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Organic Feed Grains and Livestock: Factors That Influence Outcomes in Thinly Traded Markets

Jeffrey Hadachek, Tina L. Saitone, Richard J. Sexton, Sharon Raszap Skorbiansky, Suzanne Thornsbury, and Anne Effland

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Abstract

Even as organic products have become more widely available, most organic growers in the United States still participate in niche markets, with few buyers and sellers and few trades being executed at a given area or point in time, relative to conventional segments of the market. Despite an increase in both organic production and available information to support decision making, growers continue to face challenges related to the thinness of organic markets. This report examines organic dairy and beef markets, including major feed inputs, to assess the current competitive status of these markets. Specifically, in each market, this report considers factors fundamental to determining whether buyers and sellers can form long-term, mutually beneficial buyer/seller relationships that may limit thin market challenges that might otherwise arise.

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Keywords: contracts, coordination, competition, modern agricultural markets, organic, thin markets, dairy, beef

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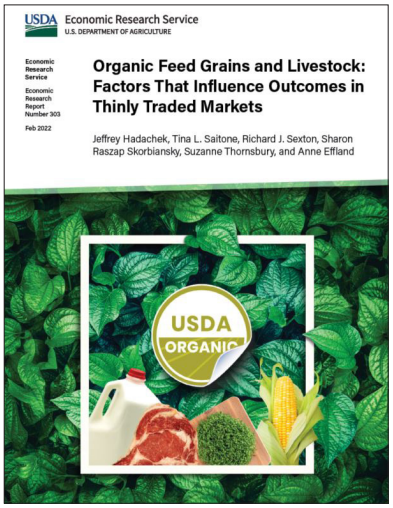


What Is the Issue?

Despite rapid growth in output, organic foods remain a niche market in U.S. agriculture. According to USDA's Organic Production Survey in 2016, about 8.4 percent of vegetables and 4.3 percent of fruits and nuts were organic, but market shares for organic grains, dairy, and livestock remained very small, with dairy the highest at 2.9 percent.

Many organic products are traded in thin markets that involve a small number of buyers and/or sellers, low liquidity, and fewer observable transactions compared with markets for conventional commodities. Longstanding concerns about pricing power have intensified as larger players have entered the market and as contracting relationships between buyers and sellers have grown more prevalent.

Previous research has shown that thin markets can result in outcomes similar to those of a perfectly competitive market[1] where both buyers and sellers of a product have sufficient interest in maintaining a long-term relationship. This theory, known as the modern agricultural markets (MAM) paradigm, sets forth conditions where thin markets yield efficient market outcomes and ensure producers earn at least a competitive return on their investments. A key tenet of the MAM paradigm is the importance of both buyers and sellers adopting a long-run perspective. If both parties attach a high value to future returns, they form a mutually beneficial, buyer/seller relationship that ensures the financial viability of the supplier and a stable source of supply for the buyer.

This report sets forth the key conditions that identify a MAM and show how these conditions relate to thin markets generally and to organic markets specifically. Our study investigates whether these conditions prevail in

[1] In a perfectly competitive market, individual buyers and sellers cannot control market prices because they are too numerous and share full information about market conditions.

organic dairy and beef markets and in markets for major organic livestock feeds. The focus on organic alfalfa, corn, and soybeans complements the discussion of organic livestock, given organic feed-related shortages are reported as an impediment to the expansion of organic livestock products. This report provides insight into the nexus between market development and the expansion of organic production.

What Did the Study Find?

The organic markets analyzed in this study (dairy, beef, alfalfa, corn, and soybeans) varied in the degree to which they met the conditions of MAM, where thin markets may operate comparably to perfectly competitive markets because buyers and sellers are able to commit to long-term mutually beneficial relationships. No one market satisfied all conditions, but sectors such as dairy—which had more experience and a greater prevalence of organic products—have generally moved closer to MAM status than other organic markets, such as beef, that are in their nascent stages. The theory of MAM suggests that greater use of contracts and the establishment of long-term relationships between buyers and sellers may reduce exchange costs in these thin markets and hasten their evolution toward MAM status.

This report found the following common factors influenced the advancement of niche organic markets:

- *High buyer concentration in local markets.* For example, in the organic dairy industry—a major buyer of organic alfalfa, feed corn, and feed soybeans—the small number of buyers relative to sellers can create an imbalance in market power. Buyers can switch easily among input suppliers, including importers, in some cases.
- *Low buyer and seller commitment.* The study revealed low buyer and seller commitment, with organic livestock operations routinely switching among multiple sources of organic feed carbohydrates while seeking the lowest available price.
- *Price availability and volatility.* Prices in the organic beef market demonstrated a high degree of volatility, in part due to low price transparency, relatively few buyers and sellers, and high vertical integration.
- *Contracts.* The use of contracts has helped organic dairies secure price premiums for raw milk, but contracts obscure market prices. Contracts can also be amended when buyers of the commodity hold bargaining power. For example, some dairy processors amended contracts with farmers to add temporary delivery fees and reduce the organic premium once the supply of organic milk increased.

How Was the Study Conducted?

The study relied on data from the USDA's Economic Research Service (ERS), Agricultural Marketing Service (AMS) and National Agricultural Statistics Service (NASS), as well as information on how these markets operate compiled from a variety of sources including open-ended discussions with organic feed and livestock growers, marketers of organic products, USDA agency personnel, organic market analysts, and other stakeholders. Using information collected from diverse sources on salient issues in these organic market segments, this report used the paradigm of modern agricultural markets to understand whether the sectors examined had characteristics that lent themselves to efficient market outcomes.

Organic Feed Grains and Livestock: Factors That Influence Outcomes in Thinly Traded Markets

Introduction

Despite increasing market shares in several agricultural industries, the organic sector remains a relatively small or niche market, with organics comprising a modest market share for all but a handful of commodities. Most organic markets are considered to be thin, with few buyers and sellers, low liquidity, and relatively few observable transactions (see box, "A Primer on Thin Markets"). This report focuses on the ongoing challenges growers face in markets for specific organic commodities.

Markets with limited transactions are characterized by what economists refer to as the thin market problem (Tomek and Robinson, 1990; Peterson, 2005). First, due to a lack of reliable and consistent data available to market participants, thin markets may not accurately reflect supply and demand conditions (Peterson, 2005). If prices tend to drift away from equilibrium, it may lead to concerns about grower welfare. Second, prices in thinly traded markets can be highly volatile (Hayenga, 1979), exposing participants to considerable price risk (Peterson, 2005). If contract prices are benchmarked to highly volatile prices established in thin markets, this volatility can be transferred to the conventional market and lead to adverse consequences for market competition (Xia and Sexton, 2004; Zhang and Brorsen, 2010). Third, thinly traded markets are susceptible to manipulation (Mueller 1996; Zhang and Brorsen, 2010; Mérel and Sexton, 2017) because the actions of individual agents can influence market outcomes.

The organic market is of particular interest because it has experienced a significant amount of growth, though it remains a small share of the commodity field crop and beef sectors. Organic food sales in the United States grew from $8.05 billion in 2002 to $39.7 billion in 2015 (Willer, 2017), and according to the 2017 U.S. Census of Agriculture, 5 million certified organic acres generated a total value of production of $7.2 billion in 2016. At the same time, certified organic acreage remains less than 1 percent of the total 911 million acres of farmland cultivated nationwide.[2]

A Primer on Thin Markets

The term "thin markets" refers to markets involving a small number of buyers or sellers, low liquidity, and relatively few observable transactions (Hayenga et al., 1978; Hayenga, 1979). Over the last several decades, agricultural markets have been thinning for a variety of reasons. Prominently, there has been an expansion in horizontal and vertical coordination among producers (Adjemian et al., 2016; Saitone and Sexton, 2017; Sheldon, 2017; Sexton and Xia, 2018). Horizontal concentration among buyers means fewer buyers are competing to procure farmers' production. Vertical coordination implies reduced reliance on open-market processes and is most often accomplished through contracting or integration.

[2] California is the leading organic production State with more than 2,000 organic farms cultivating 1.1 million acres, which accounts for 21 percent of the total national organic land area. By comparison, California ranks 16th in total agricultural land and 9th in number of farms (USDA-NASS, 2020).

Another factor causing market thinness is increasingly diverse consumer tastes and preferences. Consumers make purchases based on quality dimensions of products, including inputs used or avoided in the production process (e.g., pesticide-free), animal treatment and welfare (e.g., cage-free eggs), location of production (e.g., local), and "fairness" of marketing arrangements (e.g., Fairtrade International). These attributes—which are often unobservable, save for a label—serve to differentiate markets for products that would otherwise be viewed as homogenous, thus creating submarkets.

Concerns surrounding the performance of thin markets have persisted for decades (Hayenga, 1979; Tomek and Robinson, 1990) and have intensified as agricultural markets become increasingly differentiated. These concerns are threefold:

1. Prices discovered and reported may not accurately reflect supply and demand conditions (Peterson, 2005);
2. Prices in thinly traded markets may be highly volatile (Hayenga, 1979); and
3. Thinly traded markets may be susceptible to manipulation (Mueller, 1996; Zhang and Brorsen, 2010; Mérel and Sexton, 2017).

If these problems are present, they could have a number of implications for market participants. Poor price discovery and manipulation can lead to declines in farmer welfare. Growers may be held up even where there are several buyers if production is tailored to the specifications of a single buyer, exposing growers to opportunistic behavior on the part of the buyer. Volatile prices expose market participants to considerable price risks (Peterson, 2005).

For more information on thin markets, see Adjemian et al. (2016).

Organic food products represent a classic example of what economists refer to as a "credence" good (Darby and Karni, 1973). This is a term used to characterize products for which there is an asymmetry in information between buyers and sellers that, in this case, results from consumers' inability to detect whether the product was produced without the use of synthetic herbicides, pesticides, and fertilizers, or bioengineered genes (GMOs). Markets plagued by informational asymmetries between suppliers and consumers are prone to fraud and opportunistic behavior.

Due to the unobservability of the credence attributes, trust in the integrity of a product and the veracity of organic label claims are imperative for consumers to be willing to pay a price premium for organic products (Golan et al., 2001). For U.S. consumers, trust in organic products is grounded in the U.S. Department of Agriculture (USDA) organic certification process. The National Organic Standards (NOS) and the associated USDA-certified organic seal are vital in signaling to consumers that organic products meet the suite of production and handling practices required for organic certification (see box, "National Organic Program"). The USDA organic regulations define organic agriculture according to a systems approach wherein a "set of cultural, biological, and mechanical practices support the cycling of on-farm resources, promote ecological balance, and conserve biodiversity" (USDA, 2015).

National Organic Program

In 1990 the U.S. Congress passed the Organic Foods Production Act (OFPA) to establish national organic food and fiber production standards. The OFPA mandated that the U.S. Department of Agriculture (USDA) develop Federal guidelines that addressed the methods, practices, and substances allowed when producing and handling organic crop and livestock products. Under the auspices of the OFPA, the USDA, Agricultural Marketing Service (AMS) established the National Organic Program (NOP) (7 CFR 205).

The NOP facilitates domestic and international marketing of fresh and processed foods to assure consumers that products meet consistent and uniform organic standards (7 CFR 205). Through a series of equivalency agreements, the United States has established that imported products from Canada (2009), the European Union (2012), Japan and Korea (2014), Switzerland (2015), and Taiwan (2020) do not have to meet a separate standard.

The legislation that established the NOP also created a national-level accreditation program for certification of compliance with program requirements. Organic certification is handled by State organic programs and private certifiers approved by USDA and is required for individual producers and companies that sell or process over $5,000 annually in agricultural products that they wish to label and market as organic (7 CFR 205.101). The National Organic Standards (NOS) specifically address the methods, practices, and substances used in producing and handling crops, livestock, and processed agricultural products.

For more information on the National Organic Program, see Code of Federal Regulations Title 7 Part 205.

Organic Production and Market Penetration

According to the Organic Trade Association's (OTA) Organic Industry Survey (2018), 5.5 percent of total consumer food purchases, by value, were organic in 2017. However, the degree of market penetration varied considerably across food product categories. Fresh produce commodities held the highest organic share of the total market (OTA, 2018), while organic livestock products lagged significantly behind.

The organic market with the highest market share in 2016 (the most recent year for which complete data are available) was the fresh vegetable category, where nearly 7.1 percent (186,178 acres) of the total acres harvested (2,636,150 acres) were cultivated organically. Organic livestock inventories account for a minimal share of the herds in the United States. For example, organic beef represented only 0.14 percent of total production while organic dairy cows accounted for 2.86 percent of the total dairy herd.[3] Organic forage and feed concentrates represented small shares of the total acreage planted: organic alfalfa 1.7 percent, organic corn 0.25 percent, and organic soybeans 0.15 percent (table 1). Organic feed shortages have been cited as one of the major impediments to the expansion of organic livestock products (Drouillard, 2018).

