

The Business Merits of Agricultural Trade

By Michael A. Boland

Since the early 1990s, there has been a growing convergence of global production and trade in agriculture, which is also true for other industries. Firms with supply chains that operate within the food-marketing channel have increased the vertical coordination of these chains through greater use of contractual arrangements. The rationale for this coordination has been articulated by multiple winners of the Nobel Memorial Prizes in Economics such as Coase (1937), Holmström (1979), Ostrom (1990), Williamson (2005), and Hart (2017). The ability of firms to govern activities beyond their vertical boundaries has broadened the application of these economists' work, especially in agriculture. In doing so, it has laid the groundwork for the development of global supply and value chains within these marketing channels.

In this article, I describe the advantages and disadvantages of agricultural international trade. In doing so, I focus on firms operating beyond the farm gate in the food economy. Because virtually all global trade in food made from agricultural products is sold through some form of supply or value chain, I first define and describe these terms. Furthermore, because the governance of these supply chains differs among the types of agricultural products, I discuss this concept in terms of types of agriculture. Finally, I discuss the role of bilateral and multilateral agreements and describe current risks that are important for producers, agribusinesses, and lenders.

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I. Global Trade Flows

The United States has long exported a higher value of agricultural goods than it imports, with Canada, Mexico, and East Asian countries being key U.S. trade partners. When discussing why countries or firms engage in trade, three terms are common: marketing or distribution channels, supply chains, and value chains. These terms are related to logistics, the process of providing activities within a firm involving delivery of raw materials, packaging, and distribution of the product to buyers.

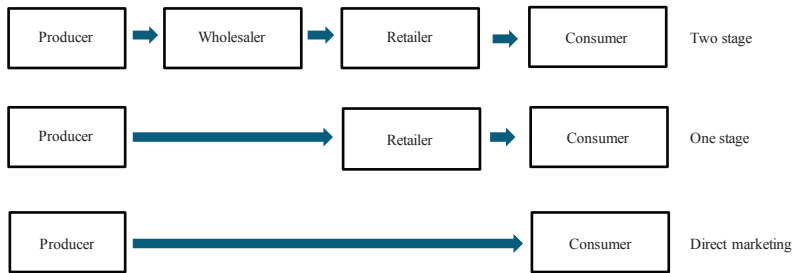
What are marketing channels?

A marketing or distribution channel is often viewed from the point of the buyer or customer, as seen in Figure 1. In the food system, the customer, from the viewpoint of a consumer packaged goods (CPG) firm, would be a consumer. The same would be true for a restaurant or food service organization. Marketing or distribution channels are more narrow than supply or value chains and consider the five Ps of the marketing mix—packaging, people, price, product, and promotion—when considering how to provide maximum value to customers. A direct marketing channel would be one where a producer sells directly to a consumer, as in a farmer’s market.

Stages that may lie in between the producer and consumer include processing, wholesaling or distribution, and retailing. The food system contains multiple stages with various marketing or distribution channels. For example, consider a marketing channel for breakfast cereals. Consumers desire cereals in a variety of packaged forms (for example, boxed, bagged, or single-serve) with a variety of nutritional needs (use of whole grains, no added sugars) and product attributes (organic, non-genetically modified [GM], no artificial dyes or colors, no corn sweeteners) which are communicated to the consumer in a variety of methods (in-store promotion, digital coupons, advertising). A simplified set of stages in the marketing channel would include production, processing, wholesaling, and retailing to consumers. The processor must work with multiple stages in the channel.

Figure 1

Example of Distribution or Marketing Channels with Various Stages in Agriculture



Note: This figure is representative of many such diagrams found in marketing textbooks.

What are supply chains?

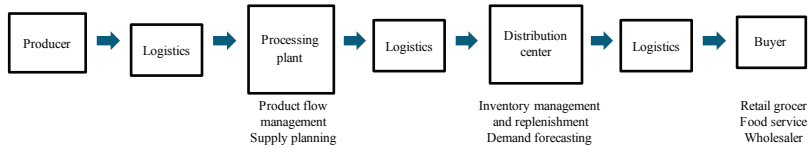
A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from production to consumption.¹ Relative to marketing channels, the goal of supply chain management is to achieve efficient methods of optimizing for low cost. Supply chain management is typically viewed from the viewpoint of decision science or operations management (Figure 2). It involves a broad network of entities within and outside the firm to deliver the product, which has been transformed in some fashion to a finished product suitable for the consumer. For example, a cold chain is a temperature-controlled supply chain used in fruits, meats, and vegetables.

There are many supply chains within a firm. For example, a multinational CPG firm with various consumer brands could have dozens of supply chains due to the various ingredients being used. A segregated supply chain is created to meet the needs of one or a limited number of buyers. An example of a segregated supply chain would be the production of an organic breakfast cereal, which involves using organic inputs in a manufacturing value chain and making the cereal available and advertised to consumers through an organic marketing channel.

A supply chain that efficiently provides consumers with breakfast cereals might begin with agricultural production crops—such as hard white wheat varieties for whole wheat grains or cane sugar as opposed to liquid sweeteners from corn—that are sold to handlers who collect

Figure 2

Example of a Supply Chain for Agricultural Products



Note: This figure is representative of many such diagrams found in marketing textbooks

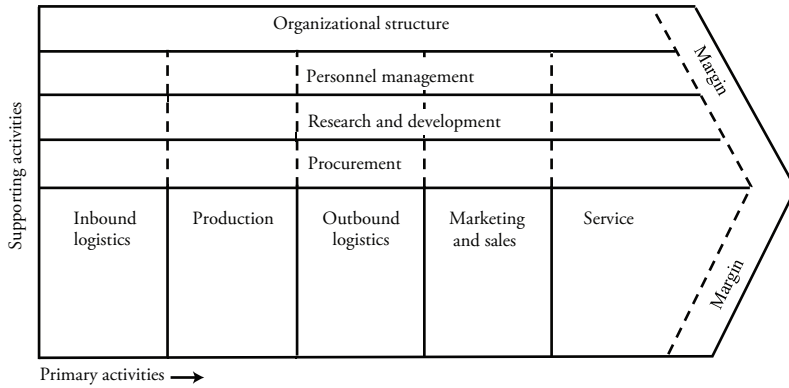
the crop and then sell it bulk to breakfast cereal manufacturers who use a food extrusion technology to create the actual cereal flakes. This manufacturing process is quite complicated and involves a number of processes. The cereal is packaged, shipped, and stored in a distribution center warehouse and sold to a wholesaler or directly to a retail grocer or food service distributor that sells to consumers. The breakfast cereal firm uses logistics services to manage this entire process. Inventory management, warehouse replenishment, demand forecasting, and raw material procurement are included in this process. Thus, a supply chain is defined as an integrated process through which a number of business entities cooperate in an effort to acquire raw materials through product procurement, convert these raw materials into specified finished products, manage standards of quality, and deliver the finished products to retailers.

