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My name is David L. Ortega, and I am assistant professor of global agrifood systems in the Department of Agricultural, Food and Resource Economics at Michigan State University. As a faculty member, my research program focuses on understanding consumer, producer and agribusiness decision-making to better inform food policies and agribusiness strategies. A significant portion of my work centers on food quality issues in China. I have made approximately 10 research trips to China, published 20 articles in peer reviewed journals on the topic, and served as a visiting scholar and instructor at two Chinese universities. With funding from the U.S. National Science Foundation, I conducted one of the pioneer studies that assessed demand for food safety in China. In the wake of a sequence of food contamination events that occurred in 2007 and gathered global attention, I implemented a series of research projects to measure consumer demand for food safety and estimated welfare changes from various policies in the Chinese meat and dairy sectors. I have also conducted an evaluation of the Chinese agricultural marketing system that identifies key factors contributing to food safety problems and offers a road map to remedy the situation. The expert view expressed in this testimony is my own. Thank you for providing me with the opportunity to testify.

Introduction

The food safety situation in China’s agricultural and food marketing system is an issue of paramount importance with serious domestic and global implications. Throughout much of the second half of the last century, China’s centrally planned, inward-looking economy was an insignificant player in the global trading system. Today, having gone from a sleeping giant to the fastest growing major economy in the world, China has become a significant player in global agricultural markets. Many economists have called China’s emergence a “positive economic shock,” unleashing a consumer base and workforce of nearly 1.4 billion people into the global market and positioning it as a key supplier and consumer of food products globally. However,

China's rapid growth and development has not occurred without setbacks and challenges. A series of globally recognized food safety scandals (e.g., melamine tainted milk and baby formula, contaminated pork) have brought increased awareness to China's inefficient food certification and inspection system. As a result, China's role in the world export market has suffered as countries have rejected its food exports for failing to meet rigorous food safety standards. Within China, heightened public concern over the safety of its food supply has raised questions regarding consumer confidence in the government-run food inspection system.

China's highly fragmented food supply chain is composed of millions of small farmers, traders, and retailers, many of whom operate unsupervised. The size and complexity of the supply chain poses a great challenge to the implementation of a comprehensive and effective domestic food safety system. Many of China's food safety problems can be traced back to the farm level, as some farmers still rely heavily on the use of highly toxic pesticides to cope with various production problems.^{1,2} The use of antibiotics in the livestock sector has also led to a series of public health concerns focused upon the rise of new antibiotic-resistant pathogens.³ China's food safety situation poses a significant risk to its domestic economy, threatens the safety of the U.S. food supply and at the same time presents an opportunity for high quality U.S. agricultural exports.

Food Safety and the Chinese Consumer

Over the past ten years, I have found that Chinese consumers *are very concerned* about the safety of the food products they purchase. Furthermore, they are willing to pay significant premiums to ensure the safety of their food.^{4,5} The high level of concern regarding food safety can be linked to incidents involving pork and dairy products, most notably the clenbuterol contaminated pork and melamine-tainted dairy and infant formula incidents. These, however, are not isolated events. Reports of contaminated foods and incidents of food fraud have been frequently reported since China joined the World Trade Organization in 2001.^{6,7,8} Although it might appear that Chinese consumers' confidence in the government is eroding, as reported in the wake of these events, my research found that consumers were confident in government food safety control measures. This indicates that there is a strong need for the Chinese government to provide adequate food safety and quality control.

In addition to government food safety assurance, Chinese consumers are, in some cases, also demanding third-party food safety certification and product traceability.⁹ This suggests that the implementation of non-government food safety and quality certification programs will potentially generate a more robust domestic market. The realization of such a program in China will increase competition and potentially eliminate some of the inefficiencies that arise from a government monopoly on food safety certification. Demand for product traceability is growing for large Chinese agribusinesses. Processing facilities and packaging plants are emerging outside urban centers that are trying to capitalize on consumers' need for additional safety assurance.

Although Chinese consumers are highly concerned about food safety, it is worth noting that there are significant differences in their willingness and ability to pay premiums to cover the costs of providing food safety assurance. As Chinese per capita income continues to increase, and more people join the middle and upper classes, consumers will be more willing and able to obtain

better food safety information. This should give the government and private sector confidence and an incentive to invest in quality control for food safety.

