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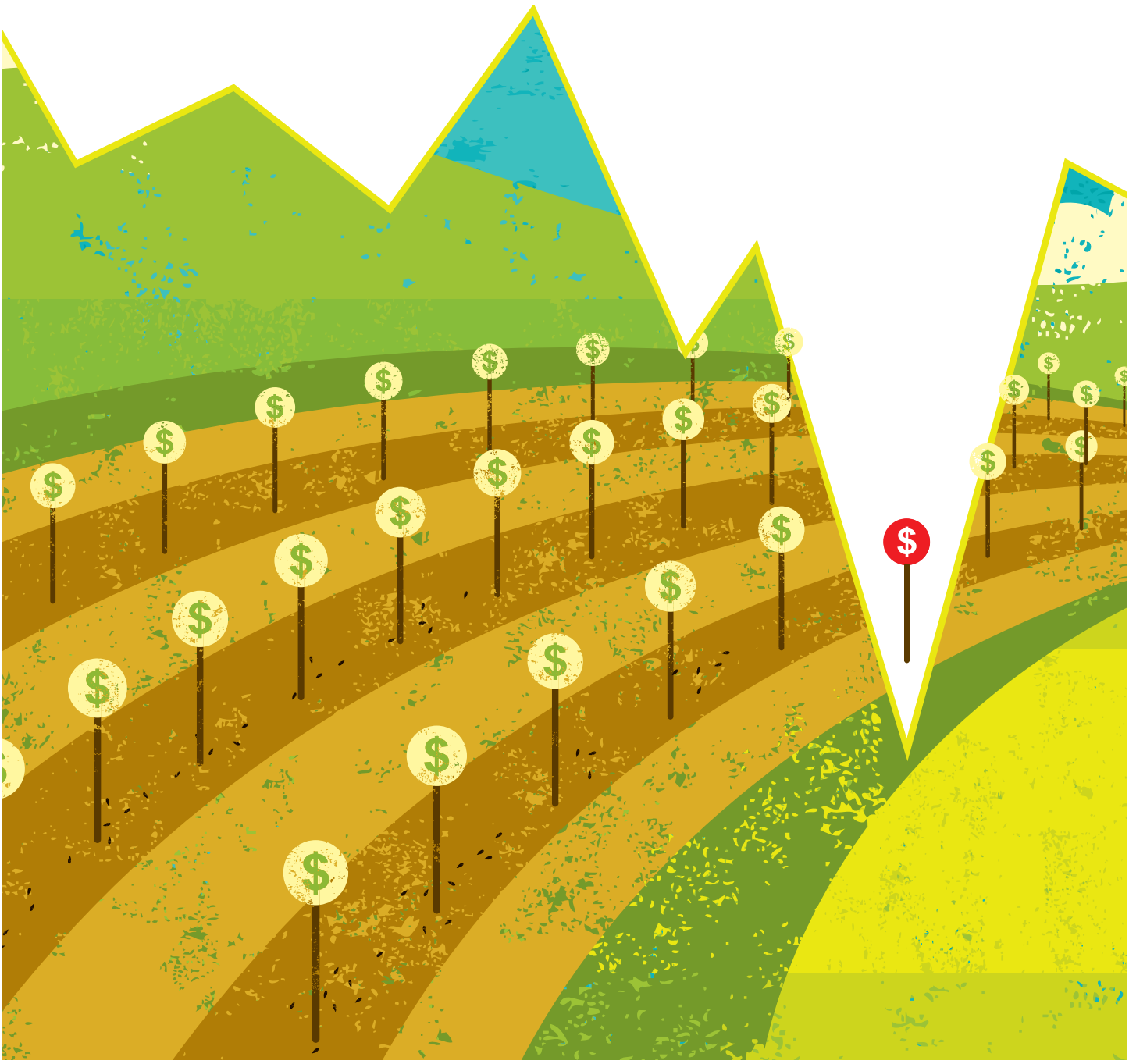
Thinning Markets in U.S. Agriculture

What Are the Implications for Producers and Processors?

Michael K. Adjemian, B. Wade Brorsen, William Hahn, Tina L. Saitone, and Richard J. Sexton



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Abstract

Concentration levels in U.S. agriculture are high and rising. As downstream competition declines, marketing opportunities for producers are constrained to—in some cases—a single buyer. Processors in thin markets (those with few purchasers, low trading volume, and low liquidity) could use informational advantages to depress farm-level prices for commodities (compared to a competitive market). Moreover, the low volume of trading in thin markets makes it difficult for participants and observers to gather market information and assess market performance.

At the same time, many markets are moving away from traditional cash markets to bilateral contracts and vertical integration, which offer more opportunities for coordination and may foster efficiency gains that ultimately benefit producers. Both methods resolve information problems not addressed by the cash market, and forward-looking processors in many thin markets pay producers high enough prices to ensure a stable input supply. Thin market producers who can successfully enter and maintain contracts with these processors can achieve returns that meet or exceed their longrun costs.

Attempting to impose greater competition on naturally thin markets can have adverse consequences for producers, processors, and consumers. However, small producers face new challenges in a thin market environment.

Keywords: Thin markets, farm prices, competition, coordination, market power, contracts

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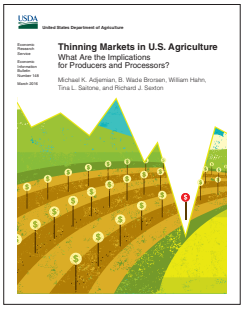

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Thinning Markets in U.S. Agriculture

What Are the Implications for Producers and Processors?

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What Is the Issue?

U.S. agricultural production is growing more concentrated or *thin* (few purchasers, low trading volume, and low liquidity), reviving longstanding tensions between producers and processors and raising concerns that producers may not be getting a fair price due to less competitive market conditions. According to economic theory, processors who have market power (little competition) could increase their profits by simply lowering the prices they pay to producers. There have also been concerns that low trading volume and liquidity in thin markets could lead to heightened price volatility due to impaired price transparency and price discovery (how new information about supply and demand affects market prices). Reduced price transparency also complicates USDA's efforts to administer price support and crop insurance programs in thin markets.

Furthermore, contracting and vertical integration are growing more popular than traditional cash markets for thin commodities, leading to additional questions of fairness to producers. Alternative exchange mechanisms like these lead thin markets to provide less data for market observers and regulators to use, analyze, and publish, so producers are left to wonder whether they are being paid a fair price in a shrinking cash market or in bilateral contracts.

What Did the Study Find?

Despite sharply increased concentration in many U.S. agricultural markets, most research finds that it has had negligible price impacts. Even in shortrun theoretical models, greater concentration does not necessarily mean significantly lower prices to producers. Most agricultural processors are forward looking; they consider their profits over the medium and long run. Therefore, processors have substantial incentives to form mutually beneficial, long-term relationships with producers and to pay at least the price that would be generated by a competitive market. This keeps their favored suppliers in business and ensures efficient processing and a stable supply of outputs for their own buyers.

In addition, the increased coordination between producers and processors afforded by bilateral contracts reduces costs of production and opportunity costs of inputs, and transmits more information about consumer demand than traditional cash markets. Both of these outcomes increase total returns to producers and processors.

Although forward-looking processors have strong incentives to pay at least a competitive price, the lack of transaction transparency in thin markets can lead to suspicion by producers, who have access to far less information than processors. This lack of transparency also complicates regulatory efforts to support producers and insure crops, as regulators may not know how much support to offer producers or how to fairly price crop insurance. Financial distress, a declining market, and higher uniformity of farm products also make shortrun profits via market power more attractive to processors (even though this can lead farmers to instead plant alternative crops, degrading longrun processor returns). Additionally, smaller producers can be left behind in thin markets due to the transaction costs associated with contracting and scale economies in production.

Given the efficiency gains afforded by coordination, attempting to impose competition by limiting vertical integration or contracting practices could have negative consequences for producers, processors, and consumers. However, targeted policies to address potential negative effects associated with thinning markets could include: (1) facilitating contracting by establishing a common contracting format in each market that uses clear language to communicate terms, reducing transactions costs and improving the footing of small producers; (2) improving data collection and dissemination of information on prices and price mechanisms, quantities transacted, and the size and number of market participants; and (3) providing production and marketing advice to producers through public extension services.

How Was the Study Conducted?

This report describes the thinning of U.S. agricultural markets and the factors driving that trend, drawing on data from the USDA's Economic Research Service and National Agricultural Statistics Service. It also reviews academic literature for evidence of market power among commodities with few buyers and develops a theoretical model of processor behavior to describe when processors may choose to forego thin market power. Several policy options to address thin market issues are discussed, along with their potential consequences for market participants.

Thinning Markets in U.S. Agriculture

What Are the Implications for Producers and Processors?

Introduction

U.S. agriculture has routinely been cited as an example of perfect competition (Stengel, 2012)—i.e., a market structure where many sellers and buyers, none large enough to sway prices and free to enter or exit the market, buy and sell a similar product. While it's true that the markets for some agricultural commodities display more of these characteristics than other industries do, concerns over the power that marketing firms hold over producers is longstanding (Nourse, 1922). In 1919, the U.S. Federal Trade Commission published an influential report that was critical of the influence over prices held by large packing firms (and the practices employed by them). This culminated in the 1921 Packers and Stockyards Act (PSA) and a regulatory framework for livestock marketing that emphasized the value of competition among processors[1] for promoting producer welfare. President Harding signed the Capper-Volstead Act in 1922, supporting the formation of marketing cooperatives by producers as a counterweight to the power of large agricultural buyers.

Despite the bulk of empirical evidence gathered over the ensuing decades showing little evidence of processor market power in U.S. agriculture (Azzam and Anderson, 1996), these concerns persist and have intensified due to recent trends in the supply and demand of agricultural products.[2] Over the course of the 20th century, capital-intensive technological improvements vastly increased the production of agricultural goods, while the advantage of scale efficiencies led to increased market concentration at the farm, processing, and retail levels. The number of farms accounting for half the value of all sales of several major U.S. commodities fell by at least 50 percent from 1987-2012 (table 1). Likewise, increased U.S. retail concentration is depicted in figure 1 (Elitzack, 2014).[3]

Table 1
Number of U.S. farms accounting for 50 percent of all sales, 1987-2012

	All products	Cattle and calves	Hogs and pigs	Poultry and eggs	Dairy	Grains and other crops*
1987	75,682	39,879	15,017	12,776	11,828	40,904
1992	61,673	30,178	9,844	11,109	8,551	32,137
1997	46,068	20,083	6,769	10,138	5,565	21,281
2002	34,085	14,314	4,850	7,116	4,841	13,852
2007	32,886	14,414	4,701	7,311	4,786	16,291
2012	33,330	12,879	4,465	6,123	4,211	20,197

Source: USDA, National Agricultural Statistics Service, *Census of Agriculture*, 1987-2012.
* "Other crops" includes oilseeds, dry beans, and dry peas.

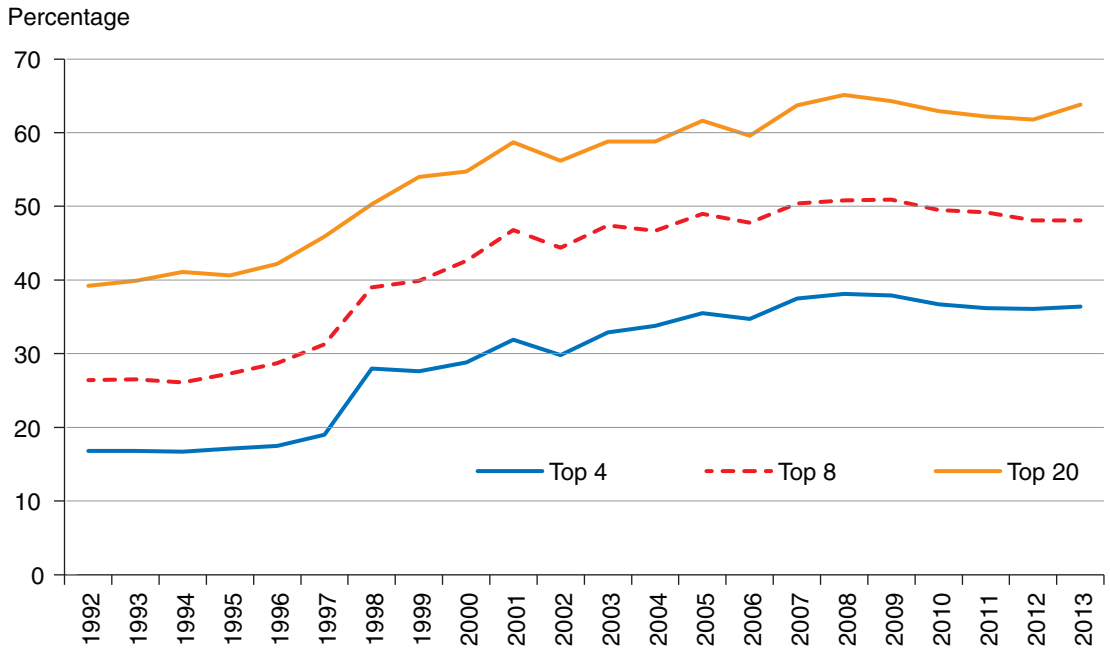
[1]The terminology for downstream buyers varies based on the industry: packers, handlers, shellers, etc. We use the generic term *processors* unless a more specific term is applicable to the industry under discussion.