The organic segment of the produce market in the United States has evolved such that small-scale organic producers primarily market directly to consumers (Greene et al., 2009) while larger scale grower/shippers—who typically cultivate conventional produce as well—market to supermarket retailers. Most organic final-product sales take place through conventional and natural-food supermarkets. This evolution stems from a conventional produce supply chain that was already dominated by large grower/shippers, who expanded into organic production to meet buyers' growing demands for organic produce. These large grower/shippers have the ability to provide assured supply while also providing additional marketing services and incentives to buyers (Dimitri et al., 2003). The economies of scale possessed by these large grower/shippers limits the ability of small-scale producers to participate in the organic segment of produce markets beyond roadside stands and farmers markets.

Table 1
Organic share of total production by commodity, 2016

Commodity	Organic[1]	Total[2]	Share (by percentage)
	Forage and grains (acres harvested)		
Alfalfa	290,809	17,029,000	1.71
Corn	213,934	86,748,000	0.25
Soybeans	124,591	82,706,000	0.15
Pasture/Rangeland	2,304,998	440,606,426	0.52
	Livestock inventories (head)		
Beef cows	42,554	31,170,700	0.14
Dairy cows	267,523	9,368,500	2.86

Sources: [1] USDA Certified Organic Survey, 2016. [2] Alfalfa, corn, and soybeans: USDA Acreage Report 2017; pasture/rangeland, beef cows, and dairy cows: Census of Agriculture 2017.

New organic producers face a major impediment: the 3-year period required for the transition from conventional production to certified organic production. During this time, a farm or ranch must operate in accordance with organic standards but cannot market its production as organic. This transition creates a prolonged period where production costs are generally higher, yields are lower, and producers are unable to earn a premium for organic certification. This represents a substantial sunk investment cost associated with converting a conventional farm to organic production. To assist with this investment cost, the USDA

[3] Fluid milk accounted for the largest organic share of livestock-derived products in the U.S. in 2016, 5.2 percent, according to USDA, AMS Federal Milk Marketing Order Statistics.

Organic Certification Cost Share Program reimburses producers up to 50 percent or $500 of the administrative certification expenses, but capital investments and lost profit during the transition period are not reimbursed. Transitioning producers may also benefit from provisions of the National Organic Initiative under the Environmental Quality Incentives Program (EQIP).

Land is eligible for organic status if no prohibited materials have been used on it for at least a total of 36 consecutive months.[4] Further, land use and material application during the transition period must be documented. Following the transition period, additional sunk investments are required in terms of preparing certification documents and plans and having a certifying body conduct the requisite inspections. Participating in this process gives compliant producers the right to use the USDA third-party certification label. This label is easily identified at the point of sale and provides consumers credible information and assurance of product attributes.

In contrast to the domination of produce markets by large grower/shippers, conventional beef (cow-calf and stocker), forage (alfalfa), and grain producers are primarily smaller, family-based operations. The sustainability of small-scale cattle operations in conventional supply chains suggests likely entry opportunities for small-scale producers in the organic segments of these markets. Further, the persistent shortage of organic feed inputs and importation of organic feed concentrates into the United States also suggests entry opportunities in these markets.

Organic Production Costs and Yields as Barriers to Entry

Higher costs associated with organic production and lower yields incurred without the benefit of an organic price premium during the 3-year transition period are a major barrier to entry into the organic market.[5] For these reasons, returns during the transition period are normally negative (Delbridge and King, 2016; Smith et al., 2011).

Organic producers must implement substantially different production practices (e.g., different seeds, weed and pest management practices, and fertilizers) that increase production costs relative to those of their conventional counterparts (McBride and Greene, 2008; McBride et al., 2015). For example, organic soybean growers may substitute field labor for chemical use (McBride and Greene 2008). The greater use of labor relative to machine technologies reduces economies of scale in organic operations, resulting in their being smaller on average than their conventional counterparts.[6]

The yield gap between organic and conventional commodities is well documented, ranging from 20 to 25 percent across most crops and countries (de Ponti et al., 2012; Seufert et al., 2012; Ponisio et al., 2015; Wilbois and Schmidt, 2019). Over time, some researchers expect this gap to increase as producers convert more acres to organic (Meemken and Qaim, 2018).[7] Collectively, the increased production costs, lower yields, and fixed costs of organic entry contribute to organic farmers facing a higher cost structure relative to their conventional counterparts.

[4] Organic eligibility for livestock and livestock-derived products has some nuances and is discussed in detail in a subsequent section.

[5] A nascent development within the organic industry is to create a separate designation for "transitional organic" products that might enable such products to earn a price premium relative to conventional products and ease the transition to organic. However, transitional organic is a somewhat controversial designation, as some organic trade groups fear that competition from transitional organic products could dissipate the organic premium.

[6] The 2017 Census of Agriculture documented that the average number of acres harvested from a conventional soybean operation was 297 acres, while the 2016 USDA, National Agricultural Statistics Service Organic Survey reported organic soybeans cultivated on average 71 acres.

[7] The yield gap may increase as the organic share grows as production that is less suited to organic practices (e.g., due to pest pressures) is brought into organic production. A counterpoint is that growth in organic production may cause better organic technologies to be introduced and stimulate "learning by doing."

Price and Yield Risk as a Barrier to Entry

Research has documented that organic prices are more volatile than their conventional counterparts (e.g., Oberholtzer et al., 2005; Adjemian et al., 2016; Saitone, 2018), with the thinness of organic markets likely contributing to the price volatility observed in these settings. Organic growers are also likely to face greater yield risks than their conventional counterparts (Smith et al., 2019). Given that organic production practices limit producers' abilities to utilize certain applied inputs (e.g., pesticides, fertilizers), organic growers have a limited arsenal for confronting unexpected growing conditions, such as severe pest infestations (Reganold and Wachter, 2016).

The greater price and yield risk faced by many organic growers means a price premium for risk bearing is needed in addition to the premia needed to compensate for higher production costs and lower yields. Thus, producers considering entry into organic production must anticipate market and production conditions that will support price premiums through time that are relative to conventional production and sufficient to justify the upfront (i.e., transition) costs, greater production costs and lower yields, and price and yield risks.

A key question, thus, is whether organic buyers have an incentive to pay premium prices sufficient to sustain local organic production, or whether they have and will exercise their market power as buyers to depress the organic premium. Additionally, buyers may seek to acquire low-cost organic products from outside the local market (e.g., through imports).

Lack of useful and continuous price data is a major challenge for researchers analyzing whether thinly traded organic markets are operating efficiently and whether farmers are receiving a price that is fair, relative to the value of the production and sufficient to achieve a return on investment comparable to alternatives, such as growing for the conventional market. At this time, there are no futures markets to trade organic commodities, so this widely used source of market information for many conventional commodities is not available to organic growers. Cash market transactions are idiosyncratic and generally limited to volumes produced outside of contract parameters. Although the USDA collects and reports organic prices for a handful of commodities, they are based on thin cash markets and may be unrepresentative of prices specified for contract production (Adjemian et al., 2016). Additionally, due to the thinness of the markets, there may be periods with no price reporting, as well as commodities where no public price information is collected.

Market Access and Spatial Consideration as Barriers to Entry

The organic and conventional versions of a commodity are most often grown in the same geographic area and are thereby generally subject to similar production shocks. In the United States, for some commodities, there is a higher concentration of organic production compared with conventional production in more northern regions, as shown in figures 1 and 3–6, where cold winters help reduce pest pressures.

Because most agricultural products are bulky, perishable, and expensive to transport, procurement markets are generally local or regional in geographic scope (Graubner et al., 2011). Localized procurement markets can easily create scenarios wherein only one or very few buyers compete to acquire the farm product. The geographic overlap, or lack thereof, of conventional and organic production has numerous thin-market implications. First, the conventional market acts as a residual market for surplus organic production beyond a contracted amount.[8] The ability to sell in the conventional market means that the conventional price acts as a floor (i.e., minimum) on the price for organic production in the sense that, if necessary, an organic producer can usually sell in the conventional market. The conventional market is also usually the only market

[8] Though, in practice, only a very small percent of organic production was marketed in conventional markets according to the 2011 Organic Production Survey.

available to producers while they transition to organic production. Therefore, crops produced and sold in the same markets as their conventional counterparts will receive this lower conventional price. Moreover, organic producers who are spatially distant from conventional sales outlets will bear higher costs if they must account for transportation to conventional markets. An organic producer forced to sell in the conventional market beyond the 3-year transition period will likely not succeed because profits from selling in the conventional market will normally not cover the higher costs and lower yields associated with organic production (McBride and Greene, 2016).

For cattle and milk producers, the organic and conventional market overlap is even more critical. Many cattle and some dairy operations run two herds: a conventional herd and an organic herd. This allows cattle that require medications that are prohibited under organic production regulations (e.g., antibiotics) to be transitioned to the conventional herd and contribute to the revenue stream of the operation. Further, organic dairy producers (and some organic cattle producers, depending on the type of cattle they raise) are dependent upon organic forage and concentrates. Thus, an overlap of organic livestock operations and the geographic areas where forage and concentrates are cultivated could increase efficiency and reduce transportation costs for both types of operations.

Modern Agricultural Markets

Crespi et al. (2012), Sexton (2013), and Adjemian et al. (2016) set forth a framework for viewing and evaluating thin markets, referred to as the modern agricultural markets (MAM) paradigm. According to the MAM paradigm, even if markets are thin, they can attain outcomes comparable to a perfectly competitive market when they satisfy certain conditions. In particular, two conditions are necessary for a buyer to engage a set of suppliers capable of producing the volume and quality of product required to meet its needs, and at the same time, offer payment terms to these suppliers sufficient to yield a competitive return on the suppliers' investments:

1. The buyer must be able to retain the production benefit associated with maintaining the farming resources in the relevant geographic procurement market; and
2. Both buyers and sellers must have relatively low discount rates, so they place sufficient value on future economic outcomes (Adjemian et al., 2016).

Both Sexton (2013) and Adjemian et al. (2016) point out that the degree to which growers customize their production to meet the needs of a given buyer has a significant influence on a buyer's decision making in the MAM framework. The more a buyer's future profits are tied to the viability of the suppliers of its farm input, the greater the specificity of the buyer's needs in terms of the farm product's characteristics. Ultimately, buyers in a MAM rationally forego short-run profits that could be gained through using market power to depress farm prices to instead seek mutually beneficial, coordinated production relationships with geographically proximate producers as a way of maximizing returns over a long-run horizon.

A long-run commitment to engage in a particular market is a two-way street, and opportunistic behavior by farmers can disrupt a MAM setting. For example, many malting barley producers abandoned malting barley production in favor of corn during the runup of commodity prices that occurred in 2007–09, coincident with the expansion of the ethanol industry in response to the adoption of the Renewable Fuel Standard. The move from barley to corn disrupted a symbiotic relationship among farmers, maltsters (firms that process malting barley into malt for breweries), and breweries that provided proprietary barley varieties to the farmers (Adjemian et al., 2016).

Organic producers are unlikely to switch to conventional production unless organic market options are unavailable because they have committed substantial resources in undertaking the lengthy and expensive transition to organic production. Meanwhile, buyers of organic inputs likely have a supply chain specifically created for organic inputs and are reacting to demand for their products from final consumers. Research shows that consumers are willing to pay a premium for organic products, particularly for goods with a USDA-certified organic label (Van Loo et al., 2011; Janssen and Hamm, 2012; Lee and Hwang, 2016). The long-run commitment of participants in the organic sector to their industry can represent an essential ingredient to the organic market evolving to MAM status.

Analysis of Thinly Traded Organic Markets

We evaluated several segments of organic markets to gain insight into some of the ongoing challenges that organic market participants may face. We evaluated the markets' current position on the MAM spectrum to understand challenges that may impede them from achieving efficient outcomes and generating sufficient returns on producers' investments to sustain production. In each instance, we examined:

1. *Degree of buyer concentration*—The degree of concentration among organic input buyers is an indication of buyer market power and whether organic producers may be able to engage in long-term (symbiotic) trading arrangements with a buyer, or whether farmers face difficulties in selling their production due to a lack of alternative proximate buyers.

2. *Level of buyer commitment*—If the buyer has credible commitments to trade, such as a processing facility requiring the organic input, they are likely to be committed to the relationship and unlikely to default or engage in opportunistic behavior.

3. *Level of seller commitment*—Similarly, if farmers have made credible commitments to the industry, they are unlikely to default. In the case of organic commodities, the 3-year transition is a classic example of a seller commitment.

