renegotiate the price within the contract down until that point. In sum, for contracts under a private standard, hold-up opportunities increase for the buyer and decrease for the farmer, as shown in panel (b) of Figure 7.

So, in a private standard world, the farmer risks earning only p_L even when he complies with the standard. If this risk is deemed too great a priori (because of the buyer's reputation or monopsony position) a rational farmer will decide not to comply with the standard, earning p_L but without having to make the investment. Contracting will not occur and the buyer will find himself unable to sell high-standard agricultural produce. This stands in sharp contract with the case of a public standard, where the buyer can always rely on a supply of high-standard products as all farmers have to comply with the public standard. In the spirit of our definition, such a private standard value chain cannot be considered economically sustainable.

If the buyer wants to uphold the private standard, the only way to credibly signal his intention of not holding up the farmer is to shift some of the hold-up potential back to the farmer, as demonstrated in panel (c) of Figure 7. The buyer can achieve this by tying his own hands and taking on some of the investments that would and could otherwise be borne by the farmer. This could come in the form of input, credit or technology provision, training or information, which always comes down to some sort of vertical coordination. These kinds of investments increase the farmer's hold-up possibilities since he can now also divert these investments to other buyers (as illustrated in the previous section). Or, in other words, even if the farmer is able to make the necessary investment to comply with the food standard, buyers wishing to introduce a private standard, will engage in increased vertical coordination to make contracting more sustainable. A crucial finding of this section then is that economically sustainable contracts under private standards will be accompanied by vertical coordination to a greater extent than contracts under public standards.

2.3.3. Summary of the Theoretical Findings

The findings of Section 5 can be aptly summarized using Figure 8, which shows how much vertical coordination is minimally needed for the value chain to be economically sustainable, as a function of market imperfections (Section 5.1) and the type of standard (Section 5.2). Every level of vertical coordination under the bold (dotted) line will not be sufficient for an economically sustainable value chain under a private (public) standard. The key points of this report can then easily be distilled from this figure.

First, following our analysis, we argue that high-quality food production, regardless of the type of standard, requires at least some vertical coordination between buyers and farmers. After all, contracting between parties can and should be considered as a rudimentary first step towards vertical coordination.

Second, the figure shows graphically what we have demonstrated in Section 5.1, namely that as farmers are increasingly unable to make the necessary investment to upgrade to high-standard production due to various combinations of (factor) market imperfections, the buyer will have to engage in vertical coordination to an ever growing extent. In the case of only minor market imperfections, the buyer could come away with only providing some information for instance. On the contrary, in the limit, when markets do not function at all, the only option for the buyer will be to completely vertically integrate.

Third, as shown by the analysis in Section 5.2, even if the farmer is able to make the investment (i.e. if there are no market imperfections), the buyer will have to commit to more vertical coordination in the case of a private standard compared to the case of a public standard to ensure economic sustainability of the value chain. This remains true also for higher degrees of market imperfections, but in the limit of course, the distinction between public and private standards in terms of the level of vertical coordination needed slowly fades away as buyers will have to vertically integrate regardless of the type of standard.

Finally, so far, we have maintained a rather strict dichotomy between public food standards on the one hand and private food standards on the other. However, as mentioned in Section 2, there are many different types of private food standards, some of which can be considered more specific than others. For instance, standards set by consortia of retailers such as GlobalGAP and BRC can

be considered less specific than the standards set by individual retailers. The same applies to standards set by independent organizations such as Rainforest Alliance, UTZ and Fairtrade. To capture this, we could introduce a new variable, which we could call standards specificity. In line with our analysis in this section, value chains that operate under intermediate levels of standards specificity leave more room for farmer hold-up than value chains under company-specific standards as there are more potential buyers that attach value to the standard-specific investments. Conversely, this also means that those buyers will not need to engage in such a high degree of vertical coordination in order to convince the farmer. In terms of Figure 8, the line for minimal vertical coordination will lie in between the one of the public and the private standard.

Our analysis bears many similarities to Williamson's (1991) analysis on asset specificity. In line with our findings, Williamson argues that as asset specificity increases, the way the value chain is organized evolves from a simple market configuration over hybrid forms like contracts to a full hierarchy (which he uses to refer to vertical integration).

PART III – POLITICAL ECONOMY OF FOOD STANDARDS AND VALUE CHAINS

Up until now, we have largely ignored the role of the different actors within and outside the value chain in setting the food standard while in reality this is a complex process which involves a continuous strategic interaction and coalition-building between governments, retailers, consumers, farmers, input suppliers and NGOs, which could in theory all initiate a food standard (public or private). In this final section we aim to shed some light on this process by venturing into the realm of political economy models. Given the limited amount of research published in this field, we will also use this opportunity to outline some possibilities for further theoretical and empirical work.

Before delving into the specifics of the political economy of food standardization, we discuss some conceptual issues general to the context of the agricultural sector.

3.1. Some Conceptual Issues

Political economy models of agricultural and food policy often consider "producers", "consumers", and "taxpayers" as the main agents to study the impacts of policies, the political incentives, and the impact on policy outcomes (Anderson et al., 2013). One (theoretical) reason is its didactic use, i.e. to avoid unnecessary complications in deriving policy effects and identify equilibria. Another (empirical) reason is the absence of disaggregated information of policy impacts on various agents within (or outside) the value chain.

Swinnen (2015) emphasizes that in reality many more agents are affected – and also play a role in lobbying governments to introduce or remove certain policies. In agricultural and food policies "other agents" include input suppliers (such as land owners, seed and agro-chemical companies, and rural banks), traders, food processors, retail companies, etcetera. These agents may be differently affected by policies, depending on the nature of the policy (e.g. whether the policy is targeted to the (raw) agricultural commodity or to a processed commodity) – or whether farm subsidies affect land or other production factors. As a consequence, these different agents have sometimes joined forces ("political coalitions") with farmers or with final consumers to influence policy makers in setting public policies.

Several factors play a role in how all those agents in the value chain affect the political economy of agricultural and food policies. Three key aspects are: (1) the nature of the policies, (2) the costs of collective action, and (3) how structural changes affect incentives for political action.

3.1.1. The Nature of Policies and Coalitions in the Value Chain

The nature of public policies influences the structure of the political game by determining the possible coalitions – and vice versa. Consider a simple value chain as illustrated in Figure 1. While this value chain is more elaborate than the producer-consumer dichotomy, it still ignores many potential other value chain issues, such as competition between feed and food (and thus livestock versus crops), between food and fuel use, "environmental interests", etc. Yet, despite its simplicity, Swinnen (2015) shows it is useful to illustrate several potential coalitions.

Agricultural and food policies typically intervene in specific parts of the value chain. The type of instrument used and the "location" of intervention has a major impact on the possible political coalitions. The nature of the policy instrument will determine whether the interests of farmers and processors or other agents are aligned or not (i.e. whether they have opposing or conflicting interests in setting public policy interventions).[24]

Consider trade and price interventions, such as import tariffs and price support measures, which have long been the dominant way of supporting farmers in European agriculture. The use of tariffs goes back centuries. Price support measures, combined with variable import tariffs and export subsidies, were the main component of the EU's Common Agricultural Policy in the 1970s and 1980s.

Import tariffs may differ strongly between processed food products (e.g. pasta or specific cheeses) and agricultural products (e.g. cereals or milk). In case import tariff and price interventions are at the level of the agricultural commodities, the food processors (buyers of cereals or milk) may have opposing interests to the farmers, since they are "the consumers" – even if they can pass part of the increased costs on to "final consumers". However, "agricultural policies" (such as tariffs, import quota, or price interventions) often

[24] Not surprisingly, this makes the choice of the policy instrument the subject of lobbying itself. In this paper we do not explicitly analyze this issue. For studies on the endogeneity of instrument choice in agricultural and food policy, see e.g. Swinnen et al. (2012) and references therein.

do not apply to the raw agricultural products as they are sold by the farmers, but to products which have undergone a certain level of processing or marketing. For example, it is typically not the raw milk or the sugar beets that are traded or purchased by government agencies but processed products such as milk powder, cheese or sugar. Hence, interests of food processing companies involved in early stage processing will often be aligned with these of farmers, while those of further processing may be opposite. Take the case of sugar: the "production side" includes sugar processing companies and the farmers producing sugar cane or sugar beet (and other agents, such as land owners and agribusinesses supplying inputs to the farmers). The "consumer side" also includes food companies. Some sugar is "consumed" directly by households, but most is sold to the food industry, which uses the sugar in various products sold to retailers and only then households consume the sugar. This separation is well illustrated by the current debate on the ending of the sugar production quotas in the EU. The EU's beverage and confection industries and sweetener companies have lined up to lobby the EU decision-makers against the extension of the EU sugar quota; while the sugar producing companies are lobbying in favour.

