THE PARADOX OF SAFETY STANDARD SETTING
IN THE US BROILER INDUSTRY
1980 to 2013

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By

Lu Hao, M.A.
Communication, Culture and Technology
Georgetown University
Section 1: Introduction

Today’s globalization is driven by four factors, namely cost, the market, the environment and competition (Czinkota & Ronkainen, 2011). The practice of international trade is oriented toward optimizing these factors by reducing costs, expanding markets, utilizing the environment and consolidating competitive advantages. Much of this optimization process is conducted via outsourcing and offshoring, engendering a globalized value chain. Simultaneously, coordination and regulation of such a complex system have become extremely challenging given the huge number of players with disparate interests as well as cultural and social diversity. It is this challenge that begs a solution to cope with such complexity: namely, standardization.

The proliferation of standards organizations during the past two decades mirrors the increasing importance of standardization and its indispensable role in facilitating globalization. Standards, as the interface that governs interactions (Garcia, 2013), embody powers that can be utilized to generate and maintain social order. They prescribe rules or protocols to be followed by individuals and organizations, as well as penalties in case of violation. The power of standards is legitimized by their arguably science-based objectivity. Standards bring certainty and predictability by eliminating alternatives and regulating interactions.

Paradoxically, the scientific attributes of standards often veil the political maneuvers of standard systems. Market-driven private standards organizations make profits by selling standards (Office of Technology Assessment [OTA], 1992). Inefficient standards may prevail due to factors other than the quality of standards per se\(^1\). Inefficient standardization schemes may also engender new conflicts and uncertainties, which translate to economic loss and impediment of social development\(^2\). Meanwhile, standardization, by the mechanism of inclusion and exclusion, creates winners and losers (Grewal, 2009). This standards paradox illustrates how standards not only reduce complexity but also generate new complications.

Such complications are especially salient in the broiler industry in the United States. This is

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\(^1\) The QWERTY keyboard may be the best example illustrating the ways in which inefficient standards won out via network externalities and lock-in effects (David, 1985).

\(^2\) This is easily seen in the continuous food safety scandals worldwide. China’s melamine milk scandal in 2008 sickened hundreds of infants, and almost destroyed the entire Chinese dairy industry.
evident in the frequent salmonella outbreaks in chicken products\(^3\). Besides, the drastic growth of chicken production and consumption over the recent three decades\(^4\) has presented greater challenges for standard setting in the industry to assure safety goals. Compounding the problem is the expanding value chain of chicken production spanning multiple nations (including developing countries with notorious “food safety scars”). In August 2013, the USDA approved processed chicken imports from China, arousing huge public consternation in American society (Elliot, 2013). Meanwhile, the newly announced USDA poultry inspection standards are reportedly inefficient and inadequate to assure the safety of chicken products (Kindy, 2013).

These issues reveal a tension between the economic benefits of value chain production and the public goal of safety assurance with regard to standard setting in the US chicken industry. This disparity begs the question: what, if any, are the gaps between production and safety standard setting in the US chicken industry?

This paper argues that a combination of economic, social and institutional processes in the last thirty years have shifted the landscape of standard setting in the US chicken industry. To this end, section II explores the globalization and increasing complexity of the US chicken industry by examining the extended global value chain of the industry and its implications on food safety and safety standards. Section III unpacks the safety standards system of the US broiler industry. Section IV provides in-depth analysis, elaborating on the connections and tensions between the two complex systems: the globalized value chain networks and the safety standards. This paper concludes with a summary of the key results derived from this study.

Section II: Globalization of the US broiler industry: a global value chain analysis

Studies of agribusiness production parse the input-output process of agri-food production into five general stages: inputs, production, processing, distribution and retail (Humphrey, 2006; Nadvi, 2008; Gereffi, Lee & Christian, 2009) with minor variations when applied to different sectors. In the context of the US broiler industry, the input-output structure presented in this paper is based on Gary

\(^3\) Examples are seen in the Salmonella Heidelberg Infection in Tyson Chicken in 2014 and the Salmonella Outbreak in Forest Farm Brand chicken in 2013 (Centers for Disease Control and Prevention [CDC], 2014).

\(^4\) Average annual per capita consumption of chicken in the US increased from less than 50 pounds in 1980 to 60 pounds in 2012 (USDA, 2012).
Gereffi’s framework on US-based agricultural value chain and extended with a global dimension, adding exporting, and importing elements to the inputs, production, processing and distribution stages (See Figure 1).

Figure 1. Input-Output Structure of Globalized US Broiler Value Chain
Source: Author
The US broiler industry is distinguished by its vertically integrated and horizontally concentrated organizational structure. Large poultry firms (also known as “integrators”) have assumed a dominant position, with direct control over the inputs, processing and distribution stages. Deepened integration is driven by the increasing dependence on R & D in all stages. Meanwhile, low profit margins and high sunk costs have pushed small poultry companies out of business, leading to growing concentration in the broiler industry.