4. *Primary exchange mechanisms*—Contracting and vertical integration are widespread in thin markets, limiting the availability of data for regulators and researchers to effectively analyze market conditions. However, contracts and related forms of vertical coordination are also associated with markets that are functioning according to the MAM paradigm.

5. *Price transparency*—Price transparency is highly affected by the primary exchange mechanism. However, availability of price data is highly important and conducive to more symmetric information. When market prices are readily available, farmers can make more informed decisions on whether to enter or exit the market and whether they could be earning higher premiums for their products by exploiting alternative selling opportunities.

6. *Geographic conditions of the market*—Spatial considerations are important to note for several reasons. First, buyers and farmers located in close proximity to each other may signify a well-coordinated and symbiotic production relationship. Second, proximity to conventional markets can provide farmers a secondary outlet.

7. *External factors that influence price determination*—For example, economic conditions facilitating or creating impediments for efficient market outcomes, changes in demand, or changes in government oversight.

The above factors were explored for U.S. organic dairy and cattle markets, as well as major feed inputs (alfalfa, corn, soybeans) to understand whether each market satisfies the tenets of a MAM paradigm: (1) buyers retain production benefit of insuring supplier viability, and (2) both the buyer of farm input and farmers place sufficient value on the future.

Organic Dairy

According to the USDA Organic Survey, as of 2016, California and Texas led the nation in organic dairy production, accounting for a combined 35.5 percent of organic milk sales nationally. California was home to 20.1 percent of organic milk cows in the United States (figure 1), and the average organic dairy in California had 469 milk cows. Texas had 6 National Organic Program (NOP) certified dairies, 11.3 percent of organic milk cows, and an average of 4,617 milk cows per farm. The average organic dairy farm in the Northeast

United States (ME, NY, PA, and VT) in 2016 consisted of 58 milk cows, while the average dairy operation in the Upper Midwest (MI, MN, and WI) was somewhat larger with 72 milk cows.[9] The majority of organic dairy operations (65 percent) were in the Northeast and Upper Midwest portions of the United States.[10]

Organic dairy production differs somewhat across locations due to many factors. The location of organic dairies will influence an operation's decision to grow feed crops on-farm, which may be an important profitability consideration given a dairy's largest cost is feed. The USDA, ERS 2005 Agricultural Resource Management Survey (ARMS) found that feed costs accounted for 65–75 percent of total operational costs (McBride and Greene, 2009b). The survey found that only 16 percent of dairy farms in the West produced corn for grain or silage, and 55 percent produced hay that was fed on-farm (McBride and Greene, 2009b). In contrast, 79 percent of organic dairies in the Upper Midwest grew corn and 93 percent grew hay to feed on their operations. The tendency for organic dairies in the Midwest to grow their own feed inputs may reduce their production costs, but this can have a domino effect on the thinness of organic input markets, as it removes these dairies from the set of operations procuring feed inputs through the market.

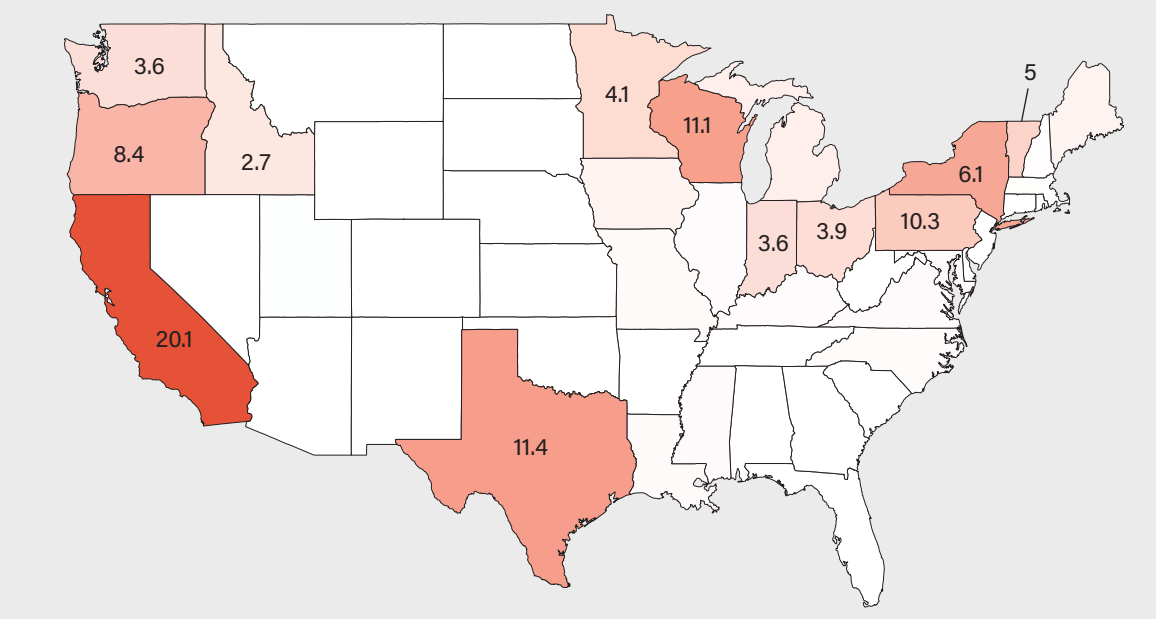
Many of the organic dairy operations in the United States, particularly those in the West and Northeast, transitioned to organic because they were too small in scale to be profitable in conventional dairy production (Pereira et al., 2013; AcMoody, 2019). MacDonald et al. (2020) compared conventional and organic dairies with the same herd size and found organic operations were more profitable for all herd size categories. Much of California's organic dairy production, for example, is concentrated in the Northern Bay Area (i.e., north of San Francisco) and in Humboldt County near the Oregon border, where dairies are too small to be profitable or to compete with the larger dairies in California's Central Valley (AcMoody, 2019).

[9] Data on dairy production, number of cows, and average cows per farm are from the 2016 USDA Organic Survey. Regional definitions were constructed to be consistent with McBride and Greene (2009). A 2012 survey of organic dairy operations in the Northeast (NY, PN, and the New England States) also found that the average operation had a herd of 57 milk cows operating on a farm consisting of 309 acres (Pereira et al., 2013).

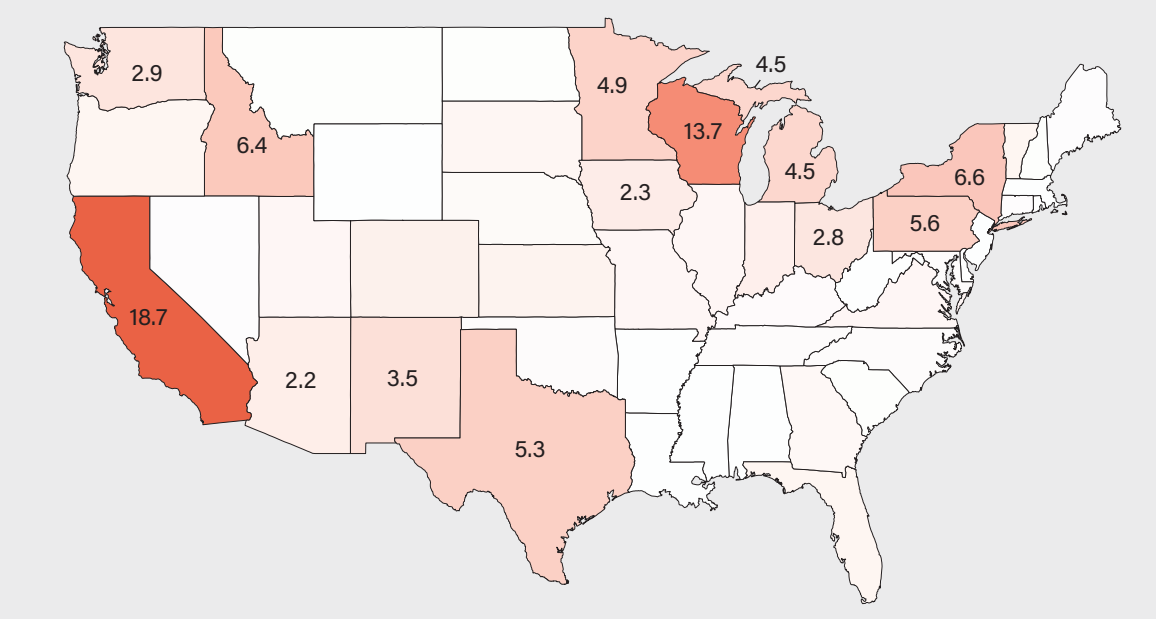
[10] These statistics are based on USDA, Agricultural Resource Management Survey data for a subset of States in the U.S., and some organic dairy producing States (e.g., Texas) are not included (McBride and Greene, 2009b).

Figure 1
Organic and total milk cow inventory in the United States, 2016

Panel A: Percentage of organic milk cow inventory by State



Panel B: Percentage of total milk cow inventory by State



Source: Calculated by USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service Organic Survey and dairy production data.

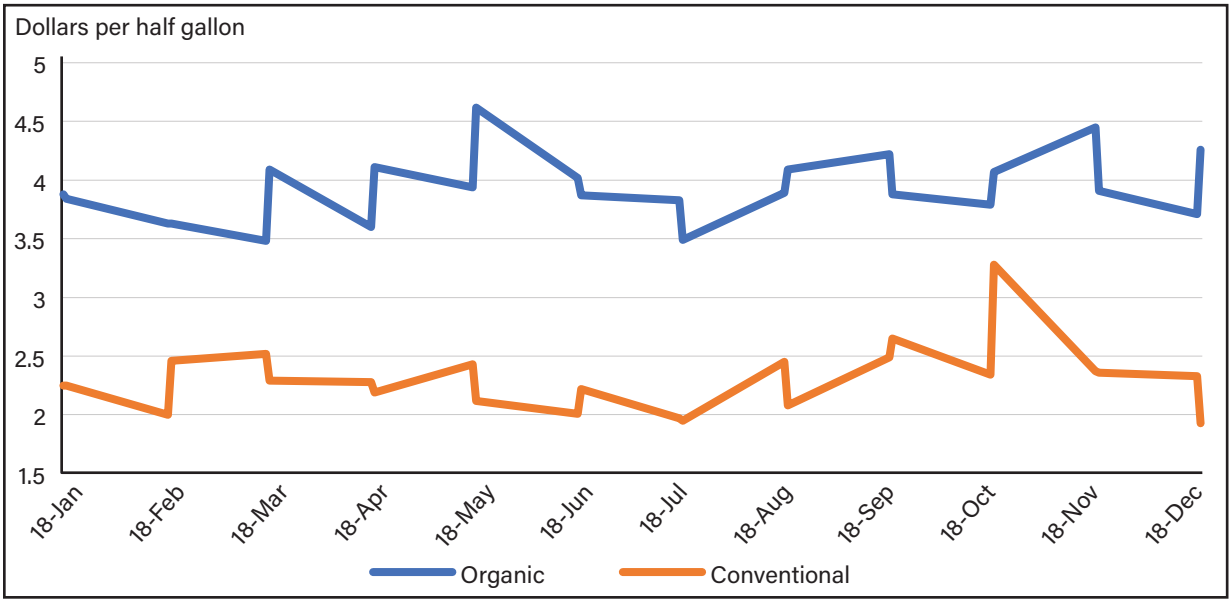
USDA, Economic Research Service (ERS) found in 2016 that organic dairy cows produced 35.5 percent less milk than cows on conventional dairies (USDA, 2016). Organic dairy operations had higher costs relative to conventional dairy–41.7 percent more per hundredweight (100 pounds) than conventional milk production. Specifically, organic dairies experienced both higher feed ($15.66 compared to $9.14) and allocated overhead ($15.33 compared to $7.52) costs per hundredweight (USDA, 2016).[11] Organic dairy operations also

[11] ERS provides a detailed cost comparison of traditional and organic dairy costs found in its 2016 survey (USDA, 2016).

have additional costs associated with the regulations governing animal-based production (see box, "Organic Livestock Requirements"). These factors combined require that organic dairy producers obtain substantial premiums above the conventional price for the milk they produce if they are to be profitable. A survey of organic dairy producers in the Northeast in 2012 confirmed that obtaining a "steady, fair price" for their milk was their most significant challenge (Pereira et al., 2013). Indeed, organic milk does sell at retail for a substantial, although variable, price premium over conventional milk (figure 2), making the farm-retail price spread a key consideration for organic dairies or those contemplating entering.