[2]Several recent joint USDA & U.S. Department of Justice workshops on competition and antitrust enforcement in U.S. agriculture document widespread producer concerns about scarce marketing opportunities and their implications (U.S. Department of Justice, 2010a; 2010b; 2010c; 2012).

[3]For more information about increased concentration in production, processing, and retail markets, see the *Concentration in Agriculture* report (U.S. Government Accountability Office, 2009).

Figure 1

Concentration in the value of sales among U.S. food retailers, 1992-2013



Source: USDA, Economic Research Service, "Slow Sales Growth and Increased Company Acquisitions Impact U.S. Food Retailing," *Amber Waves*, 2014.

Changes in consumer preference further segregate markets—rising incomes allow consumers to express more sophisticated and varied tastes. One hundred years ago, U.S. consumers didn't go to the market to look for organics, seek out free-range or environmentally friendly products, or ask about where a product was grown or raised. New facets of demand open new opportunities to producers, but they also serve to further concentrate the industry as fewer producers fill each niche. Today, large agricultural firms seek to process or market differentiated farm products aimed at diverse consumer preferences, and consequently, producers have fewer potential buyers.

To better coordinate agricultural production in a modern, dynamic retail environment, participants in many commodity markets have searched for marketing alternatives to the traditional, local cash market. The two most common approaches are bilateral contracting and vertical integration (MacDonald and Korb, 2011). Contracts provide producers and processors with attractive features like risk sharing, lower search costs, cost sharing, and farm product customization, while vertical integration brings producing and processing under one roof. In both cases, the processor has increased control over the production process, shaping it to better meet consumer demand.

Although thin markets—those with few buyers, low trading volume, and low liquidity—raise serious questions about processor market power over price setting in the framework of the traditional static, competitive market model, researchers have documented substantial efficiency gains (in the form of lower per-unit production costs and higher outputs) tied to improved levels of coordination in American agriculture (where stable contractual relationships dominate). On the other hand, increased market concentration means that fewer traders are making fewer observable transactions. Market observers and regulators find less data to use, analyze, and publish, and producers are left to wonder whether they are being paid a fair price in a shrinking cash market or in contracts where price benchmarks may not be available. Additionally, because the contracting process involves real transactions costs, it poses several new risks to some thin-market producers.

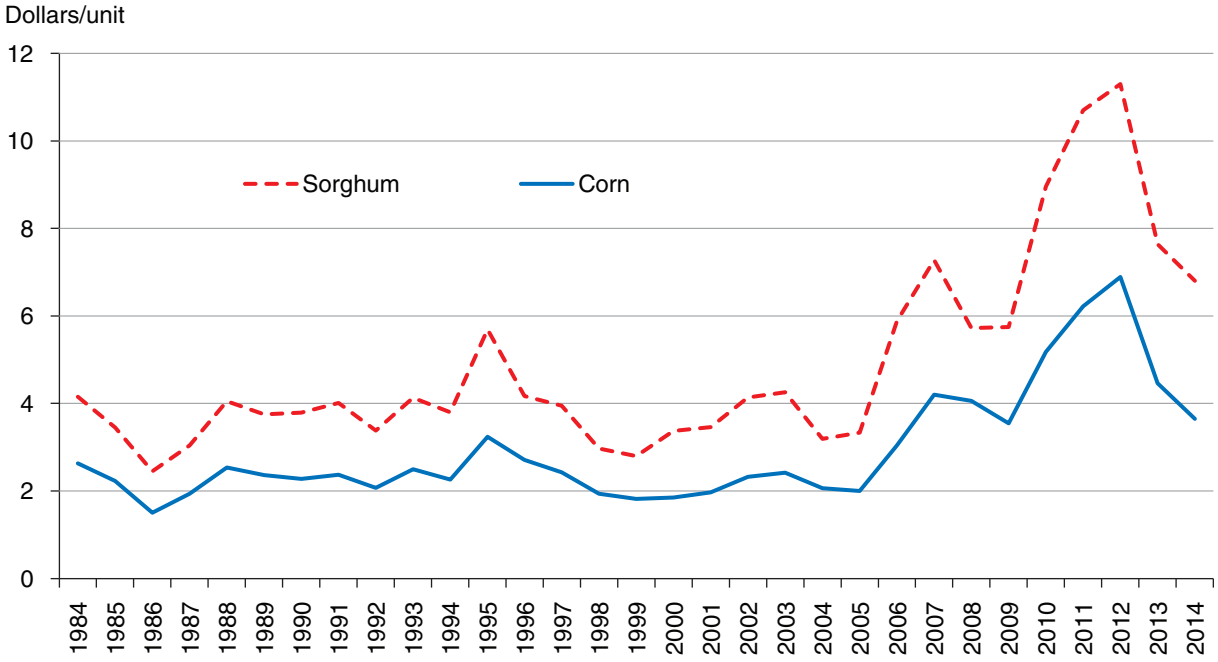
What Are Thin Markets?

Economists refer to markets as thin when they have a small number of buyers and/or sellers, low liquidity, and relatively few observable transactions (Hayenga et al., 1978).[4] If market thinness is conceived as a spectrum, commodities with popular cash markets and liquid derivatives markets (like futures and options), where products or contracts are repeatedly traded and prices are determined, would be at one end (i.e., thick markets). The price determination process is known as price discovery—thick markets have more efficient price discovery and market information is easier to observe.

At the other end of the spectrum, very thinly traded commodities have a weak cash market—or perhaps no cash market at all—and no related derivatives. Market data are not public and are difficult to obtain. As a result, the price discovery process for thin commodities is not well understood by outsiders (and, oftentimes, by many insiders).

In the middle of the spectrum, some commodities have cash market activity but nonexistent or inactive derivatives. Their prices are often benchmarked to the price of a related commodity. For example, as a substitute feed grain, the price of sorghum is closely tied to the price of corn (fig. 2)—so much so, in fact, that the old Chicago Mercantile Exchange and Kansas City Board of Trade grain sorghums futures contracts withered as traders realized they could effectively hedge sorghum cash price risk using far more liquid corn futures contracts (Hieronymus, 1977; Kennedy, 2012).

Figure 2
U.S. prices received for sorghum ($/hundredweight) and corn ($/bushel), by marketing year, 1984-2014

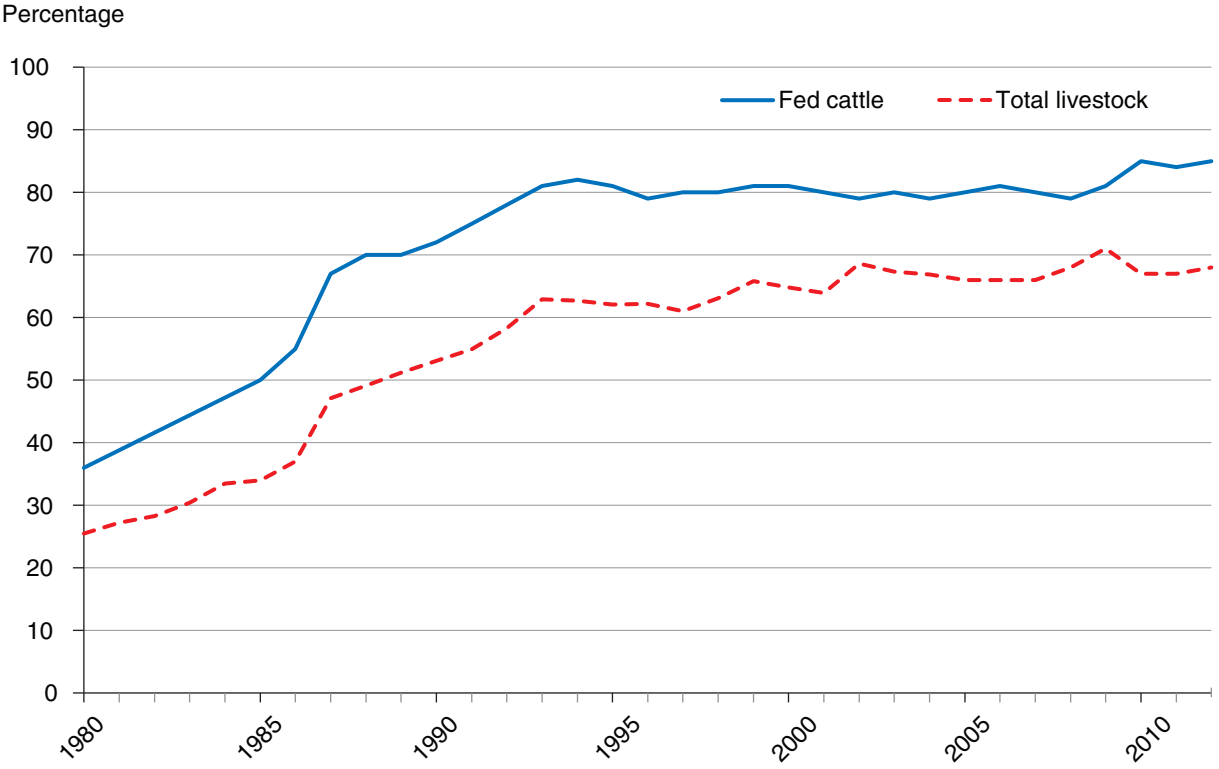


Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, *Quickstats*, 2015.

[4]Current concern over thin markets is focused on those with few buyers (Sexton, 2013).

Some agricultural markets have always been thin, and this feature has not generated much outside interest. However, modern trends in agricultural production and consumer tastes are pushing many important commodity markets towards the thinner end of the spectrum, and some stakeholders and policymakers have expressed substantial concern over the phenomenon (see box 1, "Thin Markets Under Scrutiny: The GIPSA Rule"). This is particularly true for the livestock markets (Crespi et al., 2012). For example, the share of all U.S. cattle slaughtered by the top four firms (four-firm concentration ratio (CR4)) increased from 39 percent in 1985 to 69 percent by 2006; for hogs, this figure doubled from 32 percent to 64 percent over the same period (Johnson and Becker, 2009). For fed cattle, the concentration level is even higher (due in part to the fact that their markets are more regionally focused); in figure 3, fed cattle's CR4 increased from 36 percent to 85 percent from 1980-2012. The four largest packers now account for nearly 70 percent of the value of all U.S. livestock purchased for slaughter, compared to just 26 percent in 1980.

Figure 3
Share of total livestock and fed cattle expenditures for the four largest slaughterers, 1980-2012



Source: USDA, Economic Research Service using data from USDA, Grain Inspection, Packers and Stockyards Administration's *Packers and Stockyards Program Annual and Statistical Reports*, 1995-2013.

