# AN ECONOMIC EVALUATION OF BASIC FORMULA PRICE (BFP) ALTERNATIVES

Interim Report
AFPC Working Paper 96-5

October 1996



AFPC
AGRICULTURAL & FOOD POLICY CENTER

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Center for Cooperatives
Department of Agricultural and Applied Economics
The University of Wisconsin
cooperating with
Dairy Division, Agricultural Marketing Service, U.S. Department of Agriculture

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# AN ECONOMIC EVALUATION OF BASIC FORMULA PRICE (BFP) ALTERNATIVES

Interim Report
AFPC Working Paper 96-5

BFP University Study Committee

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## Acknowledgments

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Within the Dairy Division certain individuals that were particularly supportive of our efforts include Richard McKee, Silvio Capponi, Connie Brenner, Myron McKinley, James Daugherty, Donald Nicholson, John Rourke and Robert Miller. Many Dairy Division staff undoubtedly supported their efforts.

At Texas A&M University, Robert Schwart provided extensive data and industry expertise support which made USC analysis run smoothly. David Ernstes assisted in data collection and assembly for processing. Dawne Hicks managed the production of the report and was assisted by Katrina Marx, Natalie Outlaw and Sandra Norman. As usual, other faculty on the AFPC team picked up the workload while USC members were working on this project.

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## Executive Summary

The University Study Committee (USC) for the basic formula price (BFP) was assembled to evaluate the performance of alternative BFP pricing procedures. It was established to draw analytical conclusions but not to make recommendations. The establishment of USC recognizes that in the absence of a sufficient supply of Grade B milk, there can be no reliable M-W price. USC concludes that there are sufficient concerns about the reliability of the M-W price that the Secretary should install a replacement BFP.

Thirty-two BFP options were evaluated including six competitive pay prices, 22 product formulas, two economic formulas and two having no BFP. To evaluate these options, a two-step procedure was pursued.

In step 1, the original 32 options were narrowed to 11 utilizing criteria of long life, understandability, geographic uniformity and reflecting the manufactured milk market. All of these criteria were decisive in eliminating one or more of the 21 options that were concluded not to merit further consideration. However, the most influential of these step 1 criteria included long life, understandability and reflecting the manufactured milk market. Of particular significance was the conclusion that product formulas had to include all three manufactured products (butter, NDM and cheese) to survive step 1 and that derived make allowances were too volatile to reflect the prices of manufactured products (an aspect of reflecting the manufactured milk market).

In step 2 the 11 remaining options were subjected to econometric analyses and statistical tests designed to measure:

- How well does the calculated BFP reflect national supply and demand conditions for manufactured products?
- How well does the calculated BFP reflect changes in the value of milk used in manufacturing?
- How stable is the calculated BFP?

These three criteria have obvious roots in the Agricultural Marketing Agreements Act of 1937 (AMAA) as amended.

The application of statistical measures to these three criteria led to the conclusions that the performance of the following two options was superior to the other 9 step 2 alternative pricing procedures:

- Pricing components with no BFP. This option sets no minimum price for milk used for manufacturing. However, uniform minimum component values are set based on transaction or spot market prices. Plants are audited to assure that producers are paid consistent with the established procedure. A benchmark price per cwt can be determined to move the Class I and II prices.
- Butter/powder-cheese formula, seasonal yields, CA cost-based make allowance with national product weights. This option calculates the BFP utilizing product prices that are seasonally adjusted for yield. A cost based make allowance is utilized with weights based on national production.

The following observations are relevant to the conclusion that 9 of the 11 options did not indicate superior performance:

- Product formulas with prices adjusted for seasonal yields tended to perform superior in reflecting national supply-demand conditions.
- Grade A/B competitive pay price options indicated an unexpected positive price response to an increase in stocks. In addition, their performance was not in the upper quartile of options for any of the three criterion.
- Pooling with no BFP was not quantitatively evaluated. However, USC concluded that this option could be expected to generate geographically variable market prices for milk used for manufacturing as determined by competitive conditions and that these prices would be more unstable.

The AMAA authorizes the establishment of minimum prices to be applied to each milk Class. These minimum price provisions applied to Class III would provide latitude for market forces to operate on a regional basis while providing stability, orderliness and a reflection of national supply and demand conditions. In the absence of a support program, clearing the market is assured only if prices are free to fall to the point where supply and demand are equal.

If the dairy industry is to maintain the classified pricing system, it must find a way to come to grips with the Class IIIA issue. The current Class IIIA price is undermining the Class II and Class III price by providing the incentive for milk to be manufactured into NDM at a lower price which, in turn, is being utilized in increasingly large quantities to produce cheese and soft products. An increasingly large share of the soft product production appears to be occurring in unregulated plants.

Coming to grips with the Class IIIA issue requires that federal order and California state dairy policies be coordinated. It may not only require the elimination of Class IIIA and its

California counterpart but also that all soft and hard products be part of the same Class. The movement back to a two-Class system will be a particularly relevant consideration as barriers to trade in dairy products are reduced. At that point, U.S. soft and hard product manufacturers will need to be in a position to compete with NDM traded at the world market price and with products made therefrom.

Because of the thin market controversy involving manufactured products, it is critically important that the industry provide the USDA with transaction price information from which it can determine the BFP and/or the related component values. If the industry is unwilling to provide this information voluntarily, it should be mandated utilizing order provisions. This is essential to allowing the order system to continue to operate in a competitive, trustworthy and orderly environment.

Product formulas require make allowances. Even component pricing with no BFP arguably requires a make allowance if it is to be used to move higher Class prices. Since formulas have been demonstrated to perform better with cost-based make allowances, a procedure would need to be established for ascertaining manufacturing costs. This might include the development of representative cheese and butter/powder plants to act as an indicator/mover of cost changes.

It makes no sense for prices in one milk Class to be moving in one direction while another Class moves in the opposite direction. The resulting problems have been demonstrated time and again in pricing Class II and III products. Accordingly, coordination of Class prices is an integral part of an orderly marketing system.

# CHAPTER 1

## INTRODUCTION TO STUDY

The Federal Agriculture Improvement and Reform Act of 1996, hereinafter referred to as the 1996 Farm Bill, mandated reform of the Federal Milk Marketing Order (FMMO) system. One aspect of this reform process specified by the Farm Bill included the assessment of alternatives to the Minnesota-Wisconsin (M-W) price series. For the past 35 years, the M-W has played the very important role of serving as a mover/adjuster for changes in FMMO prices. As such, the M-W has often been referred to as the Basic Formula Price (BFP) because of the key role it has played in milk pricing.[1]

The M-W price series is derived from a monthly survey of the prices paid by manufacturing plants for Grade B milk. One problem is that the quantity of Grade B milk has continuously fallen as its producers either went out of business or converted their dairies to meet Grade A standards (Figure 1). In the absence of a sufficient supply of Grade B milk, there can, as a practical matter, be no reliable M-W price. In addition, it is often asserted that excess manufacturing capacity in the Upper Midwest and related structural adjustment leads to regionally higher milk prices. The University Study Committee (USC) concludes that there are sufficient concerns regarding the reliability of the M-W price that the Secretary needs to move swiftly to install a replacement.

The need for an alternative BFP has been recognized for over two decades. In 1973, Assistant Secretary Lyng's Milk Pricing Advisory Committee recommended that the Department initiate research to develop an alternative to the M-W price series (AMS, 1973). In 1991, the

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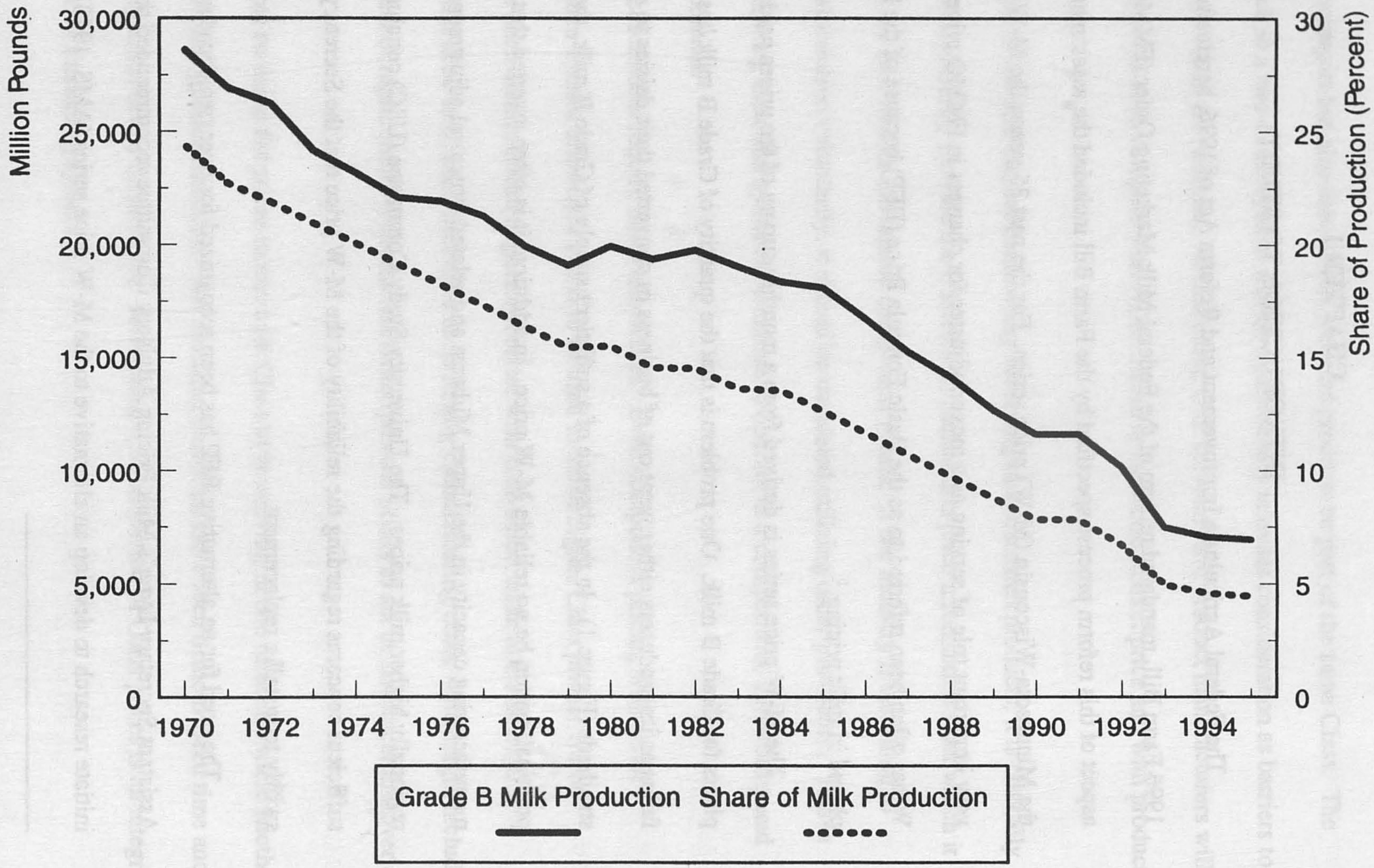
[1]In 1995, the BFP was institutionalized in FMMO regulations by updating the M-W price with product prices. This action was taken as a temporary measure pending the installation of a more permanent BFP.

**Figure 1: Quantity of Grade B Production and Share of Total U.S. Milk Production, 1970 to 1995.**



Dairy Division of the Agricultural Marketing Service issued a report which developed and analyzed over 16 alternatives to the M-W series (AMS, 1991). In May 1995, it modified the M-W series to include changes in manufactured product prices as a temporary measure to shore up the validity of the series, pending the development and adoption of a permanent replacement. *To reduce confusion in this report, the BFP both before and after May 1995 will be referred to as the M-W price series.*

As a result of its 1996 Farm Bill mandate, the Agricultural Marketing Service authorized the establishment of this University Study Committee (USC). The USC represents a geographic cross-section of economic expertise on marketing and pricing of agricultural products, including milk. A number of members of the USC have devoted much of their professional careers to studying the economic dimensions of the dairy industry. Two committee members served in administrative positions in USDA, one was an economist for a major dairy cooperative, and another has served as a cooperative director.

**Objectives**

The AMS Dairy Division requested the USC to:

- Identify alternative BFP procedures and update those contained in the 1991 study.
- Evaluate how each alternative procedure would be expected to perform relative to the objectives of the Agricultural Marketing Agreement Act of 1937, as amended (hereinafter AMAA).
- Specify, for those BFP procedures best meeting the criteria, the data and operational requirements for effective performance.

## Study Approach and Procedures

USC approached the problem of evaluating a replacement for the M-W price series from the perspective of the AMAA which states that the Secretary shall set minimum prices -- not necessarily the price for milk. In so stating, the framers of the AMAA recognized the difficulty of setting and administering prices. Increasingly, over time, the Secretary's FMMO decisions have recognized the importance of setting minimums rather than attempting to set individual prices.

USC concludes that in the absence of an effective price support, and, after 1999, no price support at all, minimum Class III pricing takes on special significance in that the market for manufactured products must clear. This requires that the Class III price be set sufficiently low that the market will clear. At the same time, USC recognizes that an important objective of the AMAA is to stabilize and enhance producer returns. It can, however, do so only within the bounds of market relationships and forces affecting the supply and demand for milk in different use classes.

As indicated previously, there are numerous options for setting the BFP -- the 1991 study analyzed 16 basic alternatives. These 16 options, plus 16 more, were identified and analyzed in this study. As indicated in Table 1, these 32 options fall into four broad categories:

- Competitive pay price.
- Product price formula.
- Economic formula.
- No BFP.

## Table 1. Basic Formula Price (BFP) Options Analyzed.

**Competitive Pay Price Options**

- M-W price
- Adjusted M-W
- Spot market
- Grade A/B price
- Adjusted Grade A/B price
- Futures market

**Product Price Formulas Options**

- Butter/powder, annual yields and price support make allowance
- Butter/powder, seasonal yields and price support make allowance
- Butter/powder, annual yields and derived margins as make allowance
- Butter/powder, seasonal yields and derived margins as make allowance
- Cheese formula, annual yields and price support make allowance
- Cheese formula, seasonal yields and price support make allowance
- Cheese formula, annual yields and derived margins as make allowance
- Cheese formula, seasonal yields and derived margins as make allowance
- Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and price support make allowance
- Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance
- Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and price support make allowance
- Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance
- Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and derived margins as make allowance
- Butter/powder-cheese formula, annual yields weighted by US milk production and derived margins as make allowance
- Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and derived margins as make allowance
- Butter/powder-cheese formula, seasonal yields weighted by US milk production and derived margins as make allowance
- Butter/powder, annual yields and CA cost based make allowance with national production weights
- Butter/powder, seasonal yields and CA cost based make allowance with national production weights
- Cheese formula, annual yields and CA cost based make allowance with national production weights
- Cheese formula, seasonal yields and CA cost based make allowance with national production weights
- Butter/powder-cheese, annual yields and CA cost based make allowance with national production weights
- Butter/powder-cheese, seasonal yields and CA cost based make allowance with national production weights

**Economic Formula Options**

- Butter/powder-cheese formula, seasonal yields weighted by U.S. milk production, price support make allowance, and a cost of production snubber.
- Cost of production with a stocks snubber.

**No BFP**

- Pricing components with no BFP.
- Pooling differentials with no BFP.

With numerous options in categories such as product formulas, USC perceived there was a need to narrow the set to a manageable number. The basic approach in narrowing the options involved analyzing only those options that would solve the problems posed by the M-W price. This was done in the following series of steps:

**Step 1 Criteria**

USC agreed on a set of criteria that any BFP option had to satisfy. Options failing to satisfy these criteria were dropped from further consideration. The Step 1 criteria were as follows:

- **Long life.** There is no point in going through this exercise every few years. Those options that were concluded to have a useful life of less than 10 years were eliminated in Step 1. There is nothing magic in 10 years except to indicate if USC concluded that a particular option had a limited foreseeable life, it was excluded from further consideration. The most obvious example of an option with a limited useful life is the M-W price itself because Grade B milk is disappearing.
- **Understandable/transparent**. Economists can develop many different means of pricing milk. Some of these involve the use of complex economic models. Such models may do a very good job of pricing milk used for manufacturing. But, to have confidence in the pricing system, people must understand how the price is determined. It cannot be derived from a black box that is difficult to either explain or understand. In other words, the procedure must be transparent in that people can see and understand how the BFP is derived. In this study, we operate under the assumption that complex models and statistical methods are very useful to evaluate the BFP options but not to develop prices.

- **Geographically uniform**. Manufactured dairy products compete in a national market. This contrasts with Class I products which compete in regional markets. A national market for manufactured products suggests a uniform BFP.

  The arguments in favor of a national market for milk and, therefore, a uniform BFP, have become increasingly strong over time as production of milk for manufacturing has expanded rapidly beyond the Northeast and the Midwest into the West and Southwest (Knutson, Schwart, Ernstes, Outlaw). On the demand side of the market, population has become more dispersed with rapid expansion throughout the South and West. The effect is to make both the supply and demand side for milk used for manufacturing and the resulting products to be more national in scope.

  The result tends to be a more uniform distribution of both production and consumption of manufactured products, although processing is concentrated in the Upper Midwest, Northeast and West. With manufactured products being storable and transportable at a relatively low cost, greater uniformity of consumption and production provides a compelling economic argument for a geographically uniform BFP.

  This does not mean that prices of milk used for manufacturing will be absolutely uniform throughout the country. It is quite reasonable to anticipate that manufactured product prices will be different geographically and related to the location of population/demand centers, production/supply centers, and transportation costs. Market-determined geographical differences in prices of milk for manufacturing are facilitated by the minimum pricing principles encompassed in the AMAA. The complexity of the Federal order regulatory system would be significantly increased if geographically different prices were to be charged for milk used for manufacturing from two or more basing points. Moreover, in establishing such higher levels of regulation, little or nothing would be accomplished in terms of the objectives of AMAA.

This criteria raises questions regarding the consistency between California regulation and Federal regulation. USC looked closely at the California regulatory system and believes that regulators of both systems can learn from each other. That is, there are virtues in both systems. Taking the best of each would improve the performance of the FMMO system.