Although organic operations are likely to continue to be smaller than their conventional counterparts, an organic operation must achieve a minimum efficient scale (i.e., a size sufficient to achieve least cost production methods) to be sustainable over time. MacDonald et al. (2020) evaluated returns to organic production for four herd-size classes (10–49, 50–99, 100–199, and greater than 199) and found average net returns were positive for only the two larger herd classes. The smaller size classes, on average, suffered substantial losses: –$11.77/cwt. of milk produced for operations with 10–49 head and –$2.52/cwt. for farms with 50–99 head. Operations that fail to achieve a minimum efficient scale are unlikely to persist when a market achieves MAM status because downstream buyers will not be willing to engage in long-term procurement arrangements with less efficient suppliers.

Figure 2
Organic and conventional retail milk prices in 2018



Source: USDA, Economic Research Service calculations based on USDA, Agricultural Marketing Service, *Dairy Market News* data.

USDA (2016) reported that operating costs for organic dairies fell with herd size, with costs for those milking fewer than 50 cows about $3.50 higher per hundredweight of milk produced than for those milking over 200 cows. That cost advantage could give them the means to avoid the limitations that geographic location can play in the thinness of the organic dairy market. Smaller operations in the West, Northeast, and Upper Midwest may have access to only a handful of processors that are potential buyers for raw organic milk. In contrast, large organic dairies in Texas have been able to exploit economies of scale to reduce their costs sufficiently to profitably transport their production to other regions of the United States for processing (McBride and Greene, 2009b). Their high production volumes facilitate access to more efficient transportation than is generally available to their smaller scale counterparts. Formal contracting between dairies and processors is the norm in the market for organic milk production where contracts can range from 6 months to 3 years.

Pricing terms vary based on the end products manufactured by the processor (e.g., fluid milk, cheese), with the most frequent terms being a fixed price or a price pegged to a Class III (cheese) price emanating from Federal Milk Marketing Orders, plus a premium for organic production.[12] Pegging the contract price to the price of an actively traded commodity minimizes transaction costs and mitigates some of the concerns surrounding price discovery in thinly traded market settings (Adjemian et al., 2016) and can be emblematic of a MAM if the premiums are set to account for the higher costs of an organic producer relative to their conventional counterpart.[13]

Organic raw milk is generic in the sense that there are not precise specifications associated with organic milk production for a specific processor or particular end use. Given that an organic dairy does not have to make a sunk commitment to a specific processor, organic operators have the ability to contract with available processors in the area or switch processors without altering the product they produce. By the same logic, organic processors also have the flexibility to procure raw milk from alternative dairies without impacting the quality of the end products they produce.

Recent years (2015–18) have eroded long-term relationships established between organic dairy farmers and processors. The generic nature of raw organic milk that enables organic dairies to switch processors (if such options are available) can make a processor reluctant to invest in the long-term viability of its organic producers. After seeing persistent, strong organic premiums for a number of years, more dairies transitioned from conventional to organic production, expanding the available supply (AcMoody, 2019). This increase in the supply of organic milk prompted some organic processors to amend their contracts with temporary fees for milk delivery (i.e., a reduction in the contracted price) while other processors have terminated their contracts, giving producers notice to find a new home for their production. This oversupply of organic milk has occurred at a time when conventional milk prices are also low, limiting alternatives for organic dairies that have lost contracts.

This market evaluation shows two sides to the fundamentals underlying the MAM paradigm. Although long-term symbiotic relationships mitigate processor incentives to exercise market power to suppress raw milk prices, the generic nature of raw organic milk affords organic dairies the opportunity to market their milk to different processors when multiple sales outlets are available. This behavior may augment the organic premium by a few additional cents, but it deters symbiotic buyer/seller relationships from forming. The lack of such relationships is reflected in the cases of processors seeking to squeeze margins of incumbent dairies as new entrants into organic production expand supplies in local market areas. The high concentration of raw milk processors and low incentives for commitment both from the dairy and processor side suggest the organic dairy market does not currently conform to MAM status.

Organic Livestock Production Requirements

In addition to compliance with organic standards that apply to all agricultural products, livestock producers must observe requirements specific to livestock operations:

- *Breeding stock*—Livestock products sold, labeled, or represented as organic must be produced from livestock under continuous organic management from at least the last third of their gestation period (7 CFR 205.236).

[12] The Federal Milk Marketing Order is a complex system of regulations that regulate the prices processors pay for raw milk in different regions of the country.

[13] Organic Valley, an organic dairy-processing cooperative owned and operated by farmers, provides an interesting case study. The cooperative states it is committed to the economic viability of its member owners and, thus, the philosophy is consistent with what we expect to see in a MAM setting.

- *Dairy cows*—Dairy cows must be under organic management (meeting standards for feed and practices listed below) for a minimum of 1 year prior to milking or prior to their milk products being sold as organic (7 CFR 205.236). Dairy cows from non-organic sources that have transitioned to organic milk production cannot be sold as organic at the time of slaughter (7 CFR 205.236).
- *Livestock feed*—All U.S. Department of Agriculture (USDA) certified organic livestock must be fed organically grown and prepared (processed or handled) feedstuffs (7 CFR 205.600). Ruminant animals must consume at least 30 percent of their dry matter intake as pasture or residual forage during at least 120 days (i.e., the grazing season) each year.
- *Livestock health and care practices*—Organic regulations for livestock are focused on promoting organic systems that improve conditions and practices that support health. Certain pain medications and deworming medications can be used in dairy and breeding stock if preventative strategies fail and animals become ill (7 CFR 205.603). If all approved organic health interventions fail, animals must be given all needed or appropriate treatments, but once given a prohibited substance, the animal and products derived from that animal may not be sold as organic.
- *Livestock living conditions*—Livestock producers must establish and maintain living conditions that accommodate the health and natural behavior of their animals. The organic regulations (7 CFR 205.239) stipulate that all livestock have access to outdoor areas, shade, shelter, space for exercise, fresh air, clean water, and direct sunlight.

For more detailed information about organic production requirements, see the USDA's Guide for Organic Livestock Producers and Code of Federal Regulations Title 7 Part 205.

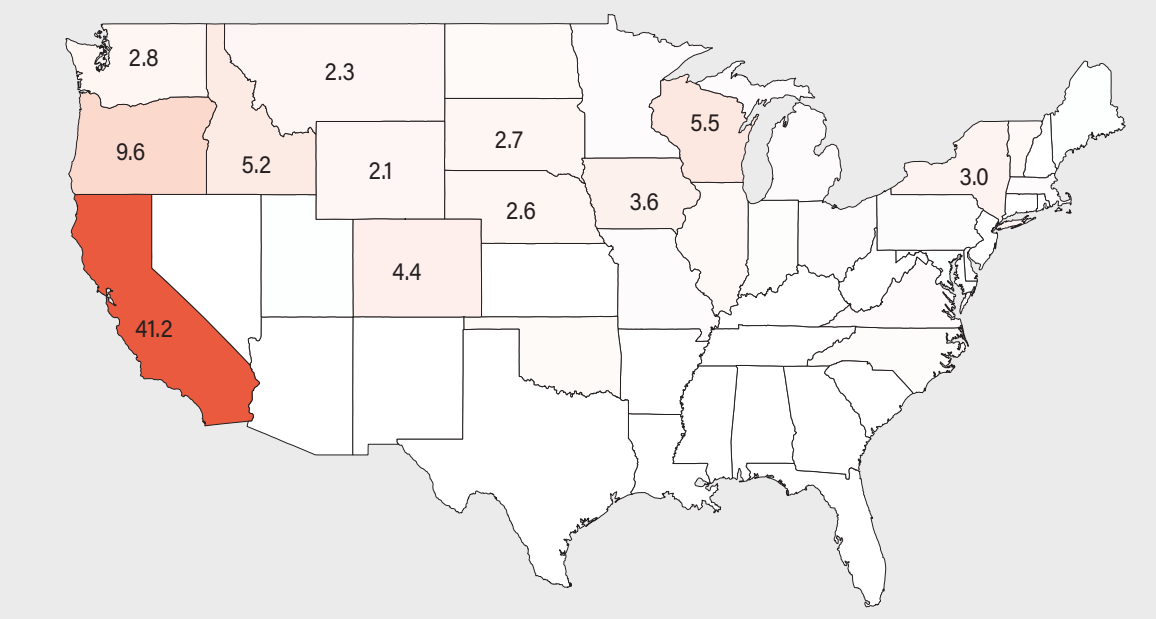
Organic Beef

According to the USDA Organic Survey, the United States certified organic beef cow herd totaled 42,554 head in 2016 (table 1). The beef cow (i.e., breeding) herd dictates the production capacity of the industry. These organic beef cows were maintained on only 360 farms distributed throughout the country. More than 40 percent of the total organic beef cow herd is in California, and 57 of the certified organic beef operations are in California (figure 3). The remaining herds and operations are spread rather diffusely across the country. The total organic beef cow herd in the United States remains very small—only 0.1 percent of the total beef cow inventory as of 2016.

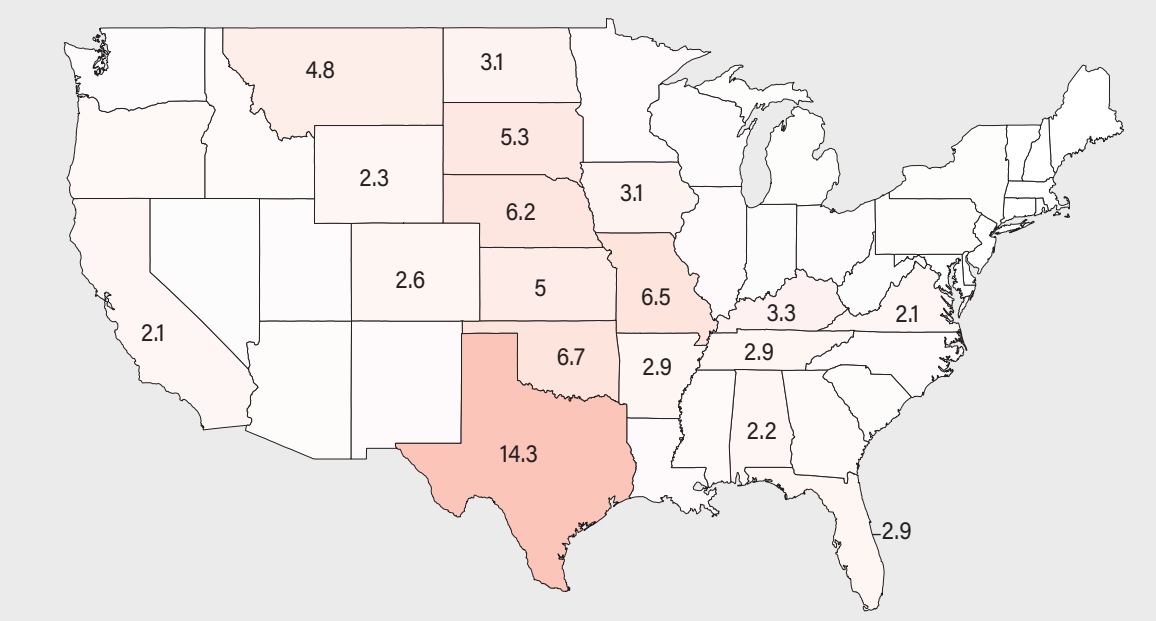
Typically, the conventional beef supply chain in the United States is organized into distinct production stages that correspond to the age of the animal: A cow-calf operation manages a commercial herd of beef cows bred to produce calves; calves are raised at their mothers' sides until they are weaned at roughly 6–8 months of age; calves are sold to stocker operations through local sales yards or satellite video auctions, or retained through the stocker phase; stocker operations feed animals on pasture for roughly 6 months; finally the cattle are sold to feeding operations to add weight before slaughter.

Figure 3
Organic and total beef cow inventory in the United States, 2016

Panel A: Percentage of organic beef cow inventory by State



Panel B: Percentage of total beef cow inventory by State



Source: USDA, Economic Research Service calculations based on USDA Organic Survey and USDA, National Agricultural Statistics Service cattle production data.

Based on discussions with industry participants, the organic supply chain differs from the conventional in that the majority of organic operations are vertically integrated through the processing stage, with processing performed on a custom basis. Organic beef operations typically have a cow herd that produces calves retained by the same operation through the processing stage. The substantial degree of vertical integration in the organic beef segment of the market may be an indication that this market has yet to become well established, or alternatively, that it reflects an efficient production strategy given the specialized nature of this market. If ranchers are unwilling or unable to trust market sources to supply the necessary feed inputs from certified organic sources, they are likely to contribute to the thinness of the market by only entering existing markets

for feed inputs for their limited residual needs. By participating in markets in this way, ranchers, although acting rationally on their own behalf, are contributing to the volatility associated with price discovery because vertical integration reduces market trades, thereby perpetuating thin market conditions.

