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Formula Pricing in Five Commodity Marketing Systems

Marvin L. Hayenga and Lee F. Schrader

Formula pricing has been a subject of concern in the food industry for twenty years, and perhaps longer (NCFM Report, p. 98). Formula pricing contracts involve prices on individual shipments or transactions which are tied directly, by formula, to a specific market price quotation. After buyers and sellers agree on the formula, subsequent transactions are routine and low in cost.

Formula pricing is a delegation of price discovery to those who negotiate prices. Consequently, the market mechanism and the price reporting services which generate the prices used in formula-priced contracts have an increasingly important and potentially more difficult burden placed upon them. Formula-pricing arrangements reduce the fraction of total supply entering into market price determination, and the resulting, more thinly traded markets may be more sensitive to erratic or manipulative influences on market prices or market price reports.[1] More recent concerns in the beef subsector are evidenced by several court cases, hearings before a House Small Business subcommittee, a special USDA Meat Pricing Task Force, and congressional bills focusing on meat industry pricing and price reporting systems (e.g., H.R. 91, 1979).

This study focuses on formula pricing in five commodity marketing systems where formula pricing was known or expected to be heavily used. We analyze the extent of formula pricing use in those markets, the incentives for or benefits of formula pricing, and the disadvantages and problems associated with formula pricing. Through a comparative analysis of formula pricing in the beef, pork, cheese, turkey, and egg markets, we offer some insights into the similarities and differences found in these markets and the sources of the controversy surrounding formula pricing systems. A few policy alternatives are then briefly considered.

The Extent of Formula Pricing

To determine the extent of formula pricing in these five marketing systems in 1978, we surveyed via personal or telephone interviews a high proportion of the largest firms involved in the markets where formula pricing was prevalent. In beef and pork, the large slaughter-processing firms surveyed accounted for 40% and 60% of the total market volume, respectively (Hayenga 1978, 1979b); the major cheese-marketing firms surveyed accounted for 85%–90% of the cheese consumed in the United States (Hayenga, NC-117 Work. Pap. No. 38); the firms surveyed in the turkey subsector accounted for about 66% of the industry's volume (Schrader and Lang). In addition, supplemental surveys of a smaller number of buyers and suppliers provided confirming evidence of the extent of formula-pricing use and supplemental views of the perceived advantages and problems. The egg market analysis draws upon a recently completed comprehensive study of coordination systems in the egg subsector (Schrader et al.) and Schrader's experience from years of work with the egg subsector. While the firms interviewed were not a random sample of the relevant populations, they accounted for a sufficiently large proportion of the relevant market volume that the survey results should provide a reasonable approximation of the extent to which various pricing systems are used in these markets.

Our studies revealed important differences in the use of formula pricing. These differences were not only between commodities, but at different levels of the marketing system and between closely related products at the same level of the commodity marketing system (see table 1).

Beef

The primary use of formula pricing in the beef subsector occurs in the beef carcass and wholesale cut markets. In a typical formula price contract, the quantity is established one to five days (sometimes longer) before shipment; the infrequently negotiated premium or discount is applied to the carcass price reported in the *National Provisioner* (the "Yellow Sheet") on the day prior to shipment.

Formula pricing is used in approximately 70% of the beef carcass sales which comprise 50%–60% of the output of beef slaughter-processing firms. In contrast, only 10%–20% of boxed beef primal and subprimal (including ground beef) sales are formula priced. Most boxed beef formula sales involve processed carcass units (with the price related to the Yellow Sheet carcass price), or ground beef (with the price based on the lean trim quotations). Be-

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[1] These issues are discussed in more detail in several places in the literature, including the National Commission on Food Marketing Summary Report and Technical Studies No. 1 and 2; Forker; Williams; Rogers and Voss.