Box 1

Thin Markets Under Scrutiny: The GIPSA Rule

Over the last decade, increased concentration at the processing level of several agricultural markets, combined with a shift away from traditional cash markets towards exchange dominated by bilateral contracts, motivated policymakers to take action regarding contract provisions in thinning markets. Increased concentration is sometimes considered a sufficient condition to signify that farm prices will be suppressed as a result (although this has not been established theoretically or empirically). Perhaps the most notable example is USDA's GIPSA rule, pertaining to USDA's Grain Inspection, Packers and Stockyards Administration (GIPSA). The 2008 Food, Conservation, and Energy Act (the Farm Bill) amended the Packers and Stockyards Act (PSA) to offer poultry growers and swine producers certain protections in contractual dealings with processors. It also directed the Secretary of Agriculture to establish criteria to determine if producers/growers are treated with "undue or unreasonable preference or advantage" (The Food, Conservation, and Energy Act of 2008, p. 2120). In June 2010, GIPSA published a proposed rule with the goal of leveling "…the playing field between packers, live poultry dealers, and swine contractors, and the nation's poultry growers and livestock producers" (GIPSA, 2010, p. 1). GIPSA extended its initial 60-day comment period by an additional 90 days in response to a wave of feedback and concerns expressed by industry participants and members of Congress—the proposed regulation generated over 61,000 public comments (Greene, 2015).

GIPSA's proposed rule covered four broad areas: competitive injury, unfair or unjust discriminatory or deceptive practices, undue or unreasonable preference or advantages, and arbitration requirements. The proposed rule specified permissible contract terms for the hog and poultry markets, mandated that processors file and disclose samples of all non-unique contracts issued, prohibited the paying of premiums or discounts without substantiating revenue and cost justification, required the maintenance of records regarding differential livestock pricing and distinct contract terms, classified specific processor/packer actions as retaliatory, proscribed the transfer of animals from one packer to another, and prohibited dealers from representing more than one packer at a time (Saitone and Sexton, 2012; Sexton, 2013). Prior court rulings under the PSA sought evidence of a market impact (such as price changes) to establish an unfair practice, but the proposed rule only called for an increase in the likelihood that competitive injury could occur, specifically stating that observed price effects of a practice were unnecessary.

Proponents of these provisions argued that standardization of contract terms and pricing would promote heightened interest and vigor in the livestock cash markets,[1] or establish what Crespi et al. (2012) call a cash market for contracts. This line of reasoning is motivated by the belief that a cash market, rather than a coordinated system, is the ideal form of exchange to support producer and consumer welfare and ensure fairness in dealings between producers and processors—including limiting possibly collusive behavior on the part of the latter. Opponents, however, worried that the proposed rule would overregulate the contract exchange mechanism

–continued

[1]The cash market accounts for about 27 percent of all fed cattle sales, but less than 3 percent of the value of all hog sales (Mathews et al., 2015). The cash market for broilers (poultry) is virtually nonexistent because production contracts are used almost exclusively (Greene, 2015).

Box 1

Thin Markets Under Scrutiny: The GIPSA Rule–continued

(threatening the considerable efficiency gains it offers), raise costs and reduce prices paid to producers, threaten U.S. competitiveness in global markets, and lead to unintended consequences (like increased processor vertical integration—i.e., processors could simply buy up more farms rather than pay considerable sums to certify compliance).[2]

Before the final rule was issued, USDA removed some provisions based on review of public comments, and Congress stepped in and halted the inclusion of others (Greene, 2015). However, many of these provisions are likely to influence future policy discussion, given the strong sentiments on both sides of the debate about the industrial organization of thinning markets and the appropriate goals of regulators.

[2]Another set of proposed legislation (HR 5247 in 2002 and S. 460 in 2009) would restrict packer ownership of livestock, arguing that vertical integration makes cash markets thinner, hides the price discovery process from public view, promotes collusion, and increases the potential for price manipulation; opponents discount all but the concerns over price discovery (Saitone and Sexton, 2012).

The most concentrated food processing industries (in terms of own sales) include cane sugar processing (95 percent of sales generated by the four largest firms), wet corn milling (84 percent), beet sugar processing (82 percent), soybean crushing (82 percent), breakfast cereal manufacturing (80 percent), and malt manufacturing (73 percent) (fig. 4). Each of these industries use (as dominant inputs) commodities that are included in USDA's premier monthly outlook publication, the *World Agricultural Supply and Demand Estimates* (WASDE). While sugar, soybean, and corn processing are listed separately, breakfast cereals use all the major grains as well as oats, rice, and barley (which is also the principal malted grain). Going further down the list, over half the production for the following industries (which rely on several WASDE commodities) is controlled by just four firms: cookies and crackers (wheat is a significant input), chocolate and confectionaries (sugar), animal slaughtering, dry pasta (wheat), butter manufacturing (dairy), tortillas (corn and wheat), flour (wheat), and rice milling.

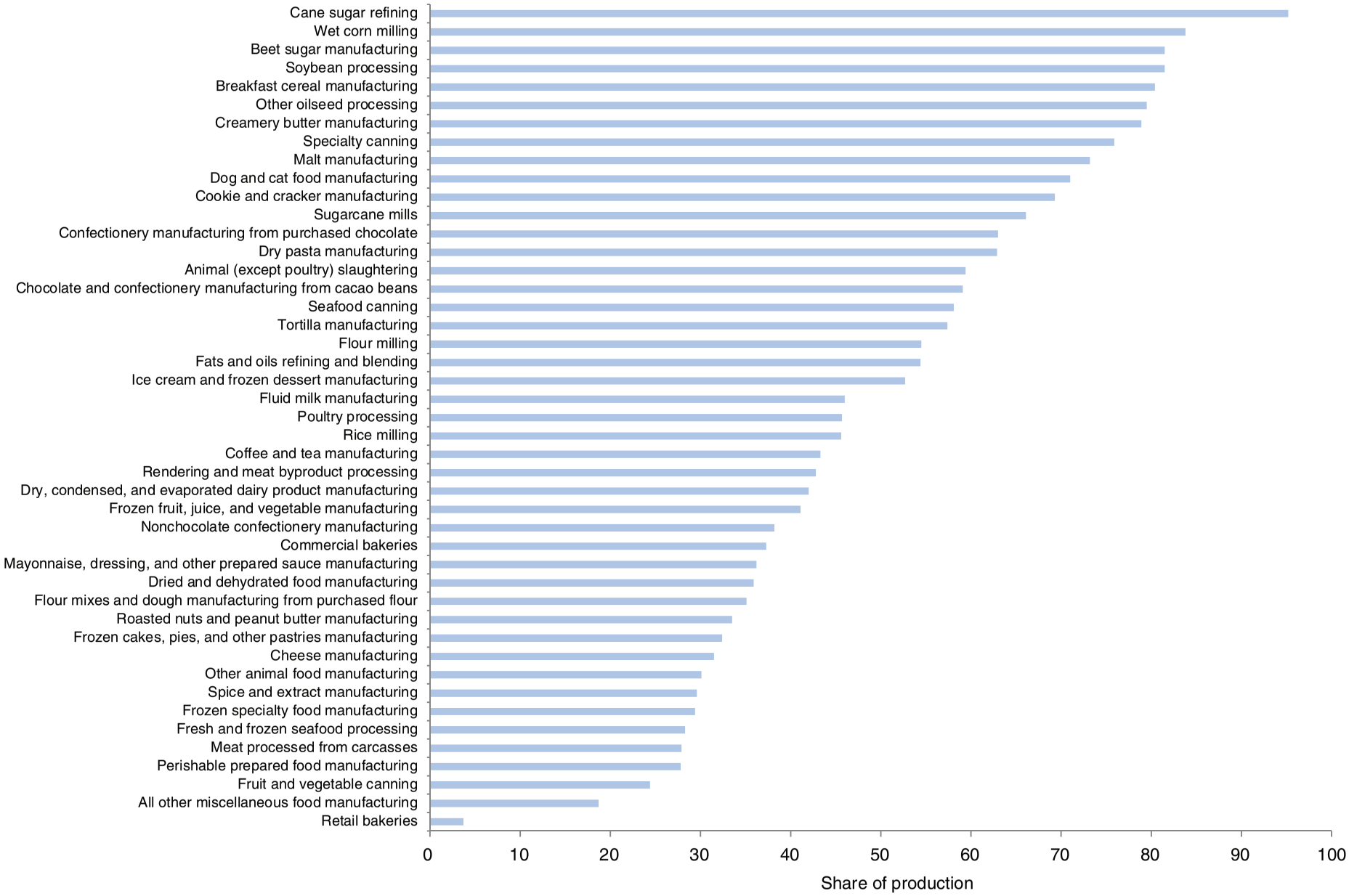
In contrast to livestock markets, however, none of the major grain markets can reasonably be considered thin. Although the CR4s in these industries are (in many cases) high, grain is clearly diversified in use and most grains have liquid futures and cash markets with abundant price and volume data (as well as strong export demand). Likewise, dairy, sugar, oats, and rice have futures contracts listed on major exchanges. Of the WASDE commodities used by industries with a CR4>50 percent (fig. 4), the malt barley market can most easily be described as thin; it doesn't have a strong cash or existing domestic futures market.[5]

Among the pressures to concentrate at the processing level are technological improvements with large fixed costs that tend to favor larger processing and marketing participants with better access to capital; these firms are able to capture economies of scale and gain market

[5]Barley is a useful example of why thin markets do not necessarily generate lower producer prices. Despite facing relatively limited competition in the procurement market, barley maltsters must offer producers attractive enough prices and contract features to draw sufficient acreage away from competing crops, including other grains (Colby, 2015). Most malting barley production is contracted, with prices offered at a premium to the December delivery Chicago Board of Trade Soft Red Wheat futures contract.

Figure 4

Share of 2007 production represented by the four largest firms in selected food processing industries



Source: USDA, Economic Research Service using data from the 2007 U.S. Economic Census.

share, increasing concentration downstream from producers. At the same time, the share of the household budget devoted to food is falling, affording consumers the luxury of seeking out new dimensions of farm product quality (Saitone and Sexton, 2010). These include physical attributes like color and size of vegetables, environmental concerns like pesticide use, the treatment of animals, location of production (e.g., local foods), and the perceived fairness of marketing arrangements with producers. Some examples include organically produced yogurt, corn chips, and eggs—products that are far easier to acquire today than just a decade ago (see box 2, "Organic Products: Thin Markets That Benefit From Certification"). As consumers express more heterogeneity of demand, producers and processors find new opportunities but must deal in increasingly differentiated farm products, reducing the volume of trade in each niche market.

Box 2

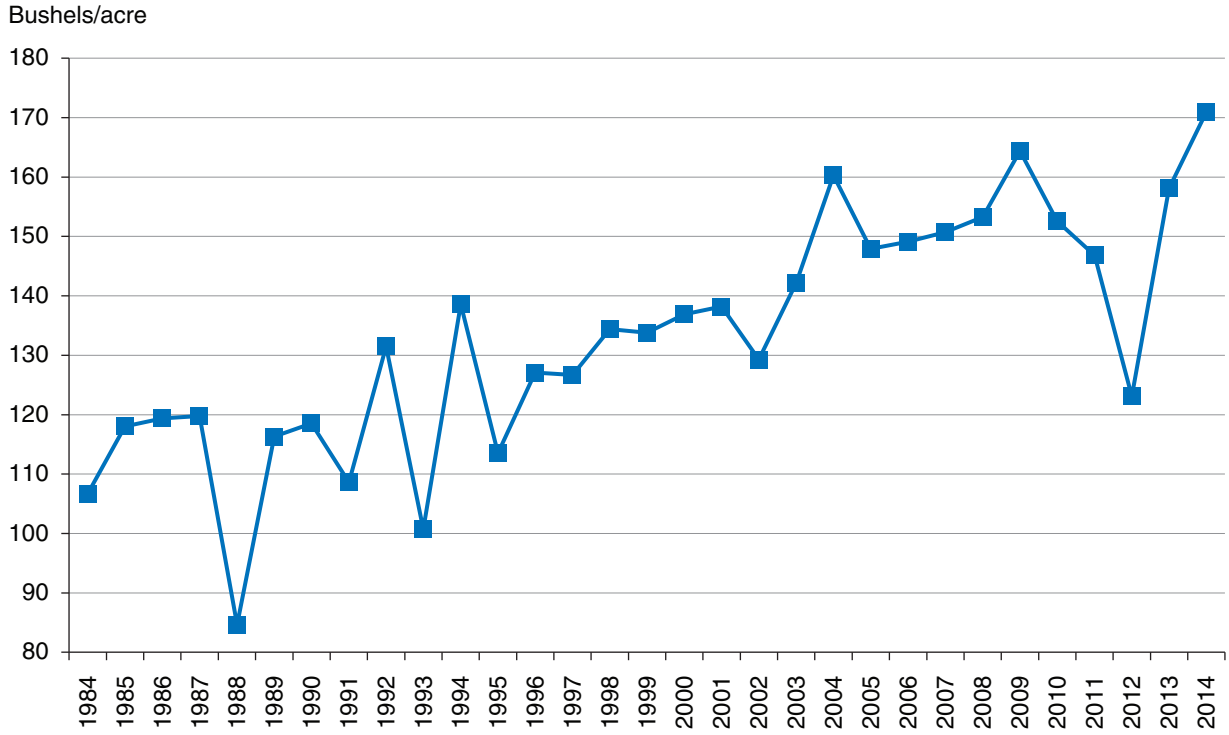
Organic Products: Thin Markets That Benefit From Certification

The 1990 Organic Foods Production Act required the U.S. Department of Agriculture to develop national standards for production, processing, and handling of organic foods; the final rule establishing the National Organic Program (NOP) and its recognized certification mechanism was published in 2000. Before then, organic foods were produced and marketed under a hodgepodge of private and State-level standards (Greene et al., 2009). Organic certification under the NOP requires that a field undergo a 36-month transition period while production incurs the higher costs associated with meeting organic standards as crops are sold conventionally. Only after the transition period is complete and the field is inspected by a certifying agent, can its production be labeled and sold as USDA-certified organic. After national standards were introduced, the amount of cropland planted to organic crops grew from 1.3 million acres in 2002 to 3.1 million acres by 2011 (Greene, 2013), increasing from 0.4 percent to 1 percent of total U.S. acreage planted to principal crops over that time span.