- **Reflect manufactured milk market.** The BFP must reflect market conditions for milk used for manufacturing. This requires that the BFP be an interface between the supply and demand for finished products, namely butter, NDM and cheese, and the supply and demand for raw milk. Local competitive conditions for milk should not be a prime BFP determinant. Manufactured product prices do not all move together uniformly. If the supply and demand for manufactured products is to be reflected in the price of milk for manufacturing, as stated or at least as implied by the AMAA, then all major products (butter, NDM and cheese) must be directly reflected in the BFP. Moreover, in order to direct milk to its highest valued manufacturing use there must be a single manufacturing milk price. USC recognizes that this criteria is controversial because its effect is to exclude several product formulas from being the BFP and raise questions regarding how tenable IIIA pricing is -- an issue which will be addressed separately in Chapter 5.

**Comparison with M-W Prices**

Each of the BFP alternatives that survived Step 1 screening was compared to the M-W price series. An adjusted M-W price series was developed to take into consideration known flaws in the M-W series. That is, the adjusted M-W series modifies the M-W price by standardizing for protein, as is done for milkfat, and by adding hauling subsidies. People will differ on how useful comparisons with the M-W and adjusted M-W series are since both have problems and a very limited useful life. For industry participants, the comparison with the M-W is a useful reference point in terms of price levels generated by the options relative to those that were actually paid for Class III milk. However, the adjusted M-W series is clearly preferred by USC to the current M-W because the former takes into consideration protein premiums and hauling subsidies.

**Step 2 Criteria**

The options that survive the Step 1 criteria are subjected to the econometric analyses of Step 2. (The same analysis was applied to those options that did not survive Step 1 and their results are contained in Appendix D. The econometric analyses generally supported the Step 1 decision.) The Step 2 analysis involved statistical tests designed to determine the extent to which the following three evaluation criteria were satisfied:

- **Reflect national supply-demand conditions for manufactured products.** The BFP needs to reflect national supply and demand conditions for manufactured products. AMAA explicitly notes that prices under orders should reflect market supply and demand for milk and its products. USC interprets this as meaning that the price for milk used for manufacturing should reflect the supply and demand for milk used in making manufactured products. In reading the 1995 BFP decision, reflecting supply-demand conditions appeared to be the most frequently mentioned consideration by all hearing participants and by USDA in choosing among the options (AMS, February 1995).

USC spent considerable time and effort studying and deliberating over the best way to measure whether a price reflects supply and demand conditions. Economic theory and applied research relating to this issue suggests that under stable, competitive market and policy conditions prices tend to closely reflect stock levels (Tomek and Robinson). That is, when stocks increase, prices often decline and vice versa. In agricultural market analysis, stocks-to-use ratios are frequently used as price change/trend indicators (Newbery and Stiglitz).

In this study, the basic statistical procedure utilizes a time series analytical procedure known as vector autoregression (VAR). This procedure allows for consideration of the feedback effects between the milk price and manufactured product prices as well as the effects of product prices on milk prices. While the conventional theory of price discovery indicates that the price of milk for manufacturing is determined by product prices, it can also be inferred that milk prices influence product prices. Recent research supports this notion (Perera, Outlaw, and Knutson). Both of these directional effects are captured by the VAR procedure explained in Appendix C.

In the application of the VAR technique, manufactured product stocks were measured on a total solids milk equivalent basis. Total solids were measured giving milkfat a 40 percent weighting and solids not fat a 60 percent weighting. The VAR procedure allowed USC analysts to simulate the impact of a change in the level of stocks and determine its effects on the price generated by each BFP option. In the simulations, stocks were changed by one standard deviation from the trend based upon monthly U.S. stocks data for the period 1991-95, which is 248 million pounds of milk equivalent or roughly 24.5 million pounds of cheese. Four statistical measures were used to determine the degree to which the BFP reflects national supply-demand conditions:

- When stocks were increased or decreased in the simulation, did the price of milk move in the appropriate direction? The expectation is that an increase in stocks would lead to a decrease in the BFP. A movement in the wrong direction is viewed by USC as warranting a rejection of the option.
- What percentage of the variation of changes in the monthly milk price is explained by changes in the milk equivalent of manufactured product stocks? The preference is given to the BFP option where changes in stocks explain a larger proportion of the price change as measured by a higher coefficient of determination ($R^2$).
- What is the magnitude of influence of stocks on price at the end of 12 months? In other words, how much has the price of milk (BFP) changed in response to a 248 million pound milk equivalent increase in stocks? A larger price decrease is preferred, although there is a tradeoff against the stability criterion.

- What percentage of the price variation is explained by stocks at 12 months after the shock in stocks? In other words, over the 12-month period after a shock equivalent to 24.5 million pounds of cheese, what share of the price variability was accounted for by the change in stocks? A larger percentage is preferred, although once again there is a tradeoff with the stability objective.

- **Reflect the changes in the value of milk used in manufacturing.** The BFP must reflect changes in the value of milk used in manufacturing. This criterion more directly links the BFP to the price of manufactured products than the previous one, although they clearly overlap. The tie here to the AMAA is that of providing an orderly flow of products, avoiding unreasonable fluctuation in supplies and prices and assuring a level of income to maintain production capacity. In a sense, this is a producer equity criterion -- seeing that the producer gets a fair share of product values.

In this case, the VAR statistical procedure was used to measure how well the milk price responds to the three manufactured product prices sequentially from cheese, to butter to NDM. The statistic utilized is a coefficient of determination ($R^2$) which measures the percent of the variation of changes in the monthly milk price accounted for the combined change in prices of the three products. Once again, the VAR statistical procedure allows for consideration of the feedback effects between milk prices and product prices as explained in Appendix C.

Subsequent to measuring the impact of changes in all product prices, each BFP option was analyzed to determine the percentage of the variation in the BFP accounted for by changing each individual product price -- cheese, butter and NDM.

- **Provide price stability.** The BFP should generate prices that are relatively stable. This criterion relates to the AMAA objective of avoiding unreasonable fluctuation in prices. In the absence of an effective support price floor, milk prices have become considerably more unstable (Figure 2). Thus, if stability is to be considered a policy goal, it will need to be through the Federal order pricing mechanism, one component of which is the BFP.

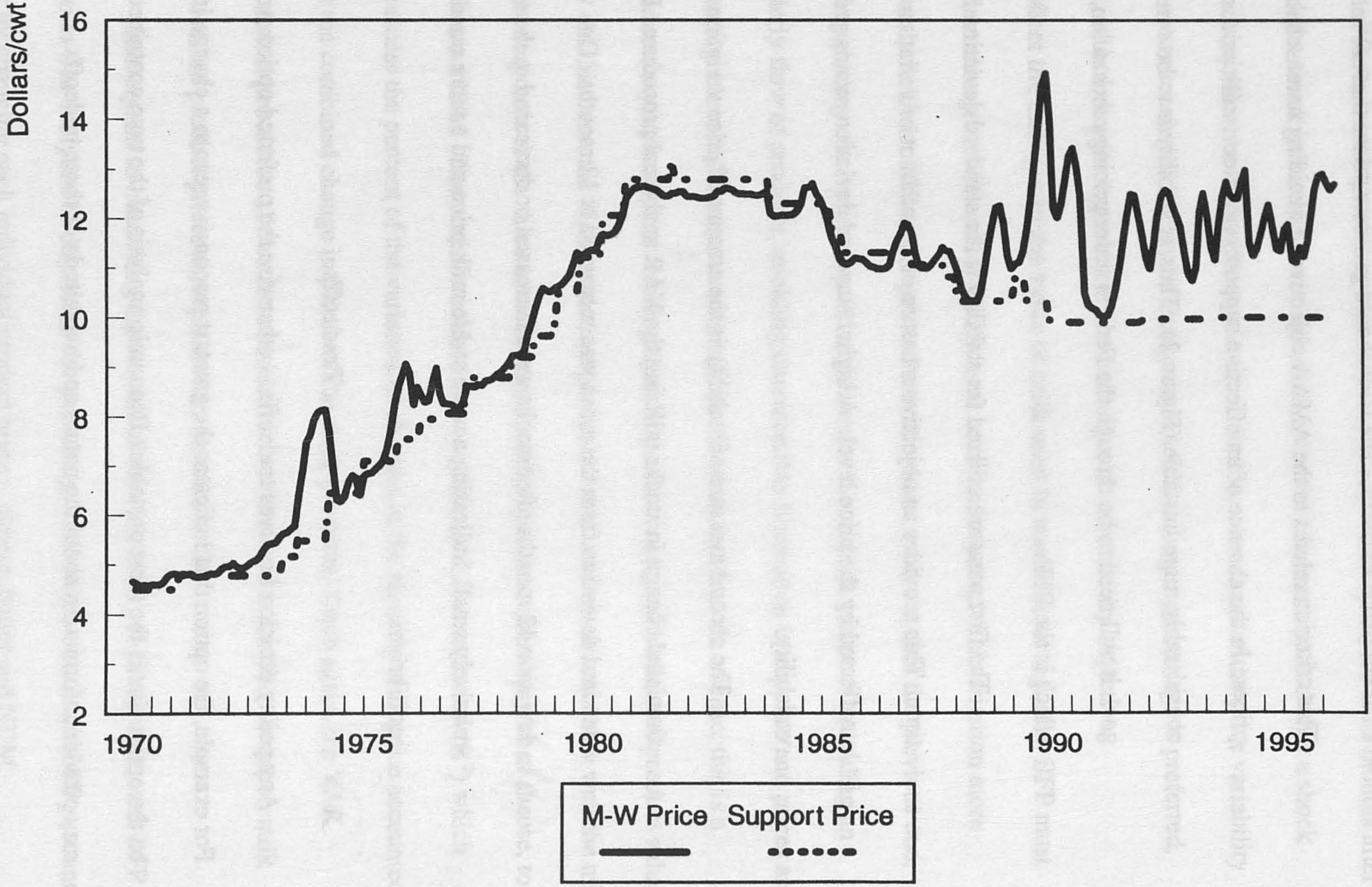
  The first measure utilized for stability is the standard deviation of the BFP over time. This provides an objective measure of the amount of variation in the BFP that is unaffected by the price level. A higher standard deviation means greater price variability.

  The second measure of stability is the amount of price variation resulting from the simulated change in stocks utilizing the VAR analytical procedure. In this case, the standard deviation from the mean was measured at 12 months. One would want the deviation 12 months after stocks were increased or decreased in the simulation to be relatively small, indicating a more stable milk price and a more rapid return to long-run equilibrium.

## Tradeoffs

Any policy decision involves tradeoffs -- otherwise the preferred option would be obvious. For example, the option that indicates the greatest responsiveness to a change in stocks may also be the option that is the most unstable. Economic analysis of the type contained in this report may provide information about the nature and magnitude of these tradeoffs.

**Figure 2: Minnesota-Wisconsin and Support Price Series, 1970 to 1996.**



## CHAPTER 2

## NARROWING THE BFP OPTIONS

As indicated in Chapter 1, the analysis proceeded in two steps:

- **Step 1:** USC agreed on a set of criteria that any BFP option had to satisfy. Options failing to satisfy these criteria were dropped from further consideration.
- **Step 2:** The options surviving Step 1 were evaluated according to a specified set of criteria consistent with the objectives of the AMAA.

This chapter reports the results of Step 1. Of the 32 BFP options (Table 1, Chapter 1) that were studied, this chapter concludes that 11 have sufficient potential to effectively perform the functions of a BFP to warrant further study in Step 2 of the analysis.

### Criteria

Chapter 1 set forth four criteria that any BFP option had to satisfy to be considered as a replacement for the M-W price series. These included:

- Long life: The BFP option should have a life of at least 10 years.
- Understandable/transparent: The BFP option should be understandable by the major industry segments.
- Geographically uniform: The BFP should be the same in all orders.
- Reflect manufactured product market: The BFP must reliably reflect market conditions for all manufactured products.

## Options Analyzed

The options analyzed fell into the broad four categories of competitive pay price, product price formula, economic formula, and no BFP (Table 1, Chapter 1). This section evaluates options in each of these four categories relative to the four criteria.

**Competitive Pay Prices**

The six competitive pay prices that were analyzed included the M-W price series, an adjusted M-W (baseline) series, U.S. average Grade B price, the A/B price series, an adjusted A/B series, spot market for Grade A milk, and the futures price for milk used for manufacturing. Of these, only the two A/B price series survive the first step (Table 2).

**M-W price series.** The M-W price has a limited life. Some might suggest that it has already passed the limits of its useful life. Grade B milk production has fallen to 4.5 percent of the nation's milk production (6.9 billion pounds in 1995). In Minnesota and Wisconsin, Grade B production accounts for 8.9 percent of the milk supply (2.8 billion pounds in 1995). Figure 3 indicates that the trend in Grade B milk production, both in the United States and in the Minnesota-Wisconsin region, is consistently downward. Admittedly, a small share of the U.S. milk production will likely always be Grade B because certain facilities cannot be upgraded to Grade A standards. However, this reason for Grade B production will diminish over time as scale economies continue to make smaller dairies uncompetitive. Since questions exist regarding the reliability of the M-W today, these questions are sure to intensify over the next 10 years.

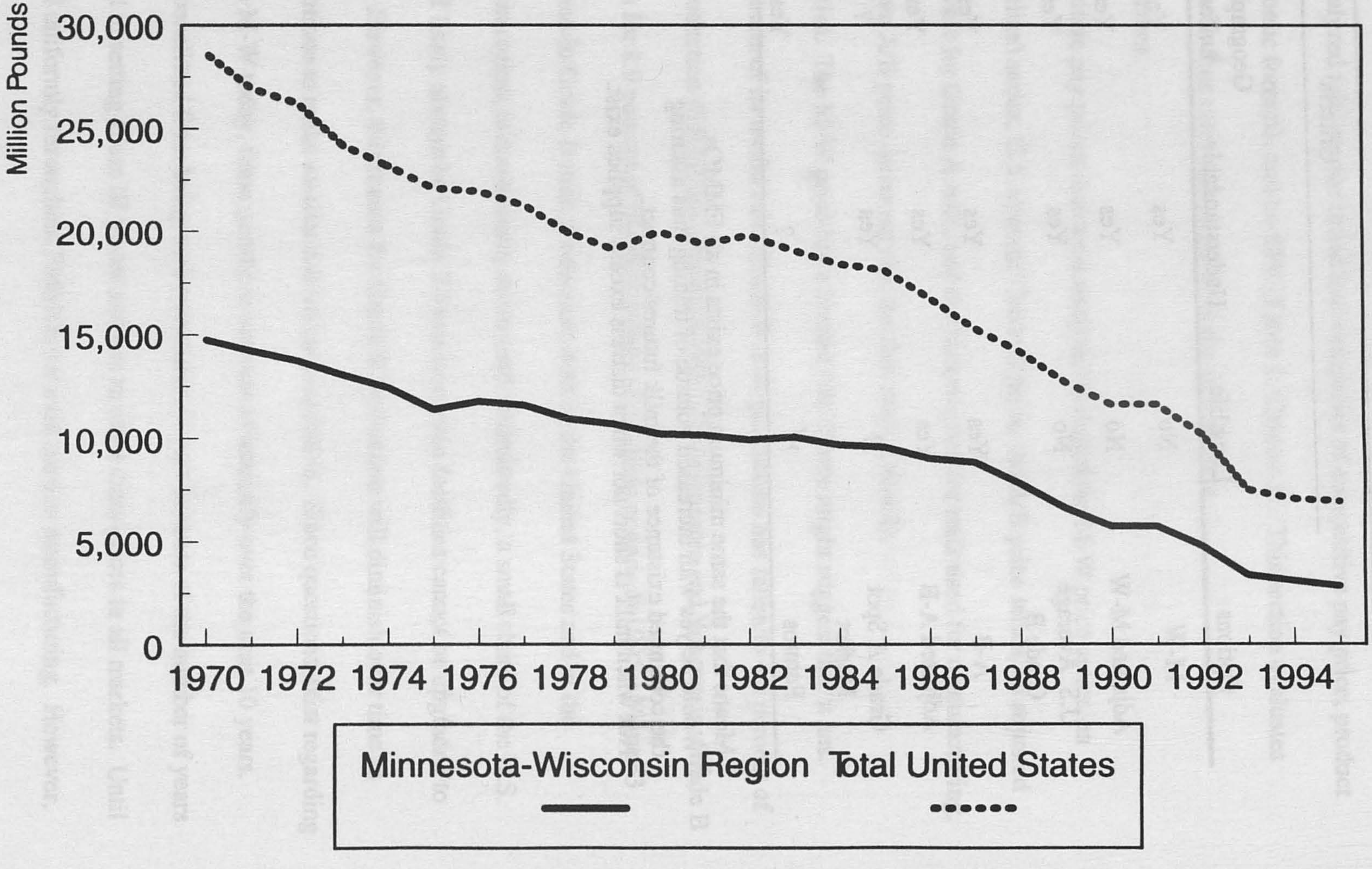
The M-W has benefitted from being understandable, in part because of the number of years that it has been used in setting Class III prices and ties to other class prices in all markets. Until 1992, it was applied uniformly throughout FMMOs for milk used in manufacturing. However,

**Table 2. Evaluation of the Competitive Pay Price Options Relative to Step 1 Criteria.**

| Options | Criteria | | | |
|---|---|---|---|---|
| | Long life | Understandable | Geographically uniform[1/] | Reflect manufactured milk market |
| M-W | No | Yes | Yes | ? |
| Adjusted M-W | No | Yes | Yes | ? |
| U.S. Average Grade B | No | Yes | Yes | No |
| A-B | Yes | Yes | Yes | ? |
| Adjusted A-B | Yes | Yes | Yes | ? |
| Grade A Spot Market | ? | Yes | ? | No |
| Futures | ?[2/] | ? | Yes | No[3/] |

[1/] Means that the same minimum price exists in all FMMOs.
[2/] Would be yes with increased volume of trading thus assuring the continued existence of the milk futures contract.
[3/] Not when milk is short nor when distress excess supplies exist.

Figure 3: **Quantity of Grade B Milk Production, U.S. Total and Minnesota Plus Wisconsin, 1970 to 1995.**



there is a question of the extent to which the M-W price reflects national as opposed to regional competitive conditions for milk for manufacturing. This question results from the perception that competitive conditions in the Minnesota-Wisconsin region may be unique due to a restructuring of farms in the region and excess processing capacity.