Large integrators, as shown in Figure 1, own feed mills, hatcheries, processing plants and access to domestic and international markets. They outsource broiler breeding to independent farmers under a unique contract system and provide the growers with feed, chicks, veterinary medicine and technical assistance. In turn, the contracted growers provide labor and time, as well as cover the costs of fully equipped modern grow-out houses and required facility upgrading. Upon reaching market weight in 6 - 7 weeks, the broilers are transported to the processing plants to be slaughtered for initial and further processing. Various chicken products are sold to different buyers, including supermarkets, fast food chains, restaurants, and other local food retailers.

From the early 1980s to 2013, drastic growth of chicken exports and imports, reflected the expansion of the US broiler value chain on a global scale. Export volume of broiler meat in 2013 is 13 times the volume of that in 1980 (USDA-ERS Data on Broiler Exports). The 3 largest foreign markets for US broiler products are Russia, China (including Hong Kong) and Mexico. Imports of chicken products have grown remarkably between 1995 and 2013 (Figure 2). Broiler imports multiplied 25 times during this period. The top 3 nations for US broiler meat imports are Canada, Chile and Mexico. In 2013, the USDA allowed processed chicken imports from China with the condition that the broilers must be born and raised in the US. This announcement has engendered public consternation for the potential safety hazards of imported broiler products. Although no empirical data exists yet to analyze

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5 Two of the largest integrators, Tyson Food and Pilgrim’s Pride, together shared 48 % of the US market in 2006, up from 30 % in 1996 (Gereffi, Lee & Christine, 2009).
6 Retail giants, such as supermarkets and fast food chains have increased their power in the chicken value chain over time through increased buying power and deepened consolidation. Fast food chains accounted for 55% of the chicken consumed in food services in 2005 (Gereffi et al., 2009).
7 The volume of broiler exports in 1980 and 2013 are 275, 000 million tons and 3, 354, 000 million tons respectively (ERS Broiler Export Data).
8 The United States did not import broiler meat until 1995. The volume of broiler imports in 1995 and 2013 are 2, 000 million tons and 51, 000 million tons respectively (USDA-ERS Data on Broiler Imports).
the safety implications of this policy decision, it indeed indicates an increasing impact of international trade on the value chain structure of the US broiler industry and the concomitant challenges for safety regulation.

![Graph: US Broiler Meat Export and Import between 1989 and 2013](image)

**Figure 2. US Broiler Meat Export and Import between 1989 and 2013**  
*Source: “Chickens, turkeys, and eggs: Annual and cumulative year-to-date US trade-All years and countries”, USDA ERS Data*

**The Coordination Pattern of the Value Chain**

This section addresses the linkages within broiler value chain networks. In particular, it utilizes Gereffi and Lee’s framework of Value Chain Governance and Food Standards to explore how the globalized value chain structure of the US broiler industry has altered the landscape for food safety assurance.

**Value Chain Governance and the Food Standards Model**

Supplier-buyer linkage constitutes the most fundamental unit of analysis in understanding
the structure, coordination and power distribution within a particular value chain. The degree of concentration in the value chain for supply (suppliers) and demand (buyers/retailers) determines the degree of power asymmetry, thus the pertinent governance patterns. Based on this premise, Gereffi and Lee derive an analytical framework to address the relationship between value chain governance and food safety standards (Gereffi and Lee, 2009). As shown in Figure 3, the 2 by 2 matrix includes four scenarios depending on the degree of concentration in the markets for supply and demand.

**Figure 3. Value Chain Governance and Food Standards Framework**

*Source: Gereffi and Lee*

The typology in Gereffi and Lee’s model is based on the premise that,

“[T]he more a particular value chain is concentrated and governed through tight explicit coordination⁹ by a few consolidated actors, the more value chain is likely to obtain comprehensive private standards to regulate food safety and quality. Conversely, fragmented value chains at both the supply and demand ends are likely to encounter more limited public standards” (Gereffi & Lee, 2009).

The framework shown in Figure 3 summarizes four categories of supplier-buyer linkages and the pertinent types of food safety standards that prevail in particular segments within the value chain. When both suppliers and buyers (retailers) of a particular value chain segment are highly concentrated and competence, the coordination is governed by bilateral oligopolies (Box A).

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⁹ “Explicit coordination” refers to “non-market forms of coordination of economic activity”. The term is first used by Clemons et al. (1993) (Gereffi, Humphrey & Sturgeon, 2005).
Competition is driven by product differentiation with regard to food safety. Both suppliers and retailers are motivated to develop safety standards to differentiate their products with superior quality and better safety assurance in order to enhance their competitive advantages. In this scenario, private standards driven by suppliers and retailers are expected to be the dominant mechanism for regulating food production with comprehensive safety and quality requirements (Gereffi & Lee, 2009).