Thin Markets at the Farm Level

Corn provides a good example of a commodity with an active and well-functioning cash market (i.e., a thick market): it is a relatively homogeneous crop, and it is the most widely produced and heavily traded feed grain in the United States (Capehart and Allen, 2013; Chicago Board of Trade, 2014). For over a century, the Chicago Board of Trade has listed a futures contract for corn. At planting time, corn producers who want to estimate the price they will receive for their harvest can observe the market's price expectation, using corn's harvest-time future contract,[6] and make adjustments depending on how the price in their local cash markets differs from the reference cash market for the futures contract. Moreover, the existence of a futures (and associated options) contract gives farmers and other market participants risk management tools that they can use to shield their returns against adverse price changes. Each contract represents 5,000 bushels of corn, about 30 acres at recent average yields (fig. 5). Hedging the price is accomplished by purchasing a short position (i.e., selling) in enough futures contracts to represent the size of their expected harvest, or at least the portion for which they want price protection, because short positions increase in value when futures prices fall.[7] Once corn is harvested, producers can offer it to a feed

Figure 5
U.S. corn yields, 1984-2014



Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, *Quickstats*, 2015.

[6]Traditionally, the futures contract price is thought to equal the expected cash market price at contract delivery, but this isn't always the case. Under nonconvergence, a phenomenon that arose in the late 2000s, contract design issues forced grain futures prices above expected cash market prices for an extended period of time (although the two price series were still related) (Adjemian et al., 2013).

[7]Hedging protects a producer against the possibility that prices will fall, but also limits the gains that would be achieved were prices to rise (since the value of short positions fall in that case).

processor, sell it to an elevator, market it to another buyer (e.g., an ethanol plant), or store it on the farm for later. They *lift* the hedge by *offsetting* their futures contracts, taking long positions (i.e., buying future contracts) to cancel outstanding shorts.

Things work very differently in a thin market, such as peanuts, where there are a small number of buyers. Until 2002, USDA managed a quota program that was intended to regulate the domestic peanut supply; each year, USDA set quotas on production and distributed them to producers based on available peanut stocks. Under the program, a peanut producer could only sell peanuts to the domestic market at a quantity covered by the marketing quota. These in-quota peanuts were assured a high support price, while the peanuts that a producer grew in excess of the quota were restricted to the export and crush markets (and brought much lower prices). A producer's planting decisions were based on the amount of marketing quota available in a given year. After the quota program was eliminated, peanut producers have sought to manage price risk by entering into contracts with peanut processors, but their options are limited—just two processors account for about 70 percent of all peanut shelling in the United States (Adjemian et al., 2016).[8] Each year, shellers offer contracts to producers at a fixed price per ton above the USDA marketing loan repayment rate, for delivery at the processor's shelling station. Based on that price, available government support payments, and the opportunity cost measured by the expected revenue for competing crops, producers decide how much of their land to plant to peanuts. They can decide when and how much to contract with shellers, depending on their expectations of price movements over the crop year. However, once the contract is signed, a peanut producer has one buyer: the processor.

Due to differences in market depth, corn and peanut producers face starkly different circumstances in the production and marketing of their crops; table 2 describes how market thinness constrains farm choices and potentially impacts commodity prices and producer welfare. Corn accounts for more than 90 percent of total U.S. feed grain production and use (USDA, World Agricultural Outlook Board, 2014) and is transacted by many buyers and sellers at observable prices in a multitude of active cash markets. Without an active cash market, price determination for a much smaller crop like peanuts is far murkier. How can peanut producers be sure they are receiving a fair price?

Numerous marketing options are available to corn producers, who are assured of price competition over their crop, but peanut growers are restricted to a choice between far fewer potential buyers. Moreover, corn derivatives (like futures and options) afford a wide variety of risk management strategies; peanuts have no derivatives markets, so risks tend to be shifted towards the Federal Government via heavy use of the marketing loan system.

[8]Golden Peanut Company and Birdsong Peanuts, combined, operate 13 shelling plants and over 200 receiving stations. Smaller shellers operate just a single processing facility, at most.

Table 2
Thick versus thin market example

	Corn (thick)	Peanuts (thin)
Price discovery	Competitive buying and selling by many traders at the Chicago Board of Trade futures exchange and numerous cash markets incorporates commodity information into prices.	No futures or cash markets exist. Prices are negotiated bilaterally between growers and shellers.
Planting decision	Price expectations generated by large derivatives markets like futures inform the planting decision.	No futures markets exist, so no consensus price expectation is available. Growers generally base their planting choice on the contract terms, including price, assigned by the processor, as well as the expected price for other candidate crops and available government support payments. The peanut contract price is usually based on the USDA loan repayment rate, plus a premium.
Risk management	Producers have a variety of risk management options available: direct use of derivatives to hedge price risk, forward contracting, cooperative marketing arrangements, and storage. Quantity risk is usually addressed with insurance.	Because no derivatives markets exist, and cooperatives account for a small fraction of production, most growers use forward contracts to lock in a price for their crop. Nearly all peanut farmers purchase crop insurance, although USDA's efforts to generate accurately priced insurance products are complicated by limited data.
Potential buyers	Cash markets are strong and buyers are plentiful. Farmers usually sell their grain directly to feed processors or a local elevator that distributes it to millers, other agribusiness firms, and ethanol plants.	Growers sell their contracted harvest to shellers at contract prices; any non-contracted peanuts can be marketed later, and growers can use marketing assistance loans to improve cash flow in the interim.

Source: USDA, Economic Research Service.

Coordinating Farm Production

To satisfy downstream demand, increasingly concentrated agricultural processors seek better coordination of farm production with their own processing capacity and consumer tastes. One method to enhance coordination, bilateral contracting, increased in the United States from 11 percent of the value of nationwide agricultural production in 1969 to 40 percent by 2011 (Hoppe, 2014). For some commodities, especially livestock, the share of contracting is far higher (e.g., contracts accounted for 90 percent of domestic poultry and egg production in 2008 (MacDonald and Korb, 2011)).

By providing a guaranteed buyer, price, and production terms, contracts offer considerable potential for efficiency gains and risk management to producers (MacDonald et al., 2004). They can also include attractive features like cost sharing or a premium pricing scale with rewards for using key inputs or achieving a desired output quality (Sexton, 2013) (which is unavailable in traditional cash markets, where buyers and sellers transact already produced, relatively homogeneous goods). Although they do exhibit price premiums or discounts based on certain attributes—for example, wheat prices are affected by their protein content—cash markets cannot accommodate the degree of farm product customization that is increasingly demanded by downstream buyers. For example, a retail market might demand organic, free-range eggs produced using environmentally sound practices, but producers who sell in cash markets would not observe this market signal and most would face excessive search costs to make retail contacts. They, therefore, would lack the information necessary to direct production resources to fulfill more sophisticated and differentiated demands. Ward (2001) traces the shift away from livestock cash markets to a coordinated production model due to this inadequacy of translating consumer demand to producers.

Processors have downstream buyers and, therefore, valuable information to transmit to producers about those buyers' preferences. In matching producers with processors, well-designed contracts resolve the information problem and guide producers to more efficiently meet output demand. For example, producers and processors can work together to alter the quantity and quality of inputs, better select and direct the use of farm equipment, and shift the timing of production; each of these has the potential to reduce per-unit costs and/or increase total factor productivity, representing efficiency gains. Together with directing production towards attributes that consumers demand (and are willing to pay a premium to obtain), efficient contracting has the potential to generate higher returns for processors and those producers who contract with them.[9] Contracting is increasingly common in many agricultural markets, helping producers and processors learn to cooperate and coordinate production (MacDonald and Korb, 2008; MacDonald and Korb, 2011). The two most popular forms are marketing contracts and production contracts (see box 3, "Different Sorts of Marketing Arrangements").

The other primary method of coordinating farm production is direct control through vertical integration by processors (i.e., processors control the production of the farm commodities they require). According to USDA's 2008 Agricultural Resource Management Survey (ARMS), vertical integration accounts for a small proportion of the value of U.S. agricultural production—only about 5 percent of production occurs on farms owned by firms that also own processing facilities.

[9]Efficient contracting increases total producer surplus by reducing production costs and boosting demand via the resolution of information problems. How that surplus is shared among processors and producers remains an important question.

On the other hand, vertical integration represents a more substantial share of livestock production, particularly in the case of domestic hogs (Lawrence, 2010).

However it is achieved, the rise in producer-processor coordination through contracting or vertical integration makes traditional cash markets thinner as they support fewer and fewer public trades.

Box 3

Different Sorts of Marketing Arrangements

Contracting in U.S. agriculture takes on two primary forms, differing according to the ownership of the underlying commodity (MacDonald and Korb, 2011). Under *production contracts*, a processor who owns the commodity associates with a producer to provide production services. For example, poultry processors provide growers with hatchlings, feed, veterinary services, and compensation in return for labor, housing, and the equipment necessary to raise suitable broilers. Producers are paid for their services, rather than the market value of the product, although in the case of poultry growers, the fee schedule is usually structured around the success a grower has in achieving desired farm product characteristics (e.g., feed conversion or mortality rates).

Marketing contracts, on the other hand, specify the means by which ownership is transferred from the producer to the processor. For example, a forward contract for corn—agreed to in advance between farmer and miller—identifies the amount of bushels; the desired oil content; the delivery location, method, and timing; and the price or price-determination method to be used.

In both cases, the processor gains some assurance and a degree of control over the supply of farm products. Processors can gain even more control through *vertical integration* (purchasing and managing the entire production process).

How Are Prices Set in Thin Markets?

The price discovery process in thick markets is characterized by many traders engaged in competitive buying and selling based on their knowledge of current and expected commodity conditions (e.g., liquid futures and cash markets). Consequently, important information about a commodity is quickly reflected in a thick market's prices. Flexibly determined prices allow market participants to adjust their production, storage, and marketing decisions according to the best available information, and the commodity market operates efficiently.

Thin markets, in contrast, have fewer participants and fewer observable transactions; their prices less efficiently incorporate important information about a commodity (see box 4, "Thin Financial Markets"). As a result, thin market prices could more easily lead to suboptimal decisions on the part of producers and processors, with potentially serious consequences (e.g., shortages and increased downstream price volatility). When markets are thin and bilateral contracts are used, price determination is usually characterized by a negotiation process between buyer and seller. However, because thin market prices may not be disclosed publicly, processors who interact with several producers have an advantage during negotiation—for example, processors who successfully contracted with nearby producers have a clearer picture of a similar producer's likely costs and the lowest price they are willing to accept.

