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How and Where is Price Established?

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The question "How and Where is Hog Price Established?" is a seemingly simple one. The pricing mechanism for hogs, however, is complex. Prices for hogs, as for other commodities traded in competitive markets, result from the interaction of supply and demand. But a long list of factors affects supply and another long list affects demand. In addition, the precise state of each of the factors and the exact influence on supply and demand are often not fully known at any given time.

Demand

"Demand" for a product is not consumption. If true, demand for pork and hogs would be nearly synonymous with production since, after making adjustments for imports, exports and carryover stocks, the pork produced in any given year is consumed. The important question is: At what price? Demand must therefore be defined in terms of both price and quantity. *Demand is the relationship between alternative prices and the quantities of a commodity which buyers will purchase at those alternative prices.* Lines D_1 and D_2 in Figure 1 represent two such relationships.

To understand the demand for pork, one must have a clear idea of two concepts: change in quantity demanded and change in demand.

A "change in quantity demanded" occurs when only the price of pork changes and consumers respond by altering the quantity they are willing to buy. This is illustrated in Figure 1 by the move from point A to point B in response to an increase in supply from S_1 to S_2 . Quantity demanded changes from Q_1 to Q_2 . This adjustment is merely a move along D_1 , the existing relationship between quantities which buyers will purchase and the alternative prices at which the product may be purchased. D_1 is a demand schedule.

A "change in demand" involves a shift of the entire demand schedule. This is represented by the shift of D_1 to D_2 in Figure 1. With supply constant at S_1 , price changes from P_1 to P_3 solely because of the change in demand. Demand shifters for pork include 1) consumer preferences, 2) consumer income, 3) prices of beef, broilers and other competitive products, 4) prices

of complementary products and 5) season of the year. Note that advertising, promotion, race, religion and culture are not listed as demand shifters. These factors are manifested in the demand structure through consumer preferences.

For many years, the demand for pork was about constant—a given quantity placed on the market brought about the same price as before. During the '60s and '70s, though, the demand for beef increased thus putting pork in a disadvantageous position. In the early '80s, however, demand for both beef and pork declined markedly. It appears that the demand for pork has shifted upward somewhat since 1986, while the demand for beef declined through 1987. Beef demand appears to have improved in 1988, but declined again in 1989. The exact cause of these shifts is not known. But a combination of factors such as declining poultry prices, health concerns over cholesterol and changing lifestyles probably all played a part.

Finally, the nature of a given demand schedule, as well as the factors which shift it, are vitally important. Demand for pork is "inelastic." This means that a given percentage change in the

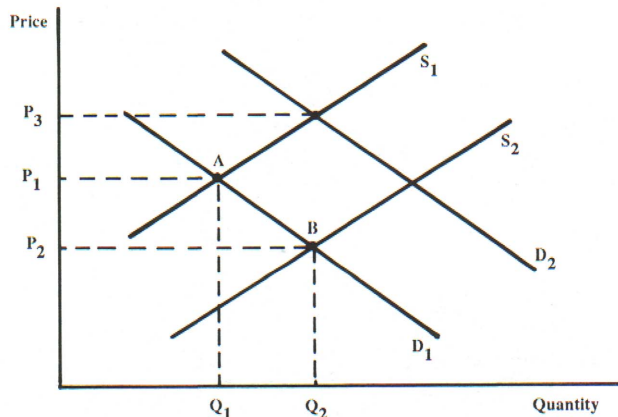


Figure 1. Change in demand and change in quantity demanded.

quantity of pork placed on the market will cause a larger percentage change in retail prices. And of course, the larger percentage change in retail prices will be in the opposite direction of the change in supply. This is why a relatively small increase (decrease) in pork supply often causes a surprisingly large decrease (increase) in prices. The relative size of these changes when demand is inelastic causes total revenue to fall when quantities increase, and to rise when quantities decrease.