In box B, where buyers are concentrated while suppliers are fragmented, buyers control and influence myriads aspects of supplier activities by imposing their own private standards. In contrast, producer-driven linkages (box C) entail highly concentrated suppliers and fragmented buyers. Brand-name suppliers are likely to dominate various stages of the value chain and thus develop the incentives to establish private standards to insure safety in the production process. In both scenarios shown in box B and C, public standards are called for to facilitate regulation of the fragmented suppliers or retailers. Lastly, in box D, where both suppliers and buyers are fragmented, production is most susceptible to safety hazards. Actors under such structure usually have no brand recognition and transactions between them are price-based. In this circumstance, there are almost no incentives for the private sector to invest in food safety standards, rendering public intervention and regulation crucial in assuring food safety.

The US broiler value chain contains two sets of supplier-buyer linkages: (1) between small farmers and integrators; (2) between integrators and retailers. For the former, buyers (integrators) are highly integrated and concentrated while suppliers are fragmented, leading to a buyer-driven governance pattern. For the later, both buyers (including foreign buyers who import broiler products from the US) and the suppliers (including foreign suppliers who export broiler products to the US) are concentrated. The suppliers and buyers are highly competent with recognizable brand names. In this case, the exchanges are governed by bilateral oligopolies.

Based on the analysis above, this paper raises two hypotheses regarding the value chain governance and its implications for food safety standards in the US broiler industry:

**Hypothesis (i):** At the fragmented segments of the chain (upstream), where private incentives for investing in safety standards are weak, safety regulation is primarily driven by the public sector.

**Hypothesis (ii):** At the concentrated segments of the chain (downstream, including domestic and import chain segments), where private incentives for investing in safety standards are strong, safety regulation is primarily driven by the private sector.
Bearing in mind these two hypotheses, section III explores the safety standards system in the US broiler industry.

**Section III: Safety standards system of the US broiler industry**

Food safety in the US is regulated by multiple agencies at both federal and state levels. At the federal level, the USDA-FSIS and the FDA are the main government agencies authorized by federal laws to regulate food safety. In the broiler industry, the USDA ensures the wholesomeness, safety and proper labeling of all broiler products by inspecting the slaughtering, processing and distribution of all broiler products sold in the US market (including imported broilers) (Murray, 2013). The FDA primarily oversees the chicken feed\(^\text{10}\).

The US safety standards system for broiler products is designed to address the core issue associated with the high-risk profile in the industry: foodborne illnesses\(^\text{11}\). The Poultry Products Inspection Act (PPIA), Food Safety Modernization Act (FSMA) and Animal Feed, together with other policies, regulations and directives, undergird the public safety standard system that regulates the various stages along the value chain of broiler production to ensure food safety. This section maps the safety standards to the critical food safety points along the domestic and import broiler value chain\(^\text{12}\).

**Domestic value chain**

Safety standards can be found in domestic value chain production from the point of input all the way to the retailing segment. At the input stage, regulation of chicken feed\(^\text{13}\) is primarily

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\(^{10}\) In addition to USDA and FDA, the US Environmental Protection Agency controls pesticide use and animal waste on the farm (Terry, 2014). At the state level, local government agencies, such as the local health department, also develop regulations and inspection programs to assure food safety. In addition, all establishments in the United States that produce raw chicken products (including farms and processing plants) are required to register in the Public Health Information System (PHIS) for real-time monitoring.

\(^{11}\) According to CDC statistics, since 1999, about 48 million Americans have gotten sick annually from foodborne illness. That is to say, 1 in 6 Americans will get sick from food-borne bacteria, viruses and microbes each year, resulting in about 128,000 hospitalizations and approximately 3, 000 deaths (CDC records).

\(^{12}\) The export chain of the US broiler industry, although constitutes an important part of the transactions in the industry, is not discussed in this paper. This is because broiler exports are mainly subject to the safety requirements of the foreign nations. This paper focuses on the safety standards for the chicken products in the US market.

\(^{13}\) Chicken feed primarily contains corn and soybean, with additional vitamins and minerals added. No
established and enforced by the FDA. The standards are intended to regulate the nutrition formulation of the feed and to specify the minimum tolerance level of bacteria (e.g., Salmonella Enteritidis) presence in the feed. The FDA also specifies the types of approved medication to be used in the broiler breeding stage. The USDA-Animal and Plant Health Inspection Services (APHIS) regulates the health of the live broilers (including the broiler chicks). The APHIS specifies criteria for identifying health hazards to the chickens. However, as indicated by Dr. Michael Ollinger, an agricultural economist at the USDA-Economic Research Service (ERS) in an interview with the author, APHIS regulations do not apply to the safety hazards brought by the chickens to people. “Many of the bacteria do not harm the chickens, but do harm people. And there is, to my knowledge, no agency to step on that area” (Michael Ollinger, personal interview, March 25, 2014).