Environmental and Soil Pollution

China's rapidly growing economy has also put heavy strain on the environment, with rapid industrial growth and a large population contributing to air, water and soil pollution. The use of untreated sewage and industrial wastewater for irrigation, as well as high agricultural chemical use and increasing livestock production waste, have led to soil contamination in many of China's agricultural areas.¹⁰ Progressive monitoring between 1990 and 2007 has shown evidence of marked reduction in agrochemical use (specifically hexachlorocyclohexane and its isomers [HCHs] and dichlorodiphenyltrichloroethane and its metabolites [DDTs]) owing to governmental prohibition, significantly reducing the public health risk.^{11,12,13,14} Nevertheless, despite efforts to reduce agrochemical use in China over the last few decades, China's agrochemical application rates remain among the world's highest, with a 2009 survey detecting 65 pesticides and herbicides in 16 provinces across China.^{15,16,17} In addition to chemical contamination, concerns about heavy metal contamination in the soil have increased drastically, with evidence of excessive levels of cadmium, nickel, copper, arsenic, mercury and lead found.^{18,19} Moreover, the rate at which heavy metals have accumulated has increased.^{20,21} Health consequences of water and subsequent soil pollution are already occurring within China amongst the rural population, with increased rates of cancer morbidity in villages with the closest proximity to contaminated areas.²² The risks of these contaminants entering the food system are also high. A 2012 survey found that 28.4% of rice exceeded the maximum residue concentration levels for lead and 10.3% exceeded cadmium levels.²³ To address China's soil pollution problem, Chinese officials announced intentions to draft legislation to fight soil pollution in 2018, hoping to meet the goal of making approximately 90% of contaminated Chinese farmland safe for crop production by 2020.²⁴

Biotechnology

Recent advances in biotechnology, have raised the possibility of genetic engineering techniques being applied to improving the quality of food products. The adoption of genetically engineered crops in China has resulted in lower pesticide use and positive health and environmental impacts.²⁵ The advent of gene editing technologies is promising for the development of higher quality and safer foods. For example, Chinese researchers have been able to produce leaner pigs via the gene editing tool CRISPR Cas-9 without the use of traditional veterinary drugs or feed additives.²⁶ Whether this and other food products developed through advances in genetic engineering are commercially viable depends, in part, on consumer acceptance of the use of biotechnology in plant and animal agriculture, and how messages from scientists and innovators are received by consumers. Preliminary findings from my research in China show that, even with strong opposition to the use of biotechnology in food products, Chinese consumers are open to purchasing products that were genetically modified to improve their safety and quality.²⁷ These preliminary findings should be encouraging to scientists working in this area and suggest that consumers are likely to support breakthroughs in biotechnology that address their food safety concerns.

E-commerce

Factors affecting food safety go beyond production and distribution, and span into food retailing and emerging channels. E-commerce is changing the way consumers purchase food, obtain

product information and get access to safe, high quality food. China has the largest e-commerce market in the world, with online sales expected to grow from 17% of total retail sales today to 25% by 2020, and Chinese consumers are increasingly turning to the Internet as a medium of acquiring food products.^{28,29} In contrast to American online food demands which are generally driven by convenience, the increasing interest in purchasing food online in China has been primarily linked to food safety concerns, with Chinese consumers placing greater confidence in the quality and safety of products purchased online.³⁰ The Chinese e-market place is dominated by Alibaba (Tmall and Taobao) and JingDong (JD), which jointly make up approximately 80% market share in business-to-consumer e-commerce sales.³¹ These and other companies are rapidly adopting blockchain technology to fight counterfeit goods and add traceability and transparency to the food supply chain. For example, JD has partnered with IBM, Walmart and Tsinghua University to form the Blockchain Food Safety Alliance, a collaboration designed to improve food tracking and safety in China.³²