In addition, these same operations also commonly raise conventional herds of cattle. This provides the operator with the flexibility to transition animals requiring medical treatment not available in the certified organic framework to the conventional herd. Although this insulates organic operations from some of the cattle cycle-related price swings that conventional ranchers face, it creates numerous other challenges.

While organic beef operations are required to use pasture-based feed for a substantial portion of their herd's forage needs, the supplemental feed they purchase is more expensive than non-organic feed (Dalton et al., 2008; McBride, 2009), resulting in higher feed costs. According to Drouillard (2018), the organic beef industry faces a significant barrier to growth as a result of the limited availability of certified organic feed components. In the face of low availability and high expense associated with organic feed rations and of regulatory requirements associated with feeding organic livestock (see box, "Organic Livestock Production Requirements"), a majority of organic cattle feeding operations choose not to use grain-based rations and instead use pasture and hay to add weight prior to slaughter. Adding weight to cattle with grass allows organic producers to comply with organic livestock feeding and living requirements while mitigating their feed-related costs. Reflecting these conditions, USDA data indicate that in 2016 California had only 3 percent of the total pastureland in the United States but had 46 percent of the total certified organic rangeland and pasture in the United States.

The markets for procuring organically raised calves and yearling cattle are extremely thin. For example, Western Video Market (WVM) Auction, the second-largest satellite video auction in the United States, has historically had a very low number of lots of calves and yearlings marketed as organic. In 2017, only 1 percent of calves and 2 percent of yearlings marketed via WVM were certified organic (Saitone, 2018). The premium for organic calves sold at WVM in 2017 was $7.92 per hundredweight (cwt) and $6.60 per cwt for yearlings. While the premium was substantial, there was considerable variance around these averages, reflecting the thinness of these markets and the price risk that participants face, whether as sellers or buyers (Saitone, 2018).

Processing and marketing pose two additional challenges to expanding the organic beef market. Possibly the most significant production challenge faced by organic producers as they work to maintain or expand their operations is finding processing capacity. Processing operations available to small-scale producers are few, and those with the certification and ability to provide credible segregation of organic from conventional head are extremely scarce.

Given that many organic producers retain ownership through the processing stage, marketing may be limited to farmers' markets or niche grocery stores. As operations expand, they may outgrow traditional organic market outlets and need to access mainstream consumer outlets, such as supermarkets. These outlets are likely to be even more demanding in terms of quality and consistency of delivery than direct-to-consumer sales and require more investments and higher costs. For organic operations that rely on grass-based feeding, the potential for inconsistency in supply is exacerbated. Differences in pasture-based forage availability and quality throughout the year create the potential for significant variations in the number of animals ready for slaughter at a given time.

We see little evidence that organic beef production exhibits the characteristics of a MAM. There is little contracting in the main organic beef production area, California, and only a few auction-based sales.

Organic Alfalfa

Organic alfalfa is cultivated primarily in the northern parts of the United States. Idaho, Wisconsin, and Oregon are leaders in organic alfalfa production, with 19.8 percent, 11.2 percent, and 10.4 percent of the total organic alfalfa acreage in 2016, respectively (figure 4). Despite being the leading organic producer, Idaho accounted for only 6 percent (1 million acres) of total acres of alfalfa harvested (figure 4, panel B).

A number of agronomic challenges and soil fertility factors influence the regions in which organic alfalfa can be grown. Given that organic crop production must occur without the use of synthetic herbicides, pesticides, and fungicides (see box, "Organic Crop Requirements"), organic alfalfa production is concentrated in regions where climatic conditions reduce pest and weed pressure. For example, North and South Dakota, Idaho, and higher elevations in California (e.g., intermountain valleys) can cultivate organic alfalfa successfully because low winter temperatures reduce the resident pest pressure during cultivation. At the same time, the relatively dry conditions in the spring and summer months help maintain forage quality.

Organic crop production requirements

The crop-specific organic requirements include:

Land requirements—Areas from which organic crops are harvested must have distinct and defined boundaries and buffer zones (7 CFR 205.202) to guard against contamination by prohibited substances (e.g., synthetic fertilizers and pesticides) used on proximate lands.

Soil fertility and crop nutrient management—Organic regulations require producers to maintain or improve the "physical, chemical, and biological condition of the soil and minimize erosion" (7 CFR 205.203).

Seeds and planting stock—Organic regulations provide guidance for the propagation of seeds, annual seedlings, and planting stock (7 CFR 205.204). Materials used to propagate must be organic unless they are not commercially available, may not be treated with substances that are prohibited, and may not be genetically engineered varieties (7 CFR 205.204).

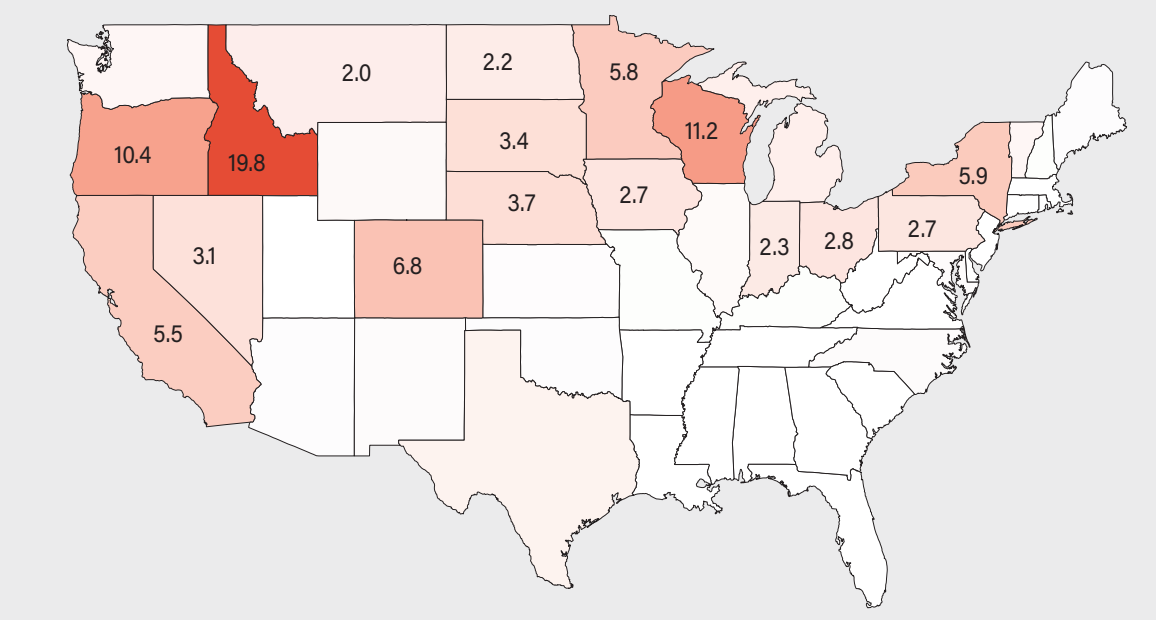
Pests, weed, and disease management—Pest, weed, and disease management is the most significant challenge associated with growing organic crops. The organic regulations stipulate a tiered approach to dealing with all three: (1) prevention, (2) use of mechanic or physical methods, and (3) application of allowed materials (7 CFR 205.206).

Crop rotation—Crop rotation, planting different crops sequentially over time on the same field, is a requirement in U.S. Department of Agriculture (USDA) organic regulations (7 CFR 205.205). The crop rotation mandate is geared toward reducing pest pressure, mitigating soil-borne disease, fixing nitrogen, and increasing soil fertility. Even perennial crops are required to be part of a long-term (15-year or more) rotation strategy.

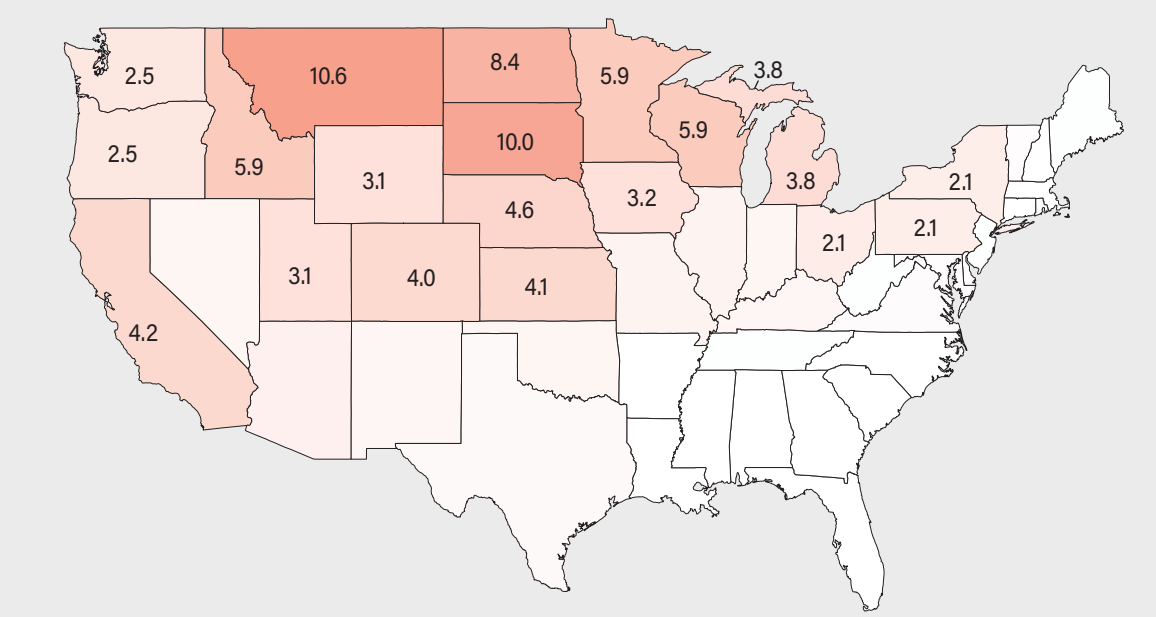
For more detailed information about organic crop production requirements, see the USDA's Guide for Organic Crop Producers and Code of Federal Regulations Title 7 Part 205.

Figure 4
Organic and total alfalfa acres harvested in the United States, 2016

Panel A: Percentage of organic acres harvested by State



Panel B: Percentage of total acres harvested by State



Source: USDA, Economic Research Service calculations using USDA Organic Survey and USDA, National Agricultural Statistics Service alfalfa production data.

Compared with commercial fertilizers, organic manure and compost have relatively low concentrations of plant-available nutrients, increasing organic production costs (Long et al., 2008). Ultimately, locations that require fewer inputs (e.g., fertilizer to provide phosphorus and lime) because of climate or soil health conditions are likely to have significant cost advantages in organic alfalfa production. Given the higher costs associated with farming organic alfalfa, organic farmers must receive a premium over conventional production to at least cover these additional costs to operate profitably. However, the additional requirements to grow organic alfalfa lead to a lower degree of overlap with conventional counterpart markets relative to the other crops considered in this analysis.

Dairy farmers are the primary consumers of alfalfa hay in the United States. Operators of dairy farms can choose to grow their own hay or purchase it from hay growers via spot markets or contracting. Given that the dairy industry tends to be highly concentrated, alfalfa growers are subject to the market dynamics associated with relatively few buyers. The problem is magnified for organic dairies; thin markets for organic milk contribute to thin markets for inputs such as organic alfalfa. Alfalfa contracts are typically annual, established each growing season, and based on a fixed price for a set quantity (e.g., the dairy farm's expected alfalfa needs for the season).

If dairies purchase from farmers, cultivation in close geographic proximity to organic dairies increases a grower's profit potential. When growers sell alfalfa, its price will be highly dependent on quality characteristics and priced according to the relative feed value (RFV), the most widely accepted measure of quality for alfalfa (Putnam, 2019). Depending on the RFV score, the alfalfa is classified as fair, good, supreme, or premium. While organic alfalfa has similar quality profiles to conventional alfalfa, it typically has more weeds as a percentage of total tonnage. Given the inability of organic growers to use synthetic herbicides, weeds are a persistent problem that affects organic price premiums.

Marketing of organic alfalfa differs significantly, depending on geography and, consequently, the price discovery processes are also different across regions. Due to the vast differences in marketing and price discovery of alfalfa markets between the Upper Midwest (e.g., Wisconsin, Michigan) and Eastern (e.g., New York, Pennsylvania) United States, and the Western and Central United States, we discuss the two regions separately.