### Adjusted M-W Price Series

The M-W price generally is used as the standard against which its alternatives are compared, in part because farmers, processors, and policymakers are familiar with it. One problem with the M-W price is that it is not adjusted for hauling subsidies, which tend to be unique to Wisconsin. Nor does it account for protein premiums, which are particularly common in Wisconsin, although they also exist in Minnesota. For this reason, USC calculated an adjusted M-W price series, which adds to the M-W price series the average Minnesota-Wisconsin hauling subsidy and adjusts the milk price to 3.15 percent protein based on the prevailing protein test as reported by AMS/USDA. The hauling subsidies, protein content, and derived protein premiums[2] utilized to construct the adjusted M-W are reported in Table 3. Neither the hauling subsidy nor the protein content/premium are subject to audit. However, they are the best data available. USC believes that the adjusted M-W price provides a superior measure of competitive pay prices against which the M-W replacement options for the BFP should be evaluated.

Figure 4 and Table 3 compare the M-W price with the adjusted M-W price. The adjusted M-W averaged $0.12 per cwt higher than the M-W. Only in October and November was the M-W

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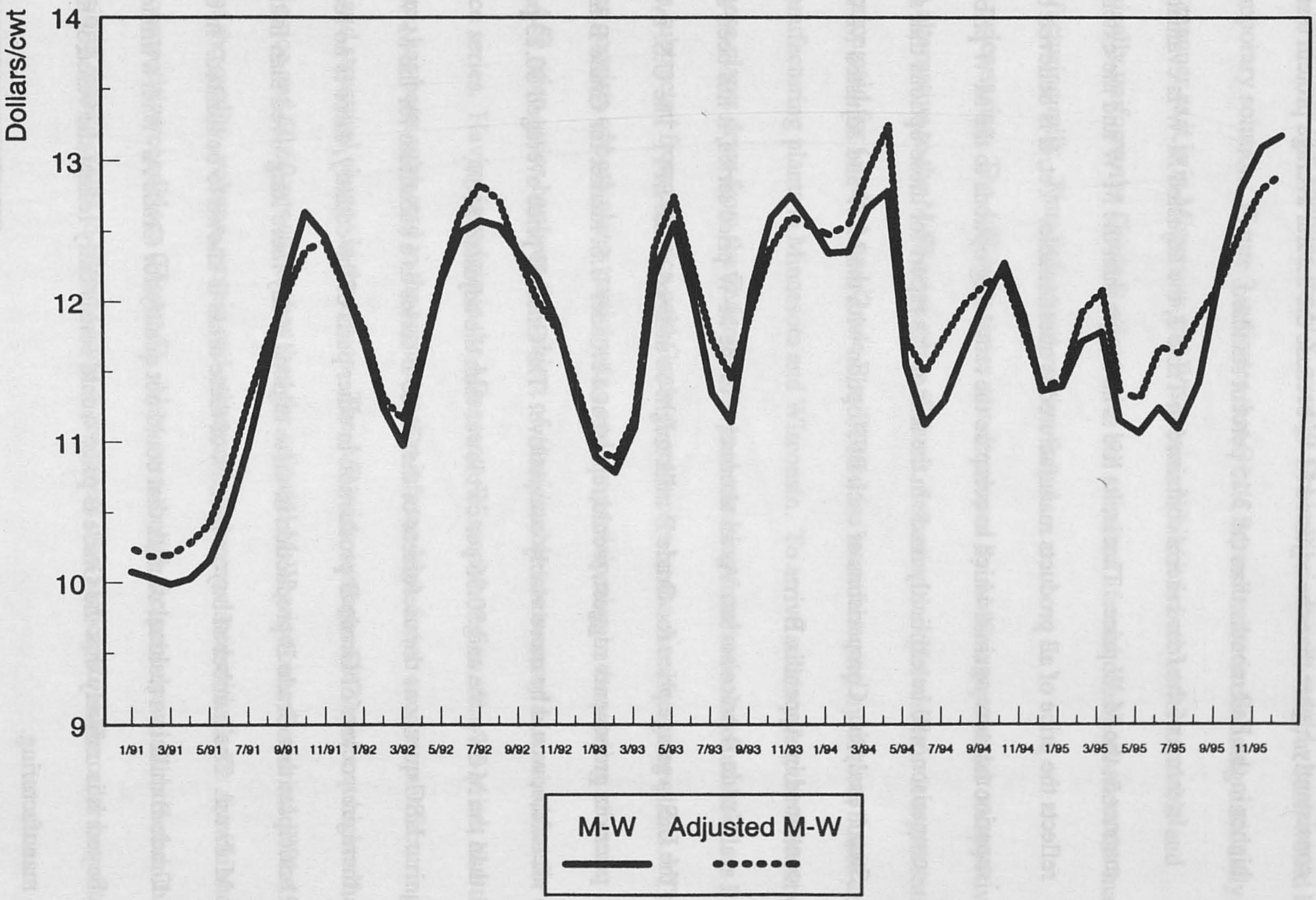
[2]The formula utilized in five Midwest FMMOs was utilized to derive the protein premium.

**Table 3: Adjustment Procedure for M-W Price**

| | | Green Bay Cheddar Cheese Price $/lb | M-W @ 3.5% B.F. Test $/cwt | Adjusted M-W Price For Protein and Hauling Subsidy $/cwt | Protein and Hauling Subsidy Adjustments for M-W Price | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Price per lb of Protein (Green Bay cheese price*1.32) $/lb | Protein Value per point (Cheese Price 1.32*10) | Protein Test for M-W Price percent | Difference in Protein Test from 3.15 percent | Protein Value Differential for Manufactured Milk $/cwt | Adjusted M-W for Protein $/cwt | Hauling subsidies M-W price $/cwt |
| 1991 | Jan | 1.0872 | 10.1600 | 10.2526 | 1.4351 | 14.3510 | 3.1900 | 0.0400 | 0.0574 | 10.1026 | 0.1500 |
| | Feb | 1.0875 | 10.0400 | 10.1944 | 1.4355 | 14.3550 | 3.1400 | -0.0100 | -0.0144 | 10.0544 | 0.1400 |
| | Mar | 1.0875 | 10.0200 | 10.2031 | 1.4355 | 14.3550 | 3.1200 | -0.0300 | -0.0431 | 10.0631 | 0.1400 |
| | Apr | 1.0875 | 10.0400 | 10.2761 | 1.4355 | 14.3550 | 3.0900 | -0.0600 | -0.0861 | 10.1261 | 0.1500 |
| | May | 1.1190 | 10.2300 | 10.4248 | 1.4771 | 14.7708 | 3.1400 | -0.0100 | -0.0148 | 10.2448 | 0.1800 |
| | Jun | 1.1788 | 10.5800 | 10.7922 | 1.5560 | 15.5602 | 3.1100 | -0.0400 | -0.0622 | 10.6422 | 0.1500 |
| | Jul | 1.2458 | 10.9900 | 11.2816 | 1.6445 | 16.4446 | 3.0700 | -0.0800 | -0.1316 | 11.1216 | 0.1600 |
| | Aug | 1.3103 | 11.5000 | 11.7000 | 1.7296 | 17.2960 | 3.1500 | 0.0000 | 0.0000 | 11.5000 | 0.2000 |
| | Sep | 1.3434 | 12.0200 | 12.0581 | 1.7733 | 17.7329 | 3.2300 | 0.0800 | 0.1419 | 11.8781 | 0.1800 |
| | Oct | 1.3506 | 12.5000 | 12.3669 | 1.7828 | 17.8279 | 3.3200 | 0.1700 | 0.3031 | 12.1969 | 0.1700 |
| | Nov | 1.3131 | 12.4800 | 12.4320 | 1.7333 | 17.3329 | 3.2700 | 0.1200 | 0.2080 | 12.2720 | 0.1600 |
| | Dec | 1.2667 | 12.1000 | 12.1061 | 1.6720 | 16.7204 | 3.2600 | 0.1100 | 0.1839 | 11.9161 | 0.1900 |
| 1992 | Jan | 1.2253 | 11.7100 | 11.7991 | 1.6174 | 16.1740 | 3.2000 | 0.0500 | 0.0809 | 11.6291 | 0.1700 |
| | Feb | 1.1699 | 11.2100 | 11.3237 | 1.5443 | 15.4427 | 3.1800 | 0.0300 | 0.0463 | 11.1637 | 0.1600 |
| | Mar | 1.1607 | 10.9800 | 11.1647 | 1.5321 | 15.3212 | 3.1600 | 0.0100 | 0.0153 | 10.9647 | 0.2000 |
| | Apr | 1.2741 | 11.4600 | 11.6332 | 1.6818 | 16.8181 | 3.1600 | 0.0100 | 0.0168 | 11.4432 | 0.1900 |
| | May | 1.3398 | 12.0600 | 12.1946 | 1.7685 | 17.6854 | 3.1700 | 0.0200 | 0.0354 | 12.0246 | 0.1700 |
| | Jun | 1.3598 | 12.4600 | 12.6341 | 1.7949 | 17.9494 | 3.1700 | 0.0200 | 0.0359 | 12.4241 | 0.2100 |
| | Jul | 1.3706 | 12.5900 | 12.8443 | 1.8092 | 18.0919 | 3.1200 | -0.0300 | -0.0543 | 12.6443 | 0.2000 |
| | Aug | 1.3795 | 12.5400 | 12.7218 | 1.8209 | 18.2094 | 3.1600 | 0.0100 | 0.0182 | 12.5218 | 0.2000 |
| | Sep | 1.3428 | 12.2800 | 12.3182 | 1.7725 | 17.7250 | 3.2300 | 0.0800 | 0.1418 | 12.1382 | 0.1800 |
| | Oct | 1.2989 | 12.0500 | 11.9957 | 1.7145 | 17.1455 | 3.3100 | 0.1600 | 0.2743 | 11.7757 | 0.2200 |
| | Nov | 1.2610 | 11.8400 | 11.8003 | 1.6645 | 16.6452 | 3.2700 | 0.1200 | 0.1997 | 11.6403 | 0.1600 |
| | Dec | 1.2041 | 11.3400 | 11.3970 | 1.5894 | 15.8941 | 3.2400 | 0.0900 | 0.1430 | 11.1970 | 0.2000 |
| 1993 | Jan | 1.1675 | 10.8900 | 10.9721 | 1.5411 | 15.4110 | 3.2200 | 0.0700 | 0.1079 | 10.7821 | 0.1900 |
| | Feb | 1.1600 | 10.7400 | 10.8841 | 1.5312 | 15.3120 | 3.1800 | 0.0300 | 0.0459 | 10.6941 | 0.1900 |
| | Mar | 1.2140 | 11.0200 | 11.1780 | 1.6025 | 16.0248 | 3.1700 | 0.0200 | 0.0320 | 10.9880 | 0.1900 |
| | Apr | 1.3720 | 12.1500 | 12.3943 | 1.8110 | 18.1104 | 3.1200 | -0.0300 | -0.0543 | 12.2043 | 0.1900 |
| | May | 1.3930 | 12.5200 | 12.7484 | 1.8388 | 18.3876 | 3.1400 | -0.0100 | -0.0184 | 12.5384 | 0.2100 |
| | Jun | 1.3200 | 12.0300 | 12.2326 | 1.7424 | 17.4240 | 3.1600 | 0.0100 | 0.0174 | 12.0126 | 0.2200 |
| | Jul | 1.2385 | 11.4200 | 11.7181 | 1.6348 | 16.3482 | 3.0900 | -0.0600 | -0.0981 | 11.5181 | 0.2000 |
| | Aug | 1.2150 | 11.1700 | 11.4602 | 1.6038 | 16.0380 | 3.1000 | -0.0500 | -0.0802 | 11.2502 | 0.2100 |
| | Sep | 1.3450 | 11.9000 | 11.9480 | 1.7754 | 17.7540 | 3.2300 | 0.0800 | 0.1420 | 11.7580 | 0.1900 |
| | Oct | 1.3450 | 12.4600 | 12.3837 | 1.7754 | 17.7540 | 3.3000 | 0.1500 | 0.2663 | 12.1937 | 0.1900 |
| | Nov | 1.3463 | 12.7500 | 12.6101 | 1.7771 | 17.7705 | 3.3300 | 0.1800 | 0.3199 | 12.4301 | 0.1800 |
| | Dec | 1.3138 | 12.5100 | 12.5366 | 1.7342 | 17.3415 | 3.2500 | 0.1000 | 0.1734 | 12.3366 | 0.2000 |
| 1994 | Jan | 1.3000 | 12.4100 | 12.4799 | 1.7160 | 17.1600 | 3.2200 | 0.0700 | 0.1201 | 12.2899 | 0.1900 |
| | Feb | 1.3049 | 12.4100 | 12.5511 | 1.7225 | 17.2247 | 3.1900 | 0.0400 | 0.0689 | 12.3411 | 0.2100 |
| | Mar | 1.3623 | 12.7700 | 12.9440 | 1.7982 | 17.9824 | 3.1700 | 0.0200 | 0.0360 | 12.7340 | 0.2100 |
| | Apr | 1.3928 | 12.9900 | 13.2468 | 1.8385 | 18.3850 | 3.1300 | -0.0200 | -0.0368 | 13.0268 | 0.2200 |
| | May | 1.2431 | 11.5100 | 11.7300 | 1.6409 | 16.4089 | 3.1500 | 0.0000 | 0.0000 | 11.5100 | 0.2200 |
| | Jun | 1.1914 | 11.2500 | 11.5015 | 1.5726 | 15.7265 | 3.1300 | -0.0200 | -0.0315 | 11.2815 | 0.2200 |
| | Jul | 1.2553 | 11.4100 | 11.7560 | 1.6570 | 16.5700 | 3.0800 | -0.0700 | -0.1160 | 11.5260 | 0.2300 |
| | Aug | 1.2785 | 11.7300 | 11.9938 | 1.6876 | 16.8762 | 3.1300 | -0.0200 | -0.0338 | 11.7638 | 0.2300 |
| | Sep | 1.3139 | 12.0400 | 12.1313 | 1.7343 | 17.3435 | 3.2300 | 0.0800 | 0.1387 | 11.9013 | 0.2300 |
| | Oct | 1.3269 | 12.2900 | 12.2147 | 1.7515 | 17.5151 | 3.3300 | 0.1800 | 0.3153 | 11.9747 | 0.2400 |
| | Nov | 1.2656 | 11.8600 | 11.7993 | 1.6706 | 16.7059 | 3.3300 | 0.1800 | 0.3007 | 11.5593 | 0.2400 |
| | Dec | 1.2091 | 11.3800 | 11.3925 | 1.5960 | 15.9601 | 3.2800 | 0.1300 | 0.2075 | 11.1725 | 0.2200 |
| 1995 | Jan | 1.2200 | 11.3500 | 11.4512 | 1.6104 | 16.1040 | 3.2300 | 0.0800 | 0.1288 | 11.2212 | 0.2300 |
| | Feb | 1.2780 | 11.7900 | 11.9325 | 1.6870 | 16.8696 | 3.1900 | 0.0400 | 0.0675 | 11.7225 | 0.2100 |
| | Mar | 1.2900 | 11.8900 | 12.0859 | 1.7028 | 17.0280 | 3.1700 | 0.0200 | 0.0341 | 11.8559 | 0.2300 |
| | Apr | 1.2110 | 11.1600 | 11.3700 | 1.5985 | 15.9852 | 3.1500 | 0.0000 | 0.0000 | 11.1600 | 0.2100 |
| | May | 1.2113 | 11.1200 | 11.3140 | 1.5989 | 15.9892 | 3.1600 | 0.0100 | 0.0160 | 11.1040 | 0.2100 |
| | Jun | 1.2526 | 11.4200 | 11.6831 | 1.6534 | 16.5343 | 3.1300 | -0.0200 | -0.0331 | 11.4531 | 0.2300 |
| | Jul | 1.2503 | 11.2300 | 11.6350 | 1.6504 | 16.5040 | 3.0500 | -0.1000 | -0.1650 | 11.3950 | 0.2400 |
| | Aug | 1.3037 | 11.5500 | 11.9105 | 1.7209 | 17.2088 | 3.0800 | -0.0700 | -0.1205 | 11.6705 | 0.2400 |
| | Sep | 1.3774 | 12.0800 | 12.1464 | 1.8182 | 18.1817 | 3.2400 | 0.0900 | 0.1636 | 11.9164 | 0.2300 |
| | Oct | 1.4148 | 12.6100 | 12.5138 | 1.8675 | 18.6754 | 3.3300 | 0.1800 | 0.3362 | 12.2738 | 0.2400 |
| | Nov | 1.4225 | 12.8700 | 12.7996 | 1.8777 | 18.7770 | 3.3100 | 0.1600 | 0.3004 | 12.5696 | 0.2300 |
| | Dec | 1.4191 | 12.9100 | 12.9052 | 1.8732 | 18.7321 | 3.2700 | 0.1200 | 0.2248 | 12.6852 | 0.2200 |

**Figure 4: Comparison of the M-W Price and the Adjusted M-W Price , January 1991 to December 1995.**



consistently higher than the adjusted M-W because the natural average protein test is much higher in the Fall months than the 3.15 percent standard.

In terms of the four criteria contained in Table 2, the adjusted M-W is evaluated in the same manner as the M-W price. That is, its life is no longer than the M-W and the extent to which it reflects the price of all products manufactured is questionable. Yet, it is believed by USC to be a superior measure against which to compare the remaining options to the M-W price. This comparison will be explicitly made in the text of this report for those options that survive this Step 1 analysis. Comparisons of each BFP option with the M-W and adjusted M-W price is contained in Appendix B.

**Grade B price series.** As an alternative to the M-W price series, it has been suggested that the U.S. average price for Grade B milk might be utilized as the BFP. The U.S. average Grade B price, its proponents suggest, would represent a broader U.S. market for Grade B milk that, therefore, would be more viably competitive. The Grade B price averaged $0.23 per cwt lower than the M-W price and $0.36 per cwt lower than the adjusted M-W.

USC questions the usefulness of the Grade B series as a substitute for the M-W price. While there are pockets of Grade B production in other parts of the country, there is no reason to anticipate that Grade B production in these regions is any more long-lived than in the Upper-Midwest. The number of buyers in most of these areas is known to be limited. In other areas, Grade B milk is a residual of milk that could not qualify for Grade A. With a limited number of buyers it is unlikely that the Grade B price would consistently reflect the value of milk for manufacturing.