This does not only apply to policies downstream in the value chain but also to upstream policies. For example, regulations which affect input prices (such as fertilizer subsidies or land regulations) may involve very different political coalitions than policies where there are important leakages to (benefits for) the owners or producers of farm inputs (such as price support or direct payments which increase land prices). In some of these regulations, interests of input suppliers and farmers will be aligned, in others they will conflict.

For example, landowners and farmers have always had a complex relationship. In countries where farms own most of their land, their interest coincide. However, in many parts of the world farmers rent a considerable part of their land – and there have been considerable changes on this through history (Swinnen et al., 2014). In Europe, a hundred years ago land was at the centre of agricultural policy reflecting major economic and political conflicts between landowners and farmers. At the end of the 19th century and early 20th century landowners and tenant farmers fought over land rental conditions. These conflicts resulted in a series of land regulations (and taxes) (Swinnen, 2002). In recent decades landowners and farmers have joined forces in lobbying for agricultural subsidies. Farm subsidies, either linked to production or to land use, have spilled over into high land prices and rents creating a coalition between farmers and landowners. In recent EU policy discussions, landowners have not

opposed moving from trade-distorting price support and land payments towards non-trade-distorting decoupled farm payments, since the payments are still linked to land use and thus keep land prices high (Ciaian and Swinnen, 2009; Ciaian et al., 2013).

3.1.2. Effectiveness of Collective Action

Obviously if there is a change in the coalition structure by agents switching sides, or new agents joining, this could change the political equilibrium. But changes in coalitions, or in the structure or organization of current coalition members could have non-linear effects if they would lead to more (or less) effective political activities.

One key element is the size, concentration and wealth of vested interests (reflected in the number and wealth of agents) and how this affects their influence in the political process through Mancur Olson's (1965) "logic of collective action". Olson's insights have been widely applied in studying the political economy of agricultural and food policies (Anderson et al., 2013). In order to effectively influence political choices, interest-group members must act in unison. They must form an organization that can mobilize resources and direct individual action. The greater the number of politically active members in an organization and the more resources at its disposal, the greater will be its political power base. However, as Olson argues (1965), individuals in the group often prefer to free ride.

Factors contributing to lower costs of political organizational and better control of free riding all enhance the group's political power. Geographic concentration of group members, a strong commitment to a broadly shared ideology, and low communication costs (which can result from members' organized activities, such as trade and professional associations) contribute to cohesiveness within the interest group and decrease the organizational set-up and maintenance costs. Such forces strengthen the group's political power.

This collective-action theory predicts changes in the political equilibration overtime. In poor countries food consumers are often concentrated in cities with lower political action–coordination and enforcement costs relative to farmers, who are dispersed in rural areas. However, as the economy develops, and especially, as the share of agriculture in employment declines and rural infrastructure improves, the cost of political organization for farmers decreases. This cost reduction is likely to increase the effectiveness of farmers'

representation of their interests and, as a consequence, of their lobbying activities.[25]

Researchers debate whether changes in relative collective-action costs for farmers alone can explain major changes in agricultural policies. Although rural infrastructure and information have improved significantly as countries have developed, even in developed countries, there remain a very large number of farmers (de Gorter and Swinnen 2002). The persistence of such large numbers of farmers, whose interests are not necessarily aligned, might imply that collective-action obstacles still exist.

However, other agents in the value chain, such as food processing and retail companies and agribusinesses tend to be less fragmented and more capitalized than the farms. So they may be more effective in organizing for political action. Hence coalition-formation may have important effects.

3.1.3. Structural Change, Political Incentives and Policy Costs

Structural changes in the value chains may influence the political equilibrium through inducing changes in political incentives (on the demand and supply side). Many agricultural and food policies are designed to alter the "without-policy" income distribution. Growth and decline of specific sectors (e.g. with economic development) affects the inter-sectoral distribution of income. This process creates political incentives—both on the demand (e.g. farmers') side and the supply (politicians') side—to exchange government transfers for political support. When farm incomes decline relative to other sectors, farmers will look for non-market sources of income, such as government support, either because the return to investment is greater from (political) lobbying activities than from (economic) production, or because the willingness to support politicians grows as the political rents that are generated increase.[26]

[25] The nature of agricultural structures also may determine the effectiveness of collective political action, but there may be offsetting effects. Traditional arguments predict that a sector with mainly large-holding farmers can more easily overcome collective action problems because its members are typically fewer and its collective-action costs lower compared to the political rents they receive. However La Ferrara (2002) argues that inequality among farmers may make it harder for collective action to succeed because small and large farmers have conflicting incentives and because free riding is likely to be more common in a heterogeneous group setting. Historical evidence from Europe also supports this result (Schonhardt-Bailey, 2006; Swinnen, 2009).

[26] The nature of the mechanism through which these changing political incentives operate has been modeled in various ways. For example, Swinnen (1994) has used a politician-voter interaction model, in which differences in marginal utility drive the result. Others, such as Freund and Özden (2008) and Tovar (2009), focus on the importance of aversion to loss in determining political reactions in order to explain why

Structural change also affects the costs and benefits of policies (Anderson, 1995; Swinnen, 1994). For example, when consumers spend a large share of their income on food, the per capita costs of agricultural price support is proportionately much higher than when consumers spent much less of their income on food. Vice versa, for a given costs for consumers, farmers benefit more when there are fewer farmers – concentrating the benefits. The per unit political cost of subsidizing farms thus decreases as the economy becomes richer and less agrarian. Even though the share of farmers in the voting population declines, there is less opposition to protecting them. De Gorter and Swinnen (2002) have shown that under plausible assumptions, the second of those two effects dominates.

3.2. Political Economy of Public Standards[27]

Now that we have developed some insight into the different coalitions that might arise in the agricultural sector and the factors that affect coalition-building, we can now look more in depth at the political economy of the standard-setting process. We begin by considering the case of only a public standard. Most of our analysis draws on Swinnen (2016), Swinnen et al. (2015), and Vandemoortele and Deconinck (2014).

One notable category of actors which has been consistently overlooked in these models are NGOs. Nevertheless, in the past few decades, NGOs have come to play a crucial role in the standard-setting process. We finish by outlining the reasons for addressing these and other gaps in the literature.

3.2.1. The Basic Model

Consider the market for a 'credence good', i.e. a good with certain characteristics that cannot be determined by the consumer, neither by search nor experience.[28] A standard which guarantees certain credence features of the product positively affects consumer utility as it reduces informational asymmetries. It induces consumers to buy more of the product through an increased willingness to pay, ceteris paribus.

declining sectors, such as agriculture, receive support. That work builds on the earlier notions of a conservative social welfare function (Corden, 1997) and of senescent industry support (Hillman, 1982).

[27] See chapter 4 in Swinnen et al. (2015) for a more elaborate overview and all computations

[28] For more details and other types of standards, such as those addressing externalities, see Swinnen et al. (2015).

A representative consumer has a utility function $u(x,s)$ where x is consumption of the good, and s is the level of the standard.[29] A higher s represents a more stringent standard.[30] Consumer utility is increasing and concave both in consumption $(u_x > 0; u_{xx} < 0)$ and the standard $(u_s > 0; u_{ss} < 0)$.[31] It is assumed that $u_{xs} > 0$, i.e. that an increase in the standard leads to a higher marginal utility of consumption. One example of a functional form that meets these assumptions is the Mussa-Rosen (1978) demand specification.[32]

Maximizing consumer surplus $\Pi^C = u(x,s) - px$ by choosing consumption x, given consumer price p, yields the first order condition

$$\frac{\partial \Pi^C}{\partial x} = u_x(x,s) - p = 0 \qquad (1)$$

which defines the inverse demand function. Given the assumptions on the utility function, the inverse demand function is downward sloping and a higher standard shifts the inverse demand function upwards. On the production side, a representative producer has cost function $c(x,s)$ that depends on output and the standard. The cost function is increasing and convex both in production $(c_x > 0; c_{xx} > 0)$ and the standard $(c_s > 0; c_{ss} > 0)$. It is further assumed that $c_{xs} > 0$, i.e. that a standard increases the marginal costs of production. Maximizing profits $\Pi^p = px - c(x,s)$ by setting output x yields

$$\frac{\partial \Pi^P}{\partial x} = p - c_x(x,s) = 0 \qquad (2)$$

which defines the inverse supply function. The inverse supply function is upward sloping, and a higher standard shifts the function upwards.