Broiler chicks are raised in the grow-out houses for 6-7 weeks when they reach the prescribed market weight. The broiler raising stage is considered most susceptible to safety hazards and contamination. This is because,

“Young birds are more susceptible to Salmonella colonization of the gastrointestinal tract during the first few days by vertical transmission from infected parents or by horizontal transmission at the hatcheries during feeding, handling, and transportation” (Bailey, 1988).

Every effort is dedicated to convert minimum input to maximum output on the farms, and safety risks prevail during the entire growing operation stage. The sanitation condition of the establishment and the over-crowdedness of the chicken confinement with over 20,000 birds growing from “what were two-ounce balls of down to 2.5 -5 pounds each” increase the possibility of cross contamination (Midkiff, 2004). Both public and private guidelines\textsuperscript{14} have been developed with respect to the housing, hatchery, and out-grow sanitary conditions of broiler breeding. However, on farm practices and animal treatment are not addressed or specified in the Poultry Products Inspection Act. Responding to this high-risk profile and industrial pressure on improving productivity, the FDA approves and specifies the use of certain antibiotics in the broiler

\textsuperscript{14} The National Chicken Council has developed the NCC Animal Welfare Guidelines and Audit Checklist, which specifies the treatment of broilers at various aspects during that growing stage. In the public sector, the USDA-APHIS has also developed initiatives with regard to broiler welfare.
breeding stage to reduce pathogen levels and to accelerate broiler growth. This, however, has fostered the rise of dangerous antibiotic-resistant bacteria (Hayes, Wilson, Christensen & Bonifield, 2013). The FDA said in an interview with CNN that many of the antibiotics used in animals are also used to treat humans when they get sick, and bacteria illness becomes fatal if overuse makes germs resistant to medication (FDA, cited in “FDA hopes to curb antibiotic use on farms” by CNN Health, 2013).

According to CNN Health, current federal regulations do not mandate data collection on the use of drugs on animals. Dr. Gail Hansen, a veterinarian and senior officer for the Pew Campaign on Human Health and Industrial Farming, argues that the massive use of antibiotics in chicken feed and water reflects the unhygienic conditions of broiler breeding. “If you need to keep animals healthy with drugs, I would argue you need to reexamine the system” (Hansen interviewed by Jen Christensen, 2013). However, different voices exist about the use of antibiotics (sometimes called antibacterial chemicals) during the breeding. The National Chicken Council (NCC) claims that “the majority of the antibiotics that may be used in poultry production are not used in human medicine…any threat to human health from antibiotic use in livestock and poultry production is negligible, if it exists at all” (NCC, 2013).

Upon reaching the prescribed weight, live broilers are transported to processing plants, where they are slaughtered, processed and packaged. The integrator-owned processing plants operate under regulations specified in the PPIA and the Code of Federal Regulations (CFR)\textsuperscript{15}. The FSIS inspectors conduct on-site carcass-by-carcass inspection as mandated by law. The newest USDA inspection plan aims to move on-site inspection to offline inspection with fewer government inspectors at the plant and to shift the inspectors’ focus to critical food safety tasks such as pathogen sampling, sanitation conditions verification, food safety hazards control at critical points\textsuperscript{16} (“USDA Seeks to Modernize Poultry Inspection in the United States”, 2012). Meanwhile, the poultry company is rendered increasingly responsible for on-site inspection by their own employees. Some have contested

\textsuperscript{15} All broiler processing establishments are required to develop and implement the Sanitation Standard Operating Procedures (SSOPs) and HACCP plan, which controls the critical contamination points during the broiler processing. In addition, performance standards are also in place to control and reduce pathogenic microorganism (e.g., Salmonella) and cross-contamination in the processing stage.

\textsuperscript{16} The new program has promised to increase the efficiency of inspection with reduced costs, accelerating the line speed by 25% (140 birds/min to 175 birds/min) and saving over $250 million annually for production costs (“USDA Seeks to Modernize Poultry Inspection in the United States”, 2012).
the integrity of self-inspection, arguing that the new plan is a severe violation of conflict of interest (Kindy, 2013; Leonard, 2013).

After differentiated processing, the finalized broiler products are distributed to the retailing segment. As competition in the food industry becomes increasingly quality-driven, the large retailers, such as Wal-Mart, Whole Foods, and Safeway, have taken initiatives to differentiate themselves by marketing superior food quality and credible safety assurance. As a result, in addition to meeting the generic and basic government regulations\textsuperscript{17} (e.g., 101.43 CFR, the Voluntary National Food Regulatory Program Standards, Retail Food Safety Initiative), retailers have increasingly invested in private safety standards as a strategy to enhance competitiveness in the global market\textsuperscript{18}.