Food Safety Regulation in China over the last 10 years

Food safety regulations in China have undergone regular evolution over the past decade. Following the series of food safety events that garnered global attention in 2007, the (2009) Food Safety Law of the People's Republic of China was passed. This was one of many government efforts aimed at remedying China's dire food safety problem. The provisions included establishment of an extensive licensing system throughout the food supply chain, record-keeping and traceability requirements, and reporting and accountability obligations for food and food additive producers and distributors. In April 2015, the Standing Committee of China's National People's Congress revised the 2009 law, imposing even stricter controls and oversight of China's food supply. The revised law placed more emphasis on the supervision and control of food production and distribution.³³ Notable changes included:^{34,35}

- *Centralization of food safety oversight.* Enforcement of food safety was previously divided among different agencies. A centralized system was created under this law with the China Food and Drug Administration (CFDA) as the main supervising body.
- *Increased oversight of imported foods.* Manufacturers of imported food products, food importers, and importing agents are required to register with the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ).
- *More stringent requirements of e-commerce vendors.* Providers of third-party online food trading platforms were required to confirm that traders hold valid permits, register their identity, and report the trader in the event of a food safety violation. Foods imported through e-commerce are subject to the same regulations as foods imported through traditional channels.
- *Health foods oversight.* Products containing ingredients outside the approved list of food ingredients must be registered with CFDA.
- *Stricter regulation for baby foods.* Baby formula must be registered with CFDA and baby formula labels and ingredient composition must be recorded with local government FDAs.
- *Labelling of genetically modified foods.* Genetically modified foods must be accurately labelled as such, and the use of "non-genetically modified" labelling must be approved.

- *Increased penalties for food safety violations.* Fines up to 20 times a product's value will be sanctioned on individuals engaging in the production of foods or food additives without proper permits or failing to register health foods and infant milk formulas.

The most recent development in Chinese food safety regulation, as part of China's Institutional Reform Plan announced last month, is the establishment of a new State Administration for Market Supervision (SAMS). Approved March 17th, 2018, the Institutional Reform Plan establishes SAMS as a direct "subordinate agency" under the State Council, replacing CFDA, AQSIQ and the State Administration for Industry and Commerce.³⁶ This restructuring abolishes the three agencies in an effort to better coordinate regulation and enforcement of food safety and puts China one step closer to consolidating food safety oversight into one agency. The regulatory responsibilities which fell under those agencies will instead be consolidated into SAMS, except quality control for imports and exports, which will be transferred to the customs service. In addition, some food safety responsibilities which were not overseen by those agencies will still fall outside of SAMS. For example, regulatory power for ensuring the quality of farm produce will remain with the newly-expanded Agriculture and Rural Affairs Ministry.³⁷

Addressing Food Fraud in China

Many of the food safety issues in China can be classified as incidents of food fraud, the practice of intentional deception for economic gain related to food.^{38,39} Food fraud can occur in all stages of the supply chain and often cross international borders. Recent examples in China highlight the failure of traditional food safety and food defense systems and processes to address food fraud vulnerability. The deception in food fraud cases can be adulteration with non-food substances, substitution, dilution, stolen goods, tampering (including date-code tampering), diversion and gray market product (e.g., products sold outside of their intended supply chain or market), smuggling, unauthorized product or unauthorized refilling, misrepresentation or mislabeling, and counterfeiting of intellectual property rights.^{40,41,42} Many food fraud acts occur outside the authorized supply chain, and often they do not involve adding an adulterant or contaminant that is monitored.

Although food fraud prevention is emerging as a unique area of interest due to the unpredictability and potential economic gain to fraudsters, food fraud events are not new. Due to globalization of production and distribution, modern food fraud events could be massive in scale and have regional or global impact. Addressing food fraud has led to a shift in focus from mitigation to prevention. Mitigation aims to reduce the severity of negative consequences, while prevention targets elimination of the root cause of the event and could eliminate or at least greatly reduced the likelihood of occurrence. While food fraud events do not always pose a public health hazard, exceptions do occur. For instance, investigations showed that, on two separate occasions, melamine had been deliberately added to raise the apparent protein content in pet food in the U.S. and infant formula in China.⁴³ In both cases, the melamine adulterant-substance caused adverse renal effects in cats, dogs and children, resulting in multiple pet deaths in the U.S. in 2007, and 6 child deaths in China, with another 50,000 hospitalized and 244,000 others affected.^{44,45} Four individuals identified as being responsible for the contaminated pet food in the U.S., and their companies, were indicted by a federal grand jury.⁴⁶ In response to these events, a new risk assessment statement on melamine in food was carried out by national and regional authorities worldwide, with several countries proposing regulatory limits for

melamine in food and feed. The U.S. FDA published its risk assessment in 2008 following the infant formula scandal.⁴⁷ The Chinese government adopted the 2009 Food Safety Law and expanded food protection in the Protection of Consumer's Rights and Interests in 2014, with the important addition of "strict liability" for a food safety event, with severe punitive allowances of three-years to a life prison sentence for "serious harm to human health".⁴⁸