One popular price-setting mechanism in thin markets is a benchmark or proxy pricing system to determine the transaction price. Examples of popular benchmarks include a cash market for the commodity (e.g., formula cattle), the USDA marketing loan rate (see box 5, "Peanuts: A Thin Market With a Government-Set Price Floor"), the price paid by a major cooperative (almonds), a futures price for a commodity that competes for acreage (malting barley), or a cash market

Box 4

Thin Financial Markets

Because they are public, financial markets (like stocks or futures markets) offer a useful illustration of common problems associated with thin markets (i.e., increased trading costs, higher price volatility, and less effective price discovery). When there are few traders in a market, the direct cost of trading is higher because the fixed cost of operating an exchange is spread over fewer participants. In addition, finding a willing trading partner is more expensive—thin markets exhibit a higher difference between market asking and offer prices (the bid-ask spread) (Cohen et al., 1981). Crossing its bid-ask spread to effect a trade entails larger price changes (i.e., more price volatility) in thin markets than in thick ones whose price changes are typically smoother.[1] Likewise, a wide bid-ask spread impedes the process by which fundamentals can update prices. In other words, before it can generate a trade, new information about a company's expected earnings (or a commodity's expected harvest) must have a significant enough price impact to justify paying high transaction and liquidity costs. Less important information updates will not be incorporated, so the most recent traded price will not necessarily reflect an asset's true fundamental value.

[1]Several empirical studies in the finance literature document the relationship between market thinness and price volatility (e.g., Cohen et al., 1976). In agricultural markets, this concept was prominently explored by Tomek (1980) and Carter (1989).

Box 5

Peanuts: A Thin Market With a Government-Set Price Floor

Peanuts have never had an active cash or derivative market. Regulatory changes in the early 2000s eliminated traditional price supports and altered the way growers are paid; producers now contract with one of a handful of major domestic shellers to market their product. Two shellers, Golden Peanut and Tree Nuts and Birdsong, have plants in all major growing areas and account for about 70 percent of all peanut handling. Shellers either market directly to downstream buyers like Hershey, Smuckers, or Kraft, or do so indirectly via brokers. Shellers contract with peanut growers, typically for a 1-year term, and pay the USDA marketing loan rate of $355/ton plus a premium.

The premium, however, varies substantially from year to year, based on inventory carryover, expected production, and the expected harvest-time price of competing crops that growers can also choose to plant (e.g., corn, soybeans, and cotton). Premium payments may also vary based on the peanut type, end use (such as seed peanuts), and quality attributes. The average price received by U.S. peanut growers by marketing year, alongside the USDA loan rate, is in box figure 5.1.

Given competing planting options, shellers must tailor the premium to attract enough quality growers, ensuring a stable supply of peanuts to downstream buyers. Farmers tend to grow cotton and the major grains alongside peanuts (box figure 5.2), and peanut farms have a high rate of turnover—only about 7 percent, 17 percent, and 30 percent of surveyed 2013 peanut farms were planted to peanuts in the spring/summer of 2012, 2011, and 2010, respectively (box table 5.1).

Thus, even though peanut shelling is a highly concentrated industry, producers have the advantage of a price floor established by the USDA loan rate, may also be eligible for Government supplemental payments, and their ability to plant other crops gives them a degree of bargaining power in the price-setting process.[1] From an efficiency standpoint, however, the existence of a known price floor even for noncontracted peanuts can encourage periodic excess plantings (depending on the expected return from production substitutes) and surplus supplies, delayed contracting, and (ultimately) a breakdown in the longrun relationship between growers and processors (Adjemian et al., 2016). Since the loan rate was introduced for peanuts (in the 2002 Farm Bill), the peanut price received by producers has approached the Government-set price floor several times, but has never meaningfully dropped below it (box figure 5.1).

–continued

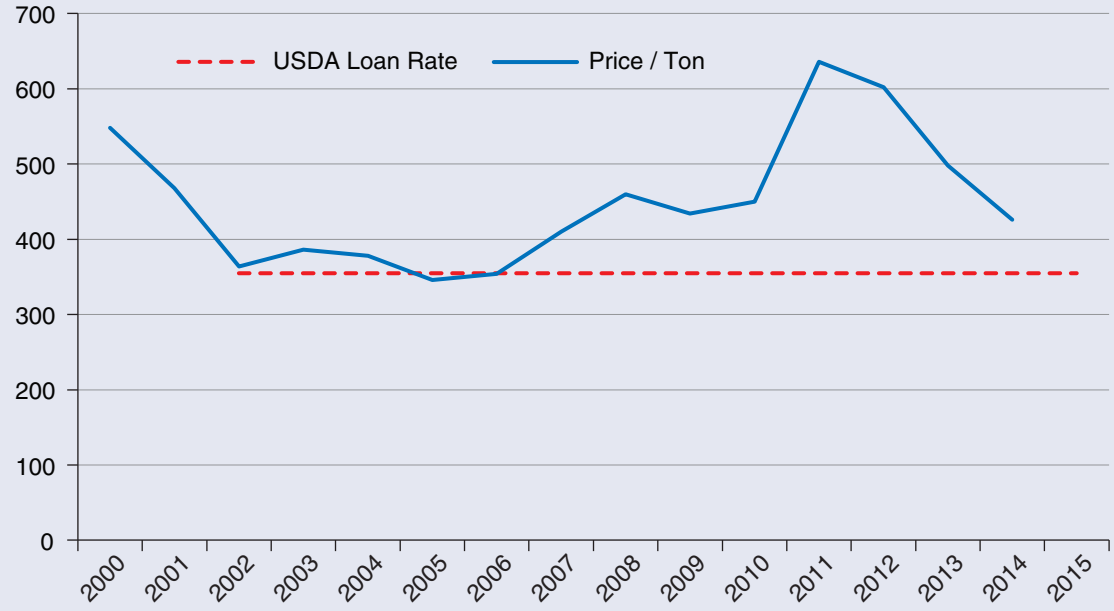
[1]Beginning with the 2014 Farm Bill, many peanut producers also receive a supplemental Government price-loss payment if the national peanut price falls below the reference price of $535/ton.

Box 5

Peanuts: A Thin Market With a Government-Set Price Floor–continued

Box figure 5.1

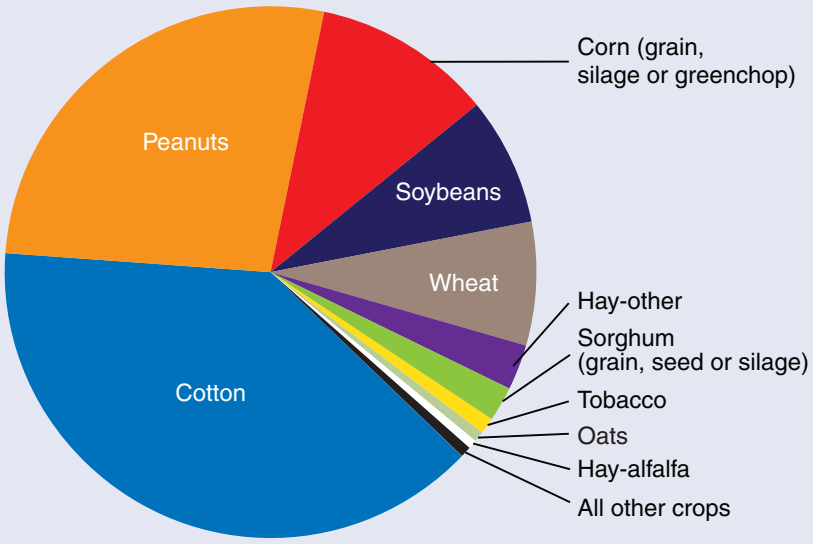
Average price received by U.S. peanut growers, 2000-15



Source: USDA, Economic Research Service.

Box figure 5.2

Average harvested acreage for 2013 ARMS Phase II peanut fields



Note: ARMS is the Agricultural Resource Management Survey, administered by USDA's Economic Research Service and the National Agricultural Statistics Service. Results are displayed for U.S. farms whose operators provided answers to both Phase II and Phase III of the ARMS survey. Only crops whose average harvested acreage exceeded 0.1 percent are included.

Source: USDA, Economic Research Service.

–continued

Box 5

Peanuts: A Thin Market With a Government-Set Price Floor–continued

Box table 5.1

Planting history for the average 2013 ARMS Phase II peanut field, 2009-12

	Fall 2012	S/S 2012	Fall 2011	S/S 2011	Fall 2010	S/S 2010	Fall 2009	Fall average	S/S average
Corn for grain	0.0%	19.6%	0.0%	11.3%	0.0%	19.0%	0.0%	0.0%	16.7%
Cotton, pima	0.0%	0.7%	0.0%	0.5%	0.0%	0.7%	0.0%	0.0%	0.6%
Cotton, upland	0.0%	54.8%	0.0%	50.5%	0.0%	30.2%	0.0%	0.0%	45.2%
CRP	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
Grasses other than clover	0.2%	0.1%	0.4%	0.4%	0.8%	0.8%	0.8%	0.5%	0.4%
Hay, all other	0.6%	0.5%	0.7%	0.5%	1.1%	1.0%	1.1%	0.9%	0.6%
Oats	4.2%	0.2%	4.1%	0.2%	3.1%	0.0%	2.7%	3.5%	0.1%
Peanuts	0.0%	6.7%	0.0%	16.5%	0.0%	29.8%	0.0%	0.0%	17.7%
Potatoes	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
Rye	11.0%	0.0%	9.2%	0.0%	8.4%	0.0%	6.9%	8.9%	0.0%
Sorghum for grain	0.1%	1.8%	0.0%	1.2%	0.3%	0.3%	0.0%	0.1%	1.1%
Soybeans	0.0%	6.5%	0.0%	7.8%	0.0%	7.8%	0.0%	0.0%	7.4%
Sweet potatoes	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	0.4%
Tobacco, flue cured	0.0%	3.1%	0.0%	4.2%	0.0%	4.2%	0.0%	0.0%	3.8%
Vegetables	0.4%	0.8%	0.0%	1.0%	0.0%	0.0%	0.0%	0.1%	0.6%
Wheat, durum	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.5%	0.3%	0.0%
Wheat, other spring	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.1%
Wheat, winter	13.1%	0.0%	13.6%	0.2%	8.1%	0.0%	12.0%	11.7%	0.1%
No crop	69.8%	4.7%	71.6%	4.8%	77.3%	4.4%	75.5%	73.5%	4.7%

Note: ARMS is the Agricultural Resource Management Survey, administered by USDA's Economic Research Service and the National Agricultural Statistics Service. CRP stands for the Conservation Reserve Program, and S/S refers to spring/summer. Results are displayed for U.S. farms whose operators provided answers to both Phase II and Phase III of the ARMS survey.

Source: USDA, Economic Research Service.

price for a related crop (cash market corn for corn silage). Benchmarking can work well if the benchmark price is liquid and responsive to supply and demand conditions; however, it can also amplify pricing problems if they already exist. As the growing system of contracting pulls more and more producers away from a shrinking cash market (see box 6, "Livestock Pricing: Cash Markets Getting Sparser"), contracts that benchmark their terms to cash prices run the risk of magnifying price inefficiencies, projecting poorly discovered—or more worryingly, manipulated—prices to otherwise unaffected participants.

Besides benchmarking, sharing arrangements are another price-setting mechanism found in the industry. Under such a contract, producers are guaranteed a fixed percentage of a transparent downstream price that a buyer eventually receives in the wholesale or retail market. For instance, some wine grape prices are tied to finished bottle prices.