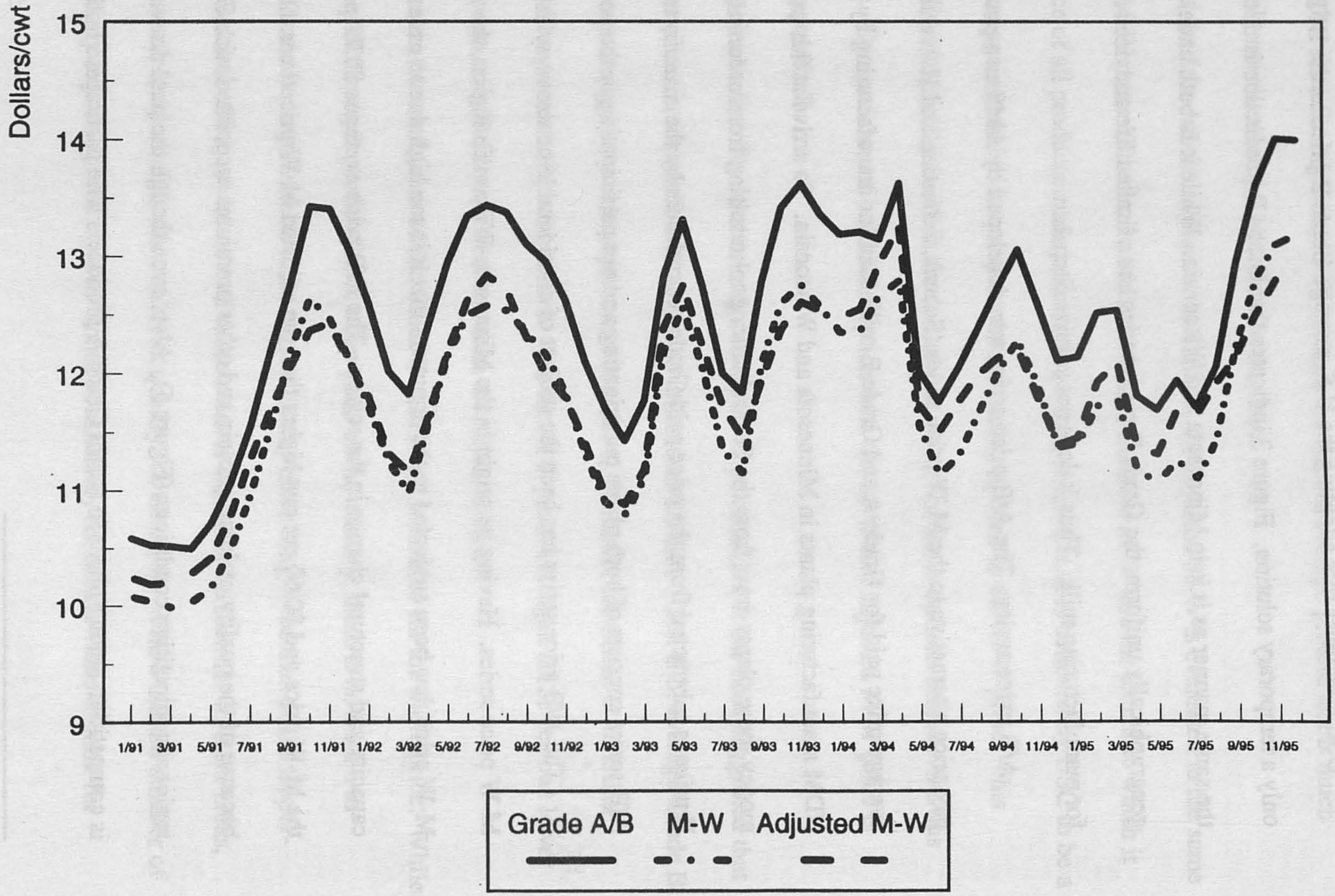
USC concludes that adopting the U.S. average Grade B price as the BFP, at best, would be only a temporary solution. Figure 3 indicates that Grade B production is declining nationally in the same manner as it is in Minnesota and Wisconsin. While it is both understandable and geographically uniform, the Grade B price series has a limited life and does not reflect the market for manufacturing milk. Thus it does not survive Step 1.

**A/B price series.** The A/B price series was developed by AMS as a potential competitive pay price alternative to the M-W price series (Schmit, Sebastian and Halverson). It represents the average price paid for Grade A and Grade B milk used for manufacturing by cheese, butter and NDM manufacturing plants in Minnesota and Wisconsin. To arrive at this price, the amount of money these plants draw from the Federal order pool resulting from order sales at the Class I and II price is subtracted from the price paid Grade A producers by the manufacturing plants.[3] The A/B series consists of both plants participating and not participating in the pooling process.

The A/B price series has been the subject of considerable controversy as a substitute for the M-W price series. Having its origin in the Minnesota-Wisconsin region, the A/B price, like the M-W price, has been subjected to the argument that it is too high due to excess manufacturing capacity and structural change in the region. The A/B price averages $0.72 per cwt higher than the M-W price and $0.60 per cwt higher than the adjusted M-W price over the period 1991-1995 because of the quality, volume, protein and other premiums associated with Grade A milk and regional competitive conditions (Figure 5). Also, even though the pool draw is subtracted, there is competition among plants to attract Grade A producers who participate in the order benefits.

[3]Arguably Class I and II over order premiums might also be subtracted from the price paid.

**Figure 5: Comparison of Grade A/B Price with the M-W and Adjusted M-W Price Series, January 1991 to December 1995.**



In contrast with the M-W price, the A/B price has a life beyond the elimination of a competitively viable market for Grade B milk. That is, over time, as the volume of Grade B milk declines, Grade A milk becomes a larger component in the A/B price series. In the event that Grade B milk disappears, the A/B series becomes a Grade A manufacturing price series. Therefore, the A/B series would be expected to have a life that substantially exceeds 10 years.

Except for the pool draw procedure, the A/B price should be as understandable as the M-W price and would be geographically uniform throughout the United States. Inasmuch as plants in Minnesota and Wisconsin compete for a milk supply in producing butter, NDM, and cheese, the A/B price reflects market conditions for all of these products. However, like the M-W price, it may give undue weight to unique competitive conditions in the Minnesota-Wisconsin region. For this reason, the A/B price is given a question mark regarding this criterion (Table 2). The A/B price survives step 1.

USC requested that AMS/USDA supply it with an A/B price series from another region, such as the Northeast. Its reason for this request included:

- We were interested in obtaining an indication of how much unique competitive conditions in Minnesota and Wisconsin might affect the price in this region.
- We were also interested in knowing whether it would be possible to compute a broader-based A/B price that might not be as subject to unique competitive conditions.

In response to this request, USC was informed that constructing a broader-based A/B series presented substantial problems. Outside the Upper-Midwest there is either a small number of plants and/or the existing plants manufactured a broader array of value-added products that could distort the producer pay price.

**Adjusted A/B price series.** As in the case of the M-W price series, an adjusted A/B series was developed that reflects hauling subsidies and protein premiums paid by manufacturing plants in Minnesota and Wisconsin. That is, estimated hauling subsidies were added to the A/B price and it was standardized for 3.15 percent protein, in the same manner as indicated in Table 3 (Appendix A).

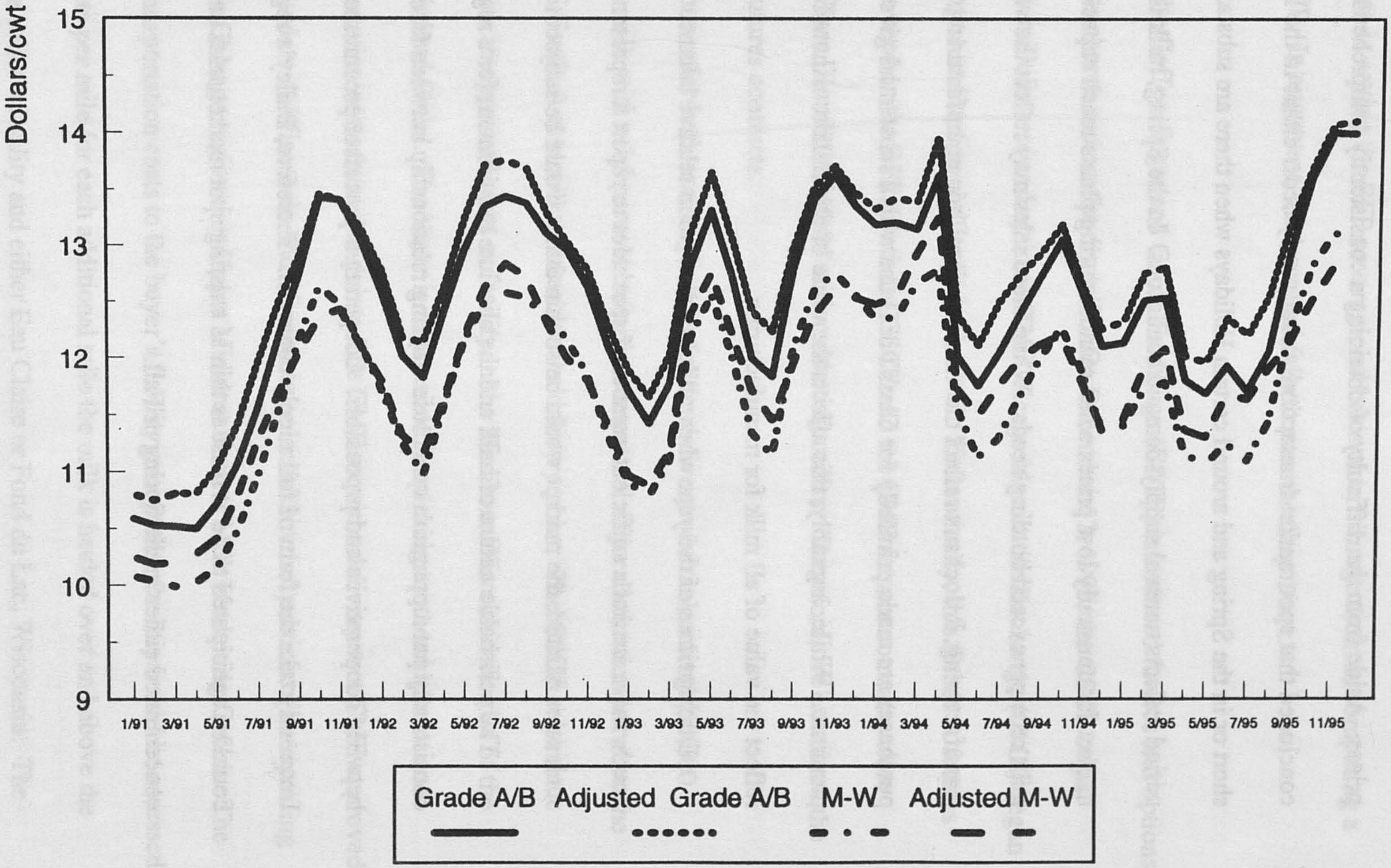
Like the adjusted M-W is higher than the M-W price, the adjusted A/B price is higher than the A/B price (Figure 6) by an average $0.24 per cwt over the period 1991-1995. The adjusted A/B is $0.84 per cwt higher than the adjusted M-W, and $0.96 per cwt over the M-W price.

For those who judge the A/B price to be too high, the adjusted A/B price is even more so. Yet, like the A/B series, the adjusted A/B series would be expected to satisfy the criterion of a long life. It would be understandable and geographically uniform. Since it is generated in the Upper Midwest, it would be subject to the same regional questions as the M-W and A/B series. However, the adjusted A/B price might be used as a mover of the Class I and II prices if an option such as pooling differentials with no BFP were chosen. The adjusted A/B price survives step 1.

**Spot Market Price for Fluid Milk.** Bailey, a dairy economist at the University of Missouri, has suggested a BFP option involving regional auction markets for fluid milk shipments whereby processors and cooperatives would bid for milk delivered in three or four days. The prices would be FOB shipping point. Bailey argues that using such regional markets as the BFP would result in higher producer prices to the benefit of dairy farmers.

Spot markets have inherent appeal to economists because they are the epitome of marketplace supply-demand interactions. Even prior to the publication of Bailey's auction

**Figure 6: Comparison of Prices Generated by the Adjusted A/B Series with the A/B, M-W and Adjusted M-W Price Series, January 1991 to December 1995.**



market option, USC had explored with AMS the potential for obtaining spot market fluid milk prices. Aside from the difficulty of obtaining a consistently comprehensive price series, USC concluded that spot market transactions usually only occur either in the Fall when supplies are short or in the Spring and around certain Holidays when there are substantial surpluses. Either period reflects unusual supply-demand conditions. In the Spring, milk is often sold on the spot market for unusually low prices when manufacturing plants reach capacity or when fluid plants milk receipts exceed bottling needs. While these sales may reflect the value of this milk in manufacturing, it does not reflect the value of all milk in manufacturing. Conversely, the Fall purchases are made primarily for Class I or II use with a substantial give-up charge price premium. While, arguably, this affects the value of this milk to a manufacturing plant, it does not reflect the value of all milk for manufacturing.

During times of the year when milk supplies are in relative balance in regions such as the South, there are not a sufficient number of spot sales to report a representative price. Even if such sales existed, the market would be so thin that it would be subject to manipulation.

The perishable nature of milk and the absolute requirement for a regular supply has consistently put a premium on a close working relationship between farmers and processors or between cooperatives and processors. Cooperative-processor procurement arrangements frequently take the form of full supply contracts. Therefore, Bailey's regional auction markets could be anticipated to be at least as thin as existing spot market sales and continue to be concentrated either in the Spring or Fall.

From material available to USC, it is not clear whether Bailey's intent was to utilize the auction market prices in setting the BFP on a regional basis or to average them in computing a national average BFP. In any event, this proposal fails to pass the Step 1 test.

**Futures Markets**

In June 1993, the Coffee, Sugar and Cocoa Exchange (CSCE) introduced futures and options contracts for cheddar cheese and nonfat dry milk. On December 12, 1995, the CSCE began trading Grade A raw milk futures and options. The Chicago Mercantile Exchange (CME) began trading Grade A futures and options on January 11, 1996. Theoretically, this Grade A futures price quote could be used as the BFP. Both the CSCE and the CME futures contracts were structured to price Class III milk in federal milk marketing orders. Therefore, we examined the Grade A raw milk futures contracts.

The futures contract for both exchanges calls for the delivery of a tanker load (50,000 pounds) of Grade A milk with a 3.5 percent butterfat content. A major distinction between the CSCE and the CME Grade A raw milk contracts is the delivery point. The CSCE contract requires delivery *from* an approved plant or facility in the Madison, Wisconsin district of the Chicago Regional Federal Order. The buyer is responsible for picking up the shipment and assuming all transportation costs from that point. The CME requires delivery *to* a CME approved facility within the borders of Wisconsin and Minnesota or located in that portion of surrounding states included in the Chicago regional or Upper Midwest Federal Milk Marketing Orders. The seller assumes all transportation costs to the buyer's facility except that the buyer will be assessed a standard freight rate per mile for each additional mile the milk is hauled over and above the distance between the seller's facility and either Eau Claire or Fond du Lac, Wisconsin. The excess hauling cost will be paid to the seller. But under both exchanges, deliveries of milk are subject to Federal order pricing rules.

The delivery months also differ between the two exchanges. Initially, the delivery months on the CSCE were February, April, June, August, October and December. But now the CSCE lists the additional delivery months of January, March, May, July, September and November. Hence, there is a Grade A raw milk futures contract listed for every month of the year. This is essential if the futures contract price is to replace the monthly announced BFP. The CME, however, only trades the delivery months of February, April, June, July, September and November.

The intent of the Grade A raw milk futures was to reflect the Federal Order Class III price. However, the M-W is a price for Grade B milk used in manufacturing. Only Grade A milk may be delivered under FMMOs. As seen with the A/B price series, the value of Grade A milk used for Class III (manufacturing) is generally higher than the Grade B M-W price.

Under the CSCE futures contract, with delivery points in the vicinity of Madison, eligible plants would not likely be willing to supply milk for delivery at the M-W price. The cost to acquire milk for delivery would be at least the Grade A cost to the plant for Class III milk use. Plants may demand even more since the unanticipated reduction in supply would disrupt manufacturing schedules and cause the plant to operate at reduced input levels.[4] Therefore, plant give-up changes, at least in parts, are the opportunity cost of not having that milk. If these added costs are reflected in the futures price, then the CSCE milk futures price would be expected to

[4]Grade A manufacturing plants typically negotiate substantial give-up charges for spot sales of milk for diversion to fluid use.

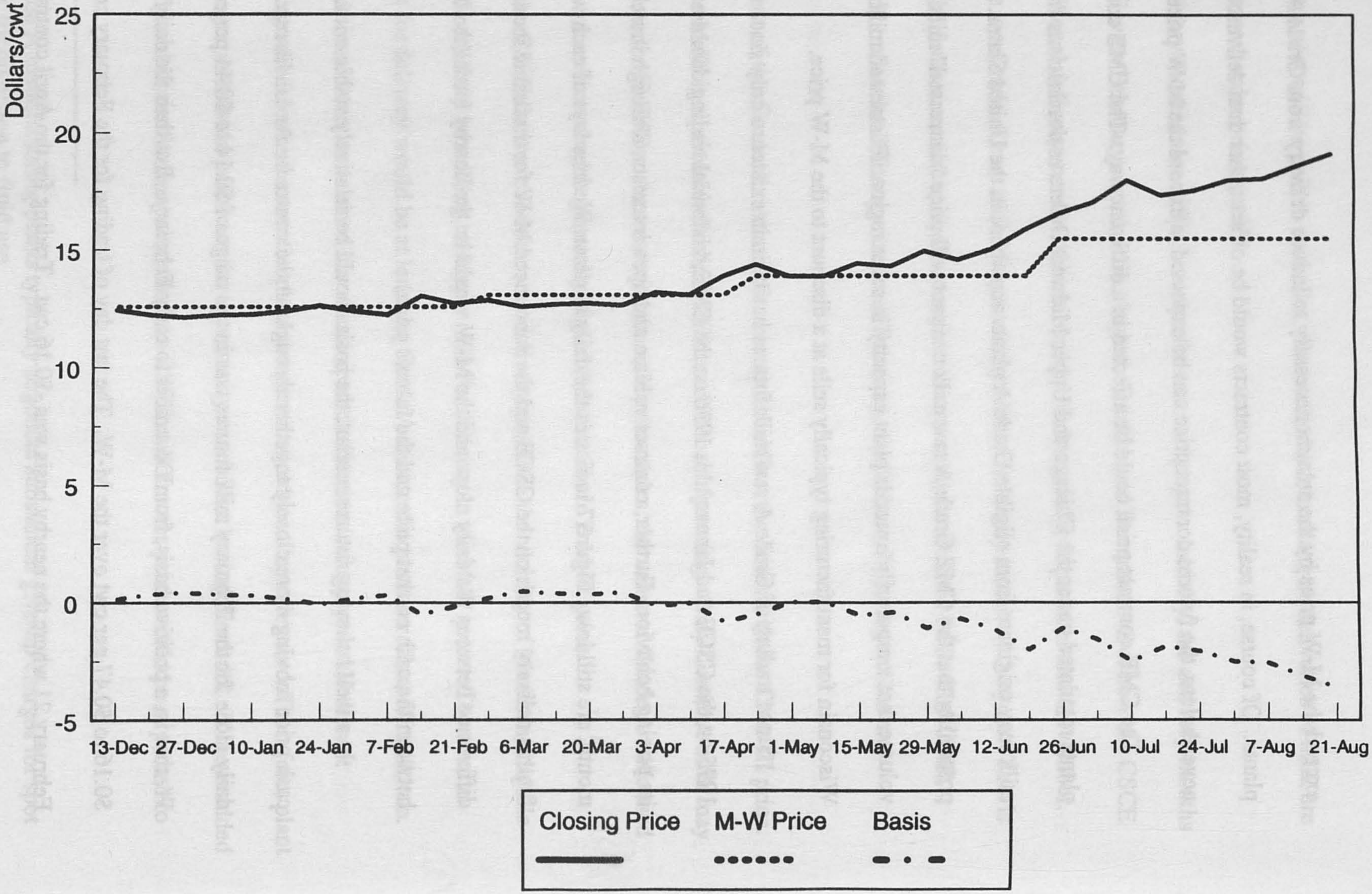
exceed the M-W price by the amount necessary to induce delivery from Grade A manufacturing plants. Of course, in reality, most contracts would be offset rather than delivered upon. But, nevertheless, the futures contract price can be expected to exceed the M-W price.