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Table 1. Pricing Systems in Five Commodity Subsectors, 1978

Product Submarket or Market Level	Beef		Pork		Cheese		Turkeys		Eggs	
	Beef Carcass	Boxed Beef	Fresh	Processed	First Handler Transactions	Packaged and Processed	Live	Processed	Nest Run	Graded and Packed
Sub-market share (%)	50+	40+	60	40	100	100	100	100	100	100
	(%)									
Intrafirm transfer[a]					20		65		35	≤5
Formula priced	70	10–20	40	5+	65–70	25–35	29	16	60	90
Negotiated prices	30	80–90	50	1–4	10–15	1–2	6	29	10[b]	5
Price list			10	90+		60–70		55		

[a] Involves vertically integrated cheese-production facilities, and a combination of vertically integrated production, producer-owned cooperatives, and cost-plus or service contracts in the turkey and egg subsectors.
[b] Includes direct sales of eggs to breakers, and resales among egg handlers; thus, there is some double counting in the nest run egg estimates.

cause boxed beef is the most rapidly growing segment of the beef market, it seems very likely that the negotiated portion of beef transactions could increase. However, the increasing boxed beef market share has been removing volume from the carcass beef market rapidly.

Pork

There has been a gradual shift toward more processing of pork by slaughter firms, with a corresponding shift in the mix of pricing systems employed. Slaughter-processors sell approximately 60% of their pork as fresh pork cuts (loins, Boston butts, fresh hams, bellies). Slightly less than 40% of slaughter-processor pork sales are processed pork (smoked or canned hams and picnics, bacon, lunch meats, frankfurters, sausage).

Formula-pricing arrangements are used in approximately 40% of fresh pork transactions, negotiated or offer-acceptance pricing systems in 50% of the transactions, and a daily price list is the primary pricing vehicle for the remaining 10% of fresh pork sales. The extent of formula pricing in fresh pork is approximately the same as that reported by the National Commission on Food Marketing in 1965.

In contrast, more than 90% of the processed pork sales are based upon a weekly price list for packer-branded products. Less than 10% of processed pork sales were "private label." More than half of the private label transactions are on a formula-pricing basis, and the remainder are priced using the branded price list minus advertising costs, or are individually negotiated transactions.

Overall, approximately 25% of all slaughter-processor pork sales are formula-priced, 35% of the prices are established at the time of the transaction through negotiation or offer-acceptance, and 40% of sales are priced via a daily or weekly packed price list.

Cheese

Formula pricing in the cheese industry is found in cheese purchases by large marketing firms (like Kraft and Borden) from many cheese manufacturing plants, and in sales arrangements between these large cheese-marketing firms and their retail, food service, and industrial customers. At each level, the standard formula-pricing arrangement utilizes the prevailing price at the National Cheese Exchange on the date of manufacture as the pricing base. While the National Cheese Exchange volume is less than 1% of the nation's cheese, it plays a major role in pricing 90% or more of the cheese sold by U.S. cheese-manufacturing plants to the large cheese-processing and marketing firms. These marketing firms also manufacture about 20% of their requirements, and import the remainder (6%–7% of sales) at negotiated prices. Thus, 85%–90% of cheese purchases by the large marketing firms are priced by formulas which may remain unchanged for three to twelve months.

Formula pricing plays a less important role in marketing firm sales to retail, food service, and industrial customers. Of the 50%–55% of cheese going through retail channels, approximately 60% is sold under a manufacturer brand, with a weekly manufacturer's price list as the standard pricing mechanism. On the 40% private label sales to retailers, some marketing firms use a price list that is essentially the branded price list less advertising and promotion costs; others use formula-priced selling arrangements.

The food service industry is the most rapidly

growing market for cheese, with 30%–40% of the cheese volume. A weekly or monthly price list is used for most sales through specialized food service distributors. Approximately 20%–30% of food service sales are directly negotiated, long-term, formula price arrangements with large-volume fast food chains which have special product specifications. Some formulas use the average Exchange price in the preceding months as the base price, so menu margins are based on known costs.