What are value chains?

A value chain is a set of activities that a firm operating in a specific industry performs to produce a product or service (Porter 1980). In this way, supply chains link value chains (Figure 3). A firm's value chain is designed to capture value for all firms by carrying out activities to meet the demand of consumers, who could be individual retail grocers, food services, or restaurant chains. Consumer demand is the source of the value and the value added to a product. That value, as viewed from the perspective of a consumer, is obtained through research and development (for example, an almond innovation lab or a private label brand kitchen), market research on consumer trends (for example, NPD Group or Nielsen), the creation of product and service innovations valued by consumers (for example, an internal customer solutions lab for food starches) and economic conditions underlying consumer

Figure 3

Representation of Porter’s (1980) Value Chain Activities



income that affect product demand (for example, government reports by the Bureau of Labor Statistics).

One type of CPG manufacturing value chain for breakfast cereal is the process used by an individual manufacturer to create the cereal, including research on consumer demand for product attributes such as whole-grain, vitamin-fortified, or natural food colors; packaging attributes such as material or portion size; or certain types of production systems such as those using non-GM or organic ingredients. A company with a value chain that handles global feed and food grain trading might be in the business of delivering grain at a specified grade year-round at certain intervals; its value comes from the entire process, from origination to delivery, as opposed to just origination.

Summary

Supply chain management can be thought of as functions that manage the flow of product, and value chain management can be thought of as functions that manage consumer demand. Ideally, these activities should work together within a firm. An economist might think of this as a firm maximizing consumer demand as measured by value subject to an internal constraint on the cost of procuring the ingredients for the product supply. Within a firm, the job descriptions for individual employees reflect these viewpoints, and the employees are working toward the same goal. Consumers purchase food products daily directly

through a retail grocery or food service, but a firm is not producing those products in “real time.” It must anticipate the needs of consumers years in advance and build a system to supply the product inputs and services needed to meet that anticipated demand. Most food value chains and supply chains exist with global reach. Generally speaking, agricultural producers and firms that supply farmers, producers, and ranchers with inputs are at the beginning of such chains, and participation in these chains allows for increased opportunities and risk.

II. The Modern Food System Is Dependent on Trade

Goldberg (2018) describes the modern global food system as the “biggest quasi-public utility in the world” (p. xvi). The changing nature of entities involved in the food system—including firms supplying inputs to farmers, agricultural producers, handlers of commodity ingredients, CPG firms, and grocery retailers—in conjunction with public policy as evidenced by recent Farm Bills, helped change the food system from one focusing on the lowest-cost supply of food to one focusing on how consumers perceive value. In their mission statements, food systems firms often talk about being a “wellness company” or “life science company.” Retail grocers employ dietitians to help consumers shop. CPG firms create segregated supply chains for organic products. Farmers balance production against societal goals related to water, employment, and the environment. This process has been ongoing for a long time, as noted by economists such as Kinsey (2001) and Sexton (2000, 2012). However, several changes in the mid-1990s accelerated these trends.

Farm policy in the United States changed dramatically in 1996 with the so-called “Freedom to Farm” Bill (Sumner, Alston, and Glauber 2010). However, that bill reflected a number of prior changes including the 1948 General Agreement on Tariffs and Trade (GATT), which culminated in the creation of the World Trade Organization (WTO) in 1994. Prior to these events, the United States had established free trade zones with Canada and signed a free trade agreement with Israel in 1985. However, the real increase in bilateral and multilateral free trade agreements began in the mid-1990s. An examination of these agreements shows the effect of trade in both agricultural goods and, even more importantly, services, which included sanitary and phytosanitary regulations (SPS), scientific protocols, and processes for approval

of products. Different countries have different tolerances for risk and safety. The precautionary principle suggests that temporary regulations are needed to prohibit a new product or technique because scientific evidence on possible risk is incomplete and consumer demand for more information may be lacking.

Global production of high-value foods, particularly processed foods, has grown rapidly since the mid-1990s for reasons described by Beckman, Dyck, and Heerman (2017). However, exports of processed foods have remained at the same percentage levels. The lack of growth in processed food trade is partly due to the preference of many manufacturers to locate production units close to their consumer bases rather than export the finished products. Consider a product such as ice cream or yogurt. A CPG firm such as General Mills has more than 50 global food brands used on hundreds of stock keeping units (SKUs). Many of these products use dry milk ingredients such as dairy proteins in their formulations, while other products are primarily dairy-based (for example, Oui, Yoplait, and Häagen-Dazs), with dozens of supply chains to create these products. General Mills does almost 25 percent of its business outside the United States, using processing plants in other countries to manufacture its products and then exporting ice cream and yogurt to those countries. To produce its dairy products, General Mills needs to source fluid milk in those countries using origination models similar to what Nestlé uses in more than 30 countries including Brazil, Chile, China, Colombia, Indonesia, Morocco, Pakistan, Sri Lanka, Thailand, and Uzbekistan (Goldberg and Herman 2005, 2006).

All of these issues point toward the importance of trade in agricultural products as well as increased trade in perishable agricultural goods such as fresh fruits and vegetables. The United States did not have enough productive land in a subtropical environment to produce the many kinds of fresh fruits and vegetables needed to feed a population that tripled between 1945 and 2010 (Alston and Pardey 2014). The increasing U.S. population led to a growing awareness of the need for supply chains that could source fresh fruits and vegetables globally and a growing convergence of consumer diets in many countries, which can be seen in the types of products sold in retail grocery stores (Rear-don and others 2003).