In the Midwest and East, only about 20 to 25 percent of the alfalfa cultivated is marketed (Putnam, 2019). Many organic dairies in these regions choose to reduce their exposure to volatile, thin-market conditions by cultivating their own forage. This task is made easier given that farmland is less expensive in these areas of the country compared with regions facing population pressures (Undersander, 2019). This has led dairy farmers in the Midwest and East to vertically integrate their dairy operations upstream into alfalfa or other forage inputs such as corn or sorghum for silage. Organic alfalfa is procured through the market only to fill feed gaps or when price differences across feed sources make alfalfa more cost efficient than other forage material in organic dairy rations. If alfalfa is relatively inexpensive, it will be added to rations to increase milk production (Undersander, 2019). Alternatively, if alfalfa is relatively expensive, dairy operations will increase the amount of silage or other feeds high in crude protein and forgo purchasing alfalfa.

Given that alfalfa hay is bulky and expensive to transport, procurement markets tend to be regional in nature. For example, organic dairy operations in Minnesota and Wisconsin procure most of their organic alfalfa from North and South Dakota and Northern Nebraska (Undersander, 2019). Because transportation is expensive, this impedes non-vertically integrated growers from seeking alternative markets. Additionally, given that most of the alfalfa hay is either grown on vertically integrated operations or via contracting, price discovery is virtually nonexistent. Diversified crop/livestock farms in the Midwest and East reflect the goals of organic production systems to cycle nutrients and support biodiversity, but the high rate of self-cultivation (upstream vertical integration) also reflects the difficulties of establishing an organic market. On-farm production of inputs is common when producers do not trust market sources to supply desired quantities and qualities at sufficiently low prices.

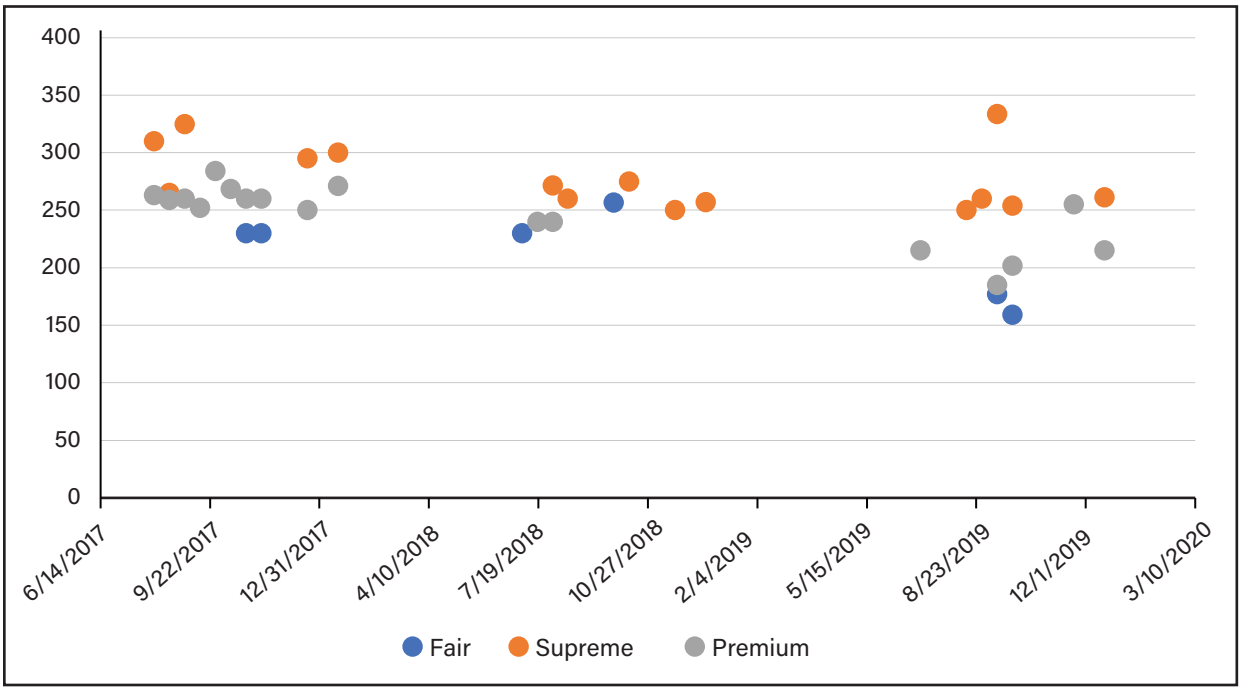
In California and other Western States, about 90 to 95 percent of the alfalfa grown is marketed off-farm, typically sold directly by growers to dairy farmers (Putnam, 2019). Organic alfalfa sales are executed either via direct sales to dairy farms or through brokers. Organic dairies tend to set prices they will pay for organic hay for the season in the summer, unlike conventional hay prices, which tend to fluctuate depending on the quantity of hay available.

Because the western and central U.S. organic alfalfa markets have more participants, there is greater support for price discovery via spot markets, although these markets remain relatively thin when compared to conventional markets. The USDA, Agricultural Marketing Service (AMS) National Organic Grain and Feedstuffs Report publishes alfalfa hay prices for quality characteristics when there are sufficient numbers of transactions in western and central regions to avoid disclosing information for individual operations. For example, the report publishes grower free-on-board (FOB) farm gate prices for fair, good, premium, and supreme quality alfalfa in small, medium, or large squares. The availability of the report provides some guidance on alfalfa pricing and improves price discovery. Figure 5 shows organic alfalfa prices for large stacks of fair, supreme, and premium alfalfa. Though information on prices collected and reported is sparse, sales typically occur during the second half of the year, and prices appear to be relatively stable throughout the year.

Organic dairy operations in California typically procure alfalfa grown in Northern California, Oregon, and Nevada, according to discussions with industry participants. Again, given that hay is bulky, markets are separated by geographic region, limiting sellers' markets to buyers in only a few States. In California and other Western States, hay-growing operations market their hay to brokers or, in some cases, directly to dairy farms. Contracts are rare, and most sales are done on a spot basis.

The two regional organic alfalfa markets differ significantly. Buyer and seller commitment are higher in the western and central regions; vertically integrated organic dairies in the Midwest and East that supply some or all of their own inputs contribute to making the market thin and lowering buyer commitment. These dairies are either nonparticipants in the markets for organic alfalfa or only enter the market to supply their residual needs.

Figure 5
Organic alfalfa prices, grower free-on-board (FOB) farm gate in large stacks, 2017–20



Source: USDA, Agricultural Management Survey *National Organic Grain and Feedstuffs* Report.

Such behavior can also contribute to the volatility of organic alfalfa prices, a key concern in thin markets. Meanwhile, while price discovery remains a concern in the West, some price data are available through AMS. Therefore, while consideration of this market provides little evidence that organic alfalfa production has evolved to the stage of a MAM in either region, organic dairies and alfalfa producers in the West appear to have a more symbiotic relationship compared with their counterparts in the East and Midwest.

Organic Corn and Soybeans

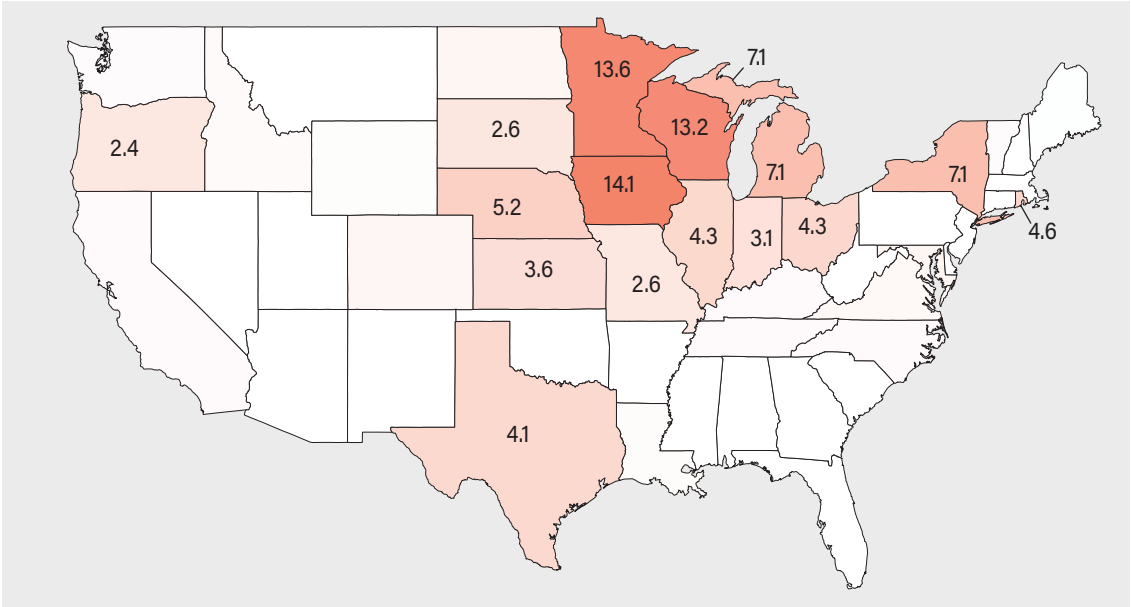
Organic soybean production in the United States increased steadily from 2008 to 2014, before increasing substantially in 2016 (figure 8). Organic corn production has also steadily increased since 2010, but as of 2016—the most recent year for which data are available—accounted for only 0.25 percent of total U.S. corn. The organic corn and soybean markets share many similarities as these crops are often grown on the same operation, as part of the National Organic Program-required crop rotation (see box, "Organic Crop Production Requirements"). Organic soybean and corn production generally match the geography of conventional soybean and corn production (figures 6–7). Organic soybean production share is higher than conventional production in the central and northern Corn Belt States of Iowa, Minnesota, Missouri, Michigan, and Wisconsin, and in both New York and Pennsylvania. Organic corn production share is higher than conventional in most of those States as well and is more concentrated than organic soybean production. Iowa, Minnesota, and Wisconsin produce 40 percent of the United States' supply of organic corn, most likely due to lower pest pressures in these more northern States and their proximity to organic dairy operations in Minnesota and Wisconsin.

In a 2006 survey, organic soybean and corn operations were generally smaller in scale than their conventional counterparts: organic soybean operations averaged 71 harvested acres, compared with a 297-acre average for conventional soybean operations, and organic corn producers averaged 65 harvested acres compared with 297 for conventional corn operations. Organic soybean and corn producers relied upon intensive tilling practices to control weeds, had lower yields, and incurred additional hired labor, repair, and fuel costs leading to higher costs relative to their conventional counterparts (McBride and Greene, 2009a). The smaller economies of scale and higher costs associated with organic grains and oilseeds require that growers receive a significant premium relative to the conventional price in order to be profitable.