At the market equilibrium (x^*, p^*), demand equals supply and

[29] For the closed economy, both consumption and production are denoted by x to simplify the notation.

[30] As the focus is on the more general economic impacts of standards, some simplifying assumptions are made. Here it is assumed that a standard can be described in terms of 'strictness'. This may not always be the case. While standards such as pesticide MRLs or car emission standards can be unambiguously ranked on a vertical scale, and hence have a notion of strictness, other standards do not have such 'vertical' qualities. Such standards can be measured as binary choices. We refer to Swinnen et al. (2015) for a classification and examples of different models. We also do not distinguish here between different types of standards such as rues of origins and safety standards. The implications of such differences are discussed briefly at the end of Section 3.

[31] Subscripts denote partial derivatives to x or s.

[32] The Mussa-Rosen specification is widely used in agricultural economics and in a particular in studies focusing on quality differentiation. We use a more general demand function, so all of the results hold for a Mussa-Rosen specification as well (see Swinnen et al. 2015, Ch.2 for a review of different approaches to modeling quality). With Mussa-Rosen demand, a continuum of consumers with different taste parameters $\theta \sim U[0,1]$ obtain utility $\theta s - p$ from consuming one unit of the good (with quality s and price p). They buy at most one unit, which implies that consumer utility is $u(x,s) = sx - sx^2/2$.

$$p^* = u_x(x^*, s) = c_x(x^*, s) \qquad (3)$$

In equilibrium, aggregate welfare $W(s)$ is the sum of consumer surplus and profits:

$$W(s) = u(x^*, s) - c(x^*, s).$$

3.2.2. Impact of a Standard on Welfare and Income Distribution

Using equilibrium condition (3), the impact of an increase in the standard on consumer surplus is

$$\frac{\partial \Pi^C}{\partial s} = u_s - x^* \frac{\partial p}{\partial s} \qquad (4)$$

The first term, u_s, is the (positive) utility gain of the more stringent standard, i.e. the value that consumers attach to the reduced informational asymmetries. The second term, $-x^* \frac{\partial p}{\partial s}$, is the marginal increase in consumption expenditure, and is negative as consumption expenditures increase because of an increase in the equilibrium price due to increased demand and the cost of implementing the standard. The net effect depends on the relative size of the efficiency gain and the increased cost of living.

The impact of an increase in the standard on producer profits is

$$\frac{\partial \Pi^P}{\partial s} = x^* \frac{\partial p}{\partial s} - c_s. \qquad (5)$$

The first term on the right hand side is the increase in revenue, due to increased prices with higher standards. The second (negative) term, $-c_s$, represents the costs of implementing the standard. The net impact depends on the relative size of the increase in revenue and the implementation cost.

The impact on aggregate welfare depends on the utility gain and increased cost due to the standard:

$$\frac{\partial W}{\partial s} = u_s - c_s. \qquad (6)$$

In summary, if the utility gain for consumers exceeds the implementation cost for producers, social welfare increases. The socially optimal level of the standard, s^*, is where the marginal utility gain for consumers equals the marginal cost for producers:

$$u_s(x^*, s^*) = c_s(x^*, s^*). \qquad (7)$$

However, standards not only affect overall welfare but also the distribution of income between consumers and producers. As is clear from equations (4) and (5), the term $x^* \frac{\partial p}{\partial s}$ represents a transfer between producers and consumers: standards lead to increased revenue for producers and increased expenditures for consumers. Prices increase due to an increase in consumer demand with higher standards and due to the increased costs. The larger the price effect, the more producers are likely to benefit from the standard, and the less consumers are likely to benefit. The size of this effect depends on the supply and demand elasticities and on the size of u_{xs} and c_{xs}.[33]

Because of these distributional effects of standards, various groups in society have a vested interest in trying to influence governments' decision processes on standards. Lobbying by interest groups may cause governments to choose standards which are not welfare maximizing.

3.2.3. Standards and Politics

Consider a government that maximizes its own objective function which, following the approach of Grossman and Helpman (1994) and applied to standards by Swinnen and Vandemoortele (2011), consists of a weighted sum of contributions from lobbies and social welfare. More specifically, the government's objective function $\Pi^G(s)$ is a weighted sum of social welfare and lobby contributions C^i of producers ($i = P$) and consumers ($i = C$):

$$\Pi^G(s) = \alpha^C C^C(s) + \alpha^P C^P(s) + W(s) \qquad (8)$$

where α^i are the political weights, reflecting relative lobbying strengths of producers and consumers (with $0 \leq \alpha^i \leq 1$ and $\alpha^P + \alpha^C = 1$). The politically optimal standard $s^\#$, is determined by:

$$\frac{\partial \Pi^G}{\partial s} = (1 + \alpha^C)\left[u_s - x^\# \frac{\partial p}{\partial s}\right] + (1 + \alpha^P)\left[x^\# \frac{\partial p}{\partial s} - c_s\right] = 0 \qquad (9)$$

where $x^\#$ denotes consumption and production in the political optimum.

The first term represents the weighted marginal impact of a public standard on aggregate consumer surplus which may also be positive or negative. The second term captures the marginal impact of a public standard on producers' profits weighted by their lobbying strength $(1 + \alpha^P)$. As explained earlier this marginal

[33] See Swinnen et al. (2015) chapter 3 for a formal derivation.

impact may be positive or negative. If producers and consumers have the same lobbying strength ($\alpha^P = \alpha^C$), this yields the social optimum. In that case, the term $x^{\#}\frac{\partial p}{\partial s}$ capturing the rent transfer between producers and consumers cancels out. When producers and consumers have differing lobbying strengths, however, the political equilibrium will generally differ from the social optimum. In that case, the rent transfer $x^{\#}\frac{\partial p}{\partial s}$ will affect the standard set by the government.

Studies that use Grossman-Helpman models often assume that producers (and in particular import-competing industries in trade analyses) and owners of specific factors of production are well organized and consumers not or much less. However, such assumptions do not seem very relevant for analyses of food standards since many food standards have been introduced under pressure from consumers. The first wave of modern public food safety and quality regulations in the mid-19th century were induced by public outrage of consumers over the use of cheap and sometimes poisonous ingredients in food production (Meloni and Swinnen, 2015; 2016). Similarly, more recently the tightening public standards in food in the EU have followed food safety scandals in the late 1990s with consumers demanding better protection (McCluskey and Swinnen, 2011). Also the introduction of various public regulations in China followed the "milk scandal" where people died from consuming milk products with poisonous ingredients (Mo et al., 2012). Hence, it appears that in all these cases, the threat to their health caused sufficient welfare threats for consumers to overcome organizational obstacles and costs to effectively lobby the governments.

Note that both 'over-standardization' ($s^{\#} > s^*$) or 'under-standardization' ($s^{\#} < s^*$) may result from the lobbying process. If consumers are more influential than producers ($\alpha^P < \alpha^C$), over-standardization ($s^{\#} > s^*$) results when consumers' utility increase with a higher standard $\left(\frac{\partial \Pi^C}{\partial s} > 0\right)$ at s^* and in under-standardization otherwise. Hence, the political equilibrium standard $s^{\#}$ may be either too high or too low from a social welfare point of view. Influential lobby groups may push for both more stringent or less stringent standards depending on the relative magnitude of the price effect compared to the implementation cost (for producers) or the utility gain (for consumers).

3.2.4. Development and Pro- & Anti-Standard Coalitions

These results may explain the empirically observed positive relationship between food standards and economic development.[34] It is often argued that this relationship simply reflects higher consumer preferences for quality and safety standards with higher income levels. While the model confirms that preferences (in the form of the efficiency gain u_s) play a role, it also suggests other factors which affect the relationship between development and the political economy of public standards, causing different standards between developing ('poor') and developed ('rich') countries.

The quality of institutions for enforcement of contracts and public regulations are also positively correlated with development. Better institutions imply better enforcement and control of standards. While poor countries, with low wages and lower land rents, may have a cost advantage in the production of raw materials, better institutions of rich countries lower the marginal increase in production costs caused by standards. A lower increase in production costs could also result from higher education and skills of producers, better public infrastructure, easier access to finance, etc.

An additional factor may be the different organization and structure of the media in rich and poor countries. Mass media is the main source of information for many people. Commercial media is more likely to highlight potential food risks (McCluskey and Swinnen 2004; 2011). The cost of media information is higher and government control of the media is stronger in poor countries. Therefore, the media structure and information provision is likely to induce a more pro-standard attitude in rich countries than in poor, as increased access to media increases attention to risks and negative implications of low standards (Curtis et al., 2008).