Supply

"Supply" is not simply the quantity placed on the market. *It is the relationship between alternative prices and the quantities producers are willing to place on the market at those alternative prices.* As was discussed for demand, changes in the quantity offered for sale can be caused by either of two distinct happenings: change in quantity supplied in response to a change in price and a change in the supply schedule itself.

A change in quantity supplied is simply a response to a different price. If the price goes up while production costs remain constant, a producer is willing to produce and sell more; if it goes down, a producer is willing to produce and sell less. These reactions illustrate movement along a supply schedule. Such a change is shown by the move from point A to point B on supply schedule S_1 in Figure 2. Note that an increase in demand from D_1 to D_2 caused price to increase from P_1 to P_2 and quantity supplied to increase from Q_1 to Q_2 , yet did not change supply schedule S_1 .

A change in supply involves a shift of the entire supply schedule. This is illustrated by the move from S_1 to S_2 in Figure 2. Supply shifters for hogs include 1) input prices (feeder pigs, corn, soybean meal, other feed ingredients, labor, interest rates, etc.), 2) opportunities for income from alternative farm enterprises such as beef cattle or crops, 3) expectations of factors 1 and 2, and 4) time.

Time is a factor because of the biological nature of hog production. Production responses to higher or lower prices will be greater over longer periods of time than they will be over a few days or weeks. In Figure 2, the short-run production response to the price increase P_1 to P_2 is a change from Q_1 to Q_2 (i.e. move along supply schedule S_1). However, the long-run increase (where "long-run" is a time period sufficient to allow for increased gilt retention and, possibly, construction of new facilities) is from Q_1 to Q_3 where supply schedule S_2 intersects demand schedule D_2 . Supply increases from S_1 to S_2 because of the increased production capacity of a larger sow herd. The fact that time allows for more production response can be seen from Q_3 being larger than Q_2 . Schedules S_1 and S_2 are short-run supply schedules, and schedule LRS is the long-run supply schedule.

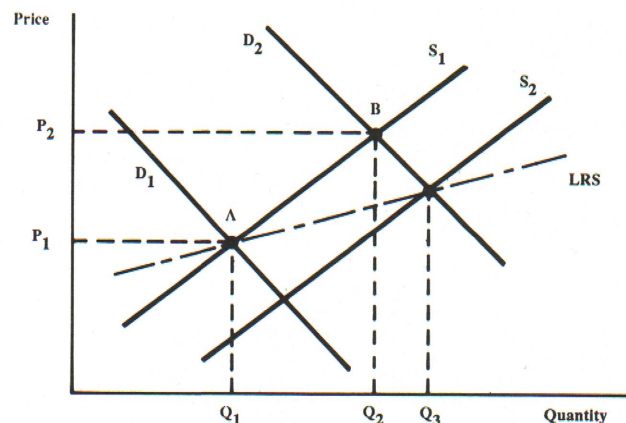


Figure 2. Change in supply, change in quantity supplied and long-run supply.

Supply and Demand: Retail vs. Farm

The demand for market hogs is derived from the demand for pork. Having an idea of the demand schedule for pork, retailers deduct an amount sufficient to cover their costs and provide a profit and thus define a wholesale demand schedule for pork. Like retailers, packer-processors then deduct an amount sufficient to cover costs and provide a profit and thereby define the demand for market hogs. So, the demand for market hogs is derived downward from the demand for pork.

The supply of retail pork is derived from the supply of market hogs. This is accomplished by all levels of the marketing system adding their costs and desired profits to the cost of the purchased item (be that wholesale cuts or hogs). So, the supply of pork is derived upward from the supply of market hogs.

Marketing margins (the difference between retail price and farm price for equivalent units of product) are most accurately characterized as being the residual of retail price over the cost of market hogs. Marketing costs (i.e. costs of processing, packaging and transportation) exert a major influence on the size of the marketing margin. The relative bargaining power of the parties involved, however, is also an important factor.