Industrial cheese sales, representing 10% of sales by cheese marketing firms, typically are specially formulated ingredients for frozen pizzas, frozen entrees, cheese-flavored products, and others. A high proportion of these sales are formula-priced arrangements with large industrial customers.

Thus, 25%–35% of the marketing firms' sales are formula-priced, based directly on the National Cheese Exchange prices. Another 5%–10% of sales are based on a price list so closely tied to the National Cheese Exchange prices that they implicitly are formula priced sales. Approximately 65%–70% of sales are based on a price list which is loosely related to the National Cheese Exchange (the raw material cost is an important influence in the pricing decision). Only 1%–2% of the sales of the marketing firms are spot sales on a negotiated basis; these often are sales of surplus inventories to another marketing firm through the National Cheese Exchange.

Turkeys

Approximately 65% of the live turkeys produced in the United States are produced and slaughtered by the producing firm, slaughtered by cooperatives, or produced under contracts (e.g., cost-plus or service fee contracts), where the ultimate producer payment is not directly tied to the spot market price. Nearly 30% of live turkeys are transferred from the grower to the processor under contract terms that relate the transaction price directly to the Urner-Barry or U.S. Department of Agriculture (USDA) market price quotation for frozen, ready-to-cook turkeys (though some contracts may have price floors, ceilings, or "sharing" formulas).

Turkey products include whole frozen turkey, turkey parts, and further processed products. Whole birds may be sold as plain Grade A (commodity) turkey or in self-basting, or otherwise differentiated form. Packer-branded whole birds and further processed products are most often price listed. Prices for sales of parts and fresh turkeys often are negotiated. Formula pricing is used mostly in the trading of private label or commodity turkey sales.

The market share of plain whole frozen turkey has declined to about 15%, and 20%–30% of that volume is formula-priced. Thus, the volume of negotiated trading in the product used as the base for pricing formulas at both the live and processed turkey levels may represent as little as 10% of turkey product sales.

Eggs

Eggs are formula-priced at two levels in the marketing system—the producer-first handler market for nest-run eggs, where the first handlers typically assemble, grade, and pack eggs (though some trading among the first handlers does occur), and the next market level where graded eggs are sold to the retail and food service sectors. In the nest-run or first handler market, 35% of the eggs are produced by vertically integrated firms. Sixty percent of the nest-run eggs are transferred to first handlers under long-term arrangements. Most contracts do not have a clear cut base price or premium established, just the handler's commitment to use his "best efforts" to achieve a "competitive" price for the producer. Yet, most handlers determine their payment by establishing a fairly stable discount from the pricing formula which they, in turn, have established with their primary customers. Thus, while the formula is not explicit in many cases, it is used implicitly in a large proportion of these transactions.

Very few nest-run egg sales involve negotiated prices. However, negotiated sales of nest-run eggs to egg breakers or among assemblers and first handlers are one point in the egg-marketing system where spot market price negotiations can be observed. These negotiated transactions (which include 1/2% of the nest-run egg volume, traded through the Egg Clearinghouse, Inc., an electronic exchange for nest-run eggs) involve approximately 10% of the nest-run egg volume.

Approximately 90% of graded eggs purchased by retailers and food service firms are acquired under long-term formula-pricing arrangements. In most cases, graded eggs that do not satisfy other customers' requirements are sold to egg breakers, also on a formula price basis. Approximately 5% of graded egg purchases are negotiated price transactions, primarily when suppliers build inventories in excess of their contract commitments, or retailers require extra volume for sales promotions. Thus, negotiated sales of graded eggs are sporadic and small in volume.

The egg price quotations typically used in formula-pricing arrangements in the eastern two-thirds of the United States at both the nest-run and graded-egg market levels are the New York graded-egg price quotations by the Urner-Barry *Producers' Price Current*. The USDA price quotation is used on the West Coast. Yet, the Urner-Barry reports do not represent any specific graded-egg market transactions; rather, the Urner-Barry report reflects changes in egg prices at other levels of the marketing system, changes in inventory levels, and other factors. The USDA price quotation does reflect prices for graded eggs paid by retailers.