An additional related element is that poor countries have a larger rural/urban population ratio. Asymmetric information may be more important for urban consumers. For example, McCluskey et al. (2016) find that people associated with agriculture are more in favor of GM crops than urban consumers because they have a better idea of the amount of pesticides used on non-GM crops than

[34] There may be an interesting comparison with the environmental Kuznets curve, which the environmental economics literature has explicitly incorporated into models of growth, environmental damage and standards (e.g. Copeland and Taylor, 2004). Like empirical research on the existence of the Kuznets curve (e.g. Stern, 2004) it would be interesting to analyze how strong the relationship between food standards and economic development is.

urban consumers, and hence of the benefits from GM (such as insect resistant crops).

In combination these factors are likely to induce a shift of the political equilibrium from low standards to high standards with development as the mechanisms identified here may result in a pro-standard coalition of consumers and producers in rich countries. Consumers may derive large utility gains from a standard, while producers incur only moderate increases in costs. In contrast, an anti-standard coalition may be present in poor countries if consumers are more concerned with low prices than with high quality (leading to small utility gains from a higher standard) while the implementation costs for producers (both in terms of production costs and transaction costs) may be large. Differences in asymmetric information may reinforce the positive relationship between standards and development.

3.3. Political Economy of Retailer Standards[35]

The previous analysis implicitly assumed that private firms are unable to credibly communicate the quality characteristics of products, so that the market was only governed by public standards[22]. However, as this report has clearly shown, that is not the case. Moreover, private standards are often considerably stricter than public standards. To explain this Vandemoortele and Deconinck (2014) extend the public standard model to incorporate a richer value chain structure. More specifically, in the previous section, like in most of the literature, a two-agent model with 'producers' and 'consumers' was considered. However, focusing only on these two groups ignores important structural features of modern value chains. The "producer" side of the value chain is often characterized by a large number of small "producers" (like farms) and a few companies (such as processing companies or retail chains) which sell products to consumers and often exercise market power (Sexton et al., 2007). In reality, many private standards are set by retailers – not by producers.[36] Therefore Vandemoortele and Deconinck (2014) explicitly introduce a monopolist retailer that may set a private standard to regulate the same product characteristics as the government's public standard and show that this has important consequences for the analysis of private standards.[37] In addition to the retailer's private standard, it is assumed there is a public standard which is determined in a

[35] See Vandemoortele and Deconinck (2014) and chapter 7 in Swinnen et al. (2015) for a more elaborate overview and for all computations

political game where producers and the retailer have political power to influence the government's standard-setting process.

The analysis shows that if the retailer can impose most of the costs of a higher standard on producers, the optimal retailer standard will be higher than the optimal standard for producers. Producers thus lobby for a lower public standard, but retailers impose a higher private standard. The joint determination of the politically determined public standard and privately determined private standard depends on a variety of factors, such as the retailer's market power, producers' political influence, the standard's efficiency gains, implementation costs, and rent transfers from the retailer to producers. Side payments from producers to the retailer may align the retailer standard more with producer interests.

3.3.1. Why Are Private Standards Stricter than Public Standards?

Retailers and producers can have a variety of motives to implement private standards in the absence of public standards. First, private standards may reduce consumers' uncertainty and information asymmetry about product characteristics such as safety, quality, and social and environmental aspects, thus increasing consumer demand. For example, Kirchhoff (2000) shows that firms may voluntarily reduce pollution to attract 'green' consumers if firms are able to signal their pollution abatement, for example through a private standard. A similar argument can be made for business to business transactions where the buyer is not a consumer but a private company. In such contexts, private standards allow to ensure and communicate product attributes about production, quality etc. which may facilitate firms to gear their activities to one another.

Second, firms may use private standards as strategic tools to differentiate their products, thus creating market segmentation and softening competition. A basic result from the vertical differentiation literature is that firms are able to reduce price competition and raise their profits by differentiating the (vertical) quality

[36] In the U.S. beef industry, for instance, fast food restaurants and retail chains are responsible for the drive toward more stringent traceability standards (Golan et al., 2004). One notable exception are geographical indications, where quality standards are set by producer organizations (Mérel and Sexton, 2012).

[37] We denote the third party as the 'retailer', but this market player may be any intermediary between producers and consumers, e.g. a processing firm. For the analysis, the third party's relevant characteristics are that it acts as an intermediary between producers and consumers, and that it has some market power in exercising its function.

attribute of their products (see e.g. Spence, 1976; Mussa and Rosen, 1978; Tirole, 1988). Such quality differences can be signaled by setting a private standard.[38]

Third, as demonstrated by Von Schlippenbach and Teichmann (2012), firms may use private standards strategically to improve bargaining power over their suppliers. Their analysis shows that if suppliers cannot adjust product quality in the short run, retailers may either undercut or surpass other retailers' standards to weaken their suppliers' outside options and bargaining power. The authors show that such strategic differentiation by retailers results in welfare losses compared to the social optimum and that in such a setting a minimum quality standard can be welfare improving.

However, private companies regularly set standards which co-exist, and often exceed, public standards. Empirical evidence shows that 70% to 80% of retailers assess their own private standards slightly or significantly higher than public standards. Animal welfare is an area where private standards often exceed public standards.[39] Food safety and quality is another typical area. Fulponi (2006) reports that 85% of the retailers maintain food safety and quality standards which are more stringent than public standards, for example by imposing stricter norms for possible allergens or contaminants.

Concerning genetically modified organisms (GMO), Vigani and Olper (2013) show that a majority of retailers in Europe are committed to selling GMO-free food, thus implementing a standard stricter than required by EU regulations.

Two theories may offer an explanation for this observation, i.e. why most retailers set their private standards at higher levels than what is required by law. First, firms may try to strategically pre-empt costly political action through voluntary private standards (Lutz et al., 2000; McCluskey and Winfree, 2009;

[38] Several other authors have shown that in a vertically differentiated market a minimum quality standard imposed by the government (a public standard) may raise welfare, depending on the type of competition between producers (see e.g. Leland, 1979; Ronnen, 1991; Boom, 1995; Crampes and Hollander, 1995; Valletti, 2000; Winfree and McCluskey, 2005). If the minimum quality standard is not prohibitively high such that it does not exceed the highest quality voluntarily supplied by producers, firms differentiate their quality levels: some produce at the minimum quality level while others produce at a higher quality level. The latter firms can signal their higher quality by setting a private standard that is more stringent than the public minimum quality standard (see e.g. Arora and Gangopadhyay, 1995).

[39] McDonalds, for instance, imposes more stringent standards for the treatment of animals than what is prescribed by law, and several U.S. producer groups such as the American Meat Institute and the United Egg Producers issue voluntary guidelines on animal welfare (Mitchell, 2001). Fulponi (2006) notes that even though animal welfare is protected by both EU and national regulation, the majority of large European retailers reports that their animal welfare requirements are higher than those imposed by national legislation.

Maxwell et al., 2000). The political economy model of Maxwell et al. (2000) shows that high private standards may preempt public standards if consumers' costs of getting politically organized are sufficiently high. In the explanation of McCluskey and Winfree (2009), public standards are imposed (even though preempted by private standards) but at equal or higher levels than private standards. [40]

Second, the vertical differentiation literature argues that those retailers who set their private standard at a higher level than the public minimum quality standard aim at differentiating themselves from other retailers that sell at the minimum quality standard, thus raising profits by reducing competition. While this may be an appropriate description of some markets (e.g. organic food), the standard vertical differentiation framework seems less appropriate for analyzing the phenomenon that organizations such as the BRC or the GlobalGAP introduce private standards that are more stringent than public standards, and that these relatively stringent private standards are adopted by almost all retailers in European countries.[40] Retailers thus seem to implement private standards which are simultaneously higher than the existing public standards but not significantly different from the standards adopted by their rivals. One possible explanation would be that consumers have come to regard the stricter private standard as the *de facto* minimum (e.g. because of a lack of trust in the lower public standard), in which case retailers have no choice but to adopt the stricter private standard as if it were a minimum quality standard. This seems to be the case for standards such as the "dolphin-safe" tuna fish, a voluntary standard which nevertheless is adopted by all players in the US market (Smith, 2009). However, while this explanation may hold true for some highly visible products and some characteristics, stricter private standards seem too pervasive to be attributable to such consumer perceptions alone.