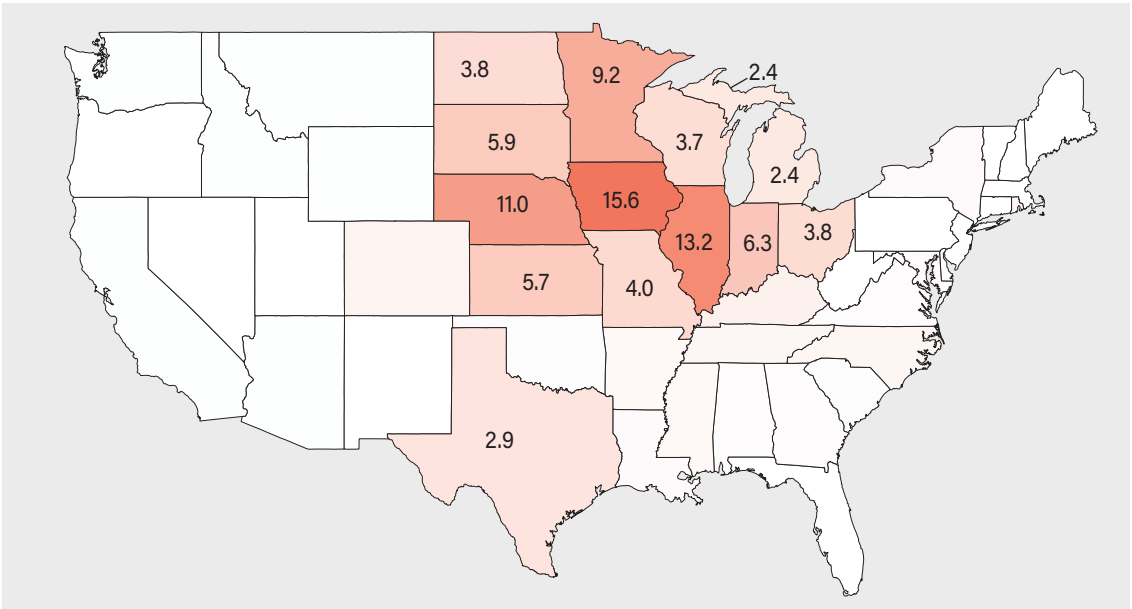
Figure 6

Organic and total corn acres harvested in the United States, 2016

Panel A: Percentage of organic acres harvested by State



Panel B: Percentage of total acres harvested by State

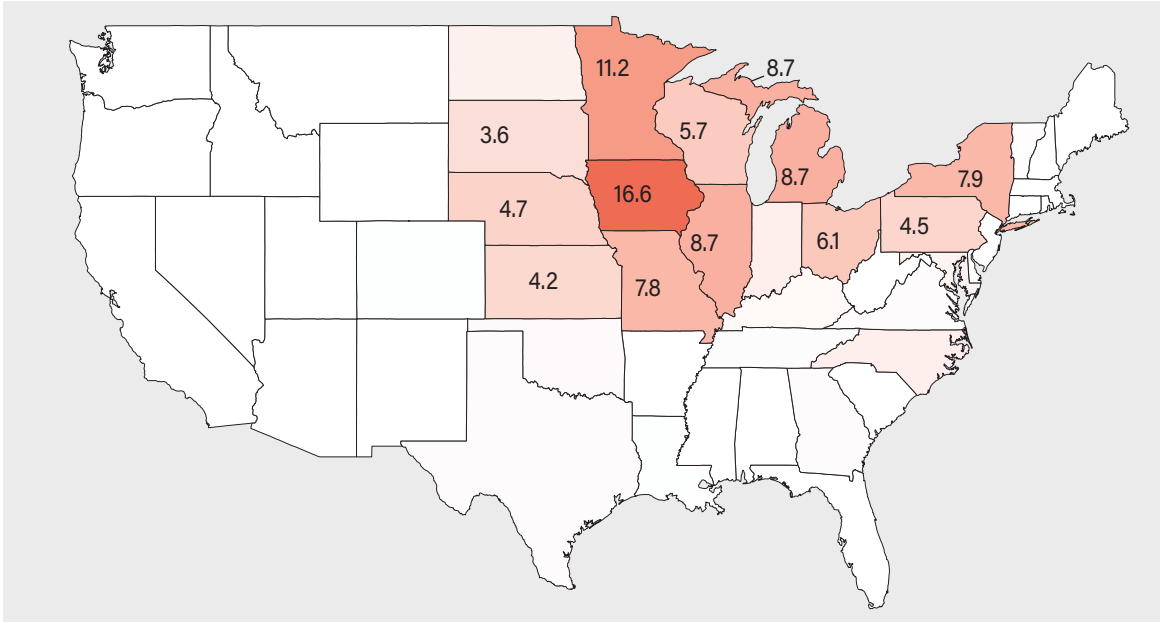


Source: USDA, Economic Research Service calculations based on USDA Organic Survey and other USDA, National Agricultural Statistics Service corn production data.

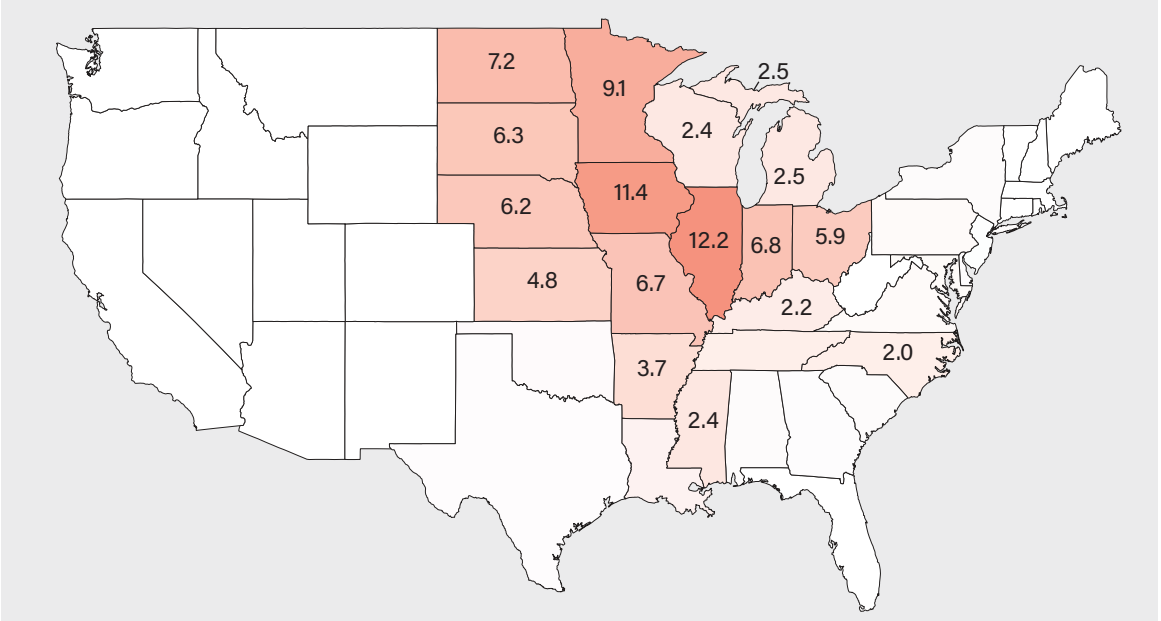
Figure 7

Organic and total soybean acres harvested in the United States, 2016

Panel A: Percentage of organic acres harvested by State

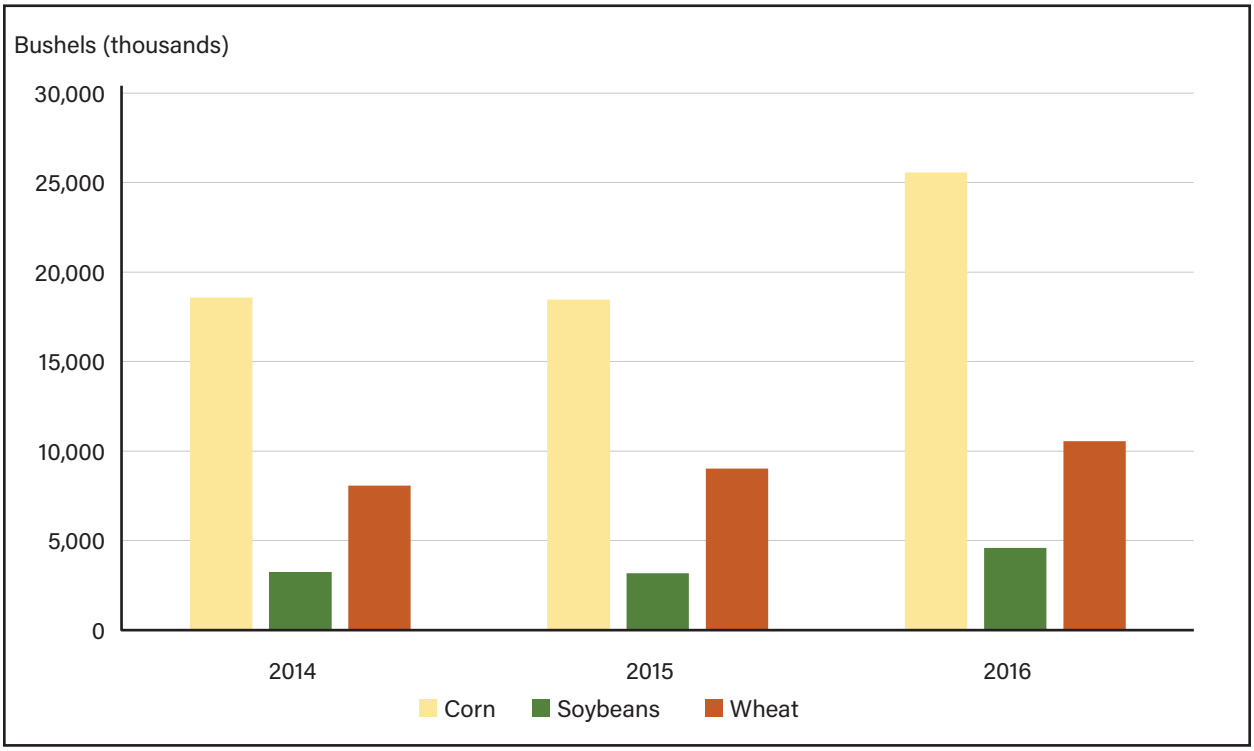


Panel B: Percentage of total acres harvested by State



Source: USDA, Economic Research Service calculations based on USDA Organic Survey and USDA, National Agricultural Statistics Service soybean production data.

Figure 8
Production of organic corn, soybeans, and wheat 2014–2016



Note: Although our case analyses do not include organic wheat, we include data on wheat in this section because of its importance as a substitute feed input for organic livestock operations.

Source: USDA Organic Survey, and USDA, National Agricultural Statistics Service.

The organic soybean and corn markets consist of two separate segments—crops grown for feed and those grown for human consumption. Organic food-grade soybeans and corn effectively have two price floors. The conventional commodity price acts as the first price floor for both organic feed and food crops because, if necessary, the organic crop can be sold in the conventional market. The organic and conventional markets do not tend to arbitrage due to the 3-year conversion period required for a conventional producer to become certified organic.[14]

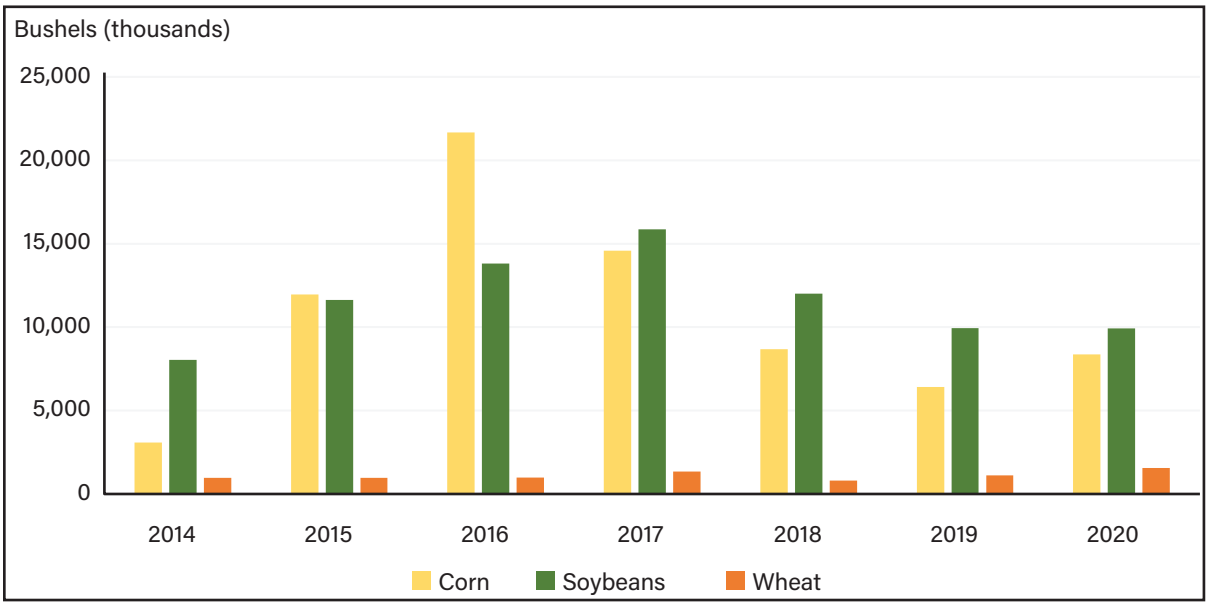
The organic feed price acts as a second price floor for organic food crops, as they could be sold for feed, if necessary. The conventional organic feed and organic food markets are, however, very distinctly based on the additional costs to produce food-grade soybeans and corn and meet supply-chain needs. Organic food-grade soybeans and corn are inputs for foodstuffs such as organic tofu, organic soybean flour, organic corn tortillas, and organic corn grits. These manufacturers require farm inputs with specific attributes to produce final products with desired characteristics. This leads to a closer linkage between buyers and the sellers who can supply these product characteristics, contributing to a market closer to a MAM because both the buyer and seller have high commitment and likely put a high value on future bilateral trade. Industry contacts emphasized the importance of trust among participants in the organic segment. Downstream buyers of organic food grains and soybeans themselves assume responsibility for the organic purity of the products they buy. Thus, the buyers value reliable sellers who have USDA organic certification. Such relationships built on mutual trust and dependencies are characteristics of markets that are evolving toward MAM status.

[14] Arbitrage refers to the process of strategic buying and selling to exploit profit opportunities created due to prices being out of a competitive equilibrium alignment. The 3-year transitional period for conventional operations shifting to organic operations limits arbitrage opportunities because producers cannot sell into the organic segment until they complete the transition. Organic sellers can, conversely, sell in the conventional market, which is why the conventional price constitutes a floor for the organic price.