\textit{Import value chain}

Safety regulation for broiler imports starts long before the broilers reach the US border, and it is primarily governed by the USDA-FSIS. For any broiler import to be sold in the US market, it must pass a multi-tiered safety verification and inspection network. As mandated by the PPIA, all chicken imports must meet every requirement specified in the five areas (Table 1).

The five required criteria are mutually interconnected. For the purposes of this paper, we elaborate primarily on the equivalence determination requirement, which specifies the standards for determining whether the safety system in a foreign establishment, although different from that in the US, can achieve the same food safety objectives or outcomes.

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1. Products must originate from \textbf{certified countries and establishments} eligible to export to the United States. \\
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\textsuperscript{17} According to FDA (2014), “the ultimate goal of all retail food regulatory programs is to reduce or eliminate the occurrence of illnesses and deaths from food produced at the retail level.” Retrieved at http://www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/ProgramStandards/ucm121796.htm.

\textsuperscript{18} For example, in 2008 Wal-Mart announced that it had become the “first nationwide US grocer to adopt Global Food Safety Initiative (GFSI) standards. These standards require all suppliers of Wal-Mart’s private label and other products to have their factories “certified against one of the internationally recognized Global Food Safety Initiative (GFSI) standards” (Walmart, 2008), which include Safe Quality Food (SQF), British Retail Consortium, International Food Standard (IFS), and etc. Whole Foods adopts the 5-Step Animal Welfare Rating Standards for their chicken suppliers, which must be audited and certified by a third-party player against animal welfare standards (e.g., natural environment, outdoor accessibility).
2. The Animal and Plant Health Inspection Service (APHIS) restricts some products from entering the United States because of animal disease conditions in the country of origin.

3. Countries and establishments become eligible following an equivalence determination proc by FSIS.

4. Imported products must meet the same labeling requirements as domestically-produced products.

5. After filling the necessary forms for U.S. Consumer and Border Protection, and meeting animal disease requirements of APHIS, all imported chicken products must be presented for inspection FSIS at an official import establishment.

Table 1. Required Criteria for Broiler Imports

Source: USDA-FSIS

The equivalence program consists of two major steps: (i) documentation review; (ii) on-site and remote audits. The program starts whenever a country files an application for equivalence determination. The FSIS responds to the request with a questionnaire of 500 questions that are directly derived and related to the Code of Federal Regulation (CFR). Here, the standards used for judging the effectiveness of safety regulation in a foreign establishment is the same with those for domestic inspection. Along with the questionnaire, the foreign applicant is required to provide all the pertinent documentation materials to supplement the validity of the information provided in the questionnaire.

In the documentation review, certain aspects are addressed to reflect the safety schemes of the foreign establishment, as Dr. Andreas Keller, Director of International Equivalence at USDA-FSIS, described,

“We are looking at what process you (foreign establishment) have in place, how you implement and how you verify, what is your laboratory structure…it is to the details of what we require here in the US…[But] how the county (foreign establishment) gets here is what in the equivalence determinant is not set…for us, how you here does not matter [as long as] the documentation has demonstrated to us that they have mechanism and means in place to ensure the food safety of that product and verification and enforcement as well as [measures] in case of violation” (Andreas Keller, personal interview, March 25, 2014).

Once the FSIS has reviewed and approved the finished questionnaire as a “desired outcome”, the equivalence program turns to an audit mode, where FSIS inspectors conduct on-site audit and verify
safety system of the foreign establishment. After the foreign establishment passes the onsite audits, the FSIS will classify it as being equivalent. However, before the final rule is made to allow imports into the US, several policy procedures are required including internal discussion and public comment. Until all the questions and doubts are properly addressed, the foreign country (or the establishment) cannot be cleared to export broilers to the US. Safety inspection continues at the US border. Broiler products are subject to APHIS regulations at the ports of entry and the FSIS sampling inspection for pathogens, water, residues, etc. All data are recorded in the PHIS system. Based on the information, the FSIS continues its inspection via remote-audits on a yearly basis to ensure the consistent safety performance of the foreign establishments as well as on-site audits once every 1 to 3 years depending on specific contexts.