Benefits and Problems of Formula Pricing

Respondents in the four marketing systems surveyed were asked to list the major advantages and disadvantages or problems associated with formula-pricing arrangements. The primary benefits or advantages which emerged from those interviews can be summarized as (*a*) assured market outlets or supply sources, especially when unique product formulations or perishable products are involved; (*b*) the greater quality assurance associated with continuing buyer-seller relationships; (*c*) the reduced risk of prices on forward sales or purchase arrangements looking bad relative to current market prices or competitors' prices at the time of delivery; and (*d*) improved physical marketing and transaction efficiency.

The relative importance of the benefits cited varied greatly in the markets studied. Firms dealing with highly perishable, standardized commodities (e.g., Choice, yield grade 3 beef carcasses, live turkeys, cheese) were quite concerned with assured market outlets or suppliers, as were firms requiring unique product specifications (e.g., unusual cheese or hamburger patty formulations or private label turkeys). Quality assurance was particularly important to firms with strong brand franchises, or to retail chain buyers of private label products. Retail chain buyers were particularly interested in forward purchases to assure the quantity required for features, with the assurance that the price would be established later at levels near competitors' prices, to avoid a significant competitive disadvantage. The low transaction cost and improved coordination of a continuing buyer-seller relationship which seldom requires extensive market information and negotiation skills was a frequently acknowledged benefit, especially to buyers and sellers who were not among the largest or smallest firms in the market, though that was seldom the primary reason given for starting the use of formula pricing.

Formula pricing lowers internal transaction costs and frees people from the task of negotiating prices. It facilitates close coordination of physical transfer of perishable commodities. Often, risks are shifted in a way that is desirable for both parties involved in a transaction. When desired quality and quantity can be assured satisfactorily only through long-term sales/purchase arrangements, formula pricing is an attractive pricing system. Both buyer and seller are assured a price in line with competitors' prices at the time of delivery. Firms using formula pricing for both raw material purchasing and product sales find that system useful in managing their margins. Many small firms feel that formula pricing reduces bargaining disparities between themselves and their larger, better informed suppliers or customers, enhancing their long-term viability. Formula pricing may be an alternative to a higher degree of vertical integration in some subsectors.

In some commodity-marketing systems, shifting to alternative pricing methods would be traumatic, with a high initial cost and perhaps higher cost per unit in the long run. For example, in the beef and pork markets, packers and retailers were asked to estimate the change in their transaction costs if they could not use formula pricing. Ten firms provided estimates which indicate that a ban on formula pricing would increase transactions cost in pork by as much as $5 million, and perhaps as much as $15 million annually for beef in the United States.

Formula pricing of cheese sold by cheese-manufacturing plants has been the standard way of doing business for so many years that most cheese plant managers could not conceive of any other way of pricing cheese. In the cheese market, long-term formula price contracts were sometimes used by marketing firms to develop new supplier capacity, yet not subject themselves to the risks associated with a pre-established price level. And some respondents felt that the alternative to formula pricing in that highly concentrated market would be the (undesirable) development of explicit price leadership by the leading firm(s). In general, there was a high level of satisfaction with the performance of the formula-pricing system and the thinly traded National Cheese Exchange in Green Bay, Wisconsin, that serves as the focal point in the price determination process at all levels of the cheese-marketing system in the United States.

A primary benefit of turkey formula pricing lies in the better coordination of production and processing. In many instances, neither the producer nor the processor desires to accept the risk of a price fixed at the time of production planning. The formula-priced contract allows for supply and market outlet assurance with price open.

Formula pricing of turkey products was least used by the largest and smallest processing firms. The largest firms felt that their own perspective on the appropriate market price was equal or superior to the market price quotations, and some felt that their product was sufficiently differentiated to be unique. The smallest also produced a differentiated product with loyal local consumers, so a price list was used instead of a price formula.