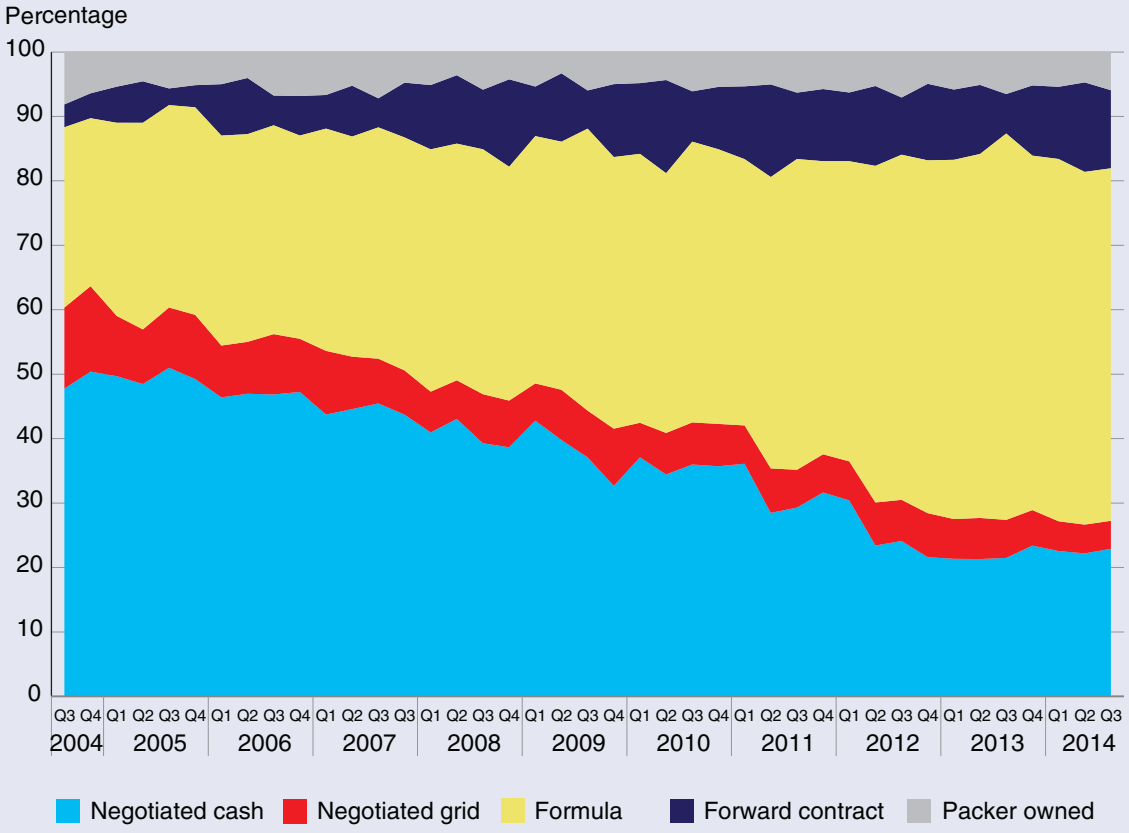
Box 6

Livestock Pricing: Cash Markets Getting Sparser

Producers and packers use three general methods to price livestock in the United States. The most common is referred to as formula pricing, and occurs in the context of a bilateral contract between producer and packer. The contract specifies a formula that benchmarks its transaction price to either a reported livestock price from a national or area cash market, a plant-average price, or a composite wholesale price (cutout) for the animal's meat. This formula system dominates alternative marketing arrangements (i.e., pricing methods outside of pure cash markets). Another method of pricing livestock, negotiated pricing, represents sales that are negotiated between buyer and seller at a cash market. Forward pricing is a third and less popular pricing method—transaction prices are based on the Chicago futures market contract prices for both slaughter hogs and cattle.

Box figure 6.1

Share of U.S. cattle sales by marketing arrangement, 2004-14



Notes: Negotiated cash and grid sales are both cash market transactions. Formula and forward sales are contracted, and packer-owned sales represent vertically integrated operations. Q = quarter.

Source: USDA, Economic Research Service using steer and heifer sales data from USDA, Agricultural Marketing Service, 2015.

–continued

Box 6

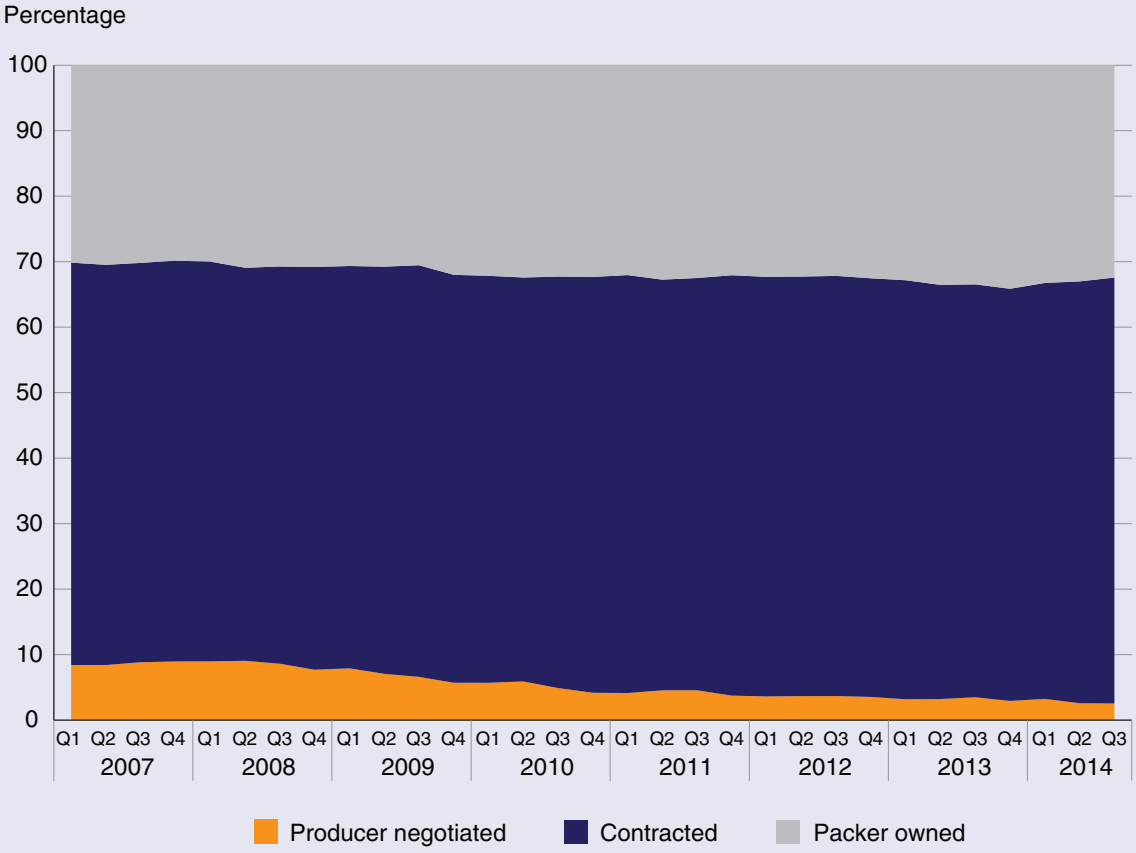
Livestock Pricing: Cash Markets Getting Sparser–continued

Because livestock futures contracts represent expected prices at cash markets, forward prices are closely related to negotiated prices but are paid via a bilateral contract.

The share of negotiated livestock has declined rapidly over the last decade (box figures 6.1 and 6.2). In 2004, over 60 percent of all cattle were sold on some type of negotiated basis; by 2014, that number had dropped to about 27 percent. The share of hogs sold on a negotiated basis between 2007 and 2014 fell from about 8.4 percent to 2.6 percent. As the popularity of alternative marketing arrangements increases—and the volume of cash market sales shrinks—for both cattle and hog markets, some observers and market participants are increasingly concerned about the reliability of negotiated prices as formula-price benchmarks.

Box figure 6.2

Share of U.S. hog sales by marketing arrangement, 2007-14



Notes: Producer-negotiated sales represent cash market transactions. Packer-owned sales represent vertically integrated operations. Q = quarter.

Source: USDA, Economic Research Service using swine (barrow and gilt) sales data from USDA, Agricultural Marketing Service, 2015.

Finally, prices may be determined on a take-it-or-leave-it basis. In the market for California walnuts, for instance, many contracts contain a provision that the buyer alone will set a price to be determined later. However, even prices that are dictated by buyers can be efficient if they clear the market and transmit the appropriate signals to its participants.

Thin markets are controversial because, as processors become more concentrated and geographically dispersed, competition to procure the farm product diminishes, constraining marketing opportunities for producers to—in some cases—a single buyer. Such a buyer holds obvious advantages over producers in terms of price setting—by forcing producers to compete with one another for the sole available sales opportunity, the buyer can bid the farm price down to the bare minimum required to call forth production. The buyer can then earn a higher margin for the final product sales, given the lower input costs.

Additionally, multiple buyers can act together, purposefully or tacitly, to jointly restrict farm prices and output (essentially acting as a joint monopsonist).[10] Such coordinated behavior becomes easier as the processing sector becomes more concentrated. Some producers and policymakers have expressed concerns that processing firms in thinning markets use informational and structural advantages to construct bilateral contracts as a means to exercise market power over producers and to depress farm-level prices and output compared to what would be generated by a competitive market (Johnson and Becker, 2009). For example, contract terms (such as liquidation fees) can be arranged to dissuade new buyers from entering the market and limit price competition among existing buyers (MacDonald et al., 2004).

The timing and duration of contracts, as well as scale economies in processing, can augment the power of these tools. Consider a packer who ties up a substantial portion of the local hog supply with production contracts; to attain enough output to operate a processing plant at the minimum efficient scale, a potential competitor packer would need to either (1) pay exorbitant contract liquidation fees to secure a large enough supply of hog inputs, or (2) wait out existing contracts until they lapse. Likewise, a poultry processor could use the short-term nature of broiler contracts to lure a grower into committing substantial capital investments to housing, and then impose extra costs and lower prices in followup contracts once the grower is in a vulnerable position (MacDonald and McBride, 2009). Large buyers who are active in both cash and contract markets could also conceivably manipulate benchmark prices through strategic behavior at a reference cash market (Xia and Sexton, 2004).

Additionally, thinning markets may make producers more vulnerable should their limited trading partners be threatened in some way (e.g., by financial distress). A producer with many trading partners has a diversified marketing portfolio and is less liable to be harmed in case one buyer can't pay the bills come harvest. In a thin market, producers have fewer potential counterparties that can make up unexpected marketing shortfalls.

[10]A monopsony is a market with a single buyer (the monopsonist). Overt coordination among buyers, such as price fixing, is illegal under U.S. antitrust laws (including Section I of the Sherman Act) and prosecutable under both criminal and civil law.

Foregoing Thin Market Power

Skepticism about thinning markets is likely justified if processors only consider their short-term profits. In that case, a rational profit-maximizing agricultural firm would use its oligopsony market power to drive down the price paid to producers to the minimum acceptable level that would keep enough producers in business in the short term to meet its processing plans.[11] However, this would cause production resources to exit the farming industry—some producers would move on to a crop with better expected returns, and others would be forced out of business. Only the lowest cost producers, or those without other options, could stay in the market. Processors who force producers out of the market by keeping prices too low jeopardize their own input supply; for example, a poultry processor who develops a poor reputation among growers will face difficulty attracting new ones (MacDonald and McBride, 2009).

On the other hand, even in many thin markets, processors recognize that consistently efficient plant operations can generate significantly higher returns over the long run (compared to short-term profits that might be achieved via market power). Because reliability of supply is paramount to their own buyers, rational processors with long-term objectives tend to promote a stable supply of farm products by paying a price that covers producers' total production costs, plus a reasonable return on investment. Such a price ensures that a sufficient number of local producers are consistently able to provide the processor with enough farm products to meet its own production plans. These processors, therefore, forego shortrun oligopsony profits to seek mutually beneficial, coordinated production relationships with geographically proximate producers as a way of maximizing returns over a longrun horizon.

The model presented in the appendix uses a net present value framework to demonstrate the conditions under which a thin market processor would choose to forego market power profits that could be earned by forcing down farm prices (see box 7, "Price and Quantity Under Different Market Structures" for the behavior of a processor with market power when only the short run is considered). The model assumes that a monopsonist processor has two options:

Box 7

Price and Quantity Under Different Market Structures

When procurement markets are competitive (box figure 7.1, panel A), a given buyer's average per-unit cost (A.C.) is equal to its marginal per-unit cost (M.C.)—i.e., as a price taker, buying an additional unit does not affect the market price. However, in a monopsony (panel B), the single buyer must pay a higher marginal cost to purchase an additional unit, so the marginal cost for each additional unit exceeds its average cost. Under both market structures, equilibrium price and quantity are realized when the marginal value of an additional unit (as indicated by the demand curve) just equals its marginal cost.

Facing the same demand curve, a monopsonist that is unconcerned about the value of a stable input supply will choose to restrict quantity purchased and pay a lower price (panel C) compared to the competitive outcome. Even in a static model like this one, the difference between the competitive and market power equilibria depends on the shape of the supply curve, as represented by the average cost curves. The more elastic (the flatter) the supply curve (firm 2 in panel D), the less important the difference between average and marginal unit costs, and the lower the effect of buyer power on price and quantity (as evidenced by the smaller difference between the price and quantity set by firm 2, compared to firm 1, with respect to the competitive price).