III. The Governance of the Global Food System

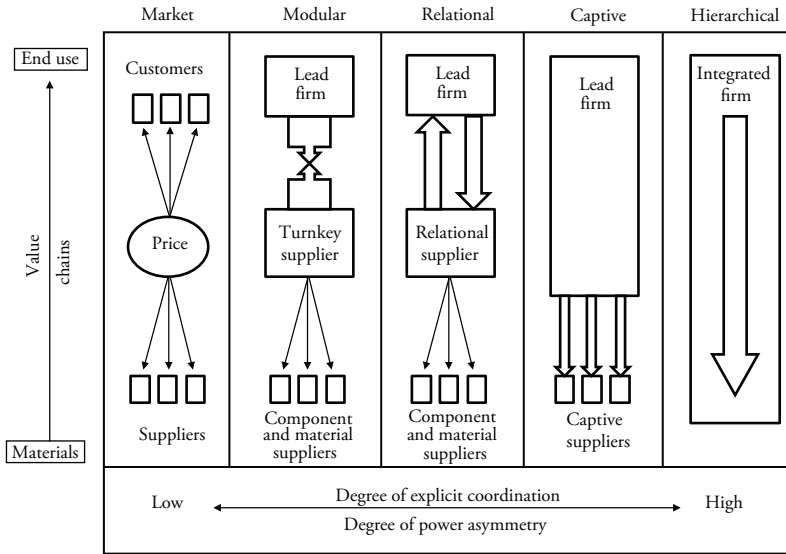
Rodrik (2018) argues that four aspects of trade agreements may yield ambiguous economic welfare and efficiency results: trade-related intellectual property rights (TRIPS), rules about cross-border capital flows, investor-state dispute settlement procedures, and harmonization of regulatory standards (that is, SPS). SPS in particular has been critical for agriculture because it includes issues such as bans on GM-foods or meat produced with growth promotants, which have been found to be protectionist barriers. Rodrik (2018) argues that countries' assessments of risk and concepts of businesses and their relationships with stakeholders will likely vary.

Gereffi, Humphrey, and Sturgeon (2005) define five types of global value chain governance: market, modular, relational, captive, and hierarchical (Figure 4). These types are listed in increasing order of complexity: the market type suggests arms-length transactions, whereas the hierarchical type suggests formal vertical integration. Modular, relational, and captive types are increasingly vertically coordinated. Modular chains are characterized by highly complex transactions and a greater need for capabilities from suppliers but also by the ability to codify a transaction like a market governance system. Relational governance systems are similar to modular systems, but they are less able to codify transactions. Captive governance systems are different from modular systems in that they require low capability from their suppliers, since they have built asset-specific investments. For a long time, market type governance was typical in agricultural trade, with price and grade specifications being standard. For example, fruit might be purchased in boxes of a certain weight and size, and a variety of intermediaries such as brokers and wholesalers might facilitate trade.

More recently, so-called "supply chain captains" have moved toward modular systems and away from market systems to meet consumer demand for a year-round supply of various fruits, new forms of packaging such as smaller containers of pre-cut fruits, and greater attention to quality including extended shelf life. Meeting these demands requires a deeper relationship with suppliers. Sporleder and Boland (2011) discuss supply chain captains such as large retail grocers and restaurants, which face a more complex regulatory environment with regard to fungicide and pesticide residues and food safety inspections. Furthermore,

Figure 4

Five Global Value Chain Governance Types



Source: Gereffi, Humphrey, and Sturgeon (2005).

stakeholder concerns about labor standards and similar issues have grown.² Consequently, retailers have turned to turnkey suppliers who can deal with all of these issues (for example, using e-verify for labor or tracing food through the supply chain to verify sustainability claims). Retailers have moved away from wholesalers and toward greater coordination through contracts of a certain duration with regular audits and inspections. Furthermore, retailers and their suppliers have begun placing greater emphasis on the efficiency of the entire supply chain.

IV. Agricultural Trade Is Important to Firms

Presentations by firm CEOs are often scrutinized very carefully for information. Boland and Çakır (2018) suggest that the economist Joseph Bain (1959), who helped create the field of industrial organization within the economics profession, was likely the first to note that such presentations often contain clues about market competitiveness. Using public archiving services available for industry publications, I create a digital database of presentations on the topic of trade by food economy CEOs and senior managers (“senior leaders”) who reported to the CEO

beginning in 1995. The industry publications in this database include *AgriMarketing*, *Baking and Snack*, *Beverage Industry*, *Bloomberg BusinessWeek*, *The Economist*, *Feedstuffs*, *Food Institute*, *Food Processing*, *Food and Beverage Processing*, *Milling and Baking News*, *Meat and Poultry*, *The Wall Street Journal*, and *World Grain*. I include these outlets because they represent a broad overview of food system firms excluding production agriculture and because they have an archival service that is searchable. I then search the database for words including “GATT,” “World Trade Organization,” “Farm Bill,” “trade agreements,” “trade,” and individual names for trade agreements such as “NAFTA” and “CAFTA-DR.” In addition, I search under specific firms, updating Boland, Golden, and Tsoodle’s (1998) set of firms characterized as closely held (for example, family-owned firms and cooperatives) or publicly held.

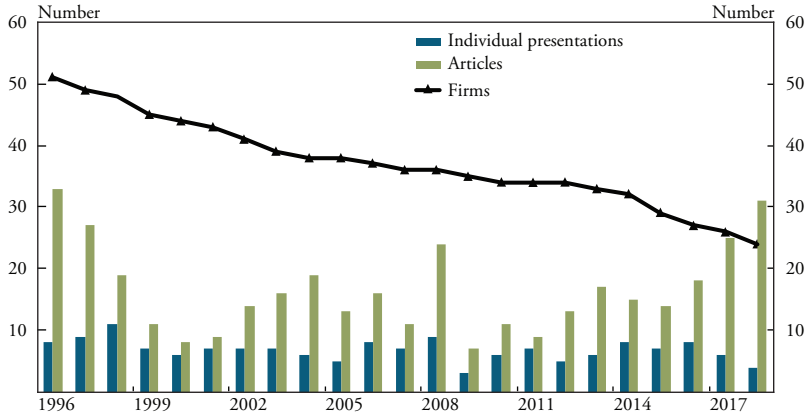
Chart 1 shows that the total number of firms in the database decreased from 1995 to 2018 due to mergers or other changes in ownership. On average, seven senior leaders spoke about the need for trade annually. However, as a percentage of total food economy firms, the number of senior leaders discussing trade steadily increased from 19 percent (using 1996–98 data) to 25 percent (using 2015–17 data). Furthermore, this percentage is already at 17 percent after the first six months of 2018. Clearly, senior leaders of food economy firms are concerned about trade and the need for trade.

While economics has few laws relative to other sciences, the law of comparative advantage states that the ability of any firm to produce goods and services at a lower opportunity cost than a different firm gives the first firm a comparative advantage. In practice, comparative advantage is often thought about in terms of average costs of production. However, when thinking about comparative advantage in terms of global trade, transportation costs become important as well as any policy issues that favor one form of agriculture over another. It is useful, for example, to think about distance when considering trade. The main port terminals in the European Union are almost half as far away as port terminals in East Asian countries (Wang and others 2000). Yet East Asian countries are far more important markets for U.S. agricultural products.