Hog slaughtering capacity is limited and tends to be scaled toward an average crop of market hogs. As hog production drops below historical averages, the bargaining power of producers improves. Packers need hogs to keep plants operating as efficiently as possible. Toward this end, they compete actively with one another for the available hogs, thereby driving live-hog prices up relative to wholesale and retail prices. Packer profits are reduced by both narrowing gross margins and higher per-unit slaughtering and processing costs which result from less-than-optimal plant utilization.

As hog production rises above historical averages, producer bargaining power drops drastically. Packer slaughtering capacity is sufficiently utilized, and packers are not forced to bid as actively or aggressively as when hog numbers are short. Farm-level prices fall relative to wholesale and retail prices and packer-processor profit margins increase.

The latter of these results is often observed by producers as inequitable. When producer prices are lowest (with production up) packer-processor margins and profits are greatest. But remember, when producer prices (and usually profits) are highest, packer-processor margins and profits are smallest. Therefore, the matter of what is equitable with regard to marketing margins is very much in the eye of the beholder. In any event, though, the situation is marked by sharp fluctuations—or instability.

Price "Determination and Discovery"

On the question of who or what determines prices, it is useful to distinguish between price discovery and price determination. It is often easiest to discover prices at assembly points such as terminal markets and auctions, because it is here that more than one buyer and seller will be present. From the above discussion, it should be obvious that this does not mean that prices are determined at these points.

Prices are determined by buyers and sellers acting upon their knowledge of supply-demand information at a given point in time. This information travels both horizontally through the system (among farmers or producers) and vertically from consumers to farmers and back again. Studies have shown that prices are simultaneously determined by everyone operating in the market and at all levels of the system.

There is some concern that the declining proportion of hogs which moves through terminal markets and auctions has impeded the price discovery process. Whether this impediment has been offset by improvements in price and market information reporting systems is, as yet, an unanswered question.

Types of Price Changes

There are four basic types of price changes in the hog industry. They are 1) trends, 2) cycles, 3) seasonal variations and 4) day-to-day changes.

Trends

Long-term trends in U.S. hog prices are related mainly to four factors: inflation, production efficiency, changes in consumer preferences and marketing-distribution service. Inflation affects hog prices simply by changing the value of the dollars in which prices of hogs and production inputs are established. Production efficiency affects hog prices by shifting the supply of market hogs and, consequently, pork. Supply increases (shifts to the right in Figure 2) when producers become more efficient and thereby reduce production costs. Conversely, supply decreases when production efficiency falls. Consumer preferences influence hog prices through their effect on retail (and thus farm-level) demand.

Marketing-distribution services can affect prices through their influence on the size of the marketing margin. If marketing and distribution can be performed at less cost, the marketing margin may decrease without affecting packer-wholesaler-retailer profits. This will allow either of two things (or a combination of them) to happen. First, farm demand may increase relative to retail demand, simply because the cost of marketing and distribution activities declines. This would allow producers to get higher prices for the same amount of live hogs without any increase in retail prices. Second, retail supply may increase relative to farm supply. Such a shift would cause the retail price to fall thereby increasing the quantity demanded at retail (and at the farm) without driving farm prices downward. Either of these scenarios results in higher revenues at the farm level and demonstrates that producers have a definite stake in an efficient marketing and distribution system.

In addition, improved marketing-distribution services may not reduce the size of the marketing margin and still help pork producers. This happens when the marketing-distribution sector (frequently in cooperation with producer groups) develops better products, more accurately identifies consumers' desires or more effectively influences consumers' preferences through advertising and promotion. All of these result in increased retail demand for pork. That is, the demand curve has been moved to the right. If marketing margins remain constant in this process, the entire amount of the increase in demand is passed along to the farm level. Even if marketing margins increase, some portion of the increase in retail demand may be passed through to the farm level. In this way, more effective marketing-distribution leads to value-added products from which producers may benefit even if marketing margins increase.