–continued

[11] An oligopsony is a market type in which many sellers compete to provide their product to a small number of buyers.

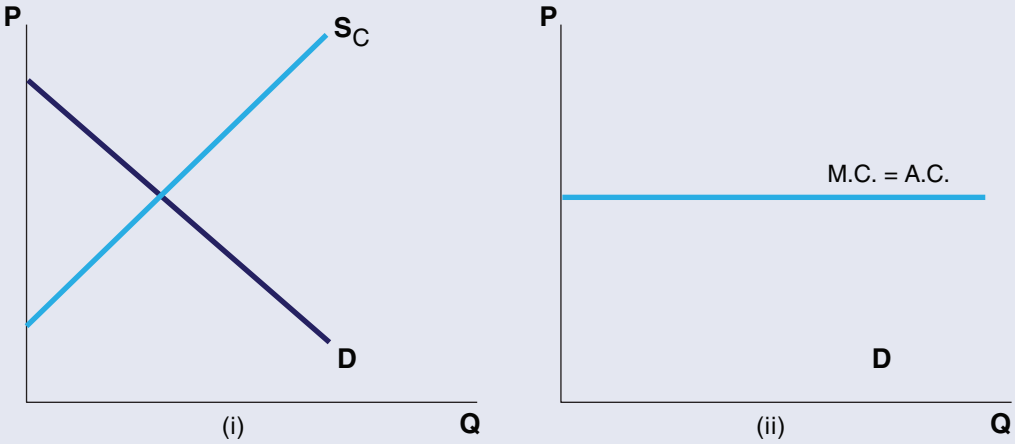
Box 7

Price and Quantity Under Different Market Structures–continued

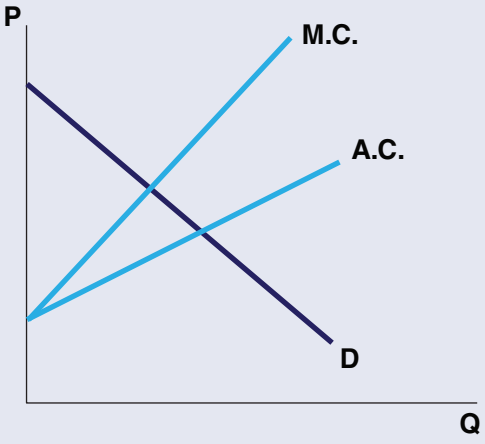
Box figure 7.1

Static procurement market equilibrium under different market structures

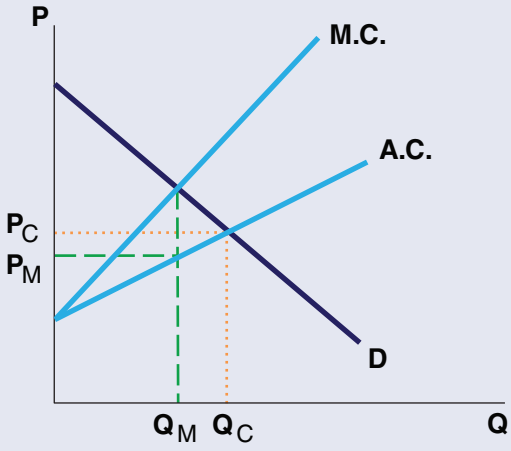
Panel A. Competition



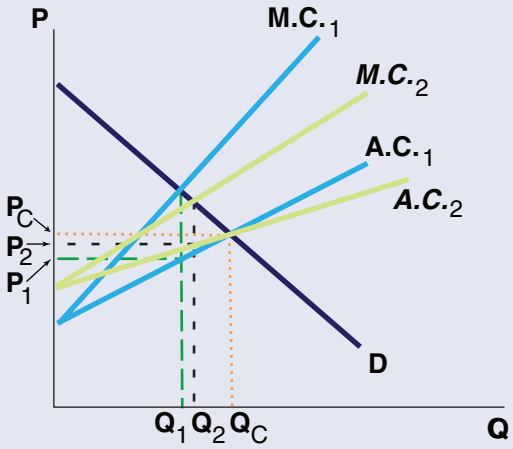
Panel B. Monopsony



Panel C. Monopsony versus competition



Panel D. Monopsony power lower with lower supply elasticity



Notes: S refers to supply and D refers to demand. Price (P) is depicted on the vertical axis, while quantity (Q) is depicted on the horizontal axis. Along these axes, specific values for price and quantity are shown for a given firm under competitive (C) and monposonistic conditions (M), as well as two different monopsonist firms (1 and 2) using these values as subscripts. Marginal cost (M.C.) and average cost (A.C.) are shown without subscripts for a single firm under consideration, and take on subscripts to compare the effect of different supply schedules in panel D.

Source: USDA, Economic Research Service.

1. Use market power and force input prices down in the near term, leading to greater shortrun profits, but also producer exit and a reduced stream of future available inputs and profits, or

2. Pay processors a higher price, generating more inputs and efficient plant operation and higher consistent longrun returns, but lower profits in the shortrun.

Using total processor profits as a decision rule, the model suggests that three main factors affect this decision: the level of farm-product customization and differentiation, financial solvency, and the discount rate (the value the processor places on profits tomorrow versus today).

First, processors with a highly customized input supply face a higher risk of reduced future production (and profits) if they lower prices below the competitive level and begin forcing producers out of the market. Even though processors can earn higher profits in the short run by using market power, their future losses grow as fewer producers are left to take up the slack, decreasing inputs. Second, financial solvency of the industry or processor makes shortrun market power profits more attractive because, in essence, there is no long run. Finally, a high discount rate, or a greater emphasis on profits today versus tomorrow, leads a processor to place more emphasis on shortrun profits, and makes them more likely to restrict prices and behave as a classic monopsonist.

Are Thin Markets Distorting Farm Prices?

Since the early 1900s, researchers and policymakers have pursued the question of market power effects in the agricultural sector (Myers et al., 2010). Over the last few decades, the focus of this work has shifted from the power of manufacturers and retailers over consumers to concerns about the potential power processors may hold over producers (and the effects this might have on small farms and farm communities) (Crespi et al., 2012). Consequently, economists have developed models to measure departures from the competitive market and conducted empirical tests to estimate market power effects in the agricultural sector.

If they exist, market power distortions seem to have only small price effects for producers. In their review, Azzam and Anderson (1996) were not persuaded that the meatpacking industry—the main focus of academic market-power research—was anticompetitive. Ward (2002) shares the results of 12 studies into oligopsony power that generally concur, or demonstrate only minor price effects, using a variety of data sources and methods. For example, Schroeter (1988) estimated a monopsony price distortion in the nationwide beef packing industry of only about 1 percent from the mid-1960s through the mid-1980s; Azzam and Schroeter (1991) produce a similar result for oligopsony distortion using annual regional industry financial data for 1986; while Koontz et al. (1993) estimate a slightly smaller effect using daily regional data from 1980 to 1986. More recently, Crespi and Sexton (2005) estimate that oligopsony power reduced cattle bids in the Texas Panhandle during 1995-96 by 5-10 percent.[12] Findings of modest departures from competitive pricing also populate the literature of other food product types (Liu et al., 1995; Crespi et al., 2005; Katchova et al., 2005; Zheng and Vukina, 2009).

However, even among studies that demonstrate a statistically significant effect of market power on prices paid to producers (farmgate prices), a common finding is that increasing market concentration provides substantial efficiency gains to the industry. The same economies of scale that support thinning downstream markets can pass processing cost savings onto consumers and stimulate demand for farm products as new attributes are addressed, working against any potential processor market power by putting more money into producers' pockets. In other words, the total pie of producer revenue increases and leaves producers better off, even if processors take the larger slice. For example, Key and McBride (2003) estimated that the contract system improves average hog output by 20 percent when compared to independent production; their estimated magnitudes of productivity gains to individual production factors on the average hog farm are even more striking—36 percent for feed, 44 percent for labor, 16 percent for capital, and 52 percent for other inputs.[13] Reduced per-unit resource costs afforded by contracting free up labor, capital, material, and land inputs for other uses and reduce the attendant pollution from the pesticides and fertilizer used to grow feed.

Reviewing several dozen academic articles published since 1999, the U.S. Government Accountability Office (2009) concluded that increased concentration in many intermediate

[12]A well-known cattle cycle complicates research on that industry's market power, and data timing may, in part, explain the difference in findings across studies (Crespi et al., 2010).

[13]These results are from Key and McBride's (2003) linear model. They estimated similar results using other functional forms.

agricultural markets provided efficiency gains that outweighed any associated market power effects. For instance, Azzam (1997) estimates that the benefits of increased buyer concentration in the beef packing industry are large enough to offset any associated market-power effects. Morrison Paul (2001a; 2001b) shows that considerable cost economies in domestic livestock markets more than offset the weak evidence for monopsony market power, and that concentrated packers place a high enough value on efficient throughput (i.e., packers want their plants operating at capacity) that they are willing to pay attractive prices to producers. As described by the model in the appendix, this motivation towards operating their plants near full capacity reflects motivation on the part of processors to forego prospective market power benefits and establish stable relationships with producers.

Cooperation, Winners, and Losers in Thin Markets

To operate plants efficiently and provide a stable supply of quality outputs, processors desire suitable farm product characteristics and reliable quantity and delivery. Bilateral contracting and vertical integration allow processors to satisfy consumers' desire for more complex farm products more effectively than traditional cash markets. To minimize their costs, processors seek out the most efficient producers who can meet their requirements. Additionally, because searching for producers, negotiating, and writing contracts have costs, processors will engage the fewest number of producers possible (whose combined expected production will meet their input demand) to reduce transaction costs.

Because of this, the welfare effects of the transition to thin markets are not equally distributed. In a thin market environment, small producers face a natural disadvantage. Larger producers can spread their fixed costs over a bigger crop, meaning lower production costs and lower sustainable prices. While small growers might be able to differentiate themselves sufficiently in the short run to fill a customization niche, scale and scope economies will attract more efficient producers as the market matures; cost-minimizing processors will tend to choose larger producers.

Furthermore, all thin market producers confront concentration risk—i.e., if they make investments to tailor their output to a particular processor's tastes, a producer may have difficulty attracting another buyer or arguing for better contract terms if the original relationship sours or becomes less stable (Vukina and Leegomonchai, 2006; Crespi et al., 2012; Sexton, 2013). For example, in the case of malting barley, a farmer who is growing a proprietary variety for one brewer must exit production and plant an alternative crop (e.g., alfalfa, wheat, corn, or oilseed) on his or her acreage to prevent contamination between differing brewery-preferred seed mixes before selling to another brewer. Because a contract with another brewer cannot be secured until the land is ready for planting, switching buyers increases costs and risks to the producer. Still, this commitment on the part of the farmer to a particular brewer improves that brewer's confidence in their longrun relationship, and thus the brewer's incentive to offer an attractive price (Adjemian et al., 2016).

Thin Markets From a Regulator's Perspective

USDA's regulatory mission includes collecting and disseminating commodity market information, administering price supports for selected commodities, and managing crop insurance programs; as a market grows thinner, each of these tasks becomes more complicated.

Markets work better and more equitably when their participants are well informed, but organizing and validating market information involves substantial search costs, so private entities have little incentive to provide those services at an optimal level. Consequently, public entities (like USDA Market News) serve an important role by publishing transaction data. Cash and derivatives markets operate in public and transparent forums—in thick markets, there are few barriers to collecting and publishing price and quantity data beyond the costs of carrying out these activities. In thin markets dominated by bilateral contracts, however, these data are privately held so USDA asks large participants to provide them on a voluntary basis.

However, sparsely collected data are generally less reliable. Aside from reporting errors, the voluntary format poses clear problems to the process used to estimate population characteristics from a statistical sample. Moreover, when there are a small number of processors who operate in a certain market segment or region, USDA withholds price and quantity data to protect their identities. USDA's National Agricultural Statistics Service requires a minimum threshold of reports from active processors for publication, and no single report can exceed a pre-set ceiling of the specific market share, unless the responsible large processor(s) agrees to waive that restriction. Even when there is a sufficient sample to publish market statistics, some highly differentiated producers complain that doing so is unhelpful because some published prices represent an average (and farm goods are often far from homogeneous). Consequently, more specialized and, in many cases, smaller producers find themselves having to justify the need to receive a higher price to their buyers, even if their product has attractive, distinctive attributes.