In the feed-grain market, buyers—such as organic dairies—cannot substitute the conventional product for the organic product, regardless of the organic premium. However, there may be opportunities to substitute alternative organic grains or oilseeds. For example, organic dairies can purchase a different carbohydrate, such as feed wheat or imported feed grains, in place of domestically produced corn if the price difference is sufficient to warrant the switch. On the supply side, organic feed corn growers prefer to keep the organic feed corn acreage fungible (i.e., not contracted ahead of planting) to preserve rotation options and adjust plantings in response to price signals. This propensity to substitute on the part of both buyers and sellers leads to low commitment on both sides in the organic feed corn market, inhibiting the progression of these markets toward MAM status.

Organic grain and oilseed brokers and processors search for opportunities to arbitrage U.S. and foreign markets by importing products when prices diverge above shipping costs and risk premiums (figure 9). This competition from imports is a persistent factor that contributes to the thinness of domestic feed markets. Traders arbitrage oilseeds based on freight charges from international competitors in Eastern Europe, South America, and China and the risk premium associated with the probability of pest-related rejection of a shipment. Black Sea countries, Argentina, and India are major sources of organic imports of corn and soybeans, with countries both exporting their own products and re-exporting products from other countries in the region (Demko et al., 2017). When import volume increases, this puts downward pressure on domestic prices, bringing U.S. organic prices down.

Figure 9
Imports of organic corn, soybeans, and wheat, 2014–18



Note: Import data for yellow dent corn, soybeans, and durum wheat. Import numbers do not include imported seed.

Source: USDA, Foreign Agricultural Service, Global Agricultural Trade Systems database.

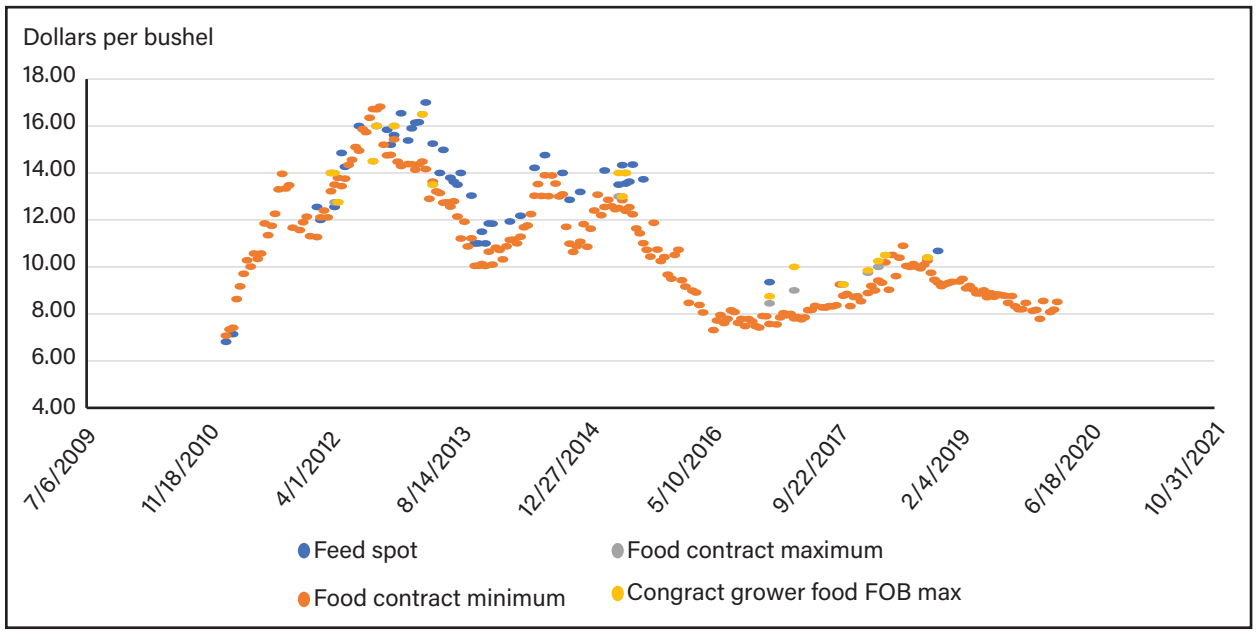
An additional issue in the import of organic soybeans and corn is fraudulent organic imports, which came to light in 2016 when Perdue AgriBusiness rejected a 46-million-pound shipment of organic corn in Wilmington, DE. Later that same year, a shipment of 36 million pounds of organic soybeans originating from Turkey and Ukraine, which had been treated with a pesticide prohibited under organic standards, ported at Stockton, CA (Whoriskey, 2017). Reported imports of organic soybeans and corn declined in 2018,

with corn imports having declined the previous year, too, after peaking in 2016.[15] Maintaining the integrity of the organic standard and lower dependence on organic soybean and corn imports would both be required for the domestic organic feed sector to develop into a MAM. Buyers who are motivated to reduce costs by acquiring an imported product, though acting rationally in terms of pursuing lower input costs, pose risks for domestic producers and impede the evolution of organic grain and oilseed markets toward attaining MAM status.

The differences in arbitrage and thinness of each market tie back to how the food- and feed-grade organic grains and oilseeds are marketed and to price transparency. Discussions with industry participants, in combination with a review of AMS data, reveal food-grade soybeans and corn are mostly contracted, while feed-grade soybeans and corn are typically sold on the spot market (Raszap Skorbiansky and Adjemian, 2021). The choice of marketing mechanism once again illuminates the path toward a MAM. Organic food-grade corn and soybean purchasers require specific commodity characteristics to meet their desired final-product quality. Entering into contracts with growers capable of efficiently supplying these product attributes is a sensible way to secure the supply of these inputs and tends then to create the long-term relationship between buyer and sellers—a central characteristic of a MAM.

The extensive use of spot or cash markets for organic feed grains leads to more publicly available data for this market segment, thus removing some concerns about the thinness of these markets. The USDA, AMS National Organic Grain and Feedstuffs Report publishes organic corn and soybean food and feed grain spot and contracted prices. While these biweekly data are limited, there is higher price transparency in the two spot feed markets (figures 10–11), as indicated by the much greater frequency of observations for these markets. However, these same figures also document greater volatility in the feed market relative to the food market, especially for organic soybeans.

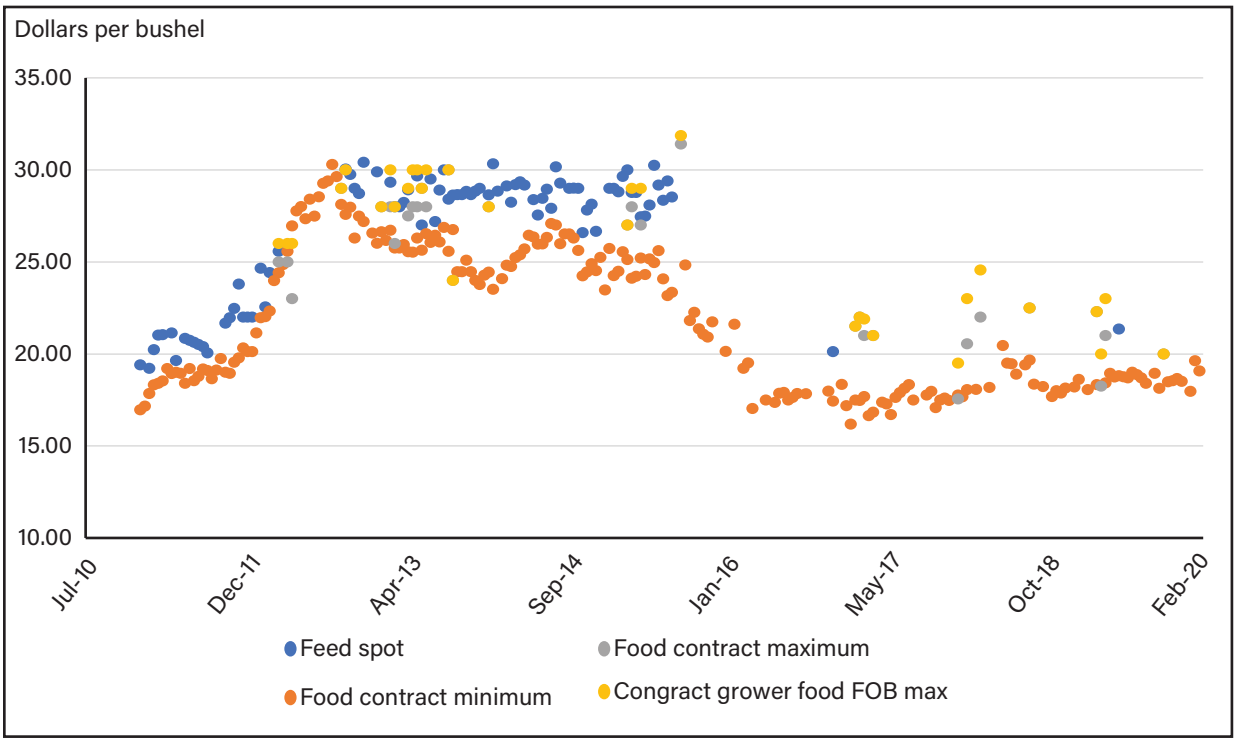
Figure 10
Organic corn prices



Source: USDA, Agricultural Marketing Service, *National Organic Grain and Feedstuffs Report*.

[15] At least part of this decline was due to the reclassification of some imports. In 2018, organic corn imports from Turkey and organic soybean imports from India entered the U.S. under the "worked corn" and "soybean cake" code due to phytosanitary requirements, a factor in the recent trend in decreasing exports.

Figure 11
Organic soybean prices



Source: USDA, Agricultural Marketing Service, *National Organic Grain and Feedstuffs Report*.

Conclusion

This report used a market studies approach to consider ongoing issues in several organic markets. These issues potentially impede growth in each market and limit the associated sector's ability to operate efficiently and offer stable returns on investment to participants in the market. Throughout, the authors have stressed that the evolution of local organic markets toward meeting conditions described in the modern agricultural markets (MAM) paradigm is a factor to be considered by potential organic producers. Key elements of MAM are that buyers retain production benefits of ensuring supplier viability and that both the supplier of farm inputs and farmers place sufficient value on the future. If both tenets are met, the market will perform efficiently, and the factors associated with thin markets that cause inefficient allocations of resources are likely ameliorated. If one or both of these tenets is not met, the market is still in a state where production may not be efficiently allocated and sellers may not receive compensation commensurate with the production benefit they are generating.

Organic markets that are evolving toward MAM status likely present lower risks and greater potential for organic producers to establish mutually beneficial relationships with organic buyers that can help ensure the success of organic conversion. On the other hand, markets that are not on the path to MAM status may present considerable risk to participants.

Organic dairy markets may be closest to MAM status, given that organic milk producers and processors have typically maintained mutually beneficial medium to long-term contracts to supply and process organic milk. With base milk prices generally regulated by the Federal Milk Marketing Order system, premia for organic production above those base prices are more transparent. However, where growing numbers of organic dairy producers have increased the number of suppliers, or in some cases where additional organic processing facilities have opened, the balance of buyers and sellers has changed. The mutual commitment to long-term established relationships that sustained each other's viability may be eroded, introducing greater volatility and greater risk to organic dairy producers. While large-scale producers may be able to absorb the cost of competing, smaller scale producers have few alternatives to accepting lower returns if local processors reduce the prices paid through their contracts.

In response to thin markets all along the production and processing chain, organic beef markets have vertically integrated, precluding the development of MAM. While vertically integrated operations avoid the risks in those markets, they may have limited outlets for their custom processed products, as well as relatively high costs that limit entry by producers who do not have the capacity to operate on that model.

Vertical integration also impacts the production of organic feed, particularly alfalfa hay. Where organic livestock producers have limited access to organically grown alfalfa, especially in the Northeast and Midwest, vertical integration of hay and other feed production limits the potential for new suppliers to enter the market. In some cases, producers who need to purchase some of their organic corn and soybean feed have turned to imports, a rational choice for producers that comes with the consequence of weakening demand for domestic production.

Thin markets, and the associated lack of market participation, may be offset through increased use of contract production. Contract production is a marketing arrangement common to MAMs. A possible policy approach to facilitate contract production in thin organic markets could be to remove barriers to the execution of mutually beneficial buyer/seller agreements. Adjemian et al. (2016) identified two potential policies that might accomplish that: (1) policies that standardize contracts to reduce transactions costs, benefitting smaller scale producers for whom those costs may be relatively high and (2) mandatory price reporting to balance the information available to both buyers and sellers, although they add that reporting a range of prices linked to particular characteristics might provide a better basis than a simple average price for producer bargaining based on product qualities. While organic dairy, beef, and related feed markets will likely continue to face the supply chain challenges that foster thin markets, market mechanisms embodied in MAMs may in some cases offer a viable alternative structure.

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