For the import chain, “equivalence” is the key concept for determining the effectiveness of the safety system of the foreign establishments that export broilers to the United States. The emphasis on safety outcomes (the performance standards) rather than safety approaches (the process standards) creates the flexibility to enable broiler trade between countries with vastly different institutional systems for food safety regulation. However, this practice may also engender new complications and unintended consequences. Since different approaches are allowed to achieve the “desired” outcomes, industries are economically motivated to develop the most cost-efficient approach to address the safety issues in order to meet the export requirement. In the worst-case scenario, the approach itself may introduce new contaminants that may be not be identified in the existing safety system until it causes severe consequences.19

Section IV: Analysis

19 In the case of China, where the efficacy of government regulation has long been contested and industrial self-regulation is far from mature, the food industry has been operating with a high safety risk profile. This is evident in the frequent food safety scandals in China. Furthermore, because of the industry and the government’s close economic and political ties, the integrity of the nation’s food safety system (including standard setting, implementing and monitoring) is compromised. For this reason, the worst scenario might take place in the export sector. In fact, this scenario has already been witnessed in China’s milk industry. Melamine, an industrial chemical rich in nitrogen, was “added to watered-down milk to fool quality inspectors with artificially high protein levels” (Fairclough, 2008). In 2008, the melamine contaminated infant formula resulted in nearly 300,000 children suffering from kidney failures and six infant deaths.
Previous sections have explored two complex systems: the value chain production networks and the safety standards system in the US broiler sector. This section identifies the gaps between them. In this paper, a safety gap is identified where safety regulation (or standards) is absent or arguably insufficient at a given critical safety point. In addition, substantial differences between safety regimes, which may contribute to potential safety hazards, are also counted as safety gaps. Based on the analyses above, two principal gaps are identified both at the upstream and downstream of the US broiler value chain with respect to safety assurance.

*Upstream gap*

Analyses in the broiler industry and the safety regulation system have exhibited safety gaps at the upstream segments of the broiler value chain: the broiler chick breeding. As described in section III, the breeding stage is highly susceptible to biological hazard. According to Dr. Michael Ollinger at USDA-ERS,

“The agency (APHIS) that oversees chick production is only concerned about their health, the health of animals…they are not concerned necessarily about the human health. So there is not any oversight at all really through here (USDA) or not much…as of now there is no real regulatory body overseeing the chicks themselves…the APHIS is regulating the chicks, [and] chicks harbor salmonella. Salmonella does not bother chickens, so APHIS does not care. But salmonella affects human health.” (Michael Ollinger, personal interview, March 25, 2014)

This regulatory absence is by no means fortuitous. Hidden behind are the controversial debates over how crucial the broiler breeding stage is to the overall safety of the final products. The answer to this question ultimately determines the legitimacy of the operation of the entire US chicken industry for the past 60 years. On the one side, the broiler firms, poultry scientists and the public sector advocate for the existing operation of the chicken industry. The USDA safety inspection in the broiler industry begins at the slaughterhouse, asserting that any kind of contamination that occurs at prior stages can be corrected in the slaughterhouse. On the other side, however, consumers groups, food safety activists and NGOs have been demanding operational changes in the US chicken industry. High levels of salmonella in chicken products (especially fresh products) and repetitive salmonella outbreaks have aroused public consternation.
Successful examples in European countries (such as Denmark) in eradicating salmonella in chickens highlight the possibility of an ideal situation (e.g., zero-salmonella) for chicken safety. Up till now, it seems that if the US adopts the Denmark model — a comprehensive approach to attack salmonella in flocks, poultry barns animal feed and slaughterhouses (Terry, 2014) — then the puzzle could be easily solved. BUT, reality is, more often than not, much trickier. The pro-industry side responds to this approach with its scientific-based and data-driven “proactive policies”. To address the high level of salmonella presence in chicken products, the USDA-FSIS has lowered (only recently) the standard of salmonella level in young chicken carcasses from 20% to 7.5% (Alvarado, cited in Spinner, 2014). The new standard depends closely on the chicken industry’s ability to establish relevant interventions to reduce the level of Salmonella (Alvarado, cited in Spinner, 2014). It is also reported that, according to the USDA-FSIS, “the actual percentage positive (for salmonella in late 2013) was 2.6% which is significantly less than the performance standard indicating that the industry really is doing a great job at controlling risks for food-borne risks for consumers” (Alvarado, cited in Spinner, 2014). Notwithstanding this optimism, salmonella outbreaks continue. Following the 2013 Foster Farm outbreak, salmonella in chickens produced by Tyson sickened 9 people early in 2014. As indicated by Dr. Ollinger, the high level of salmonella can be traced back to the breeding stage, where chicks are crowded in unsanitary conditions. And as the broilers go through different stages, the number of salmonella just multiplies.

Besides, some pro-industry voices say that the reason for repetitive salmonella outbreaks is not because chicken products are unsafe, but rather it is due to the rapid information sharing via social media. At the same time, government, researchers and poultry companies blame consumers for not being fully aware of the proper handling of food and suggest implementing pertinent educational problems of food safety. “Most food-borne illnesses are caused by cross-contamination and improper handling of products by either consumers or untrained retail and restaurant employees” (Alvarado, cited in Spinner, 2014).