Trends emerge from the interplay of these factors. If improvement in production efficiency causes supply to increase by a larger amount than changes in consumer preferences cause demand to increase, the price trend is downward. This situation is illustrated in Figure 3. On the other hand, if, say, improved marketing-distribution services cause demand to increase by a larger amount than supply increases, the price trend is upward as in Figure 4. Other situations can be easily visualized from these diagrams.

Cycles

Hog cycles are the single most important source of wide variations in hog prices. The time necessary for producers to respond to changes in profitability is one reason for cycles. This factor, however, accounts mainly for cycles' lengths, not their existence. For many years it has been assumed that the reason for the existence of price cycles is that producers make production decisions on the assumption that selling prices (or

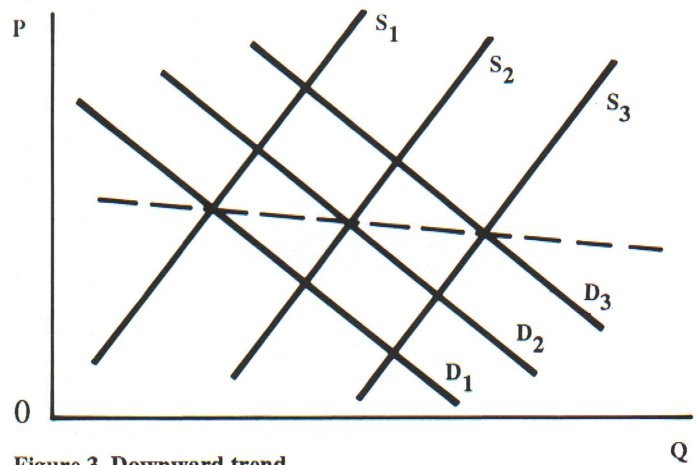


Figure 3. Downward trend.

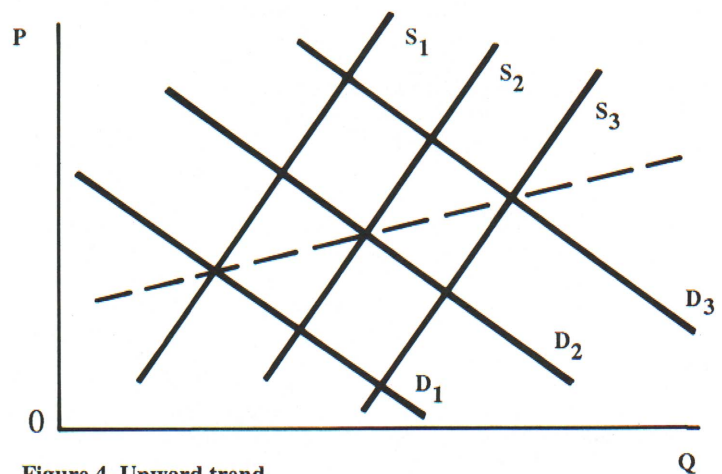


Figure 4. Upward trend.

profitability) will remain about constant at existing levels. While recent and expected profits may influence producers, it is hard to imagine that producers who have seen cycles for many years are naive or not able to learn from painful experiences.

There is a more plausible explanation. Up markets bring with them many reasons for expansion even if producers do not believe the favorable market will continue. These include the increased availability of capital, more positive outlooks of individuals involved in management decisions (i.e. bankers, spouses, consultants, etc.) and potentially high-tax liabilities which may make equipment and breeding stock purchases (and depreciation on these assets) attractive.

Conversely, down markets are accompanied by the opposite of these situations; cash flow is tight or negative, attitudes are negative and tax liabilities are of little concern. Such conditions may result in liquidation even though producers believe profitability will increase.