A U.S. food economy firm engaged in exports may quote prices in terms of free on board or freight on board (FOB) from a certain port of

Chart 1

News Articles and CEO and Senior Leader Presentations on Trade Topics, 1996–2018



Note: Firms include all food economy firms in a particular year.

origin. Taylor (2017) reports that in 2016, New Orleans Ports Region accounted for 36 percent of all U.S. agricultural exports; no other port averaged more than 6 percent. The FOB price for ports in the New Orleans region means that the seller is responsible for transporting the product to the port and including the cost of loading it onto the ship. New Orleans ships 46 percent of all agricultural products that are bulk commodities, and the two primary means of transportation to the port are barge shipping via the Mississippi River and rail transport. A buyer pays the FOB price at that port and then is responsible for shipping the product through the Caribbean and Panama Canal (if headed for East Asian countries), paying the insurance, unloading the product at its destination port, and transporting it to its final stop. The buyer assumes all risk once the ship leaves the port of New Orleans. Alternatively, a seller could price via cost, insurance, and freight (CIF) pricing and deliver the product to its final destination. Thus, the ratio of CIF to FOB prices is greater than 1, and the difference in price represents unit transport cost.

In many ways, transportation costs are analogous to a tariff. The increase in width of the Panama Canal has resulted in the ability to use bigger ships, which may be slower for fuel efficiency reasons but can carry more volume. This leads, in turn, to a shift in the supply curve

and greater trade. Free trade agreements, in contrast, decrease tariffs, leading to a shift in the demand curve and greater trade.

V. The Role of Trade for Production Agriculture and Food Economy Firms

By many different measures, U.S. producers are some of the most efficient in the world when comparing different FOB prices. Gardner (2002) documents the role of the public-private sector to explain why this has happened over time. Nevertheless, not all agricultural systems are alike. The USDA reports agricultural products in terms of bulk, intermediate, and consumer-oriented (BICO). Bulk products include canola, corn, peanuts, rice, soybeans, and wheat that are designed for further processing. Intermediate products include soybean meal and oil, other vegetable oils, distiller's grains, and sweeteners, and are generally used as ingredients in other products. Consumer-oriented products include beef, pork, poultry, fruit and vegetables, tree nuts, and dairy products. All three categories have increased, on average, since 1995. Consumer-oriented products have increased the fastest, reflecting the growth in global supply chains. However, for an audience of those in production agriculture, it is useful to think about U.S. agriculture in terms of annual crops, perennial crops, meat and poultry, and dairy.

Annual crops

Casual readers of any Midwestern U.S. newspaper or media outlet tend to read about annual crops such as corn and soybeans. In certain regions, readers might read about cotton, rice, and wheat.³ Many of these crops are sold in market-type governance systems. Farm policy discussions in a Farm Bill tend to contain many issues related to these annual crops. The two most widely used farm management textbooks make frequent use of these types of annual crop examples, which are used as inputs for livestock and poultry feed (such as soybean meal and corn) and energy (such as corn). These products or the outputs of their use as ingredients (for example, dry distiller's grain from corn-ethanol production) are important exports, and imports of these products are minimal. Thus, tariffs enacted by countries importing these crops may lead to less trade if these products do not displace other markets.

Virtually all vegetables are annual crops except asparagus, although many vegetables such as lettuce may have several crops per year. Most of these vegetables are sold through modular, relational, or captive-type value chain governance systems. For example, Green Giant-branded canned or frozen vegetables come from certain U.S. growing regions in addition to Mexico, The Netherlands, and Peru. U.S. vegetables are grown under production contracts (for example, varietal selection and the type of farming system) and marketing contracts (for example, tonnage contracts based on a market price) with growers. Martinez (2002) has written about vertical coordination in agriculture, which describes more of a modular or relational governance system. Global producers are more likely to be captive suppliers because of the nature of the farming system in those countries and the difficulty of switching buyers. The same would be true for Birds Eye Foods or other vegetable processors.

The total volume of vegetable production in the United States has declined relative to the total use of vegetables since the 1990s. Some of this decline is due to issues related to the supply of U.S. vegetables, including a decrease in the number of vegetable producers, an increase in costs of inputs such as labor and water, and a decrease in expected future prices caused by trade agreements that reduced average import tariffs and increased imports. Demand for canned and frozen vegetables relative to fresh vegetables also decreased during this period. Cannery and processors were not able to change their business strategy to enter the fresh market due to varietal issues suitable for a grower's geography and irreversible fixed assets with regard to canning and processing facilities and a lack of capital investment to consider change (Boland 2016). Lettuce, spinach, tomatoes, potatoes, and dry edible bean imports had the highest growth in imports during this period (Johnson 2016).

Perennial crops

The United States is a producer of perennial crops such as stone fruits, including peaches and plums; citrus fruits, such as lemons and oranges; pome fruits, such as apples and pears; berries, such as strawberries and blueberries; and nuts, such as walnuts and almonds. Exports of perennial crops are important for California, Oregon, and Washington state producers. Planting an orchard is similar to an irreversible investment. It takes three to five years for the crop to bear fruit or nuts,

and many fruits are alternate bearing. Most of these fruits and nuts are sold through modular, relational, captive, or even integrative-type value chain governance systems. However, some perennial crops that have seen rapid growth in recent years, such as blackberries, blueberries, and hazelnuts, are moving from market-type transactions to modular and relational governance systems. Greater awareness of the benefits of fruit and nut consumption, a growing perception that fresh fruit is better than canned or frozen, changes in consumer tastes and preferences (for example, purchasing fruits and vegetables by variety name such as Honeycrisp apples or Yukon gold potatoes), and an increasing U.S. population with higher average income have helped increase demand for fresh fruits and nuts.

On the supply side, a number of developments in fruits and nuts have affected production. A higher cost of inputs such as labor and water have changed producer enterprise diversification from certain fruits, such as citrus and stone, to almonds and walnuts. In addition, new land in Georgia, Oregon, and Washington has been brought into berry production. Public investments in disease-resistant nut varieties at the Oregon State Agricultural Experiment Station (AES) have helped increase the supply of hazelnuts. Similar public-private investments in production technologies at the University of California AES have helped reduce the cost of raisin grape and almond production, among other fruits and nuts.

All of the changes that have affected demand and supply can be seen in the U.S. supply and utilization for fruits and nuts from the mid-1990s to 2016. Overall domestic production increased but the effects were mixed (for example, prune, pear, and peach production decreased, while berry and nut production increased). Imports of citrus, berries, grapes, and stone and pome fruits increased, but so did exports of berries, grapes, and stone and pome fruits. Like vegetables, fruit imports were greater than exports even accounting for consumption of tropical fruits such as bananas, which has remained somewhat constant during this period.

Livestock and poultry

Global trade in poultry and meat has increased significantly since the mid-1990s. Meat and poultry exports are transported to many of the

same markets as annual and perennial crops. Many of these governance models are modular in nature. Factors such as an increase in per family incomes, changes in relative prices and their substitutes (for example, the ratio of beef to poultry prices has been declining for almost 40 years), dietary preferences for more meat protein, product innovations such as boxed beef and chicken, and changes in food service menus have increased the demand for trade in poultry and livestock meat.