An important exception to the voluntary format is that large packers must provide data to USDA for cattle, beef, swine, pork, sheep, and lamb meat. Mandatory Price Reporting (MPR) for certain livestock commodities was originally established in 1999 to improve available price and transaction information and to foster competition in response to concerns over packer market power (Perry et al., 2005; Mathews et al., 2015). Specifically, MPR facilitates the dissemination of information about price, volume, quantity, and location of reported transactions, with the goal of enhancing price discovery and, ultimately, the marketing strategies used by participants. The empirical evidence to date suggests that livestock market price efficiency has generally improved after the advent of MPR—price relationships between contract and cash markets have not changed for cattle and hogs, even as concentration has increased (Ward et al., 2014). There is also evidence that prices for these commodities now respond better to new information (Mathews et al., 2015).

Additionally, insuring a thin market crop is problematic. USDA offers producers a range of insurance options to protect their yield or revenue from loss due to problems like poor weather or pests. Crucial to establishing the liability level, a fair insurance premium, and payout methodology, however, is an accurate forecast of the price a producer would otherwise receive. For a thick market commodity like corn, up-to-the-second forecasts are easily found in an active futures market. For thin market commodities like organic corn or peanuts, however, the forecast procedure is more complicated. Historical data for prices are combined with prices and

volatilities for related commodities or production substitutes that have active futures markets.[14] Data reliability issues, harvest timing, and individual market supply and demand shocks affect the accuracy of the underlying historical correlations USDA uses to design insurance products.

Likewise, USDA farm support initiatives are complicated by thin markets' poor price transparency. To help producers of certain commodities avoid having to market their crop when prices are lowest and supplies are highest (at harvest time), USDA offers them cash flow assistance via marketing assistance loans (MALs) through the Commodity Credit Corporation (CCC). These loans are offered at the marketing loan rate, as established by statute, and the CCC uses historical production data to adjust the loan rate by commodity type or production region. Periodically, the CCC uses market data to arrive at a posted price. When posted prices exceed MALs plus interest charges, producers are responsible for loan repayment. But when the reverse occurs, and posted prices fall below loan rates, the producers can repay the loan rate at that lower price. As a last resort, the producer can forfeit the commodity to the CCC in settlement of the debt. A related price support is known as a loan deficiency payment (LDP), which pays the difference between the loan rates and a reduced posted price, multiplied by production size, to producers who forego the marketing loan. However, because thin market price discovery is not transparent, establishing a credible posted price is difficult and setting a proper marketing loan rate can also pose challenges (see box 5, "Peanuts: A Thin Market With a Government-Set Price Floor").[15]

[14]A detailed methodology for these procedures can be found at http://www.rma.usda.gov/pubs/index html#priceelection

[15]See Yancy (2004), Hollis (2006), and Hollis (2011) for concerns over the national posted price for peanuts.

Options To Address Thin Markets

Although the empirical and theoretical evidence to date supports the conclusion that coordinated production and marketing (and the efficiency gains a longrun perspective brings) generally supersede the exercise of processor market power, many stakeholders have expressed concern about increasing concentration in major domestic markets. Policymakers have a range of options to choose from to address thin market issues.

Limit vertical integration—Critics of coordinated production favor competitive cash market exchange, believing that it reduces market power among processors and benefits producers by increasing farmgate prices. Consequently, they support legislative efforts to curb processor-owned supplies. As evidenced by the GIPSA rule, congressional focus on such supplies is particularly significant for packer ownership in livestock markets (Saitone and Sexton, 2012). However, banning or limiting packer-owned livestock would not necessarily increase cash market volume and price transparency. Instead, affected packers would have incentive to contract with producers since contracting offers at least partial control over the production process (for livestock, feed inputs, living conditions, and the quality and age mix of animals to promote packer efficiency). Moreover, legislation that forces packers to forego efficiency gains and purchase a certain percentage of their livestock on the cash market is not likely to benefit producers. Rather, recent econometric evidence demonstrates that forcing integrated hog packers to shift their operations to the cash market would actually reduce cash prices (Wohlgenant, 2010).

Standardize contracts—Critics have also expressed concerns that contracting is used to exert processor market power, rewarding certain producers and not others, with the aim of constraining competition and reducing the prices they pay for farm goods. One potential solution would be uniformity in contracts—i.e., eliminating disparities in contract terms so that all producers get the same deal and can compete on an equal basis to obtain contracts. However, processors tend to use contracting as a means to coordinate production and improve market efficiency, rather than as a tool to effect market power. Eliminating the ability to reward producers for meeting key input requests may drive away the most efficient producers into other commodities or activities. Nevertheless, because the contracting process involves transaction costs, it can leave small producers at a disadvantage, so facilitating the contracting process is a potential area for progress. Establishing a common format in each market that uses clear language to communicate terms—while allowing terms to differ between negotiating parties—reduces transaction costs and improves the footing of small producers (while preserving efficiency gains). Efforts to collect sample contracts for informational purposes can aid this process.

Clarify the price discovery process—Although many thin market processors internalize the value of a stable input supply and pay producers well to procure it, thin markets are naturally less transparent than thick ones. Market observers and producers are then left to wonder about the fairness and efficiency of the price determination process. This is especially true in the case of livestock, as benchmark cash markets see less and less volume, and structural changes leave some participants uneasy. The jobs of regulators, too, are complicated when consensus price forecasts are not readily available. When thin cash markets become too thin, Saitone and Sexton (2012) recommend selecting a better benchmark price (such as a price paid by a large marketing cooperative if one is operating in the industry) or tying the producer price to a share of a transparent downstream price. Whatever the appropriate

reference price, gathering and publishing transacted prices, quantities, and the size and number of market participants reduces informational disparities. MPR for processors has increased public knowledge about livestock prices and is one potential approach to increasing transparency in thin markets. However, some producers complain that prices reported for average products weaken their stance during negotiations (especially if their product is customized). Rather than publishing a single average price, a price range may better represent thin market commodities that differ due to product attributes.

Recognize new challenges—Small producers operate at a disadvantage in thin markets because limiting transaction costs drives processors to contract with the fewest producers necessary to achieve their desired output. Rational processors target the most efficient producers and these tend to be the largest (due to scale economies), which can cause small producers to exit the industry and, potentially, the rural community. Policies that could improve outcomes for small producers by enhancing their economic efficiency include providing public information about expected market conditions, and production and marketing advice through public extension services.

Conclusion

Trends in the production and marketing of U.S. agricultural products are pressuring many markets to concentrate, particularly on the processor side, and move away from a traditional cash market in favor of a contract exchange system. These developments are controversial because processors could use informational and structural advantages to depress farm-level prices compared to what would be generated by a competitive market. Empirical evidence of significant market power effects, however, is itself quite thin. Nonetheless, the low volume of trading in thin markets does reduce price transparency, making it difficult to gather commodity data and assess market performance. It also complicates USDA's efforts to administer crop insurance and price support programs.

On the other hand, as farm products become more differentiated, bilateral contracts and vertical integration offer more opportunities for coordination than traditional cash markets and foster efficiency gains that may ultimately benefit certain producers. This result emerges when thin market processors internalize the benefit of a stable input supply, and resolve information problems not addressed by the cash market. Those thin market producers who can successfully enter and maintain contracts with forward-looking processors will achieve returns that meet or exceed their longrun costs, including a fair return on investment. However, small producers who are not as successful and unable to adjust to the new environment may be left behind.

Concentration does not necessarily imply lower prices, and effective regulatory efforts to address thin markets should consider the benefits offered by the coordinated production system. Attempting to impose competition on naturally thin markets can have adverse consequences for producers, processors, and consumers. On the other hand, thin markets can be improved and made more effective for producers through efforts to increase the availability of transaction information, as well as information about production and marketing alternatives, and by lowering contracting costs.

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Appendix: When Do Processors Forego Market Power?

The following framework demonstrates the conditions under which market power is exercised in a thin market. This model represents the choices available to a single buyer, although it can be extended to a market with several buyers. A monopsonist *i* faces a constant downstream demand for $\overline{Q}_i$ and chooses its input quantity to select between a market power approach and a throughput (i.e., longrun) approach to processing. Assume that by restricting the time period $t = 0$ processing demand to $Q_i^* < \overline{Q}_i$, buyer *i* can achieve single-period market power profits of $\Pi_0\left(Q_i^*\right) > \Pi_0\left(\overline{Q}_i\right)$, where $Q_i = \sum_j Q_j$, for $j = 1,2,3, \ldots, J$ producers. However, because the market power approach pays a producer price of $P^* < \overline{P}$, only those producers who have a low enough longrun average cost function, C_j^L, such that $C_j^L\left(Q_j\right) \le P^*$, can stay in the market for future time periods $t > 0$. After that, the maximum available production choice is expected to be $E_0\left[\widehat{Q}_i\right]$, which declines as P^* is reduced, since more and more producers would be forced out of the market.[16] Depending on the characteristics of the market, $\widehat{Q}_i \le Q_i^*$, so that the current expected value of future profits is $E_0\left[\Pi_t\left(\widehat{Q}_i\right)\right] \le E_0\left[\Pi_t\left(\overline{Q}_i\right)\right]$ for time periods t = 1,2,3, … ,*T*. Because the output demand and cost functions are assumed to be constant, this simplifies to $E_0\left[\Pi_t\left(\widehat{Q}_i\right)\right] \le \Pi_t\left(\overline{Q}_i\right)$.

Using the net present value (NPV) of returns, given a discount rate of *r*, buyer *i* chooses to exercise market power if the following inequality is satisfied:

$$\Pi_0\left(Q_i^*\right) + \sum_{t=1}^{T} \frac{E_0\left[\Pi_t\left(\widehat{Q}_i\right)\right]}{\left(1+r\right)^t} > \sum_{t=0}^{T} \frac{\Pi_t\left(\overline{Q}_i\right)}{\left(1+r\right)^t} \qquad (1)$$

Rearranged, this expression balances any excess market power returns at $t = 0$ against the NPV of future profits from maintaining an ample supply of the farm product:

$$\Pi_0\left(Q_i^*\right) - \Pi_0\left(\overline{Q}_i\right) > \sum_{t=1}^{T} \frac{\Pi_t\left(\overline{Q}_i\right) - E_0\left[\Pi_t\left(\widehat{Q}_i\right)\right]}{\left(1+r\right)^t} \qquad (2)$$

So, the keys to whether processors in thin markets apply market power are:

(a) Whether market power at $t = 0$ forces enough producers out of the market to push expected future returns below those available in a cooperative approach,

(b) Whether single-term profits from squeezing producers are large enough to compensate buyers for any expected losses from time periods 1,2,3, … ,*T* if (a) is true, and

(c) A processor's outlook horizon, or discount rate. The higher the discount rate, the more value is placed on short-term returns compared to distant ones—and the more likely a processor is to exercise market power over producers. In equation (2), this can be seen easily: as *r* increases, the term on the right side of the inequality gets smaller, minimizing the importance of any expected future losses in favor of the shortrun market-power gains represented on the left hand side. Alternatively, if $r = 0$, intertemporal profits are weighted equally, and the market-power

[16]We assume that, once exercised, the threat of repeat buyer market power or difficulty of customized production keeps other producers from subsequently entering the market.

returns must be very large to drive a buyer to act as a monopsonist when compared against the sum of all future throughput returns.

Several predictions can be illustrated by studying equation (2). If farm-product customization and differentiation is high, forcing established producers out of the market reduces $E_0\left[\widehat{Q}_i\right]$ and likely $E_0\left[\Pi_t\left(\widehat{Q}_i\right)\right]$, making the coordination approach more profitable. The more profitable it is to operate the plant at peak efficiency (say if differentiated goods are highly desirable), the higher is $\Pi_t\left(\overline{Q}_i\right)$ relative to $\Pi_0\left(Q_i^*\right)$ and $E_0\left[\Pi_t\left(\widehat{Q}_i\right)\right]$, favoring the throughput approach. Likewise, the same effect applies the more likely the industry is to establish itself and perpetuate, since that increases *T*. Conversely, declining industries reduce *T*, while financial distress and negative macroeconomic shocks increase *r*; both effects work the other way and make shortrun market power profits more attractive.