The CME contract price could be affected in a different way. The CME contract specifies plants regulated under the Chicago and Upper Midwest Orders as destinations for delivery. The milk may originate from eligible Grade A plants anywhere in the United States. This raises the possibility that the CME Grade A raw milk contract will price "distressed" milk, i.e., milk volume that temporarily exceeds plant capacity in some region. Distressed milk moving to Wisconsin for manufacturing typically sells at a discount to the M-W price.

Since trading of Grade A raw milk futures has been in existence only since December 12, 1995 on the CSCE and January 11, 1996 on the CME, historical trading data are limited to verify its pricing behavior. Further, contract volume and open interests, although increasing each month, are still low. Figure 7 indicates the daily close on Wednesdays of each week for a given futures delivery month on the CSCE and the announced M-W for that same month. The difference between the daily close and the M-W would be the nearby basis (the difference between the cash market price and the futures price).

In a well behaving futures market, the basis should be relatively stable with the futures and cash price moving more closely together throughout the contract. As can be readily seen, the daily close for the February milk futures was in the range of $0.14 to $0.44 per cwt under the M-W, that is, a positive basis, from December to early February. But then the daily close moved $0.16 to $0.47 per cwt over the M-W. The last day of trading for the February contract was February 21 where the nearby basis was -$0.16 cwt. Trading for the April contract started on

Figure 7. Comparison of Wednesday Closing CSCE Grade A Futures Milk Price, M-W Price for Same Month and the Resulting Basis, December to August 1996.



February 28. From then until March 27, the daily close was below the April M-W, but in April and until the last trading day for the April contract, the daily close was $0.11 to $0.81 higher than the April M-W. Hence, the relationship between the daily close and the M-W during the last few weeks of trading for both the February and April contracts was closer to what was anticipated, that is, the daily close reflecting the Grade A price for manufacturing and higher than the announced M-W. But the situation was much different for both the June and August contracts. The daily close moved well above the M-W. The daily close for the August contract was as much as $2.00 to $3.60 per cwt above the August M-W, a price relationship much higher than the expected premium paid for Grade A milk for manufacturing over that of the Grade B/M-W price.

Figure 8 shows the daily close in relation to the M-W price for the CME. The delivery months shown are February, April, June, July and September. The relationship between the daily close and the M-W was similar to that experienced on the CSCE except that the daily close was below the M-W for the entire trading period of the February contract and for the April contract until the last week of trading. This positive nearby basis reflects, as anticipated, a CME contract price at a discount to that of the CSCE.

Table 4 compares the daily close for the CSCE and CME for the comparable delivery months of February, April and June. Except for a few exceptions, the CME contracts traded at a discount to the CSCE. But, as with the CSCE, the daily close on the CME moved well above the M-W price for the June, July and August delivery months. Equally important, the difference between the CSCE and CME prices should only reflect the value of the differences in the terms

**Figure 8. Comparison of the Closing CME Grade A Futures Milk Price, the M-W Price for the Same Month and the Resulting Basis, January to August 1996.**

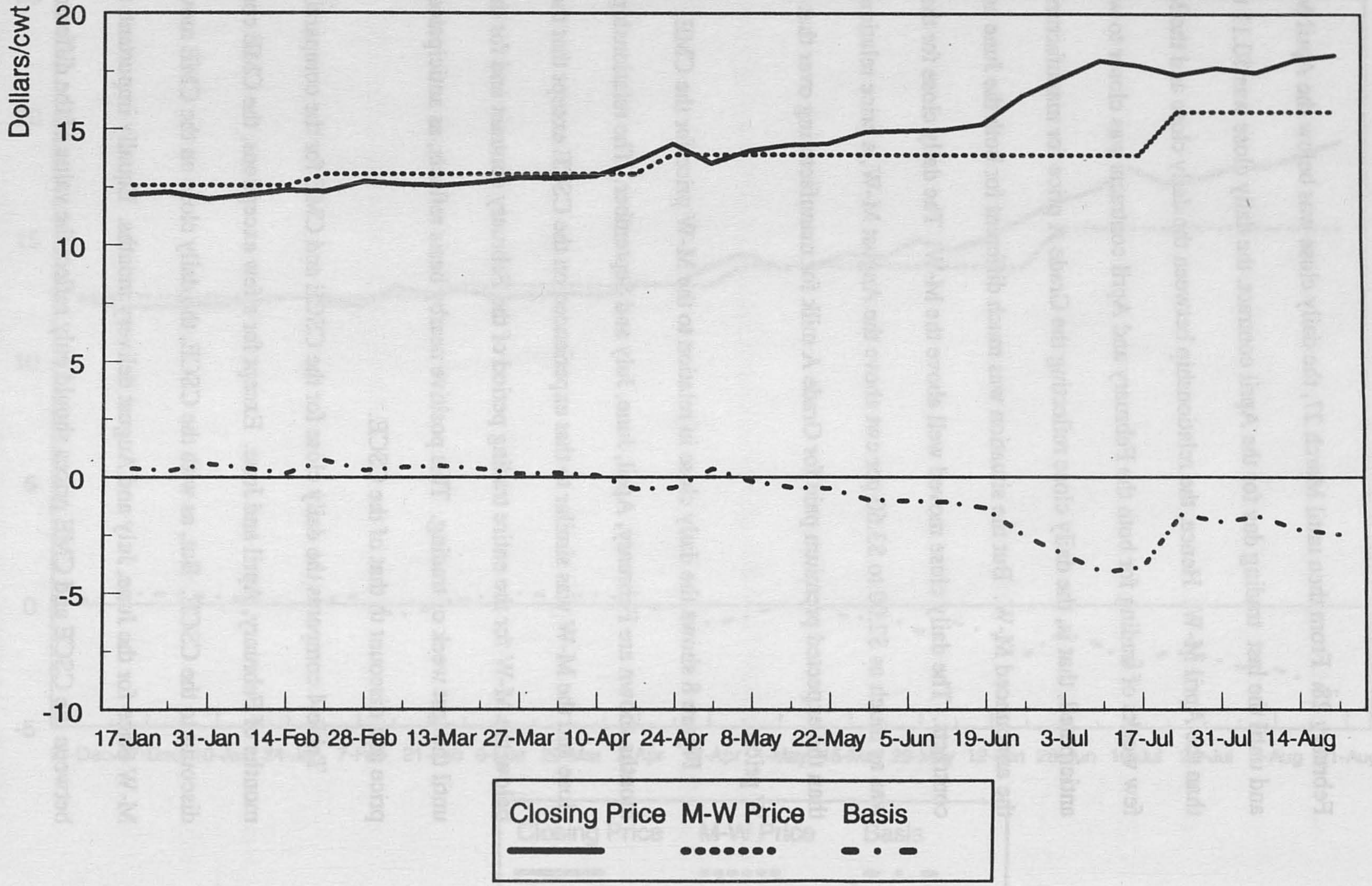


**Table 4: Comparison of Closing Raw Milk Contract Prices for the CSCE and CME January-May 1996**

| Date | Contract | CSCE Close | CME Close | Difference |
|---|---|---|---|---|
| 17-Jan | Feb. | 12.41 | 12.20 | 0.21 |
| 24-Jan | | 12.65 | 12.30 | 0.35 |
| 31-Jan | | 12.44 | 12.00 | 0.44 |
| 7-Feb | | 12.26 | 12.20 | 0.06 |
| 14-Feb | | 13.06 | 12.40 | 0.66 |
| 28-Feb | April | 12.88 | 12.75 | 0.11 |
| 6-Mar | | 12.60 | 12.65 | -0.05 |
| 13-Mar | | 12.69 | 12.60 | 0.09 |
| 20-Mar | | 12.75 | 12.73 | 0.03 |
| 27-Mar | | 12.65 | 12.92 | -0.28 |
| 3-Apr | | 13.20 | 12.90 | 0.30 |
| 10-Apr | | 13.10 | 13.00 | 0.10 |
| 17-Apr | | 13.90 | 13.60 | 0.30 |
| 24-Apr | June | 14.40 | 14.38 | 0.03 |
| 1-May | | 13.90 | 13.55 | 0.35 |
| 8-May | | 13.90 | 14.10 | -0.20 |
| 15-May | | 14.45 | 14.35 | 0.10 |
| 22-May | | 14.33 | 14.40 | -0.07 |
| 29-May | | 14.98 | 14.90 | 0.08 |
| 5-Jun | | 14.60 | 14.95 | -0.35 |
| 12-Jun | | 15.06 | 15.00 | 0.06 |
| 19-Jun | | 15.90 | 15.25 | 0.65 |

of the two contracts. Arbitrage between the two markets should make this difference relatively stable, which obviously is not the case. This is evidence of an unreliable futures market.

USC concludes that the Grade A raw milk futures on both the CSCE and CME were not reflecting the value of Grade A milk for manufacturing use. Rather, they were reflecting the value of spot shipments of Grade A milk from Grade A plants regulated under the Chicago Regional Order to the deficit fluid markets. Adding the Chicago Class I differential plus a plant give-up charge would result in a Grade A price for these spot shipments of $2.00 to $4.00 per cwt higher than the announced M-W price. This situation has occurred in the past during the summer when spot shipments of milk have taken place. Once the milk supply of Grade A milk produced in the Southeast improves to meet regional Class I needs and spot shipments from Wisconsin cease, the relationship between the daily close and the M-W will likely return to a situation similar to what was experienced for the February and April contracts, that is, the daily close will be more of a reflection of premiums being paid for Grade A milk used in manufacturing.

The above situation is a limitation of the Grade A raw milk futures as a replacement for the M-W. During periods when spot shipments of Grade A milk are not occurring, the daily close appears to reflect the competitive value for Grade A milk used for manufacturing in Minnesota and Wisconsin. But during periods when spot shipments of Grade A milk are occurring, the daily close is more reflective of the value of Grade A milk shipped from Wisconsin to other markets for fluid use.

It has been proposed that the M-W replacement be a weighted average of the prices (weighted by volume at each price) of all executed transactions that occur each day (except for the last trading day) during the calendar month in which the contract expires. For example, the

August BFP would be determined by the weighted average of all transaction prices for the August contract on every trading day in August through August 19, 1996, the day before the last trading day for the August contract. The last trading day is eliminated because it is possible that in an effort by some futures trading participants to avoid making delivery or accepting delivery, they will liquidate on the last day, and prices on the last trading day can infrequently become distorted.[5]

As an illustration of this approach, the average of the daily closes weighted by volume of trading for each trading day, except the last trading day, for the delivery contract months of February, April, June and August on the CSCE were calculated. The resulting average for the month would be the BFP under the futures option. For February, the weighted average of closes was $13.88 per cwt, $1.29 higher than the February M-W of $12.59. For April, the weighted average of closes was only $0.06 per cwt higher than the April M-W; for June the $15.23 weighted average of closes was $1.32 higher than the M-W; and the August $18.52 weighted average of the closes was $3.58 above the M-W. Because of the low volume that has existed up to this point, the weighted average of the closes resulted in an unrealistic BFP.

As volume of trading improves, the futures option could become a valid price mover with no one transaction unduly impacting the calculated BFP. Such prices would be competitively determined with buyers and sellers of all types and geographical locations participating in the futures market. There would be the potential of more participants determining prices than what exists in the cash market. Under these circumstances, a daily weighted transaction price could be announced and then a final weighted average for the contract month could be derived. This

[5]It is the delivery requirement that forces the futures and cash price to converge.

procedure would provide some advanced pricing information to Grade A manufacturing plants regulated under FMMOs. Since futures markets are under constant surveillance by the Commodity Futures Trading Commission, and the Exchange's own by-laws, rules and regulations to ensure conformity and contract performance, the integrity of the market would be protected. The futures markets would offer daily public reports of prices electronically. Since buyers and sellers nationally may be participants in the futures market, futures prices are determined nationally.[6] Moreover, the futures market derived BFP would reflect the value of Grade A milk in the *current month* in comparison with the M-W price which is based on the price for Grade B milk for the *previous month, updated* with product prices.

In terms of the criteria indicated in Table 2, dairy futures have the potential for being long lasting, providing that trading volume continues to increase, assuring the survival of Grade A raw milk futures. Pending such increases, USC finds the futures option to have a questionable life at this time.

Dairy futures are not well understood by most dairy producers, and by many buyers and sellers of milk and dairy products. This understanding will improve with more use of the contracts. The futures market option is no more complicated or less understandable than what exists with the M-W or A/B BFP alternatives. However, the issue of understandability should not be trivialized. Extension economists who teach futures to cattle and grain producers indicate substantial frustration over the lack of basic understanding of futures versus cash markets. There are commodities where futures trading has existed for many years. It is obvious from the

[6]Futures prices are not only national in scope but they also have international competitive dimensions embodied in them in that traders in futures may readily be located outside the United States.

experience of other commodities that dairy farmers will not understand futures markets from mere participation in a dairy marketing club in their local neighborhood. Study and use is required. Therefore, at this point in time, USC considers producer and processor understanding to be questionable.

The futures BFP would be geographically uniform. However, we find that a Grade A raw milk futures determined BFP would fall short of reflecting supply and demand conditions in manufactured product markets. During times of spot shipments of Grade A milk from Wisconsin south, the futures prices appear to be a reflection of these spot prices for Grade A milk used for fluid purposes. In the Spring of the year, futures prices might be expected to be a reflection of surplus milk supplies sold at distress prices. Therefore, futures do not meet the Step 1 criteria.

**Product Price Formulas**

Twenty-two product price formulas were analyzed in this study (Table 5). These formulas fall into three product categories:

- Butter/powder (B/P).
- Cheddar cheese.
- Butter/powder-Cheddar cheese (B/P-C).

The specific formulas analyzed included 16 developed for the 1991 study. We simply updated these formulas for the period 1991-95. In addition, USC added six formulas utilizing California costs as the make allowance.

The generalized product formula equation involves computing the finished product receipts from a cwt of milk and subtracting the cost of manufacturing (make allowance) to arrive at the

**Table 5. Evaluation of Product Price Formula Options Relative to Step 1 Criteria.**

| Option | Criteria | | | |
|---|---|---|---|---|
| | Long Life | Understandable | Geographically Uniform | Reflect Manufactured Milk Market |
| Butter/powder, annual yields and price support make allowance | Yes | Yes | Yes | No |
| Butter/powder, seasonal yields and price support make allowance | Yes | Yes | Yes | No |
| Butter/powder, annual yields and derived margins as make allowance | Yes | Yes | Yes | No |
| Butter/powder, seasonal yields and derived margins as make allowance | Yes | Yes | Yes | No |
| Butter/powder, annual yields and CA cost based make allowance with national production weights | Yes | Yes | Yes | No |
| Butter/powder, seasonal yields and CA cost based make allowance with national production weights | Yes | Yes | Yes | No |
| Cheese formula, annual yields and price support make allowance | Yes | Yes | Yes | No |
| Cheese formula, seasonal yields and price support make allowance | Yes | Yes | Yes | No |
| Cheese formula, annual yields and derived margins as make allowance | Yes | Yes | Yes | No |
| Cheese formula, seasonal yields and derived margins as make allowance | Yes | Yes | Yes | No |
| Cheese formula, annual yields and CA cost based make allowance with national production weights | Yes | Yes | Yes | No |
| Cheese formula, seasonal yields and CA cost based make allowance with national production weights | Yes | Yes | Yes | No |
| Butter/powder-cheese formula, annual yields weighted by MN & WI milk production and price support make allowance | Yes | Yes | Yes | Yes |
| Butter/powder-cheese formula, annual yields weighted by US milk production and price support make allowance | Yes | Yes | Yes | Yes |
| Butter/powder-cheese formula, seasonal yields weighted by MN & WI milk production & price support make allowance | Yes | Yes | Yes | Yes |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance | Yes | Yes | Yes | Yes |
| Butter/powder-cheese formula, annual yields weighted by MN & WI milk production & derived margins as make allowance | Yes | Yes | Yes | No |
| Butter/powder-cheese formula, annual yields weighted by US milk production & derived margins as make allowance | Yes | Yes | Yes | No |
| Butter/powder-cheese, seasonal yields weighted by MN & WI milk production & derived margins as make allowance | Yes | Yes | Yes | No |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production & derived margins as make allowance | Yes | Yes | Yes | No |
| Butter/powder-cheese, annual yields and CA cost based make allowance weighted by U.S. milk production | Yes | Yes | Yes | Yes |
| Butter/powder-cheese, seasonal yields weighted by U.S. milk production and CA cost based make allowance | Yes | Yes | Yes | Yes |

cost of raw milk (BFP). A detailed discussion of the make allowance issue as related to product formula pricing is contained in Appendix E.