There are two principal phases of the hog cycle: the expansion phase and the liquidation phase. Each has distinctive characteristics. During the expansion phase, hog prices are relatively high. This encourages producers to increase the quantity supplied in the long run. The culling rate on sows is reduced, sow slaughter drops and more gilts are retained in herds for breeding purposes. These actions tend to reduce marketings (i.e.

the quantity supplied) in the short run and drive market prices even higher. However, the increased number of breeding animals which results from increased sow and gilt retention eventually causes supply to increase. Because of the inelastic demand for pork, the price declines, which result from the increase in supply, are often abrupt.

The liquidation phase develops when prices turn lower. Producers keep fewer gilts for breeding and cull more sows. These added marketings put further downward pressure on prices in the short run and may result in large quantities of pork and pork products in the marketing channel and storage. Reductions in the breeding herd will eventually cause supply to decrease which, in turn, will cause prices to increase and start the entire cycle again.

Seasonality

Seasonal variations in prices are associated with seasonal changes in both supply and demand. Seasonal variation in hog production and consequent changes in hog slaughter and pork supply cause the majority of these variations. Pork demand does have some seasonal variations which can be important at certain times. Examples are the historical increase in the demand for spareribs and bacon in summer months and in the demand for ham and sausage in the winter months.

Hog prices have two fairly distinct seasonal peaks and two valleys (Figure 5). A major upturn in prices often occurs in May or June due to reduced farrowings and litter sizes in the winter months. Prices usually peak in July or August. A significant price downturn usually runs from late August through October due to the increased number of sows which farrow in the spring

and early summer months. A secondary price peak is common in January and early February. The fall pig crop, normally smaller than the spring crop, reaches market weight in March or April, depressing prices again during this season. These lower prices may extend into May or early June, depending upon winter weather and its effect upon litter sizes and rates of gain.

There is evidence that year-round farrowing has reduced seasonal variations somewhat in recent years. As the proportion of hogs produced in pasture farrowing and rearing systems continues to decrease, seasonal variations may diminish even further. It is not anticipated that they will disappear because the seasonal demand factors will still be present.

Cold storage of pork products also tends to reduce seasonal price fluctuations. Packers build stocks in periods of high-hog numbers and reduce stocks when numbers are less. While excessively large cold-storage stocks of pork can be negative factors on hog prices in the short run, the process of building stocks may well reduce price declines at some times of the year.

Short-term Factors

The major short-term factor affecting hog prices is the number of hogs marketed (and thus slaughtered) on a given day or in a given week. Figure 6 shows average weekly slaughter for 1980-89. Excluding dramatic declines in May, July, September, November and December, which are attributable to holidays, there still is substantial variability in weekly slaughter volume. These fluctuations can have a major impact on live prices because orders for wholesale and retail cuts are taken by packers in advance, and there is limited storage capacity for carcasses and wholesale cuts.