Here, Vandemoortele and Deconinck (2014) provide an additional explanation for the observation that private standards may be set at higher levels than their public counterparts – even when implementation costs and consumer benefits do not differ between public and private standards. The analysis shows that an intermediary with market power may set its private standard at a higher level than the government's optimal public standard if the retailer is able to shift the burden of the private standard's implementation cost to producers. While

[40] Another important example is the Global Food Safety Initiative (GFSI), a benchmarking organization where leading retailers collaborate in harmonizing private standards for food safety and/or sustainability (Fulponi 2007).

producers lobby for a lower public standard, the retailer uses its market power to impose a higher private standard.

3.3.2. The Extended Model

The notation regarding consumers and producers stays the same with the small difference that producers now receive a wholesale price w.

Vandemoortele and Deconinck (2014) assume that output is sold by producers to consumers through one intermediary agent – a monopolist retailer. The retailer's handling costs are normalized to zero. The monopolist retailer sets consumer and producer prices such that, under optimal price-taking behavior of consumers and producers, consumption and output equal at a level that maximizes the retailer's profits Π^R. Formally, the retailer's profits are

$$\Pi^R = max_x\big(p(x,s) - w(x,s)\big)x \quad (10)$$

where $p(x,s) - w(x,s) = u_x(x,s) - c_x(x,s)$ is the retailer's margin.

The FOC of the retailer's profit maximization is

$$\frac{\partial \Pi^R}{\partial x} = u_x - c_x + x(u_{xx} - c_{xx}) = 0, \quad (11)$$

and hence the equilibrium quantity $x^*(s)$, for a given level of the standard s, is

$$x^*(s) = \frac{u_x - c_x}{c_{xx} - u_{xx}} \quad (12)$$

Equation (12) is not a closed-form solution since the right-hand side depends on x. The denominator is always positive because the cost function is convex and the utility function concave in x. The numerator is positive if $u_x > c_x$, or equivalently if $p > w$. This condition – which is assumed to hold throughout this section – assures a positive retailer margin and profits. Social welfare $W(s)$ is now defined as the sum of consumer surplus, producer profits, and retailer profits:

$$W(s) = \Pi^C(s) + \Pi^P(s) + \Pi^R(s) \quad (13)$$

3.3.3. The Political Equilibrium

Vandemoortele and Deconinck (2014) analyze the optimal standard-setting behavior of both the retailer and the government. In line with most of the literature on minimum quality standards, they assume that the government

moves first in setting its public standard.[41] They solve the game by backward induction and determine first the retailer's optimal private standard for a given level of the public standard. Then they determine the government's optimal public standard to finally compare the level of the retailer's optimal private standard s^R to the level of the government's optimal public standard $s^{\#}$.

Being the only intermediary agent between producers and consumers, the retailer is able to unilaterally impose a private standard. The retailer maximizes profits by imposing a private standard, given the market equilibrium in equation (12) that results from the retailer's own optimal price-setting behavior and the consumers' and producers' optimal price-taking behavior. Then, the retailer's optimal private standard s^R is determined by the following FOC, subject to $s^R \geq s^{\#}$:[42]

$$x^*(s^R)(u_{xs} - c_{xs}) = 0 \qquad (14)$$

Equation (14) shows that $u_{xs}x^*(s^R) = c_{xs}x^*(s^R)$ at s^R, which indicates that the rent transfer from consumers to the retailer equals the rent transfer from the retailer to producers at s^R. The retailer sets its private standard at a level where marginal revenues equal marginal expenditures from increasing the private standard. Additionally, abstracting from the trivial case where $x^*(s^R) = 0$, Equation (14) implies that $u_{xs} = c_{xs}$ at s^R, i.e. that the retailer sets its optimal private standard such that the shift in the inverse demand function is equal to the shift in the inverse supply function.

Extending the political economy of Section 6.2 and assuming that producers and the retailer are politically organized in separate interest groups that lobby simultaneously, but that consumers are not organized[43], yields the government's objective function $\Pi^G(s)$ as a weighted sum of the interest group contributions, weighted by α^ℓ, and social welfare, where α^ℓ represents the relative lobbying strength of the interest groups (with $\ell = P, R$):

$$\Pi^G(s) = \sum_\ell \alpha^\ell C^\ell(s) + W(s) \qquad (15)$$

[41] Lutz et al. (2000) and McCluskey and Winfree (2009) assume that firms are the first movers in the standard-setting process, whereas other work on minimum quality standards (such as Leland, 1979; Ronnen, 1991; Valletti, 2000; Boom, 1995) typically assume the government to be the first mover in setting minimum quality standards.

[42] This condition reflects that the standard which effectively regulates the market is $s = max\{s^{\#}; s^R\}$. As second-mover, the retailer has no incentive to set a private standard lower than the public one, $s^{\#}$, even if the retailer's optimal private standard is lower than the public standard. Hence, the retailer sets its private standard either at a higher level than or equal to the government's public standard (which is given at this stage), or the retailer refrains from setting a private standard.

[43] The assumption that consumers are not organized is not essential to the results.

The government's optimal public standard $s^{\#}$ is now therefore determined by the following FOC, subject to $s^{\#} \geq s^{R}$:

$$\alpha^{P}\left[x^{\#}\left(c_{xs}+\frac{dx}{ds}c_{xx}\right)-c_{s}\right]+\alpha^{R}[x^{\#}(u_{xs}-c_{xs})]+u_{s}-c_{s}+x^{\#}(u_{xx}-c_{xx})\frac{dx}{ds}=0 \quad (16)$$

Equation (16) implicitly defines $s^{\#}$ as a function of the lobbying strengths of the different interest groups α^{ℓ}, the efficiency gain u_s, the implementation cost c_s, the rent transfers $x^{\#}\,u_{xs}$ and $x^{\#}\,c_{xs}$, and the marginal change in producer revenues $x^{\#}(c_{xs}+\frac{dx}{ds}c_{xx})$, all evaluated at $s^{\#}$.

With production costs sufficiently convex and consumer utility sufficiently concave in s (to ensure that both Π^{G} and Π^{R} are concave in s), it follows that, if $\left.\frac{\partial \Pi^{G}(s)}{\partial s}\right|_{s^{R}} > 0$ then $s^{R} < s^{\#}$ (and vice versa). The expression for the standard's marginal impact on the government's objective function at s^{R} is

$$\left.\frac{\partial \Pi^{G}(s)}{\partial s}\right|_{s^{R}} = \underbrace{u_{s}-c_{s}+x^{*}(s^{R})(u_{xx}-c_{xx})\frac{dx}{ds}}_{(1)}+\alpha^{P}\left[\underbrace{x^{*}(s^{R})\left(c_{xs}+\frac{dx}{ds}c_{xx}\right)-c_{s}}_{(2)}\right], \quad (17)$$

which may be positive or negative. Part (1) of Equation (17) equals the marginal social welfare effect of the standard at s^{R}, and may be positive or negative. Part (2) represents the standard's marginal impact on producer profits at s^{R}. Part (2) may be positive or negative as well. Hence, *a priori*, it is not determined which of the two standards is more stringent. The retailer's optimal private standard may be higher or lower than the government's optimal public standard.

Vandemoortele and Deconinck (2014) identify 4 factors which may lead to private standards being *more stringent* than public standards. These factors are summarized by Equation (17). First, the marginal change in producers' revenues $x^{*}(s^{R})\left(c_{xs}+\frac{dx}{ds}c_{xx}\right)$ plays an important role. If this term is smaller, the standard's marginal impact on producer profits at s^{R} (part (2) of Equation (17)) is smaller such that Equation (17) is more likely to be negative, and $s^{\#} < s^{R}$. A low value means that producers receive a smaller compensation for a higher standard. Ceteris paribus, producers thus bear a larger share of the implementation cost. The producers' interest group then lobbies in favor of a lower public standard and Equation (17) is more likely to be negative, i.e. $s^{\#} < s^{R}$.

Second, when producer profits are marginally decreasing in the standard at s^R, i.e. when part (2) in Equation (17) is negative, a larger political power of the producers' interest group α^P increases the likelihood that Equation (17) is negative and $s^\# < s^R$. In this case, producers lobby in favor of a public standard that is lower than the retailer's optimal private standard, and their larger political power means they can lobby more successfully, ceteris paribus, so that they are able to reduce the level of the government's optimal public standard.

Third, the size of the efficiency gain matters. If u_s is smaller, the marginal social welfare effect at s^R (part (1) of Equation (17)) is smaller and Equation (17) is more likely to be negative such that $s^\# < s^R$. A lower efficiency gain induces the government to set a lower public standard because of social welfare considerations, while the retailer does not take social welfare effects into account.