**Generalized Product Formula Equation**

$$\underbrace{\left(\overset{(1)}{\text{Sales Price of Finished}} \times \overset{(2)}{\text{Product yield/cwt}}\right)}_{\text{Receipts from finished product}} - \underbrace{\overset{(3)}{\text{Cost of manufacturing/cwt}}}_{\text{(Make Allowance)}} = \overset{(4)}{\text{Value of raw milk}}$$

Receipts from the finished product are equal to the prices of all products sold times the yield of products from a cwt of milk.

**Product prices** were obtained from the same sources as assumed by the 1991 study:

- Grade AA butter price = Chicago Mercantile Exchange.
- Nonfat dry milk price = Central States Area, extra grade, low heat.
- Dry buttermilk price = Central States Area, sweet cream buttermilk.
- Cheddar cheese price = National Cheese Exchange, 40 pound block.
- Whey Grade A butter price = Chicago Mercantile Exchange.

The impacts of alternative sources of product prices will be evaluated in Chapter 5.

**Product yields** per cwt were computed on either an annual basis or seasonal basis. Annual yields from a cwt of milk were assumed to be the same as those utilized by the 1991 study:

- 4.27 pounds of butter.
- 8.07 pounds of NDM.
- 0.42 pounds of dry buttermilk.
- 9.87 pounds of cheddar cheese.
- 0.238 pounds of whey butter.

Seasonal monthly yields were the same as those utilized by the 1991 study and are indicated in Table 6.

**Make allowances** per cwt were obtained from three different sources:

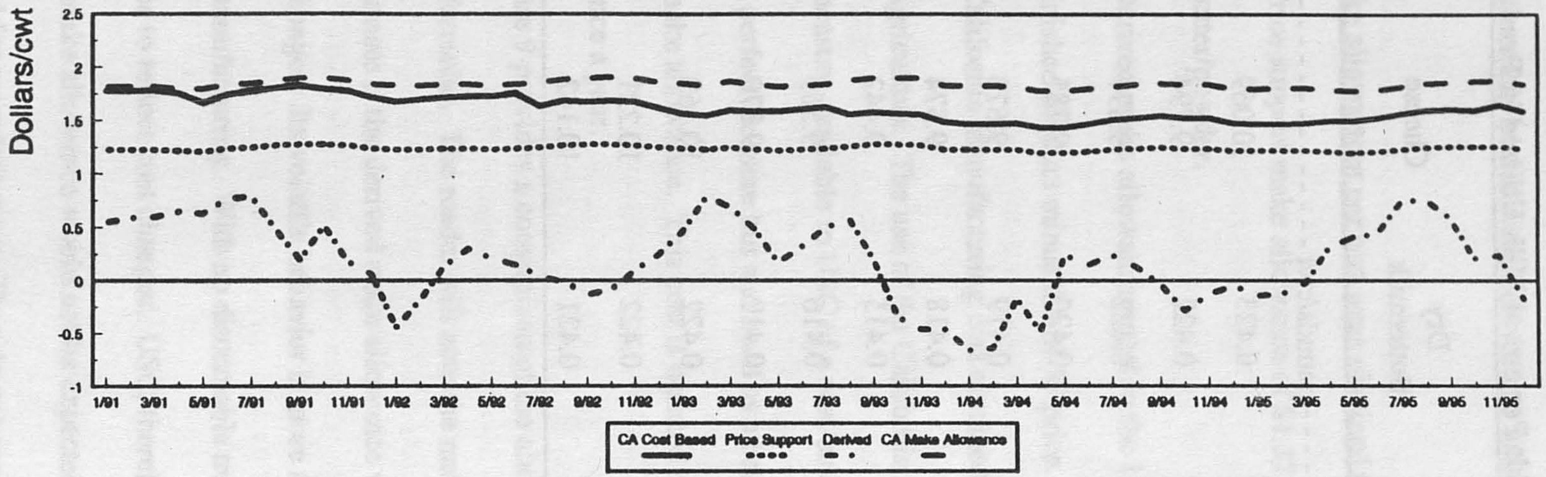
- Price support make allowance of $1.37 per cwt for cheese and $1.22 per cwt for butter/powder.
- Derived make allowance equal to the 12-month moving average of the receipts from the finished product minus the M-W price.
- California manufacturing cost obtained from the California Department of Food and Agriculture. The use of the California cost as a make allowance option was the best measure available to USC of a cost-based make allowance. It is by no means set forth as a perfect measure but was used as a better indicator of cost changes than the price support make allowance. This cost is updated on an as needed basis which is usually more than once a year.

Figure 9 provides a comparison of the alternative make allowances utilized by USC in its product formulas. The reader will note the marked difference in both level and movement. Of particular note is the derived make allowance which has been suggested by some as an indicator of cost changes. Its volatile behavior is more a result of variation in product prices than in the cost of manufacturing. With no discernable trend, there is no way of smoothing the derived make allowance to reflect cost changes. USC, therefore, concludes that any formula containing a derived make allowance would not be expected to reflect national supply-demand conditions for milk used for manufacturing. They do not survive step 1.

**Table 6. Seasonally Adjusted Product Yields Per cwt of Milk Utilized in Product Formulas.**

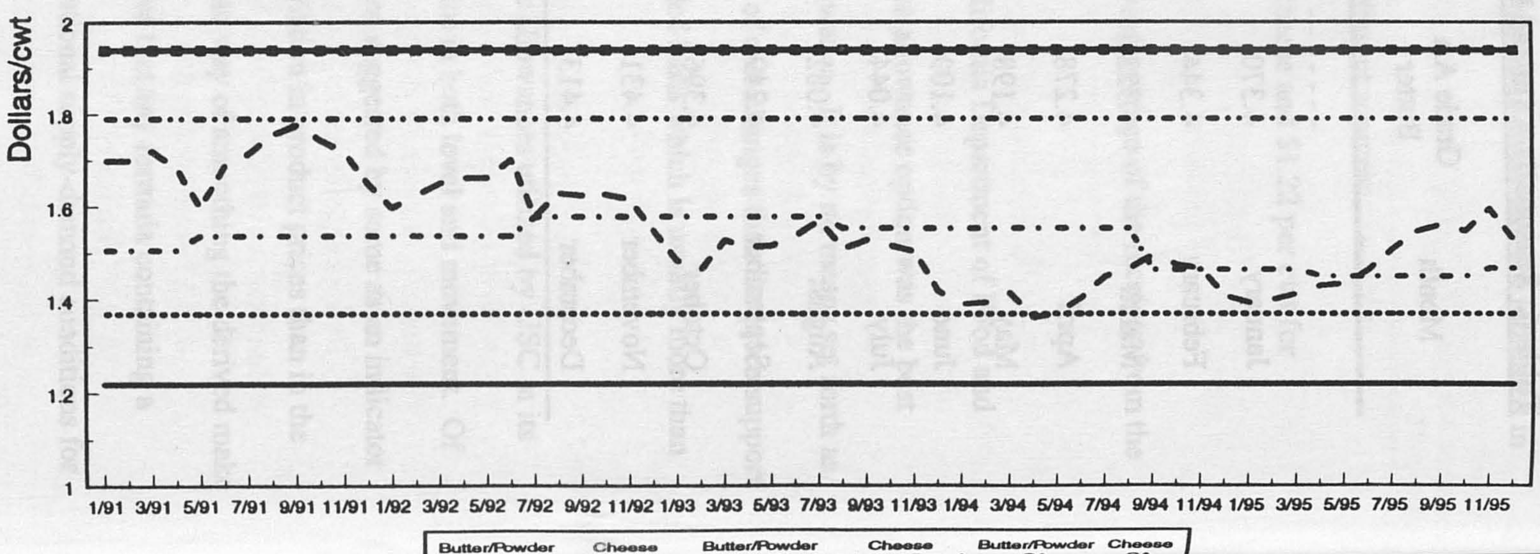
| Month | Grade AA Butter | NDM | Dry Buttermilk | Cheese | Grade A Butter |
|---|---|---|---|---|---|
| | - - - - - - - - - - | - - - - - - - - - - | pounds/cwt | - - - - - - - - - - | - - - - - - - - - - |
| January | 4.370 | 8.134 | 0.423 | 10.069 | 0.244 |
| February | 4.344 | 8.113 | 0.422 | 9.794 | 0.242 |
| March | 4.322 | 8.111 | 0.422 | 9.897 | 0.241 |
| April | 4.278 | 8.071 | 0.420 | 9.785 | 0.238 |
| May | 4.198 | 8.056 | 0.419 | 9.673 | 0.234 |
| June | 4.109 | 8.027 | 0.418 | 9.574 | 0.229 |
| July | 4.044 | 8.976 | 0.415 | 9.442 | 0.225 |
| August | 4.082 | 8.002 | 0.416 | 9.569 | 0.228 |
| September | 4.249 | 8.056 | 0.419 | 9.870 | 0.237 |
| October | 4.396 | 8.111 | 0.422 | 10.169 | 0.245 |
| November | 4.431 | 8.101 | 0.422 | 10.221 | 0.247 |
| December | 4.413 | 8.089 | 0.421 | 10.142 | 0.246 |

**Figure 9: Comparison of Butter/Powder-Cheese Price Support Make Allowance with Butter/Powder - Cheese Derived Make Allowance, Butter/Powder -Cheese California Costs Based Make Allowance and California Butter/Powder-Cheese Actual Make Allowance, All Weighted by U.S. Production, 1991 to 1995.**






**Comparison of Price Support Make Allowance for Butter/Powder and Cheese with Butter/powder and Cheese Make Allowance Based on California Costs and California Butter/Powder and Cheese Actual Make Allowance, 1991 to 1995.**



**Weighting of products by use** was done for butter/powder-cheese formulas. Use was measured on a nonfat solids and milk fat basis utilizing the same annual yields as in the product formulas. Table 7 indicates the change in the mix of manufactured products over the 1991-95 time period.

**Butter/Powder Formulas**

Product formulas that utilize only the prices of the butter and NDM product components are referred to as butter/powder formulas. The product formula assumes that 100 pounds of milk, 3.5 percent butterfat, 4.27 pounds of butter and the yield of NDM is adjusted on either an annual or seasonal basis as is indicated by the specific formula. Product prices used to compute processors' gross receipts included the Grade AA Chicago wholesale butter price and the Central State Area NDM price.[7] Make allowance alternatives that were subtracted from the processors' gross receipts included the price support allowance, a derived allowance and a California plant cost allowance.

All of the butter/powder formulas would be expected to have a long life since the product price, yield and cost components could be obtained from plants either voluntarily or under compulsory order provisions. Likewise, all butter/powder formulas should be understandable. It is assumed here that any product formula pricing would be uniform throughout the United States because of the national nature of the market. In the interest of maintaining a minimum price structure, the price of butter and NFD milk could be derived from plants located in the larger lower-priced markets such as the Northwest, California, or Wisconsin.

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[7]Questions regarding the quality of product price data will be discussed in Chapter 4.

**Table 7. Annual Manufacturing Volumes for Minnesota-Wisconsin and Total United States, 1991-95.**

| | Butter | | NDM | | American Cheese | |
|---|---|---|---|---|---|---|
| Year | Minnesota-Wisconsin | United States | Minnesota-Wisconsin | United States | Minnesota-Wisconsin | United States |
| | | | -- 1,000 Pounds -- | | | |
| 1991 | 412,731 | 1,335,782 | 53,118 | 877,525 | 1,489,578 | 2,936,561 |
| 1992 | 410,653 | 1,365,164 | 35,329 | 872,123 | 1,545,803 | 2,768,925 |
| 1993 | 382,106 | 1,315,198 | 41,812 | 954,485 | 1,516,262 | 2,957,260 |
| 1994 | 348,284 | 1,295,942 | 105,848 | 1,215,578 | 1,477,645 | 2,976,983 |
| 1995 | 333,186 | 1,260,736 | 85,884 | 1,233,838 | 1,555,041 | 3,128,568 |

There is no assurance that a butter/powder formula will accurately reflect market conditions for all manufactured products -- particularly not cheese. While it might be argued that interactions between the cheese, butter and NDM price assure that if the price of one (cheese, for example) is high relative to the butter and NDM price, capacity will be attracted away from butter and NDM. However, this attraction will be lagged and will be most likely to occur if the difference between the raw milk price and the finished product price is changing as a result of this interaction. Consequently, one can conclude that more immediate price responsiveness could be obtained by including cheese within the formula. The conclusion drawn is that none of the butter/powder formulas survive the Step 1 analysis.

**Cheese Formulas**. Product formulas that utilize only the price of the cheese product component are referred to here as a cheese formula. Obviously, there are many different types of cheese. In this analysis, USC utilized cheddar and assumed a yield of 9.87 pounds of cheese per cwt of milk. This yield, of course, changed with the protein content of the milk. Therefore, an adjustment was made in the M-W price for changes in protein on either an annual or seasonal basis, depending on the specific formula. The National Cheese Exchange 40 pound cheddar cheese block price and for whey butter and the Chicago Mercantile Exchange Grade A butter price were used. As for the butter/powder formulas, make allowances were based on the price support program, a derived allowance or California plant costs.

The application of the step 1 criteria to the cheese formulas led to the same results as for the butter/powder formulas. That is, all six formulas have the potential for a long life, all have the potential for being understood, all could be uniformly applied throughout the United States, but none of them would reflect the full scope of the manufactured product market. For the same reason discussed above regarding the inclusion of cheese as a factor in pricing milk for butter-powder usage, more immediate responsiveness can be obtained by including butter and NDM within the cheese formula. Yet, it is recognized that all analyses indicate a high correlation between the price of cheese and the M-W price. The conclusion is drawn that none of the cheese formulas survive the step 1 analysis.

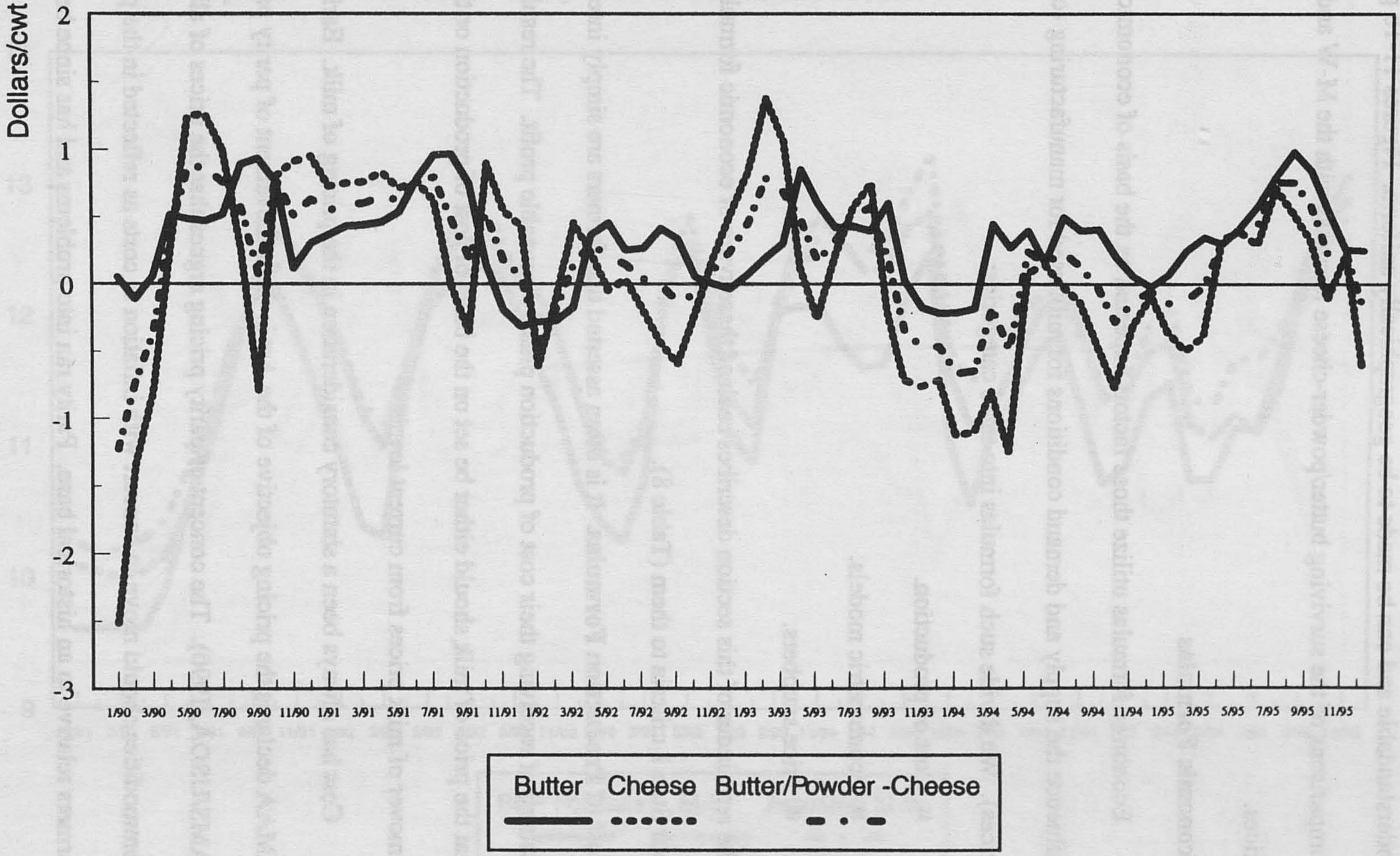
**Butter/Powder-Cheese Formulas**. Product formulas that utilize the prices of butter, NDM and cheese are referred to here as butter/powder-cheese formulas. These formulas simply are a combination of a butter/powder and a cheese formula, with prices and yields as described above, weighted by the production of these products in milk equivalent, as indicated on either Minnesota and Wisconsin production or on U.S. production.

All of the butter/powder-cheese formulas satisfied the criteria of long life, understandability and geographic uniformity. Only those formulas with a derived make allowance failed to reflect market conditions for all manufactured products. Earlier in this chapter, it was indicated that the derived make allowance is highly variable, having neither a relationship to processing costs nor reflecting any trend (Figure 10). That is, while over time milk prices reflect product prices, this occurs with time lags.

A butter/powder-cheese formula with the price support make allowance also would not reflect changing market conditions because of its lack of updating relative to manufacturing costs. However, since USC lacked a sound national cost measure, it decided to retain the price support based formulas for the second more rigorous step in the analysis.