Much of this trade is in chilled rather than frozen products—and in disassembled products rather than whole animal carcasses—due to technology improvements that have increased the supply and trade in these products. For example, more efficient feed due to genetic improvements and animal housing systems has led to lower average costs and greater supply. The creation of quotas through trade agreements has also increased the trade and supply of these products, as has a greater number of livestock and poultry production systems globally and a diffusion of animal systems technology. Research and development of meat products such as turkey has increased the overall supply of meat traded globally, and the harmonization of veterinary protocols and SPS measures through trade agreements and WTO membership have helped increase trade. Finally, the use of quotas in trade agreements (for example, the Hilton quota for Argentinean, Paraguayan, and Uruguayan beef in the EU) has led to greater trade (Marshall and others 2000).

However, the greatest increase in trade of U.S. meat and poultry products came from the NAFTA trade agreement—in particular, from trade with Mexico. The animal and meat sector accounts for the majority of SPS notifications in WTO-member countries, and these include the implementation of a new procedure, rule, or requirement that may act as a barrier to trade.

Dairy

Global trade in dry milk powder products has increased in the past 20 years. Factors such as increased consumer family income, increased awareness of the health benefits of milk-based products, and changes in how food is consumed (for example, increased snacking, smaller portions, and greater protein) have increased demand for dairy-based foods that use dry milk powder. Fonterra and Glanbia has been a global leader

in developing dairy protein-based products in this category. Primary exporters include New Zealand and the United States.

Butter demand has also increased due to new research on its health benefits and changing consumer taste for products such as European-style butter and spreadable butter products. A small amount of trade occurs in butter: the third largest U.S. butter brand in 2018 was Kerrygold, which is imported from Ireland, although the United States has many regional butter brands as well. Likewise, cheese demand has increased in part due to its use in various foods (for example, pizza). The abolition of dairy quotas in the EU and corresponding expansion in the EU Green Belt—that is, Ireland, The Netherlands, Denmark, northern Germany, Poland, and Lithuania—as well as cheaper animal system technologies (for example, robotic milkers and other labor-saving devices) and improvements in feed efficiency and milk production per cow have led to greater supply.

VI. The Role of Free Trade Agreements

Much of the discussion around the GATT and the formation of the WTO has focused on the average tariff rate reductions. These reductions helped facilitate trade and allowed comparative advantage to become more apparent, as membership in the WTO included an obligation to undertake no policies that would enable supply of an agricultural commodity to increase for reasons unrelated to price discovery. Certainly, this has helped trade of annual crops. Market access barriers, such as tariffs, are a significant obstacle to trade. Importing countries may escalate tariff rates based on the level of processing, with primary products being levied the lowest rates. In addition, countries may use other measures such as SPS to encourage imports of relatively unprocessed agricultural commodities at the expense of more processed products. However, bilateral and multilateral free trade agreements (FTA) have also been important, especially for perennial crops.

The United States has negotiated a number of FTAs with 20 countries (Office of the U.S. Trade Representative 2016). These agreements have dozens of chapters that involve complex negotiations on trade issues. The goal of SPS measures is to protect the health and lives of humans, animals, and plants from risks arising from trading agricultural products. To minimize unwarranted impacts on trade, the

WTO SPS agreement establishes general requirements and procedures for application of SPS measures by member countries. Under this agreement, member countries have the right to apply the levels of protection from risk as they see appropriate. However, the agreement requires all partnering countries to commit to using science and risk analysis as a foundation for the application of SPS measures. The agreement also encourages member countries to implement the provisions regarding fundamental principles such as harmonization, equivalency, transparency, and regionalization of SPS measures.

The WTO SPS agreement is a significant step toward eliminating SPS trade barriers, but implementation issues persist. In 2016, the Office of the U.S. Trade Representative noted that SPS trade barriers cost U.S. farmers and small businesses hundreds of millions of dollars and that their elimination is a high priority for the U.S. government. Regulations related to animal disease comprised almost one-third of all trade concerns in SPS from 1995 to 2015 (Beckman, Dyck, and Heerman 2017). A number of these concerns were related to increased trade in animal meat products, the foot-and-mouth disease outbreak in the early 2000s, and the isolated Bovine Spongiform Encephalopathy disease (that is, BSE or mad-cow disease). One of the main reasons for implementation problems is the lack of close cooperation, information sharing, and trust between trading partners. There is a close link between free trade agreements and the implementation of SPS measures. The United States requires all partnering countries in an FTA to commit to the WTO SPS agreement that mandates using science and risk analysis as a foundation for SPS measures. This has helped in a number of cases, most recently in the avian flu outbreak of 2016. Çakır, Boland, and Wang (2018) note that the ability of the U.S. turkey industry to work with United States and international stakeholders using protocols established in SPS policies in FTAs helped trade in U.S. turkey products to continue during the avian flu outbreak.

Many FTAs create quotas or increase or decrease existing quotas. For example, NAFTA includes a small quota for beet sugar from the Taber, Alberta factory in Canada into the United States. The FTA with Chile allows additional volumes of certain types of cheeses from the Xth Region near Puerto Montt not typically produced in the United States, such as Parmesan-type or Roquefort-type cheeses. Many import-

ers of fruits and vegetables built supply chains when tariff duties were reduced to zero or close to zero after trade agreements were signed. Vegetables began to be sourced from Central America while counter-seasonal fruit production began in the Central Valley in Chile and Peruvian coastal regions (Gallo 2018). Table 19 in Beckman, Dyck, and Heerman (2017) shows that the United States, New Zealand, Australia, and Singapore have the lowest average applied tariffs of any countries in the world.

Sporleder and Boland (2011) note that a key component of the food system is the concept of a marketing year and perishability. In the northern hemisphere, the marketing year is often assumed to begin October 1 with the harvesting of that year's annual or perennial crop and to end 12 months later on September 30 with inventories being depleted to prepare for the next year's crop.⁴ Consumers in the United States have benefited from counter-seasonal production for certain fruits (Chile) and vegetables (Peru). Without refrigeration in a cold supply chain from production to consumption, fruits, vegetables, dairy, and meat would perish rapidly. Changes in refrigeration and related technologies have helped increase trade in these products.