Fourth, the size of the implementation cost c_s affects both social welfare and producer profits. Equation (17) is more likely to be negative with a higher implementation cost, such that $s^\# < s^R$. The intuition behind this result is that a higher implementation cost causes the government to set a lower public standard, not only because of social welfare considerations but also because the producers' interest group lobbies in favor of a lower public standard. In contrast, the retailer is not concerned with social welfare effects, so that the retailer's optimal private standard is not affected by a change in the implementation cost. Due to producer lobbying, a change in the implementation cost c_s has a larger impact on Equation (17) than a similar change in the efficiency gain u_s (but in opposite direction), ceteris paribus.

Under these conditions, it is more likely that the retailer sets its optimal private standard at a higher level than the government's optimal public standard. Hence these factors may explain the observation that in some sectors, private standards are more stringent than public ones.[44]

[44] For instance, in a discussion of voluntary traceability standards in the U.S. food system, Golan et al. (2004) conclude that the extent and depth of these systems varies across industries, depending on varying costs, product characteristics and industry organization. Traceability standards are higher in the fresh fruit and vegetables industry, since fresh produce needs to be boxed early in the supply chain, which implies that traceability imposes only minor additional costs on producers compared to other industries.

3.4. Shortcomings and Issues for Further Research

One of the major shortcomings of the models of political economy of standards is that they ignore lobbying by other vested interests, such as NGOs. Nevertheless, as emphasized throughout this report, the importance of this omission should not be understated, especially in the case of sustainability standards. Some studies have already addressed NGO activities and their relationship with their donors and supporters (see e.g. Chau and Huysentruyt, 2006; Aldashev and Verdier, 2010; and Swinnen et al., 2014).

It is well-known that organizations such as Fairtrade, Oxfam, Rainforest Alliance, and many other NGOs have been very influential in both demanding standards and in implementing sustainability standards themselves, often related to developing countries. Other NGOs, such as those concerned with organic farming, have also played a role in Western countries.

In addition, NGOs have tried to influence regulations and standards in EU and US agricultural policy. Swinnen (2015) has documented how environmental concerns and organizations have started to play an increasingly prominent role in influencing agricultural policy. While nature conservation issues have a long history in the US, they only entered into the discussions in the EU with the 2003 reforms of the Common Agricultural Policy.

In the US, the impact of conservation on agricultural policy dates back to the Dust Bowl era of the 1930s. Environmental concerns took on new prominence in the 1985 and 1990 Farm Bill: the latter was entitled the "Food, Agriculture, Conservation and Trade Act." Farm groups seeking to limit agricultural production—thereby raising prices—joined a political coalition with environmentalists to establish a Conservation Reserve Program (CRP) for the protection of erodible land. Farmers can place their land in the CRP in exchange for CRP payments. In 2012, 27 million acres of US cropland, involving nearly 400,000 farms, were in the CRP (USDA, 2013).

The latest negotiations on the 2014 Farm Bill do not show an increased influence of environmental interests. The budget for CRP payments has been relatively constant over the past decade and is not planned to change significantly. In fact, with higher commodity prices after 2005, CRP payments have become less competitive, and fewer farmers are interested in CRP (Cuellar et al., 2014).

In Europe, a decade after the 2003 CAP reforms, hopes were high among the environmental organizations that, given the need to address climate change and other environmental concerns, important further changes could be made in the 2013 CAP reform to enhance the environmental impact of CAP payments for the 2013-2020 period. Policy discussions focused on how to reform the farm payments, as increased pressure from taxpayers and demands from environmental groups challenged the current payment structures. The Commission proposed to maintain the key elements of the CAP as they existed at the time, but with changes in the nature, structure and distribution of the payments. One key element was greening of the payments as farm support would be better linked to environmental objectives.

Farm organizations lobbied to secure the payments. They were supported in these efforts by landowners, who are benefiting from spillover effects of the land-based payments (Ciaian et al., 2013). Farm associations formed a strategic coalition with environmental groups to lobby the Ministers of Finance and Heads of the EU member states for as a large a CAP budget as possible during the economic and financial crisis – much like the 2003 reforms. However, as soon as the budget for the 2014-2020 CAP was fixed (in early 2013), farm groups started lobbying to remove or weaken environmental constraints on the payments (Hart, 2015; Matthews, 2015).

As is clear from these examples, environmentalists (and NGOs concerned with sustainability in general) can have an important impact on agricultural and food policy, not only through lobbying, but also through strategic coalition-building. This is definitely also the case for the standard-setting process, all the more since they are themselves setting private standards that often coexist with public standards and other private standards set by different organizations.

Their role in the standard-setting process has received much attention in discussions and press reports and to a lesser extent in thorough empirical studies. However, this impact has not been captured in formal theoretical models.

Future research should address these shortcomings and develop a more comprehensive – and thus more realistic – political economy model of standard-setting in the field of food and sustainability.