It was concluded that six butter/powder-cheese formulas survived the step 1 criteria in that they reflect the prices of all manufactured products, have the potential for a long life, are

**Figure 10: Derived Margins for Cheese, Butter and Butter/Powder -Cheese Formulas, January 1990 to December 1995.**



understandable and can be made to be geographically uniform. Figures 11-16 provide comparisons of the surviving butter/powder-cheese formulas with the M-W and adjusted M-W prices.

**Economic Formulas**

Economic formulas utilize those factors expected on the basis of economic theory to influence the supply and demand conditions for milk used for manufacturing (other than product prices). We divide such formulas into three categories:

- Cost of production.
- Econometric models.
- Price snubbers.

The remainder of this section describes each of these types of economic formula and applies the four Step 1 criteria to them (Table 8).

**Cost of Production Formulas.** It is often asserted that farmers are simply interested in being assured of receiving their cost of production plus a reasonable profit. The result is the suggestion that the price of milk should either be set on the basis of cost of production or that cost should be a mover of milk prices from current levels.

Cost has always been a statutory consideration in the pricing of milk. Early in Section 2, the AMAA declares the pricing objective of the Act is the achievement of parity prices (AMS/USDA, 1990). The concept of parity pricing argues that the prices of all agricultural commodities should move in concert with inflation in costs as reflected in the prices paid by farmers relative to an historical base. Parity ran into problems and has since been abandoned as a

**Figure 11: Comparison of Prices Generated by a Butter/Powder -Cheese Formula Having Annual Yields Weighted by Minnesota and Wisconsin Production and Utilizing the Price Support Make Allowance with the M-W and Adjusted M-W Price, January 1991 to December 1995.**

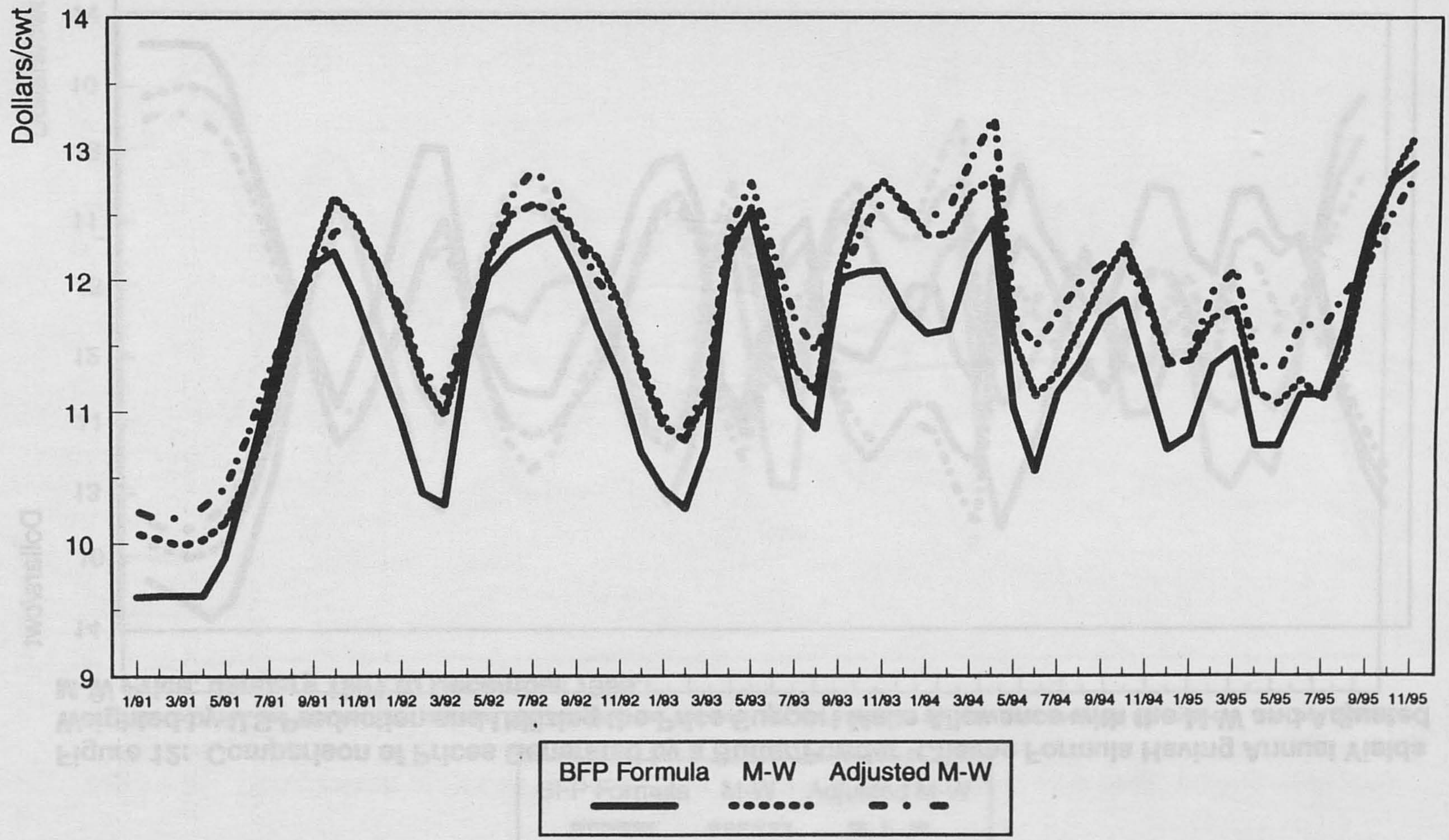


**Figure 12: Comparison of Prices Generated by a Butter/Powder -Cheese Formula Having Annual Yields Weighted by U.S Production and Utilizing the Price Support Make Allowance with the M-W and Adjusted M-W Price, January 1991 to December 1995.**

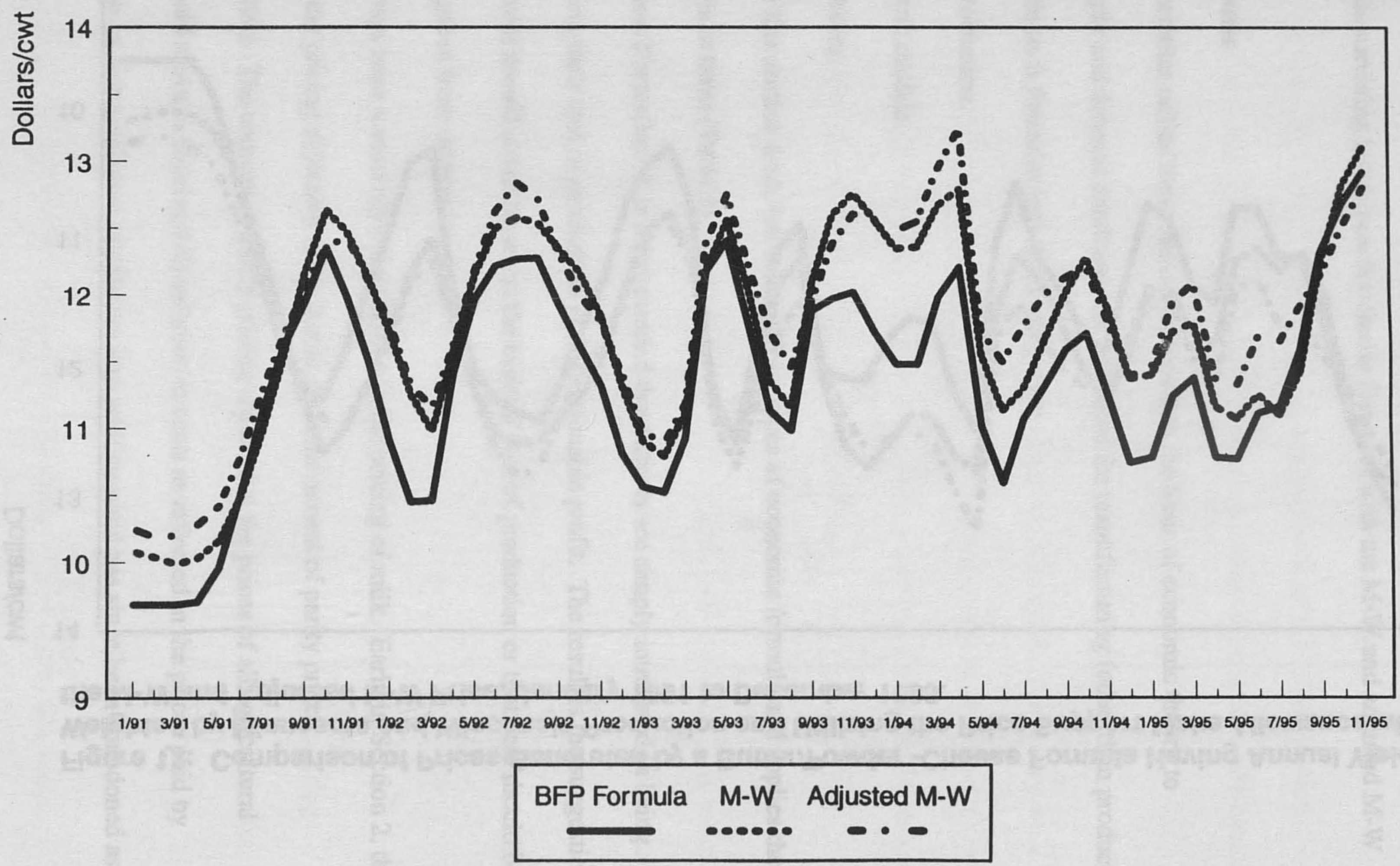


**Figure 13: Comparison of Prices Generated by a Butter/Powder -Cheese Formula Having Seasonal Yields Weighted by Minnesota and Wisconsin Production and Utilizing the Price Support Make Allowance with the M-W and Adjusted M-W Price, January 1991 to December 1995.**

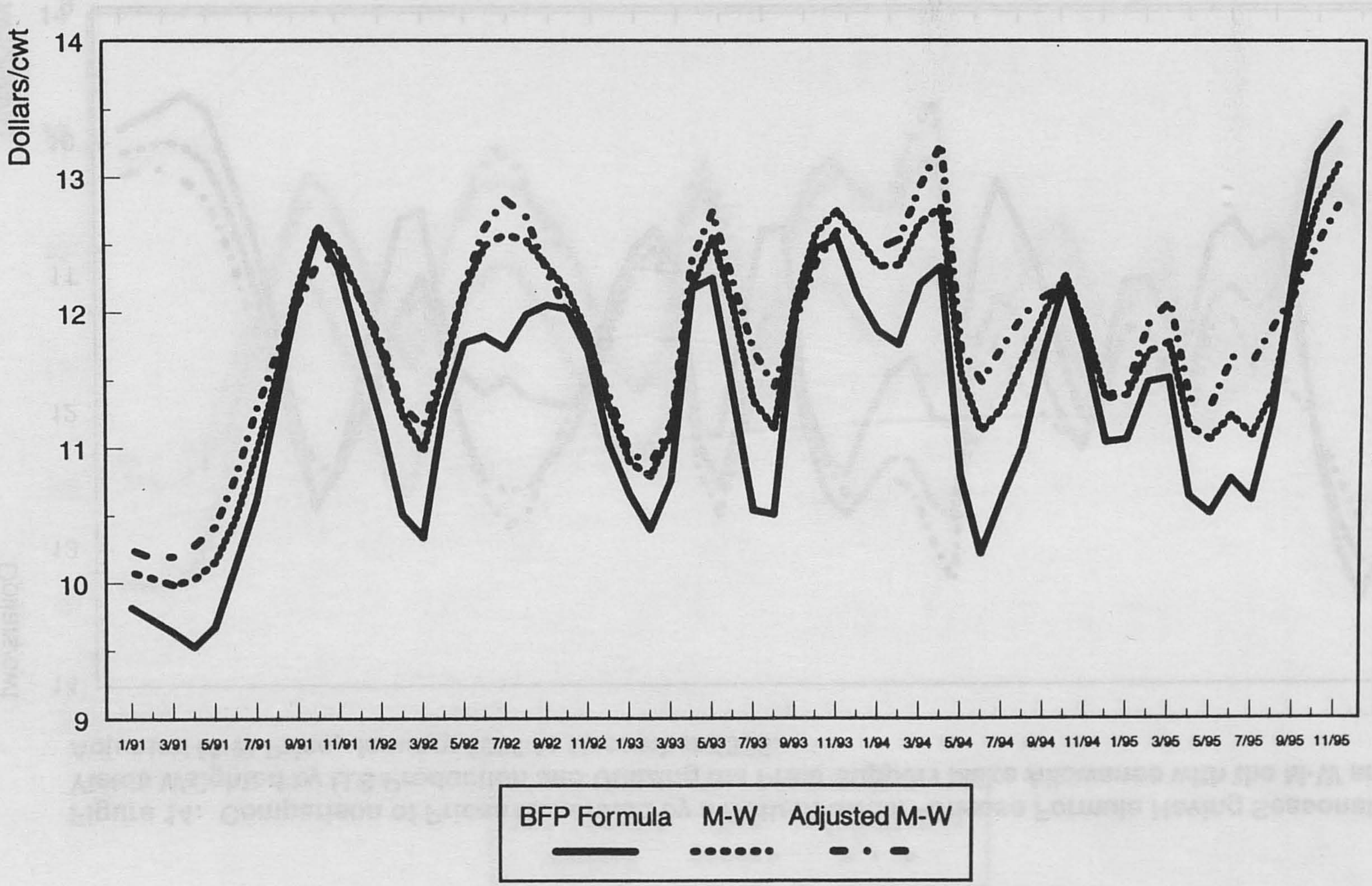


Figure 14: Comparison of Prices Generated by a Butter/Powder -Cheese Formula Having Seasonal Yields Weighted by U.S Production and Utilizing the Price Support Make Allowance with the M-W and Adjusted M-W Price, January 1991 to December 1995.

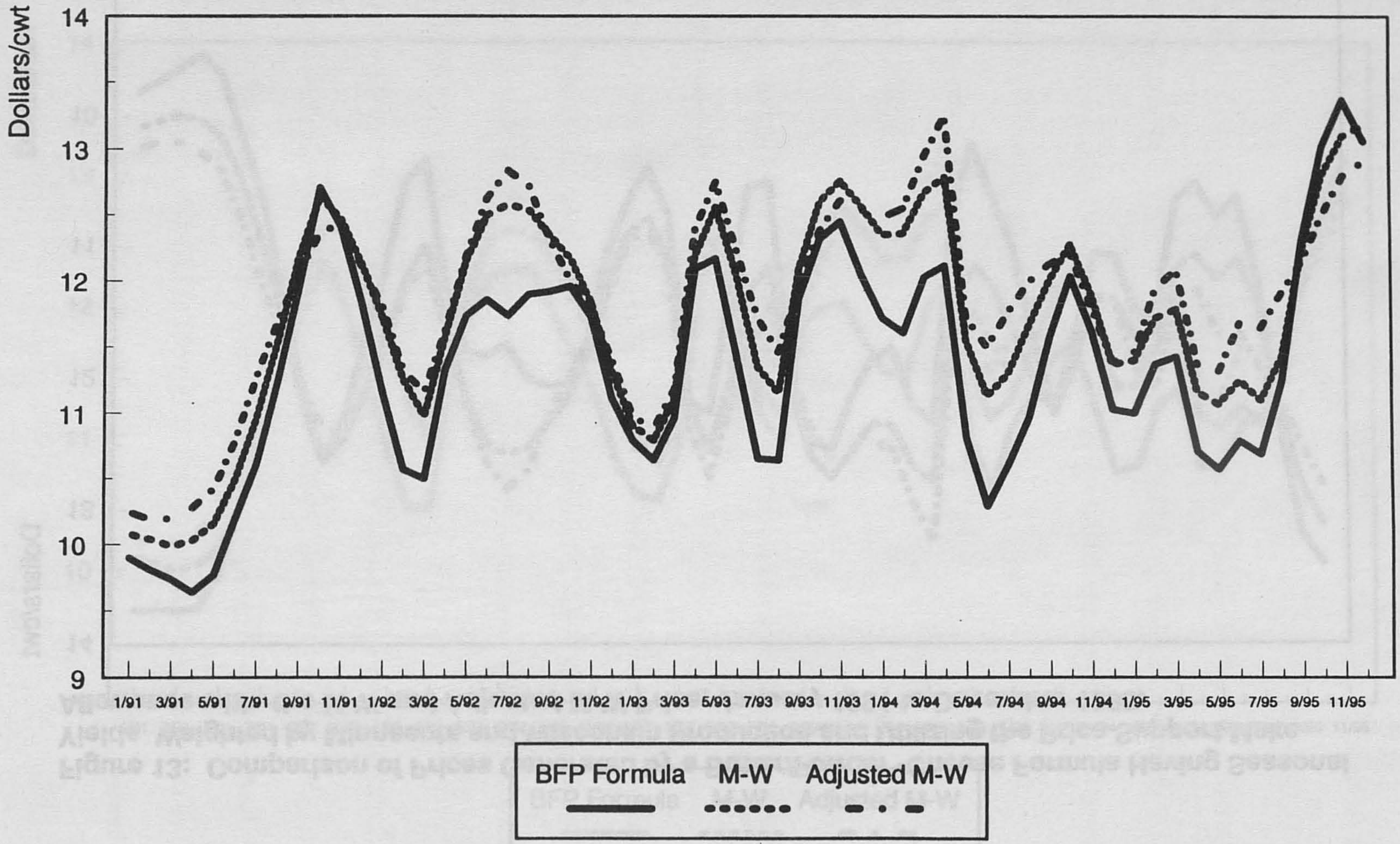


**Figure 15: Comparison of Prices Generated by a Butter/Powder -Cheese Formula Having Annual Yields Weighted by U.S Production and Utilizing a California Cost-Based Make Allowance with the M-W and Adjusted M-W Price, January 1991 to December 1995.**