Although we admit the importance of educational programs for improving the public’s awareness of potential food hazards, this is not the solution to eradicate or effectively control foodborne illnesses, especially not for a product being produced and consumed on such a large scale.
Moreover, blaming consumers for food-borne illnesses is fundamentally flawed. Consumers have no control over broiler products shelved at the retail stores, where the chicken products are already highly contaminated with salmonella before being purchased by consumers. Moreover, if most of the contaminations take place in the consumers’ kitchens, there is no reason not to conceive of it as a critical food safety point for standardized solutions. Finally, the prospect of adopting the Danish or European models is also highly contested by the pro-industry group. The scale and institutional contexts of the US and Denmark chicken industries are remarkably different. The US industry slaughters 8.5 billion chickens annually while Denmark slaughters just 100 million (Terry, 2014). For decades, chicken has been loved as a healthy source for animal protein at affordable prices in the United States. The marginal profit for chicken products is extremely low, at about 1%\textperthousand. The industry has to depend on large-scale production to prosper. Adopting the Danish model would raise the price dramatically, and drive the industry out of business (Terry, 2014).

Denmark’s success lies in its ability to generate collective changes via a top-down approach. Yet in the US, the safety regulatory system is intentionally fractured, with different agencies assigned with different authorities. No single agency is capable of initiating a top-down reform. As a result, “no single agency appears to have a legal mandate to fight bacteria that can kill people but do not harm to animals on the farm” (Terry, 2014).

**Downstream gap**

In previous analysis, we also identified a potential safety gap at the downstream segment of the import chain, which occurs where there is off-shored production and limited safety regulation. It should be noted that our analysis was highly speculative due to the lack of empirical data on this issue. Nevertheless, we consider it imperative to examine this emerging issue based on our existing understanding as well as to speculate possible outcomes. Of particular concern is the food safety management of chicken imports from countries with notorious food scars, such as China. Our speculative analysis is based on the premise that in complex systems unintended consequences occur and solutions to one aspect of complexity introduces others.

As described in section III, the USDA “harmonizes” different safety regulation regimes via the Equivalence Determination Program, where the legitimacy of a foreign safety regime is
judged based on its performance compared to the domestic system in the United States. The equivalence program allows various methods, approaches and processes so long as they all achieve the desired outcomes (as compared to the domestic situation). This regulatory mechanism can be effective if it addresses two subsequent questions: (i) the domestic safety standards, as benchmark indicators in the equivalence program, are comprehensive enough to exclude potential safety hazards; and (ii) the domestic regulatory authority can exert sufficient control to ensure constant compliance of the foreign establishment.

Based on the analyses of the previous safety gap as well as that in section III, we have good reason to lack complete confidence in domestic safety standards. For one, the domestic safety standards for chicken products are highly contested in terms of salmonella levels, in-plant inspection and so forth. For another, the mechanism for monitoring compliance of a foreign establishment is heavily based on documentation reviews and the foreign country’s self-discipline to ensure compliance. The USDA-FSIS has advocated its global safety strategy as “we trust but we verify”49. To fully assess the extent in which “verification” can eliminate potential imported safety hazards requires data on the overall safety performance of imported chicken products. Unfortunately, these data, as claimed by an USDA official, will not be shared during the period of the study. Nevertheless, we can still speculatively assess the effectiveness of the verification system based on precedents such as the Chinese-made chicken jerky treats that resulted in sickening hundreds of dogs. The US government agencies are still unable to locate the cause (Manning, 2013).

Therefore, we speculate that offshored production and limited safety regulation constitutes another safety gap within the globalized chicken industry. It stems from the fundamental differences between the institutional contexts where the production and safety regulation are embedded. China, for example, as a fragmented authoritarian state, holds bureaucratic power and profits within large enterprises. Local governments prioritize economic development with a focus on quantity rather than quality. In addition, absence from a transparent legal system and press freedom, the institutional context in China fosters private-public conspiracy that undermines safety goals. Under these circumstances, the documentary-based and periodic safety inspection from the USDA-FSIS is far from sufficient to detect malpractice in advance, engendering potential safety hazards.

Now that we have examined the dynamics and tensions at the upstream and downstream
segments of the chain, we can now assess the two hypotheses put forth in section II. Informed by the analyses above, we reject hypothesis (i) and partially accept hypothesis (ii).

Hypothesis (i):
At the fragmented segments of the chain (upstream), where private incentives for investing in safety standards are weak, safety regulation is primarily driven by the public sector.