This event highlights the effectiveness of routine monitoring for food fraud and the growing importance of timely responses based on risk assessment in limiting the proliferation of adulterated product. The response to this food fraud crisis has demonstrated that food safety is enhanced if all the stakeholders across the food supply share information and data in an effective and timely manner, as occurred with the prompt, public U.S. FDA response on pet food. Conversely, if companies fail to report consumer complaints, as was the case with the contaminated infant formula in China, many tragic illnesses and even deaths can result from these events.

Better than backward-looking food fraud detection is prevention. Addressing food fraud can be inefficient and elusive if efforts are focused on the traditional food safety and food defense systems and programs. By focusing on prevention, the challenge is simplified when looking at the event from the perspective of the fraudster and the fraud opportunity. The countermeasures become clear when the focus shifts from the problem outwards to the countermeasure (rather than from current technologies or laws inward to the problem). For companies or countries to address the root cause of fraud, efforts should expand to include food science and technology, social science, criminology, and business decision-making. Criminology provides theories to understand the problem and to evaluate countermeasures to preserve food integrity. Business decision-making and decision-science helps to address the question of "how much is enough?" Overall, the complexity of food fraud vulnerabilities will lead to a fresh and important focus to food protection: shifting from "risk mitigation" to "vulnerability prevention".⁴⁹

Chinese Food Safety Implications for the United States

China is a major supplier of food products to the United States. Behind Canada and Mexico, China since 2005 has been the third largest source of imported food products for the United States, accounting for over \$6.1 billion worth of U.S. food imports in 2017.^{50,51} Though total imports have been subject to considerable volatility in terms of growth, overall food imports from China have grown approximately 20% since 2008.⁵² Seafood and aquaculture imports from China are especially important, representing 78% of the tilapia and 50% of the cod consumed domestically in 2014, and totaling over \$2.78 billion worth of seafood imports in 2017.^{53,54} Processed fruit and vegetables, fruit and vegetable juices, snack foods and fresh vegetables, especially onions and garlic, also currently make up a substantial portion of the food imported from China.⁵⁵

Very few of the highest value or highest volume imports from China are fresh, unprocessed food products. Instead, imported foods have largely already undergone some processing prior to shipping or are intended for further processing upon entering the United States.⁵⁶ The bulk of those processed products are direct consumables like fruit juices and frozen fish and vegetables. However, food additives and ingredients that American consumers may not regularly recognize as being present in the food supply chain also make up a substantial portion of U.S. imports from

China. For example, China supplies 83% of U.S. imports of xylitol, a common sweetener in candies and chewing gums. It also supplies nearly half of U.S. imports of ascorbic acid, which is isolated vitamin C, commonly used as a preservative.⁵⁷ Other ingredients widely distributed through the U.S. food system are also primarily sourced from China. In 2017, 137 million pounds of sauces and 128 million pounds of spices were imported from China, along with 70 percent of U.S. artificial vanilla imports.^{58,59} These ingredients can often be overlooked by consumers when evaluating the origins and safety attributes of their food.