Coyle and Ballenger (2000) note that these technologies include improved communication systems, allowing for better monitoring of quality, tracking of shipments, and coordinating of steps through the marketing chain of perishable food products. Greater use of intermodal systems and the reefer box (a mobile refrigerated warehouse) from the point of production to the point of consumption, combined with modern container terminals, have allowed for quicker turnaround in ports and faster delivery of product over greater distances. Improvements in refrigeration and controlled atmospheric packaging and humidity control have reduced spoilage and allowed the substitution of cheaper ocean shipping for air transport. Many packaging innovations—including fruit and vegetable coatings, bioengineering, and other techniques that reduce deterioration of food products—have helped shippers extend the shelf life of products. Port technologies have also improved. Crane use and capacity have increased, as have storage space and access to highway and rail connections. Customs and inspection services have improved to become more efficient and timely. Such improvements and

increased use of digital technologies such as sensors and blockchain may help reduce costs and margins.

VII. Current Issues in Agricultural Trade

Since the mid-1990s, the United States has seen enormous increases in the volume and value of agricultural trade. However, several issues still require resolution, and some may never be resolved due to differing attitudes toward risk and safety.

Global trademarks, certification marks, and geographic indications

As with privacy concerns (for example, Right to Be Forgotten) and standardized financial accounting reporting between the EU and United States, the debate over geographic indicators may never be resolved, although a “work-around” solution appears to be developing. The issue under contention is, essentially, whether policies on foods with geographic indications are creating a vertical supply curve—which is how the United States views them—or whether the food is actually differentiated and on the inelastic part of the demand curve—which is how the EU views them. Alston and others (1997) show that marketing the differentiation of a product’s features and benefits has a greater effect than generic commodity advertising. Indeed, Boland and others (2012) find that these benefits are almost four times larger with regard to prunes marketed by a California cooperative. Thus, at least in California, empirical studies have found greater benefits to promoting the differentiated features of a product rather than where it happened to be grown. This debate has become important in current NAFTA renegotiations because recent trade agreements between the EU, Canada, and Japan allowed five cheeses (Asiago, Feta, Fontina, Gorgonzola, and Munster) to be recognized as geographic indications. This was the first time geographic indications were recognized in a trade agreement. Certainly, certification marks and trademarks are important issues.

Animal of origin versus farm of origin and country of origin

Current trade negotiations between the EU and Mercosur countries (that is, Argentina, Brazil, Paraguay, and Uruguay) have several issues to work through; however, a key factor in beef trade discussions is that the EU requires animals to be traced individually. Although Uru-

guay can trace animals individually, Brazil is only able to trace them to the farm of origin. The WTO has ruled that U.S. Country-of-Origin Labeling regulations in beef violate U.S. trade obligations by imposing burdensome recordkeeping and verification requirements on livestock producers and meat processors. These issues are also important to grocery retailers and restaurants. The so-called “Born in Mexico, raised in Canada, and slaughtered in the U.S.A.” label recognizes modern beef supply chains in North America.

Timely resolution of SPS issues

A common criticism of many SPS issues, especially in meat products, is their timely resolution. Bovine spongiform encephalopathy, a disease that affected Canada, the United States, and Great Britain at various times since the early 1990s, caused great trade disruptions. Timely resolution was a major issue because importing countries could not agree on common definitions such as what constituted a “young” or “old” animal as measured in months. Age may appear to be an easy problem to resolve, but it is nevertheless contentious among scientists.

Management of global price risk in a supply chain

Firms with global supply chains seek to manage global price supply risk. However, doing so is difficult for many products such as dairy, meat and poultry, fruits, and vegetables. Marketing contracts are common, but the price discovery process may depend on publicly reported prices in thin markets due to limited numbers of buyers and sellers (Adjemian, Saitone, and Sexton 2016). The ability to manage price throughout the supply chain is not readily apparent as evidenced by frequent mentions of the topic in quarterly reports of food economy firms that report to the U.S. Securities and Exchange Commission. Anecdotal evidence suggests that this is especially true in dairy, which is regulated through marketing orders in the United States and lacks timely and transparent data on current and future demand and supply, since milk supply is elastic regardless of where it is produced.

Compliance and enforcement of “buy American” in school nutrition programs

In the United States, school nutrition programs are required to “buy American.” However, many producer organizations argue that

this requirement is not enforced, and many school programs may not be in compliance. “Buying American” has been a big issue especially in canned peaches, canned pears, and applesauce. Reports have found that some school nutrition programs are purchasing imported foods rather than U.S. produced foods (Kalb 2015; Rodriguez 2018). This has implications for importing firms with global supply chains that may have purchased U.S. trademarked brands to use on imported fruit.

Organizational structural issues

Marketing organizations such as farmer-owned cooperatives have proved successful in many industries. A key part of these organizations’ success has been the ability to pool large volumes of supply and market that volume to buyers. Some marketing cooperatives have been successful in developing globally differentiated products, especially in citrus and almonds (Pozo, Boland, and Sumner 2009; Boland, Pena, and Sumner 2009). However, the development of global dairy brands by cooperatives has been limited because of the capital needed to invest in these technologies. For example, while dairy farmers might like to receive the price of milk used in products such as Bailey’s Irish Cream or whey protein powder jugs, they might not want to pay for the research and development to create these products and then market them globally. Some cooperatives such as Glanbia have developed innovative organizational forms that allow cooperatives to become part of these supply chains and have capital for the investments (Boland 2013).

Implementation of Food Safety Modernization Act (FSMA)

The United States believes it has the most modern food safety system in the world, and the recent FSMA implementation will affect global supply chains. One key issue is the Foreign Supplier Verification Program, which requires importers to verify that food imported into the United States is produced in a manner that provides the same level of public health protection as that required of U.S. food producers. In addition, the Third Party Certification establishes a program for the accreditation of third-party auditors to conduct food safety audits and issue certifications of foreign facilities producing food for humans or animals. The FSMA also includes other regulations on shipping and transportation yet to be implemented. Recent concerns over the mislabeling of organic

grain imports will likely put greater pressure on global supply chains, especially those that require a segregated supply chain built around organic labeling. Finally, adulteration risk must be considered in light of several dairy issues in China and the horsemeat issue in Ireland. All of these issues place increased pressure on possible DNA testing of certain food products, similar to what is happening with certain animal breeds.

Unforeseen policy decisions

Unforeseen issues often arise in agricultural trade, such as the Russian embargo on many agricultural products from the EU from 2015 to the present. The embargo severely disrupted EU supply chains, particularly in dairy. The current United States and Chinese trade war is another example, and it may have large effects on U.S. soybean, turkey, and chicken exports.⁵ In the spring of 2017, Canada abruptly put into effect policies designed to shut off U.S. exports of ultrafiltered milk, which had dramatic effects on dairy farmers in western Wisconsin and certain other regions. China's decision in January 2017 to not import corn ethanol but to relax imports of certain beef products was not well understood, and rice market access continues to be an issue.