Formula pricing of eggs is seldom questioned by participants in the egg subsector. A National Egg Pricing System Study Committee (an industry group) in 1971 listed as one of their recommendations, "establishment of a national base price quotation system" (Rogers and Voss, p. 254). Most industry members do not wish to abandon formula pricing, but they do desire a better system of arriving at a base quote.

The basic benefit of formula pricing in the egg subsector is improved physical marketing efficiency, achieved through better coordination of producer-handler egg movement, and a stable routing system which is essential for efficient store-door delivery.

Survey respondents were asked their views on the disadvantages or problems associated with formula pricing. The primary problems which emergd

from these interviews can be summarized as (*a*) formula pricing's reduction of the firm's potential influence on its market price; (*b*) the absence in some markets of a well-accepted, sufficiently accurate or precise market price report to serve as a base for formula prices; (*c*) inability to capture fully, in a formula price arrangement, potential benefits from superior market information, forecasting, or negotiating skills; and (*d*) significant reduction of the potential number of customers or suppliers when some buyers or suppliers refuse to use formula price arrangements.

Few survey respondents mentioned, or perhaps were cognizant of, some additional implications of formula pricing. While there were occasional complaints in some markets about unreliable or inaccurate price reports (especially beef and eggs), most respondents did not relate those complaints to the reduced volume of negotiated trading which is a result of increased formula trading. In conjunction with increased processing and product differentiation (e.g., in beef, pork, and turkeys) that removes product volume from the "basic commodity" classification, the result is a more thinly traded market which serves as the source of the base price report for pricing formulas.

Large firms with a large number of formula-priced transactions may have a greater incentive and a greater potential of manipulating the market price or report through changes in their behavior. For example, some cheese market participants expressed concern about potential manipulation of the Cheese Exchange price by four or five Exchange members who trade a high proportion of the very small Exchange volume. However, upon closer examination, significant artificial price enhancement by any one firm acting alone for more than a very short period of time seems impractical because of the instantaneous communication of prices and the potential for countervailing reactions to price distortions by Exchange participants handling 85%–90% of the cheese in the country.

The ultimate problem of formula pricing is the potential for destruction of the negotiated market which provides the base price. Haverkamp (Hayenga 1979c, p. 103) has suggested that the use of formula pricing would level off as firms limit its use in response to a thinning negotiated market. Williams (Hayenga 1979c, pp. 88, 103) argues that formula pricing is likely to increase toward an equilibrium at which private reporting remains despite the lack of an adequate number of reportable trades in the negotiated market. The markets which we studied do not provide a clear basis for choice among those alternative hypotheses. However, a small number of the firms surveyed in the beef and pork markets indicated they were attempting to limit or reduce their use of formula pricing, though no clear trend emerged. In the cheese and egg markets where formula pricing is dominant, there is no indication that any significant reduction in formula pricing is occurring or contemplated. The situation in eggs is consistent with the Williams hypothesis; that is, the market is quoted at a level where almost no trades are negotiated unless special feature sales or excess inventories require unusual negotiated transactions to supplant the non-negotiated coordination mechanisms. The egg industry did recognize that a new mechanism was required to provide a better market price quotation and organized the Egg Clearinghouse, Inc., an electronic exchange, which brought some of the previously private trading into this public market arena. However, there has been no appreciable change in the amount of formula pricing in the egg market.

Summary and Conclusions

The extent of formula pricing in the five industries studied varied significantly, ranging from 90% or more of the cheese sold by cheese-manufacturing plants to large cheese-processing and marketing firms, to less than 10% for processed pork products.