Despite an increased presence of U.S. food safety inspectors in China, U.S. monitoring of Chinese food suppliers and processors remains largely inadequate. Food safety in the U.S. is primarily overseen by the U.S. Department of Agriculture's Food Safety Inspection Service (FSIS), which is responsible for egg, poultry and meat safety assurance, and the U.S. Food and Drug Administration (FDA), which oversees all other products.⁶⁰ The FDA inspects only 1% of food shipments that arrive at U.S. ports.⁶¹ China topped the list for seafood refusals for drug-related violations, making up 37% of seafood refusals.⁶² Between 2012 and 2014, China was among the top three countries with the highest number of entry lines refused (along with India and Mexico), though high volume and prioritization of Chinese imports for inspection may contribute to refusal totals as much as propensity for violations.⁶³ Under the U.S. Food Safety Modernization Act (FSMA), the FDA also became responsible for establishing foreign offices to conduct risk-based inspections of food and other production facilities. While the foreign offices were able to successfully increase the number of inspections conducted between 2010 and 2014, the FDA has not been able to meet the annual targets mandated by FSMA. The U.S. General Accounting Office (GAO) found that inspections of imported food from China regularly fell short due to insufficient funding of the FDA.⁶⁴ As a result, data limitations continue to constrain what we know about the safety of imported foods from China.⁶⁵

Emerging Market Opportunities for U.S. Products: The Pork Example

Economic globalization has opened up new international markets—especially in emerging economies—for U.S. food products. At the same time, sociocultural differences and political events, both domestic and abroad, pose challenges for market access and promotional efforts. With a rising appetite for animal protein, China presents a growing market opportunity for U.S. livestock products. While increased demand for U.S. meat in China looks promising, more research is needed to better understand this growing market. Political and socioeconomic differences between mainland China and its special administrative regions, such as Hong Kong, often complicate market entry for U.S. products. As a result, many firms have historically relied on grey, unofficial channels as access points for bringing foreign food products to the Chinese domestic market.⁶⁶

As the world's most populous country, China is also the world's largest food consumer. My research on how the Chinese dinner plate has changed over the past half century shows a rapid increase in meat consumption in the past few decades.⁶⁷ This can be explained by rising incomes that have allowed Chinese citizens to buy higher protein foods and better food availability as mainland China has become more urban.

China as a Pork Importer

The average Chinese consumer eats roughly 80 pounds of pork per year, which is more than the 64 pounds per year for the average American consumer.^{68,69} Given rising appetites for pork, Chinese consumers are no longer focused solely on domestic pork products. Although the share of imported pork to total pork supply is still low (~3%), China has been a net pork importer since 2008.⁷⁰

Multiple factors have led China to increase pork imports. In my research I classify these as either production- or demand-related.⁷¹ Production-related factors are mainly a result of the unstable nature of China's pork industry. Chinese producers face a number of challenges, including scarce arable land, rising production costs, and various hog disease problems.^{72,73} In particular, disease outbreaks and food safety events have tarnished the reputation of domestic pork suppliers and helped increase China's pork imports.

Demand-side factors have also driven the increase in pork imports. Rising incomes have resulted in Chinese consumers demanding higher quality and greater assurance of food safety, boosting sales of imported pork. Some of my early research in China found that food-safety-sensitive consumers in Beijing and Shanghai were willing to pay for U.S. pork, implying that imported pork may be an alternative for urban consumers who seek safer and higher-quality food products.⁷⁴ Increases in urbanization and improvements to infrastructure and transportation have led to the proliferation of supermarkets in small cities and the use of cold storage both at home and in retail outlets. As a result, imported pork and processed pork products have become widely available. Busier lifestyles in China resulting from economic and social development imply that consumers have less time to purchase and prepare fresh food. Consequently, fast food restaurants, convenience foods such as refrigerated meat products, and online retailing are becoming more popular in urban China.

Given production and demand drivers, China is a promising market for global pork suppliers. The emergence of imported pork is expected to increase market competition and provide consumers with origin- and quality-differentiated products. Chinese consumer preferences for imported pork will be affected by both the origin country's reputation for food quality and its reputation in international relations and current events.⁷⁵ A major concern for U.S. meat industries wanting to enter this market has been whether Chinese consumers prefer domestic pork to U.S. pork. A number of studies have documented what is now known as "domestic country bias," a behavior that is manifested in both product perceptions and buying intentions.^{76,77,78,79} Concern can thus arise on two fronts. Chinese consumers may perceive U.S. pork as superior in some respects and yet still elect to purchase domestically produced product as a result of bias. Or domestic country bias may altogether prevent an objective evaluation of imported product, leading the consumer to make a purchase decision on the basis of characteristics largely divorced from the product itself.