VIII. Implications for Lenders

Lenders have an important role to play in global supply chains in agricultural trade. The increased need for working capital and term loans for investments have helped create the global food system. However, it is apparent that there are risks associated with the opportunities. For example, lenders financing production agriculture assets that are contingent upon exports have a degree of risk that is not readily understood due to fluctuations in exchange rates, lack of transparent information on future supplies in the United States and in export markets, lack of understanding of forecast demand and what is happening in export markets, and political risk due to changes in policy. Firm strategy can likewise be an issue. Firms practicing transfer-pricing methods can choose in what country to declare profits based on tax policies, which can disguise where the profits originated in an integrated supply or value chain. Loans made for fruits, nuts, and vineyards (olive and wine) that are long-term investments relative to annual crops deserve scrutiny, especially if the products are designed for the export market.

For example, consider the dairy industry, which has a very elastic supply. The abolition of quotas in the EU was known well in advance, and dairy farmers began to prepare for expansion as they anticipated greater income on their farms. Farmers invested in their farms and built and financed milk-processing plants for the additional capacity. Meanwhile, dairy farmers in Argentina, Chile, New Zealand, and parts of the United States were responding to the same demand signals. As a result, the milk supply increased faster than demand, and events such as the Russian embargo had a tremendous economic effect. Similarly, dairy producers in California, Idaho, and New Mexico expanded production in anticipation of East Asian demand for dried milk, even though India had already begun exporting limited dairy products and China was building a dairy industry.

The effects of disruptive technologies such as plant- or lab-based meat and aquaculture on meat demand and corresponding feed grain markets are unknown. The use of plant-based proteins in such meat products might create demand for certain nuts and vegetables.⁶ Geographic diversification of fruits and nuts could happen in Missouri and Arkansas. Similarly, advances in electric cars and similar technologies could affect the demand for corn ethanol.

Some structural changes in policy have economic effects on farmers and their cooperative balance sheets in the form of economic obsolescence, as shown by Boland, Crespi, and Turner (2014). These effects are well documented with regard to land prices. However, such effects are probably not incorporated into interest rates. Capital may become stranded in value chains due to changes in policy. Readers can think of other examples of risk that are likely to occur throughout the 21st century.

Endnotes

¹Both military and management experts have used “supply chain” interchangeably with “logistics” and “operations research” since the 19th century, beginning in Napoleonic France. Keith Oliver, a management consultant writing in the *Financial Times* in 1982, is generally credited as the first person to use the phrase “supply chain management.”

²A description of stakeholder theory can be found in Boland, Cooper, and White (2016) and Fuller, Brester, and Boland (2018)

³Beet or cane sugar might be another crop as noted by Risch, Boland, and Crespi (2014).

⁴This is somewhat simplistic because many feed and food grains, fruits (such as raisin grapes, peaches, and apricots, which can be dried), nuts, powdered milk, and frozen concentrate juices can be stored for more than 12 months.

⁵*The Economist* (2018), citing Bindiya Vakil, CEO of Resilinc, which is a supply chain analytics and management firm, writes that “most companies are unable to quantify the risk of a serious trade war.”

⁶Plant- or lab-based meat protein is a truly disruptive technology for the meat industry in many ways, because its advantages appear to far outweigh those of the meat industry. However, a detailed public analysis of this supply chain has not been conducted, as the research is being done in the private sector.

References

- Adjemian, Michael K., Tina L. Saitone, and Richard J. Sexton. 2016. "A Framework to Analyze the Performance of Thinly Traded Agricultural Commodity Markets." *American Journal of Agricultural Economics*, vol. 98, no. 2, pp. 581–596. Available at <https://doi.org/10.1093/ajae/aav074>
- Alston, Julian M., John M. Crespi, Harry M. Kaiser, and Richard J. Sexton. 2007. "An Evaluation of California's Mandated Commodity Promotion Programs." *Review of Agricultural Economics*, vol. 29, no. 1, pp. 40–63.
- Alston, Julian M., and Phil Pardey. 2014. "Agriculture in the Global Economy." *Journal of Economic Perspectives*, vol. 28, no. 1, pp. 121–146. Available at <https://doi.org/10.1257/jep.28.1.121>
- Bain, Joseph S. 1959. *Industrial Organization: A Treatise*. New York: Wiley.
- Beckman, Jayson, John Dyck, and Kari E.R. Heerman. 2017. "The Global Landscape of Agricultural Trade, 1995–2014." USDA Economic Research Service, *Economic Information Bulletin* no. 181.
- Boland, Michael A. 2016. "NORPAC Foods: An Oregon-Based Fruit and Vegetable Processor," unpublished case study.
- . 2013. "The Irish Dairy Industry and the Evolution of Glanbia." In *Proceedings of Economics and Management of Networks Conference*, November 21–23, 2013, Agadir, Morocco. Available at <http://emnet.univie.ac.at/emnet-2013/conference-program>
- Boland, Michael A., and Metin Çakır. 2018. "Agribusiness Economics and Management," in Gail L. Cramer, Krishna P. Paudel, and Andrew Schmitz, eds., *The Routledge Handbook of Agricultural Economics*, pp. 760–778. New York: Routledge Press.
- Boland, Michael A., Brendan Cooper, and James M. White. 2016. "Making Sustainability Tangible: Land O'Lakes and the Dairy Supply Chain." *American Journal of Agricultural Economics*, vol. 98, no. 2, pp. 648–657. Available at <https://doi.org/10.1093/ajae/aav062>
- Boland, Michael A., John M. Crespi, and Tracy M. Turner. 2014. "Measuring Sunk Costs in Agricultural and Food Industry Assets: Why Some Assets Sell Below Appraisal." *Journal of Agricultural and Food Industrial Organization*, vol. 12, no. 1, pp. 53–63. Available at <https://doi.org/10.1515/jafio-2014-0009>
- Boland, Michael A., John M. Crespi, Jena Silva, and Tian Xia. 2012. "Measuring the Benefits to Advertising under Monopolistic Competition." *Journal of Agricultural and Resource Economics*, vol. 37, no. 1, pp. 144–155.
- Boland, Michael A., Hilda Pena, and Daniel Sumner. 2009. "Blue Diamond Growers and the World Almond Industry," in M.A. Boland and E. Gallo, eds., *International Agribusiness Strategy Cases: A Book in Honor of Professor Ray Goldberg*, pp. 172–182. Manhattan, KS: K-State Printing Services.
- Boland, Michael A., Bill Golden, and Leah Tsoodle. 2008. "Agency Problems in the Food Processing Industry." *Journal of Agricultural and Applied Economics*, vol. 40, no. 2, pp. 623–34.
- Çakır, Metin, Michael A. Boland, and Yanghao Y. Wang. 2018. "The Economic Impacts of 2015 Avian Influenza Outbreak on U.S. Turkey Industry and the Loss Mitigating Role of Free Trade Agreements." *Applied Economic Perspectives and Policy*, vol. 40, no. 2, pp. 297–315. Available at <https://doi.org/10.1093/aapp/ppx027>