Why is the incidence of formula pricing so different in these markets? While the answer is not entirely clear, we speculate that there are several contributing causes. The least amount of formula pricing is found in the packaged and processed cheese and processed pork markets where processor brand franchises are well established and administered price lists are feasible and preferred by the seller (and perhaps by the buyer, too). Only a small amount of boxed beef is formula-priced, partly because buyers dislike the price risk associated with wide ranges on boxed-beef price reports (which may be due to poor product standardization or imperfect market arbitrage on boxed beef cuts). But, the longer shelf life of boxed beef products (compared to beef carcasses) also may reduce meat packers' incentive to insure continuing buyer-seller relationships through formula-priced arrangements on boxed beef relative to beef carcasses. More fresh pork may be formula-priced than the comparable beef primal cuts because of pork's greater perishability, the greater perceived risk of using boxed beef pricing quotations, and the relatively recent entry of many boxed beef processors, which may have prevented the development of long-term relationships. Where close coordination of perishable products is required, as in eggs and turkeys, or price risk must be avoided by one party to the transaction (e.g., a small cheese plant), formula pricing or vertical integration is prevalent.

In our judgment, the degree of dissatisfaction expressed about market-pricing systems ranged from very little in the cheese industry to substantial in the carcass beef and egg markets, with more moderate levels of concern in the pork and turkey markets. Why would there be such a difference in the apparent level of satisfaction with the pricing systems used in these markets? The egg and cheese markets appear to have similar institutional characteristics, with thinly traded negotiated markets and

an extremely high incidence of formula pricing. We would conjecture that there may be several contributing factors. While the National Cheese Exchange trades less than 1% of the total cheese produced in the United States, nearly all major market participants are present, distortions are instantly communicated, and countering reactions are quick. Further, cheese production is concentrated in one region of the United States. Contrast this with the egg market, where production is widely dispersed throughout the country and where regions that are nearly self-sufficient sometimes shift temporarily from surplus to deficit regions. Thus, a price report at one location cannot reflect accurately the changing regional price patterns in the egg market, and stable formulas based upon the New York price report will get out of alignment with opportunity costs. Thus, we hypothesize that the occasional discrepancies between the reported market price and actual market prices in some regions may be the primary cause of the greater level of dissatisfaction with pricing formulas and reports in the egg market.

In contrast, the carcass beef market still has a high volume (though declining) of negotiated trades, so the dissatisfaction noted in that market probably cannot be attributed to a thinly traded market. Rather, the dissatisfaction seems to be related to the accuracy of the reported prices and suspicion regarding potential manipulation of reported prices via various methods. This might be related to the failure of many buyers and sellers to report fully and accurately their prices to the price reporting services and to the failure of price-reporting services to increase their reported product classes to include some high volume product streams that differ slightly in trim or grade from the current report categories. At the same time, there may be imperfect regional arbitrage in the carcass and boxed beef markets due to inadequate communication of market prices that are out of line, causing occasional regional price discrepancies relative to reported prices and prompting dissatisfaction among market participants. Further, the entire pricing process and the price reporting process is clearly more difficult for the outside observer to scrutinize and understand than the "open to the public" National Cheese Exchange where fears of the unknown might be better allayed.

Policy Implications

Our study of these markets has not revealed a need for major legislative remedy at this time. The benefits of formula pricing accruing to the firms using that pricing system generally seem to outweigh the perceived problems to those firms and to society. Perhaps the major concerns related to the use of formula prices are the suspicions regarding manipulated prices or unrepresentative price reports that are used in formula price arrangements. To date, convincing evidence supporting these suspicions has not been produced in the meat industry (USDA 1979, p. 25) or in the other markets we studied.[2] Elimination of formula pricing would lead to increased transactional cost and, probably, risk. Further, the resulting changes in competitive balance and structure in the markets we have studied may not be desirable.

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[2] There is currently a civil court action alleging that the Urner-Barry egg price report is not representative of egg market prices. *Sunnyside Eggs, Inc., et al.,* v. *Urner-Barry Publications Inc.,* U.S. District Court of the Northern District of Georgia, Atlanta Division.

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