As highlighted previously, the fragmented segments of the value chain are most vulnerable to safety hazards due to the lack of private incentives to invest in safety standards. We hypothesized that safety regulation is primarily driven by the public sector. However, our findings have indicated the exact opposite.

At the fragmented segment of the US broiler value chain, there is a dearth of both private and public incentives directly linked to safety regulation. The fragmented private players (small farmers) at this stage are blocked from direct market access and do not have a brand name immediately recognizable to the consumers. In actuality, small farmers are more likely to invest in a manner (e.g., use of cheap antimicrobial chemicals to accelerate broiler growth) that allows them to maximize the broiler meat output with the lowest cost possible. For the public sector, the safety authority starts at the slaughterhouses, the concentrated and regulated segments of the chain, as opposed to the farms, the fragmented segments. This regulatory arrangement is anything but accidental. Midkiff argues that there are valid reasons for it.

“It is always easier to deal with a few ‘professional’ officers of large companies or agribusiness organizations than with un- or disorganized farmers’ groups...The USDA...leadership would prefer to deal with those who can provide assurance to the agency that their members will fall into line.” (Midkiff, 2004, p.70-71)

Surprisingly, we have seen some private sector effort, albeit indirectly, to address safety issues at the broiler farming stage. Private safety standards, mandated by some large retailers, have specified and required good breeding practice (e.g., high sanitary conditions, no or limited use of antimicrobial chemicals). Although it remains uncertain to what extent these private efforts can make a difference in the long term, we can at the very least identify the fact that private incentives at the concentrated segments of the value chain can spread and influence the fragmented segments.

Hypothesis (ii):
At the concentrated segments of the chain (downstream, including domestic and import chain
segments), where private incentives for investing in safety standards are strong, safety regulation is primarily driven by the private sector.

We have examined two branches at the downstream segments of the US broiler value chain: the domestic branch and the import branch. Our inclusion of the import chain is based on the economic rationale that if a domestic establishment (buyer) is able to outsource at an offshored location, the capacity and concentration of the establishment is presumed to be high. Likewise, if a foreign establishment (supplier) operating in a developing country is able to export to the US, the establishment is supposed to be consolidated and capable so as to meet all the safety requirements of the US. Therefore this thesis interprets the supplier-buyer linkage at the import branch as relational or modular.

The empirical analyses in section III have demonstrated a proliferation of private standards during the last twenty years. At the downstream segment of the domestic chain, both suppliers (the integrators) and retailers (the fast food chains and supermarket chains) are highly consolidated with recognizable consumer brands. Moreover, they have the capital to invest and implement their own private standards to enhance their competitiveness in the quality-based market competition (Gereffi, 2009). Safety regulation at the import branch of the broiler chain, however, is heavily governed by public standards and government agencies. The USDA is the principal agency for ensuring imported broiler safety. All broiler imports are mandated to satisfy the public standards set by PPIA and CFR and we have not observed an active role of private standards governing the import branch in the US broiler industry. This is partially due to the trade volume and interconnectedness between the US buyer and the foreign supplier. Despite the concentration at each side the supplier-buyer linkage at the import branch, the volume of US broiler imports is extremely small, accounting for less than 1% of domestic production (USDA-ERS). As a result, the degree of interdependence between supplier and buyer is low. Therefore, the economic incentives for both parties to invest in private standards may also be low.

Summary
This paper is an initial attempt to explore the increased complexity in the globalized agri-food system with respect to food safety assurance. It contextualizes the study in the US broiler industry between the 1980s and the early 2010s, a period characterized by outward expansion. Utilizing Gereffi and Lee’s model, this paper probes the dynamics within and between the US broiler industry and the food safety regulatory system. It unpacks two complex systems at play: the US broiler value chain and the safety regulatory system. Globalization is a theme identified in both systems, which has substantially altered the dynamics within and between the industry and the safety regulatory field. Specifically, for the US broiler industry, intensified globalization extended the value chain production, introducing new actors into the industry, and concomitantly new safety hazards. For the safety regulatory system, globalization has altered the landscape for safety standards setting: national governments are no longer the sole players for food safety assurance. The private sector has become a key player driving food safety governance.

Future Research Agenda

The issues addressed in this paper continue to emerge. The importance of studying emerging issues is crucial to understand the potential risks and inform decision-making. However, such a study is compromised by a shortage of empirical data. We hope in the future, more empirical data about the imported food safety hazards and the circulation of broiler imports can be either generated or made available so that we can more comprehensive and grounded studies can be conducted. In addition, due to the technical nature of safety hazards, future studies may include de-black boxing analyses of the safety hazards to generate a more balanced assessment of the safety hazards and the pertinent standards and policies. Finally, research on food safety and safety standards is interdisciplinary in nature. Therefore, collaboration between scholars with different research backgrounds on the same issue will be more likely to generate fruitful outcomes.
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