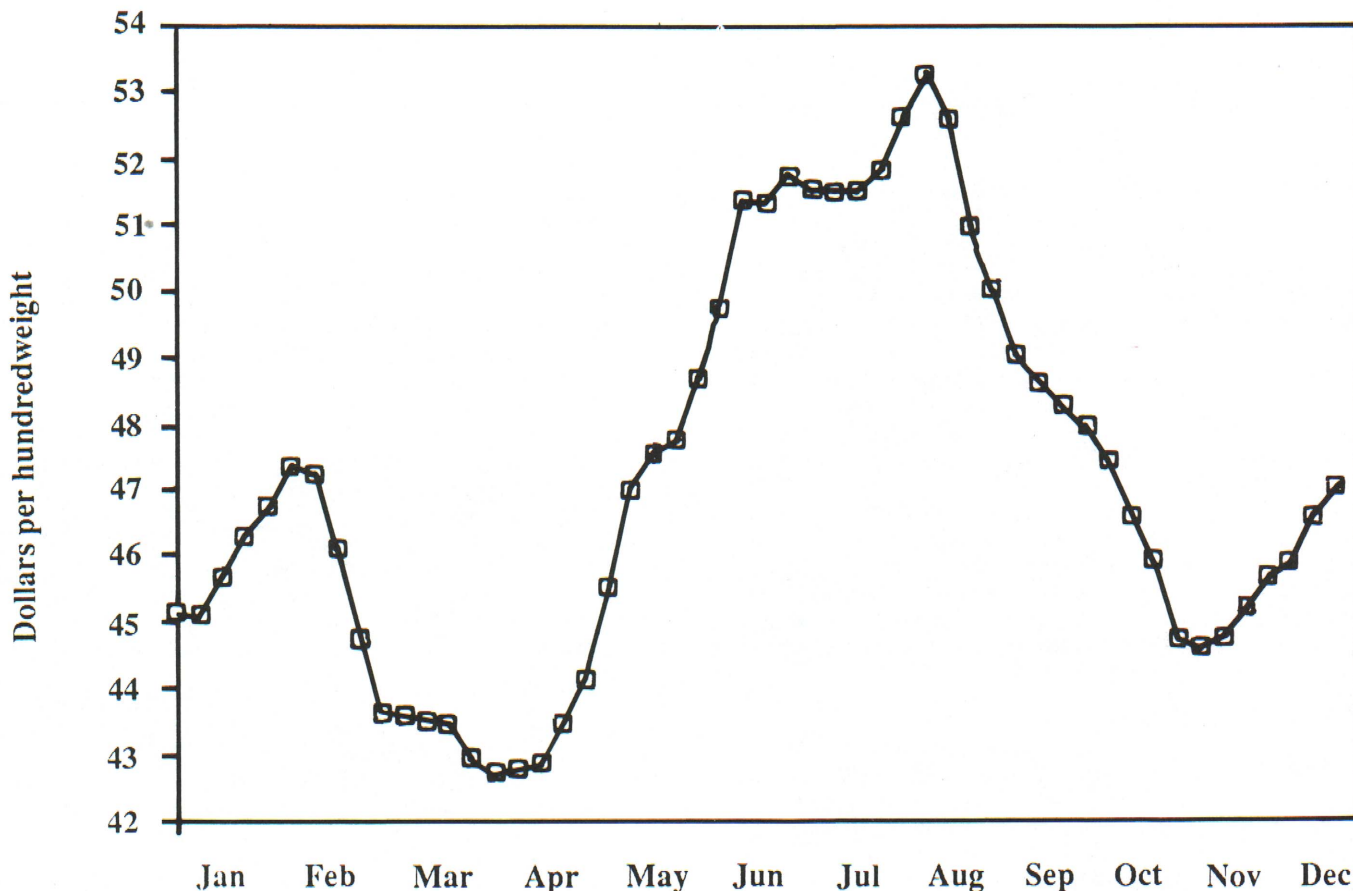


Figure 5. Average weekly barrow & gilt prices 1980-89 of seven markets.