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ANNEXES

Figures

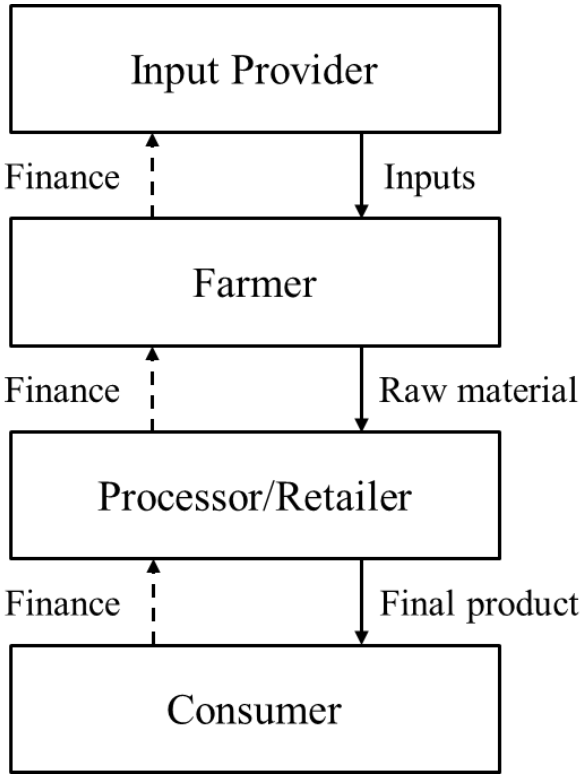

Fig. 1. Food value chain with perfect markets

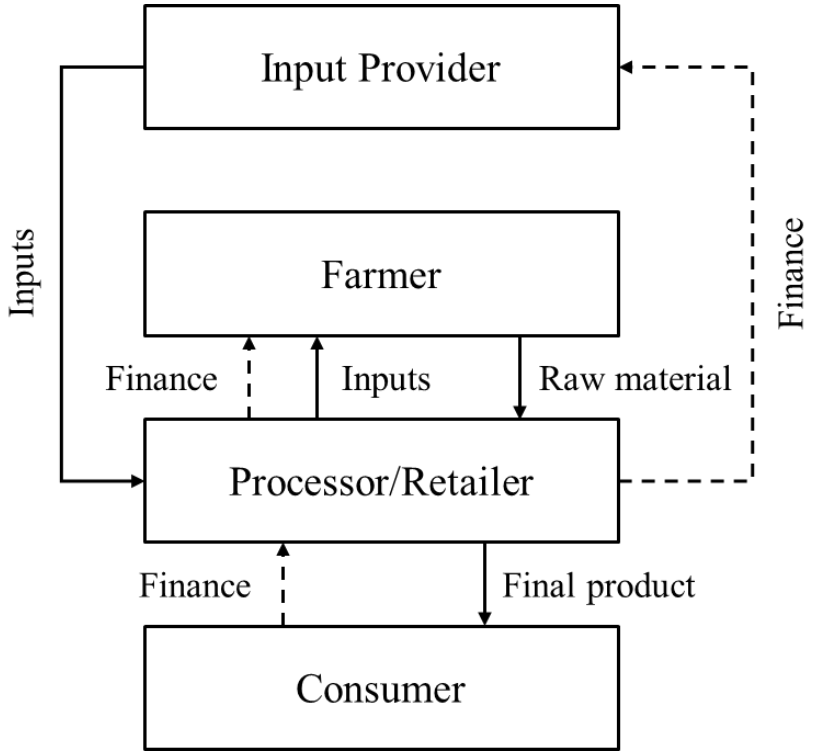

Fig. 2. Innovation 1: Contracting between farmer and processor/retailer

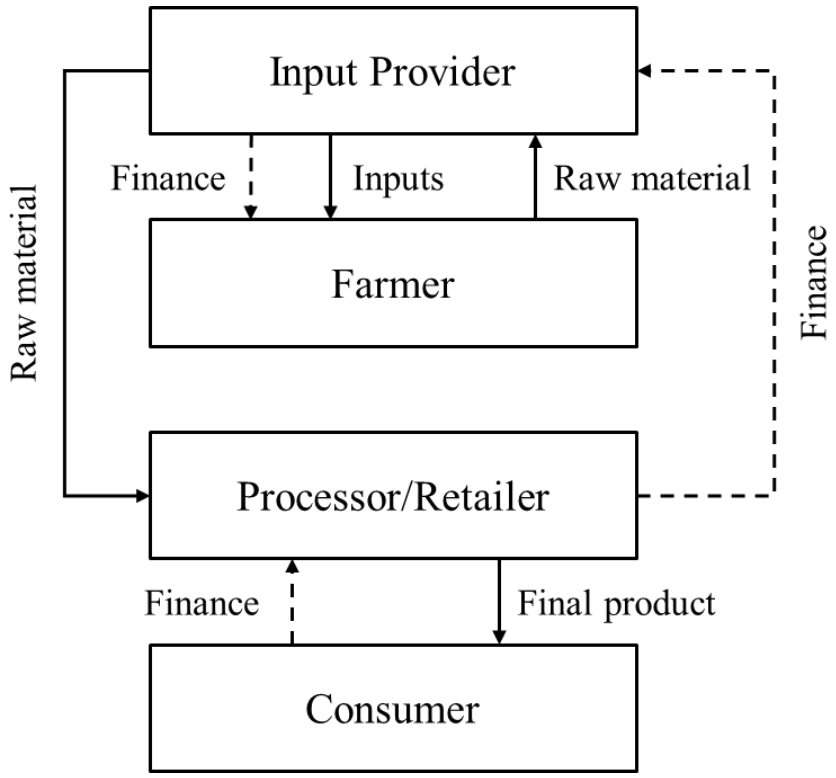

Fig. 3. Innovation 2: Contracting between farmer and input company

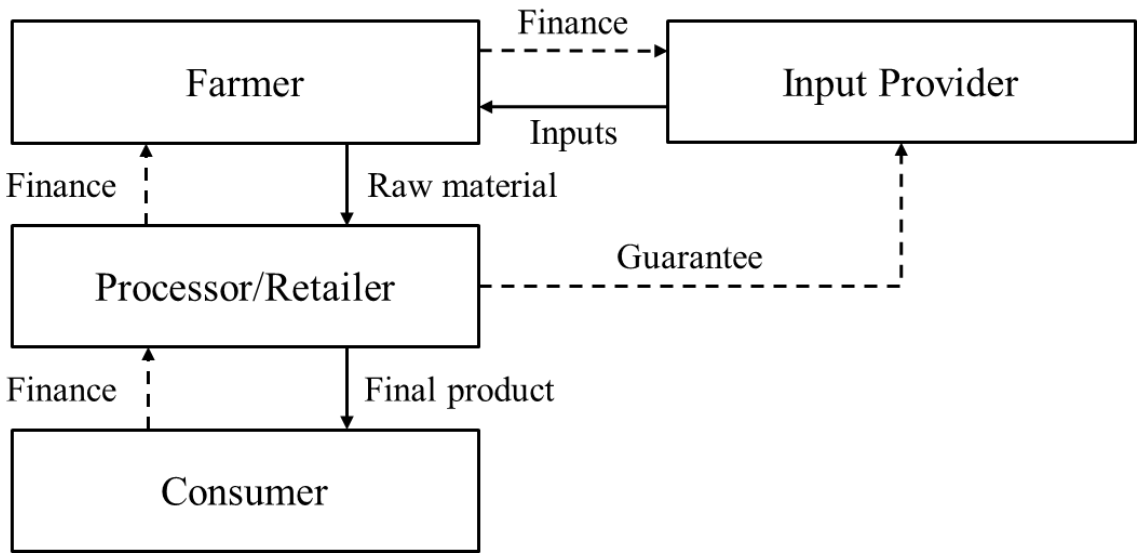

Fig. 4. Innovation 3: Triangular value chain structure

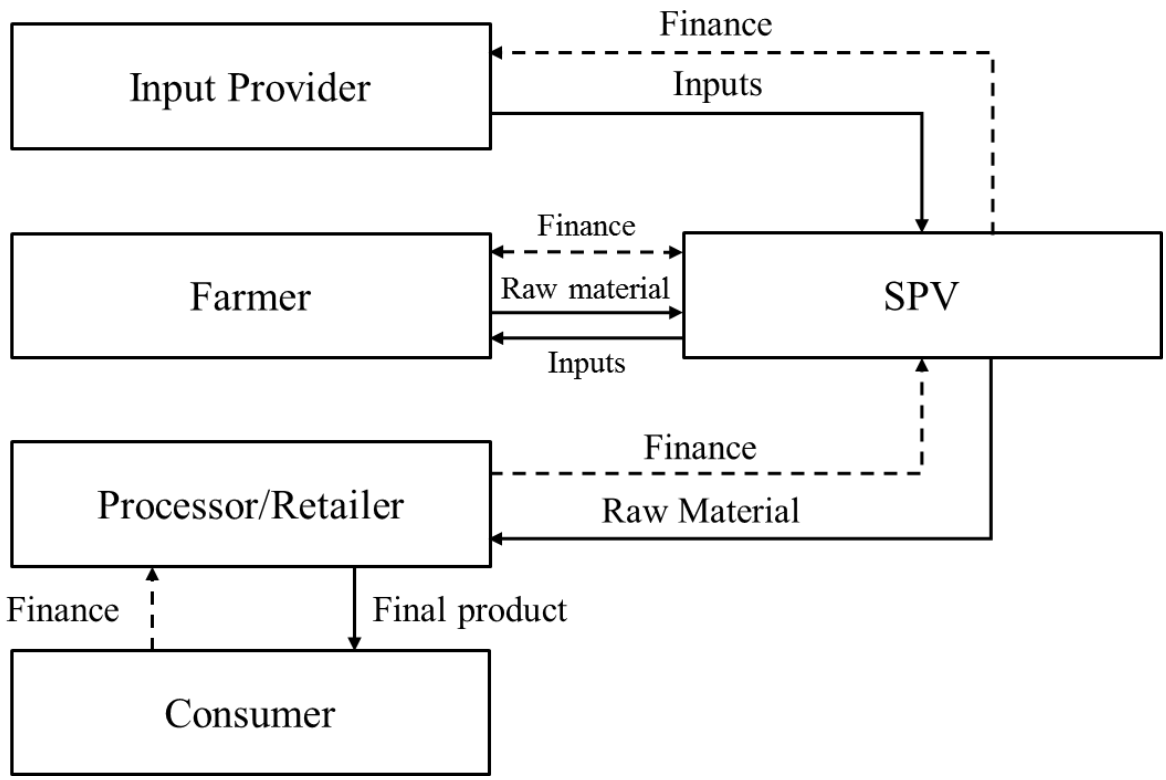