- Coase, Ronald. 1937. "The Nature of the Firm." *Economica*, vol. 4, no. 16, pp. 386–405. Available at <https://doi.org/10.1111/j.1468-0335.1937.tb00002.x>
- Coyle, William T., and Nicole Ballenger. 2000. "Technological Changes, Transportation Sector, Distance and U.S. Food and Agricultural Exports." USDA Economic Research Service, Miscellaneous Publication no. 1566.
- The Economist*. 2018. "Trade Wars Threaten to Disrupt American Firms' Global Supply Chains," *The Economist*, May 3.
- Fuller, Kate, Gary W. Brester, and Michael A. Boland. 2018. "Genetic Engineering and Risk in Varietal Selection of Potatoes." *American Journal of Agricultural Economics*, vol. 100, no. 2, pp. 600–608. Available at <https://doi.org/10.1093/ajae/aax098>
- Gallo, Javier Ernesto. 2018. *The Miracle of Peruvian Agribusiness Systems: Paradoxes and Opportunities*. Washington D.C.: CreateSpace Independent Publishing Platform.
- Gardner, Bruce L. 2002. *American Agriculture in the Twentieth Century: How It Flourished and What It Cost*. Cambridge, MA: Harvard University Press.
- Gereffi, Gary, John Humphrey, and Timothy Sturgeon. 2005. "The Governance of Global Value Chains." *Review of International Political Economy*, vol. 12, no. 1, pp. 78–104. Available at <https://doi.org/10.1080/09692290500049805>
- Goldberg, Ray A. 2018. *Food Citizenship: Food System Advocates in an Era of Distrust*. Oxford: Oxford University Press.
- Goldberg, Ray A., and Kerry Herman. 2006. "Nestlé's Milk District Model: Economic Development for a Value-Added Food Chain and Improved Nutrition." Harvard Business School Teaching Note 906-413, February.
- . 2005. "Nestlé's Milk Districts: Case Supplement." Harvard Business School Supplement 906-411, November.
- Hart, Oliver. 2017. "Incomplete Contracts and Control." *American Economic Review*, vol. 107, no. 7, pp. 1731–1752. Available at <https://doi.org/10.1257/aer.107.7.1731>
- Holmström, Bengt. 1979. "Moral Hazard and Observability." *The Bell Journal of Economics*, vol. 10, no. 1, pp. 74–91.
- Johnson, Renée. 2016. "The U.S. Trade Situation for Fruit and Vegetable Products." Congressional Research Service 7-5700
- Kalb, Loretta. 2015. "Sacramento City Unified Faces Criticism for Buying Chinese Canned Fruit," *The Sacramento Bee*, November 15.
- Kinsey, Jean D. 2001. "The New Food Economy: Consumers, Farms, Pharms, and Science." *American Journal of Agricultural Economics*, vol. 83, no. 5, pp. 1113–1130.
- Marshall, Maria I., Michael A. Boland, Daniel Conforte, and Deborah Cesar. 2002. "A Case Study of Beef Production and Export in Uruguay," in Barry Krissoff, Mary Bohman, and Julie Caswell, eds., *Global Food Trade and Consumer Demand for Quality*. New York: Kluwer Academic/Plenum Publishers.
- Martinez, Stephen. 2002. "Vertical Coordination of Marketing Systems: Lessons from the Poultry, Egg and Pork Industries." *Agricultural Economic Report*, no. 807, May.
- Office of the U.S. Trade Representative. 2016. "Free Trade Agreements." Available at <https://ustr.gov/trade-agreements/free-trade-agreements>

- Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.
- Porter, Michael E. 1980. *Competitive Strategy*. New York: The Free Press.
- Pozo, Veronica, Michael A. Boland, and Daniel Sumner. 2009. "Sunkist Growers: Refreshing the Brand." *Review of Agricultural Economics*, vol. 31, no. 3, pp. 628–639.
- Reardon, Thomas, C. Peter Timmer, Christopher Barrett, and Julio Berdegué. 2003. "The Rise of Supermarkets in Africa, Asia, and Latin America." *American Journal of Agricultural Economics*, vol. 85, no. 5, pp. 1140–1146.
- Risch, Corey C., Michael A. Boland, and John M. Crespi. 2014. "Survival of U.S. Sugar Beet Plants from 1897 to 2011." *Agribusiness*, vol. 30, no. 3, pp. 265–277. Available at <https://doi.org/10.1002/agr.21372>
- Rodriguez, Robert. 2018. "California Peach Cannery Feeling Sour over Schools Buying Imported Food," *The Fresno Bee*, April 19.
- Rodrik, Dani. 2018. "What Do Trade Agreements Really Do?" *Journal of Economic Perspectives*, vol. 32, no. 2, pp.73–90.
- Sexton, Richard J. 2012. "Market Power, Misconceptions, and Modern Agricultural Markets." *American Journal of Agricultural Economics*, vol. 95, no. 2, pp. 209–219.
- . 2000. "Industrialization and Consolidation in the U.S. Food Sector: Implications for Competition and Welfare." *American Journal of Agricultural Economics*, vol. 82, no. 5, pp. 1087–1104.
- Sporleder, Thomas L., and Michael A. Boland. 2011. "Exclusivity of Agrifood Supply Chains: Seven Fundamental Economic Characteristics." *International Food and Agribusiness Management Review*, vol. 14, no. 5, pp. 27–51.
- Sumner, Daniel, Julian Alston, and Joseph Glauber. 2010. "Evolution of the Economics of Agricultural Policy." *American Journal of Agricultural Economics*, vol. 92, no. 2, pp. 403–23.
- Taylor, April. 2017. "Profiles of Top U.S. Agricultural Ports." USDA Agricultural Marketing Service, April. Available at <https://www.ams.usda.gov/sites/default/files/media/PortProfiles2017.pdf>
- Wang, Zhi, William T. Coyle, Mark Gehlhar, and Tom Vollrath. 2000. "The Impact of Distance on U.S. Agricultural Exports: An Econometric Analysis," in William Coyle and Nicole Ballenger, eds., *Technological Changes in the Transportation Sector—Effects on U.S. Food and Agricultural Trade*. USDA Economic Research Service, Miscellaneous Publication no. 1566.
- Williamson, Oliver E. 2005. "The Economics of Governance." *The American Economic Review*, vol. 95, no. 2, pp. 1–18. Available at <https://doi.org/10.1257/000282805774669880>

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