While Chinese concerns over food safety present an opportunity for U.S. products, the food safety situation also complicates market entry due to new and changing laws and regulations. Imported products are facing higher barriers to trade due to tightening food safety standards, which are easier to enforce for imported products than for the domestic market. As a result, U.S. meat exports to China have been at the center of controversial trade restrictions and political disputes in the recent past. China bans the importation of U.S. pork that is raised with the use of

ractopamine—a feed additive that promotes lean meat production and is used in the U.S. pork sector.⁸⁰

Despite these challenges, the future of American meat exports to China looks promising. In 2014, Smithfield Foods Inc., the largest pig and pork producer in the U.S. was acquired by China's WH Group (formerly known as Shuanghui International)—the biggest Chinese purchase of a U.S. company to date. Over most of the past decade, Smithfield has been the major U.S. pork exporter to China, though these shipments have been largely unnoticed by Chinese consumers, as they have been comprised of frozen pork that ends up in meat processing and food service channels. This merger, however, has positioned U.S. pork in China's profitable chilled/processed pork market that is mainly sold in supermarkets.⁸¹

To penetrate and expand into the Chinese market for meat, poultry, and other animal proteins, U.S. industries need to 1) to recognize Chinese consumers' food culture and preferences with regards to taste, texture, and cuts, and 2) emphasize the established safety and quality reputation of U.S. products. Furthermore, as excess demand for animal protein continues to increase under domestic production constraints, the U.S. meat industry is well positioned to capitalize on the growing potential of the Chinese market. Research that I have conducted finds that demand for U.S. pork can be significantly increased by highlighting its quality and safety attributes.⁸² Thus, promotional efforts on this front are needed in order for U.S. meat industries to capitalize on this emerging market opportunity.

Effects of Recent Trade Events

The March-April 2018 U.S-China trade announcements have dealt a significant setback to U.S. pork exports to China, increasing uncertainty, and affecting the profitability of U.S. pork producers. On April 2nd, China imposed a 25 percent tariff on U.S. pork and other agricultural goods.⁸³ This action comes as a response to the Trump administration tariffs on all imported steel (25%) and aluminum (10%) products, except those originating from Canada and Mexico. China's Ministry of Commerce stated that their tariffs were intended to balance the losses caused to Chinese interests as a result of the U.S. 232 Trade Action on steel and aluminum.⁸⁴ To put this into perspective, the U.S. sold China 525 million pounds of pork in 2017 worth \$1.1 billion, representing nine percent of U.S. total pork export volume last year. China/Hong Kong is the United States' second largest international pork market by volume and third largest by value.⁸⁵ For China, which is largely self-sufficient in pork, this only makes up 1% percent of pork consumption.⁸⁶ The 25% tariff will make U.S. pork significantly more expensive than other imported pork in China, and if this tariff persists, will erode U.S. market share. As of April 13th, the length or the effect of these tariffs was not known. However, this situation has led to a rise in uncertainty, which can have lasting consequences on China-U.S. trade relations.

Conclusion and Recommendations for Congressional Action

Given our food imports from China, food safety issues should be of paramount importance to U.S. consumers, policy makers and the food industry. Similarly, the food safety situation in China presents market opportunities for U.S. products in this growing market. Our understanding of food safety issues in China, and how to best protect the safety of the U.S. food supply from this threat is limited by a lack of surveillance, data and research on the topic. Thus, there is a *critical need* for the U.S. Congress to take action to support activities aimed at protecting the

safety of our food supply and to adequately fund research that informs evidence-based policies on this very important issue. My specific recommendations include:

- Provide support for USDA FSIS activities to ensure that imported meat, poultry and egg products are safe, wholesome, and accurately labelled. This includes a thorough and detailed evaluation of Chinese regulatory systems in advance of any product being exported to the U.S.
- Increase resources for FDA to effectively inspect the increasing volume of Chinese food imports. This includes increased inspections and additional testing for processed foods, food additives and ingredients.
- Convene a food fraud task force with the goal of forming a public-private-partnership to develop and implement a food fraud prevention strategy.⁸⁷
- Provide support for federal and regional programs that inform U.S. food producers about export market opportunities and changing Chinese import requirements.
- Implement trade policy that promotes and supports U.S. agricultural export market development, and healthy trade relations.

With these recommendations I conclude my statement. Once again, thank you for the opportunity to testify.

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