Fig. 5. Innovation 4: Special Purpose Vehicles for high-standard production

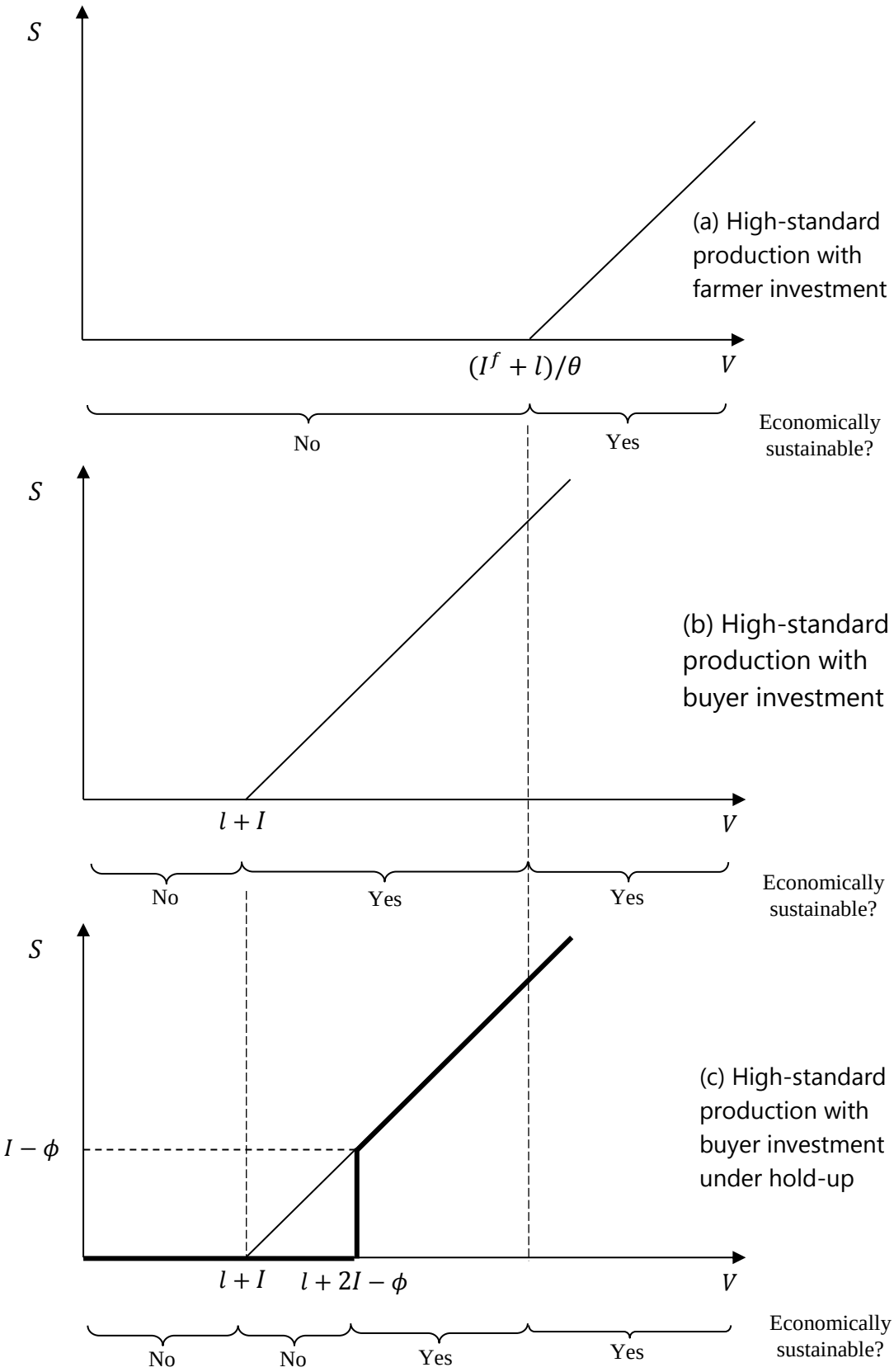

Fig. 6. Economic Sustainability of the value chain under three scenarios: (a) Farmer investment, (b) buyer investment, (c) buyer investment with hold-up

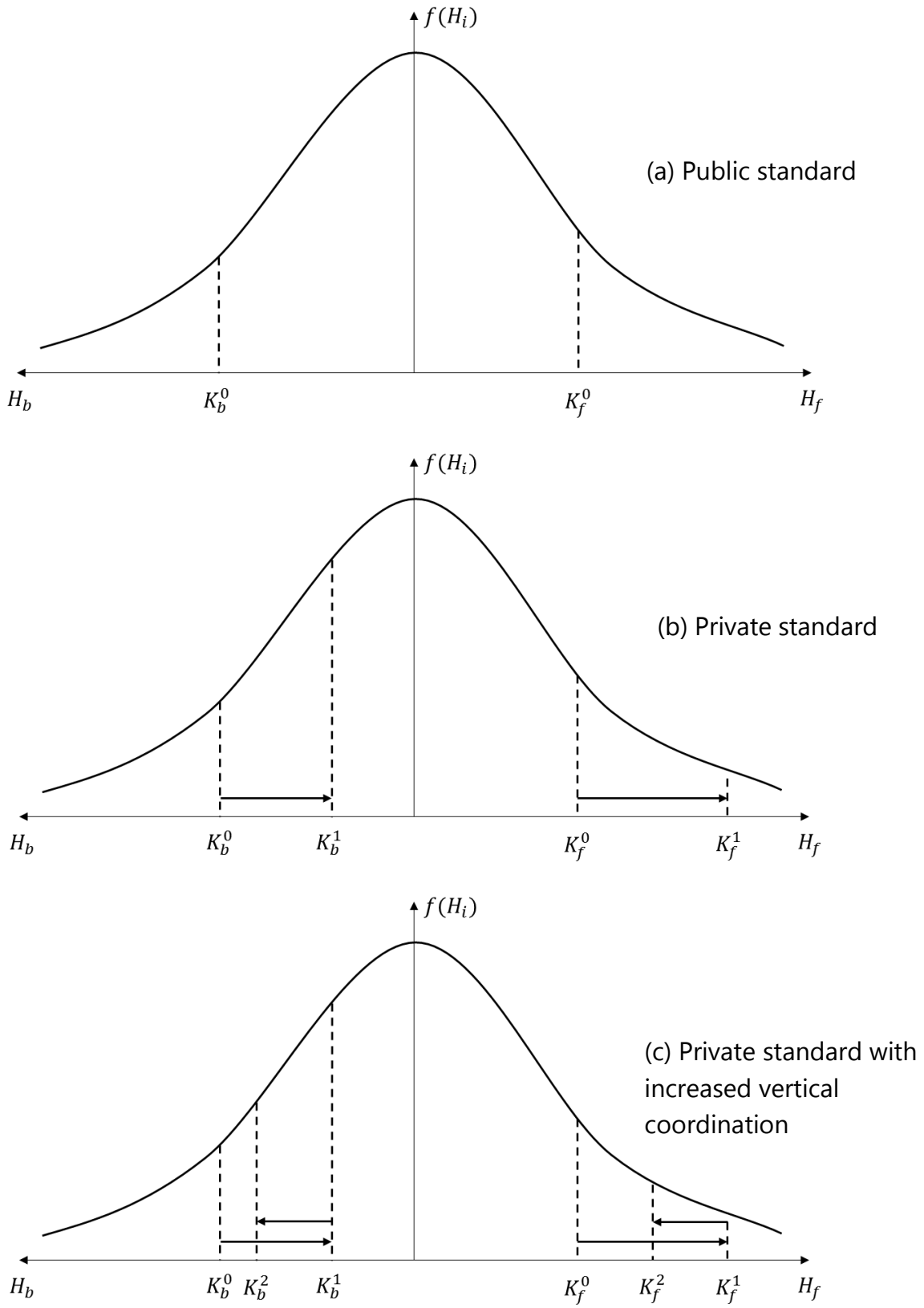

Fig. 7. Probability of Economic Sustainability

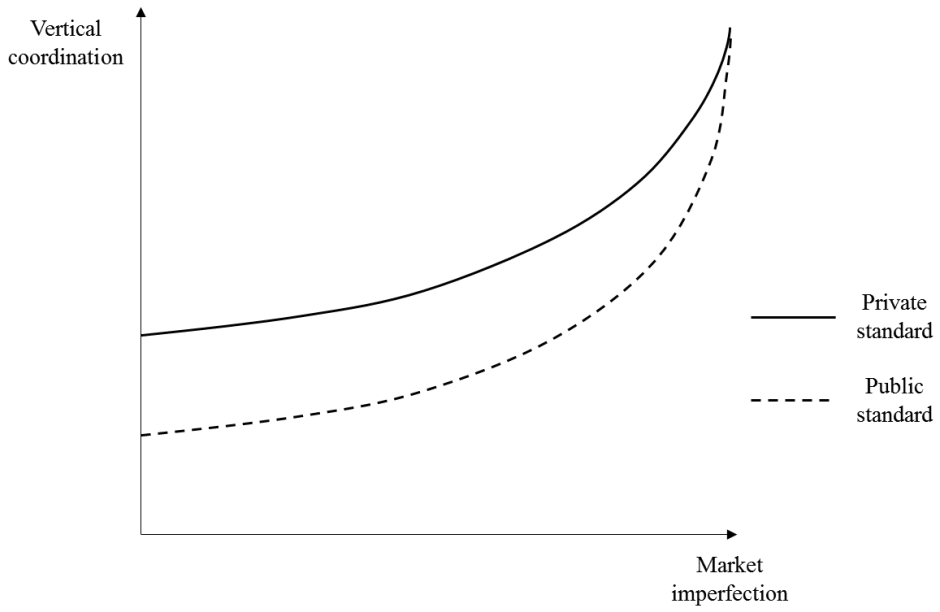

Fig. 8. Minimal levels of vertical coordination needed for economic sustainability of the value chain as a function of degree of market imperfections and type of standard