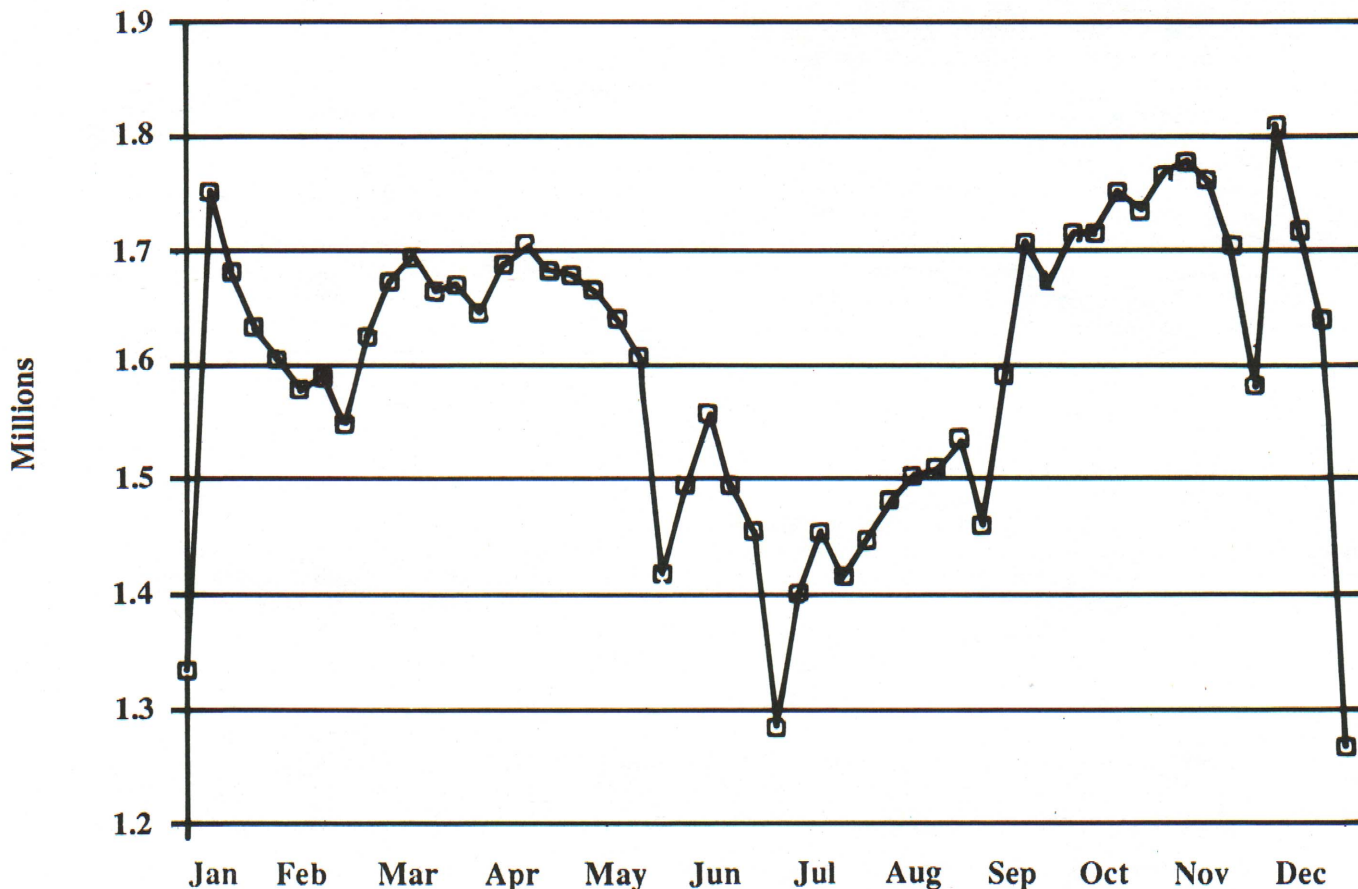


Figure 6. U.S. average weekly federally inspected hog slaughter, 1980-89.

Backlogs of hogs on farms can also cause short-term price changes. Hogs are sometimes held on farms when 1) prices are low and/or are trending downward, 2) producers are preoccupied with farming activities or adverse weather, 3) substantially higher prices are expected and 4) hog prices are high in relation to feed prices. In all cases, withholding hogs may have positive impacts on prices in the very short-term, but may cause prices to decline sharply when the animals are finally sold at heavier weights. In addition, these heavy hogs may have some long-term negative impacts on demand because of the increased fat content of heavy carcasses and the negative consumer perceptions which fatty cuts may cause.

Finally, short-term fluctuations in consumer demand for pork may contribute to short-term price changes for market hogs. These changes are most easily seen in the marketplace in wholesale prices. Stocks of wholesale cuts available on any given day are largely fixed so day-to-day variation in the prices of these items is mostly a function of variations in consumer demand.

Pricing Systems

The final source of variation in hog prices is the pricing system. The systems used are live weight and visual appraisal, reputation and carcass merit. Great variation exists from packer to packer in the system used and even the characteristics of systems.

The oldest method of pricing hogs is live weight and visual appraisal. This method is most commonly used at terminal markets, country markets and auctions. Some weight range is specified for top hogs by packer buyers. Discounts are applied to

hogs that do not fall into this weight range while both premiums and discounts may be used for hogs that deviate from some norm in terms of fatness and muscling. Degree of fatness and muscling are determined visually by the packer buyer. Price premiums and discounts for leanness and muscling are usually small in this system and therefore penalize high-cutability hogs while favoring those with low cutability.

Carcass merit pricing systems were based on USDA grades and carcass weight until the advent of the National Pork Producers' Council (NPPC) Lean Value Buying Guide in 1981. Since then, backfat thickness and, in the original NPPC system, degree of muscling have replaced USDA grades in most packer carcass merit pricing programs. Today, the terms "grade and yield", "carcass merit" and "lean value" are, for all intents, synonymous. However, individual packers have developed their own versions of the system which have 1) base carcass weights and premium/discount structures which differ from the NPPC guide and 2) usually omit premiums and discounts for degree of muscling.

In all carcass merit pricing systems, prices are paid for carcasses, not live animals. A base carcass price is applied to carcasses which meet certain standards for weight and backfat thickness. Premiums are paid for leaner carcasses of a given weight or heavier carcasses with a given backfat thickness. However, carcass weights must fall within a prespecified range to be eligible for premiums. Packer employees do all of the carcass measuring in today's systems. Only after carcass prices have been determined is dressing percentage applied to convert prices to a liveweight basis.

The proportion of hogs sold on a grade and weight system

has fallen since 1985 after twenty years of growth. In 1965, only 3.6% of all hogs were sold on a grade and weight system. This percentage grew steadily through 1985 when it reached 23.4%. The percentage fell to 19.5% and 15.7% in 1986 and 1987, respectively. The most plausible explanation for this decline is the emergence of new packers that employ a reputation pricing system in which premiums and discounts are based upon the historical quality of animals sold by the individual producer, not necessarily the quality of the lot of hogs being sold.

Summary

Hog prices are established by the interplay of many forces ranging from long-run changes in consumer tastes and preferences to short-run factors such as the fat content of the particular hog being sold. Prices are frequently discovered at concentration points in the swine-pork industry because it is at these points that information is most easily disseminated and received.

Cycles play an important part in the variation of hog prices over time. The biological lag of actual production to production decisions explains the length of hog cycles. Recent and expected profitability, the availability of resources and attitudes of influential parties are the reasons for the cycles' existence. Cycles have recognizable expansion and liquidation phases of which knowledge is important if producers are to make sound financial, production and marketing decisions.

Season affects hog prices for two reasons; variation in production and variation in demand, with the former being the more important. Hog prices usually peak in July and August and reach lows in October and November. A secondary peak usually occurs in January and February while another seasonal low occurs in March and April.

Short-term moves in hog prices are a function of the number of hogs marketed (and thus slaughtered), retail movement of pork and the resulting changes in prices of pork carcasses and primal cuts. Short-term fluctuations in demand are usually less significant than those on the supply side. The cut-out value of pork carcasses and the particular cost structures of pork processors are balanced by packer buyers in determining daily bids for market hogs.

Related Publications

The following PIH factsheets contain additional information related to swine production.

- PIH-6 Producing and Marketing Hogs Under Contract
- PIH-12 Choosing a Slaughter Hog Market
- PIH-19 Using Futures Markets for Hedging
- PIH-24 Optimal Weight to Market Slaughter Hogs
- PIH-109 Commodity Options as Price Insurance for Pork Producers
- PIH-119 Understanding Hog Production and Price Cycles
- PIH-123 Marketing Cull Sows



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Issued in furtherance of Cooperative Extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Michael J. Tate, Interim Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.