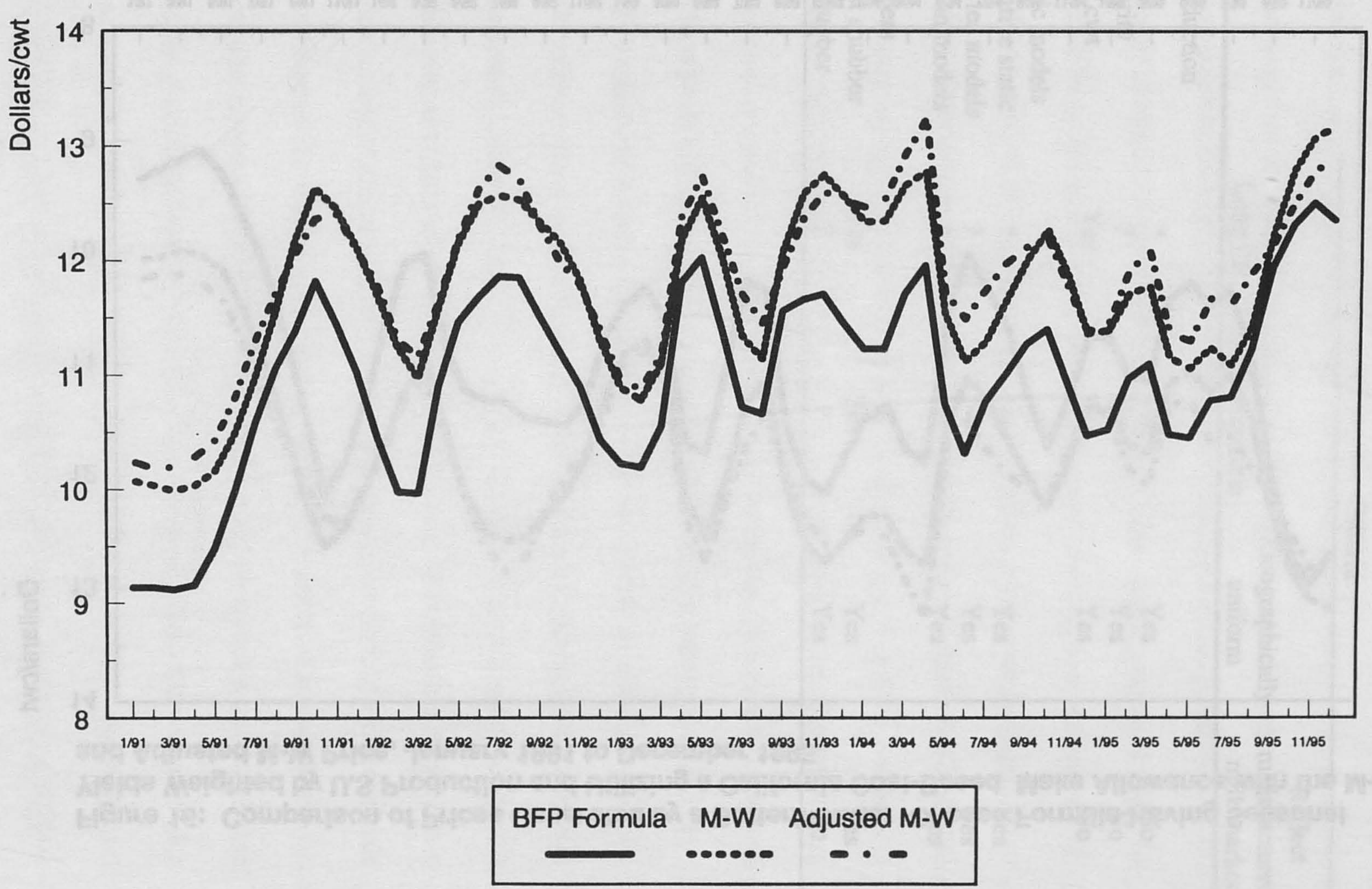


Figure 16: Comparison of Prices Generated by a Butter/Powder -Cheese Formula Having Seasonal Yields Weighted by U.S Production and Utilizing a California Cost-Based Make Allowance with the M-W and Adjusted M-W Price, January 1991 to December 1995.

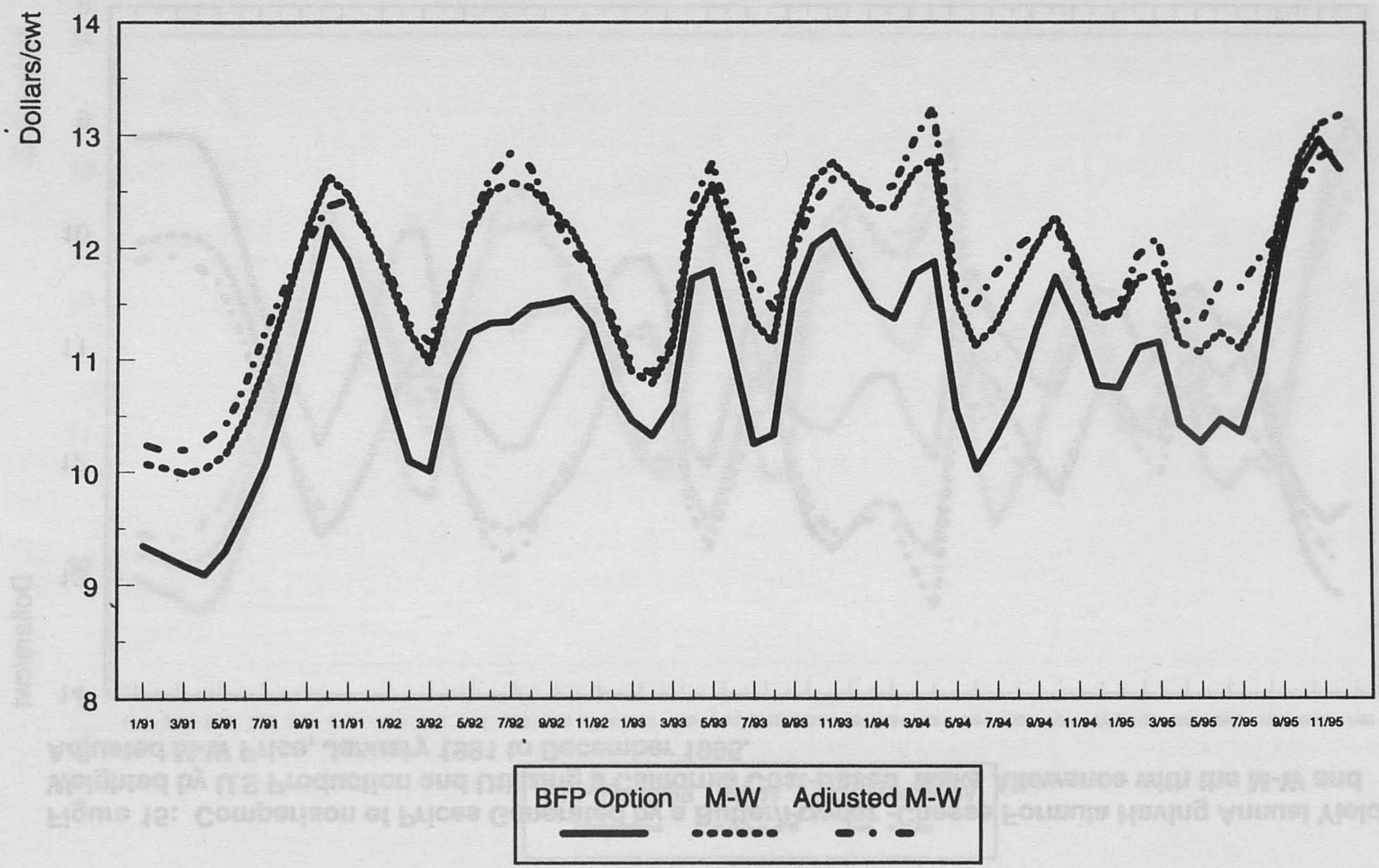


**Table 8. Evaluation of Economic Formula Options Relative to Step 1 Criteria.**

| Options | Criteria<br>Long life | <br>Understandable | <br>Geographically uniform | <br>Reflect manufactured milk market |
|---|---|---|---|---|
| Cost of production | | | | |
| Parity | ? | Yes | Yes | No |
| Dairy Parity | ? | Yes | Yes | No |
| Cost per cwt | Yes | Yes | Yes | No |
| Econometric models | | | | |
| Comparative static | ? | No | Yes | Yes |
| Time series models | ? | No | Yes | Yes |
| Simulation models | ? | No | Yes | Yes |
| Price snubbers | | | | |
| Feed cost snubber | Yes | Yes | Yes | Yes |
| Stocks snubber | ? | ? | Yes | No |

farm bill goal. Although the AMAA still contains reference to the parity objective, in Section 8c(18) it recognizes that there are conditions where parity prices are not reasonable.

Parity generated high milk prices that brought forth excess production because it was based on changes in agricultural input costs, it failed to reflect changes in technology that resulted in higher milk output per cow, it did not reflect reduced costs resulting from larger size farms, and it failed to adjust to changes in demand. Parity was never commodity specific. Therefore, when parity was used, the support price for milk reflected changes in the price paid for all agricultural inputs. The concept of dairy parity was discussed as a BFP alternative (Milk Pricing Advisory Committee, 1972, p. 7) but was rejected on the grounds that even if it was dairy specific and declined as milk output per cow increased, it could not be depended upon to adjust when either excess supplies or deficit conditions developed.

While parity may not be a feasible pricing objective, reflecting changes in costs is still a relevant consideration in milk pricing. Section 8c(18) of the AMAA suggests a balancing of factors affecting supply and demand including adjusting milk prices to reflect the price of feed and available supplies of feed (AMS/USDA, p. 22). While tying the price of milk to the cost of producing milk on a per cwt basis would reflect factors affecting the supply of milk, it would not automatically adjust prices when surpluses or deficits developed.

While cost of production concepts have had a long life, are understandable, and could be applied uniformly across the United States, they would require constant adjustment because costs only reflect supply conditions operating in the market -- not demand conditions. Therefore, market conditions for manufactured products would not be reflected in the price of milk. In summary, the cost of production alternatives fail to pass the step 1 tests (Table 8).

This conclusion may appear to run contrary to California's use of a relatively sophisticated producer level cost accounting system in pricing milk for many years. The answer lies in their willingness to utilize unit costs to move the price of Class I and Class II milk in both an upward and downward direction and the fact that if a mistake is made in pricing milk, the U.S. market has absorbed the shock of greater manufactured product production. Without the U.S. market as a supply-demand shock absorber, the warts on the California cost-based pricing system would be more apparent.[8] Even so, California discontinued adjusting its producer pay prices by a cost of production index in 1994 and now adjust the milk price by a commodity reference price index.

**Econometric Dairy Models**

Mathematical and statistical models that are designed to quantify and explain the forces affecting supply and demand are referred to by USC as econometric dairy models. The ability of economists to model dairy markets by product, over time and geographically, is constantly improving. Yet, most of these models utilize annual data as the basis for analysis. Methodological and analytical results from these models are in three basic forms:

- Comparative statics models can be used to generate the equilibrium price before and after a supply or demand shock but no indication is provided of the price path over time required to reach the new equilibrium.
- Time series models utilizing techniques such as vector autoregression (VAR) can be used to develop a price time-path based on the behavior of prices and other supply-demand determining factors in an historical context.

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[8]The California system of milk pricing is discussed in greater detail by Cropp and in Appendix E.

- Market simulation models can be utilized dynamically to develop a price path based upon available data. These are essentially supply-demand models constructed to simulate the behavior of a market over time. Because of their complexity and cost, few of these models are routinely maintained. Those that are utilized regularly require substantial monitoring and "adjusting" to obtain what are considered to be "reasonable" results.

In applying the step 1 criteria, econometric models fail primarily due to their complexity. They are difficult enough for economists to understand, with the developer of the model frequently being the only one to fully understand its intricacies. Those models that are regularly used and maintained are in a constant state of adjustment, respecification and reestimation as knowledge improves and more data becomes available.

**Price Snubbers**

The addition of an economic variable to alternatives such as a product price formula is referred to as a price snubber. The snubber adjusts the price to reflect the added economic variable. Two types of snubbers are discussed here because of their potential for improving the performance of another pricing option:

- A feed cost snubber.
- A stocks snubber on the cost of production pricing option.

Each merit separate discussion.

**Feed Cost Snubber.** The alternatives discussed thus far are often criticized in that prices do not respond sufficiently rapidly to changes in costs of production. At the extreme, costs may be rising while prices are falling. Such was the case in 1995. Since feed costs constitute approximately half of milk production costs, questions arise as to whether it might be possible to add a snubber to the price of milk generated by a product price formula or a competitive pay price that reflects changes in cost of dairy feed relative to the previous month. The snubber would need to work in both an upward and a downward direction. If such a snubber had been in operation in 1994-95, the fall in prices in 1995 could have been slowed while the dramatic runup to record prices in 1996 could have been dampened.

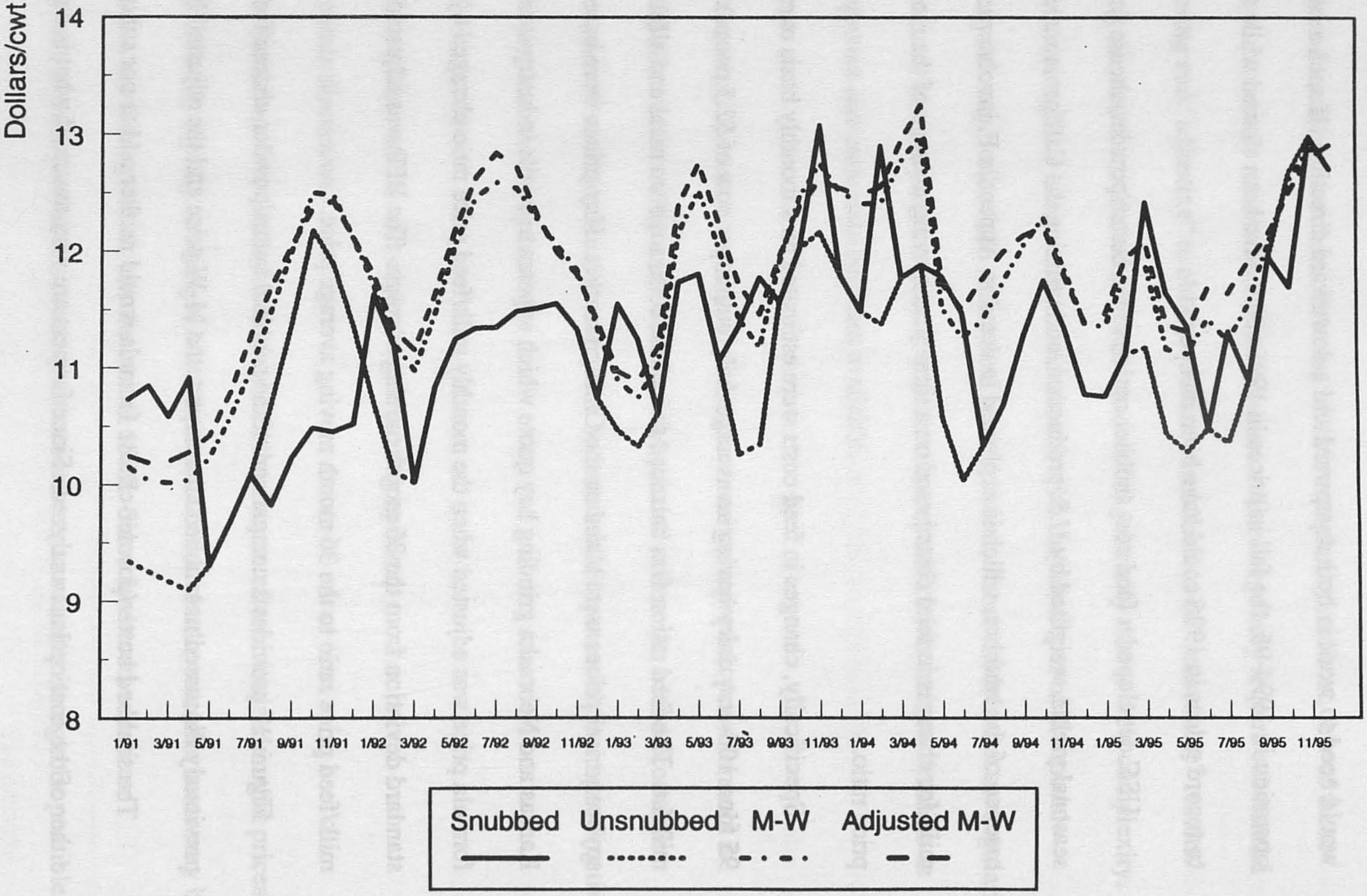
USC developed a feed cost snubber option to the butter/powder-cheese formula having seasonal yields, weighted by U.S. production, and utilizing the California make allowance. The essence of the snubber, which is explained in detail in Appendix F, involves adjusting the price of milk for changes in feed costs based on a three year moving average of the monthly milk feed price ratio.

Specifically, changes in feed costs were estimated on a monthly basis over the period 1991-95 for a 100-cow dairy having an average daily output per cow of 52.5 pounds at 3.5 percent milkfat. The feed ration was balanced to include corn, soybean meal and alfalfa. Corn and soybean meal prices were based on the Chicago market. Hay prices were based on the AMS Kansas and Nebraska grinding hay quote which appears to be the industry standard. The product formula price was adjusted when the monthly milk/feed price ratio changed by more than one standard deviation from the 36 month moving average. The BFP was adjusted to bring the milk/feed price ratio to the 36 month moving average price.

Figure 17 provides a comparison of the snubbed butter/powder-cheese formula with its previously discussed unsnubbed counterpart, the M-W price and the adjusted M-W price.

The snubbed butter/powder-cheese formula would neither add to nor subtract from the life of either of the cost options analyzed. Since farmers are very aware of what is happening to their

**Figure 17: Comparison of Prices Generated by a Feed Cost Snubbed Butter/Powder-Cheese Formula Having Seasonal Yields Weighted by U.S. Production and Utilizing the CA Cost Based Make Allowance With the Unsnubbed Formula, the M-W and Adjusted M-W Prices, January 1991 to December 1995.**



costs, this option should be understandable to them. This snubbed formula could be applied in a geographically uniform context. It would still reflect manufactured product market conditions, although more weight would be given to what is happening on the supply (feed cost) side of the market. Therefore, this snubbed formula survives the step 1 criteria.

**Stocks Snubber**. Previously, it was concluded that a cost of production formula did not satisfy the step 1 criteria of the need to reflect product market conditions because demand and stocks are not considered. Moreover, estimates of monthly changes in costs of production do not exist. If there were monthly production costs, a stocks snubber would hold the potential for remedying this deficiency. The stocks snubber could adjust prices upward when stocks were below a normal range and downward when stocks were higher than normal. The snubber could set a normal range for the milk equivalent of total stocks, or for each individual product. The effect of such a snubber would be to reflect the interrelation of supply and demand pressures. In part, it reflects the frequently stated notion that any economic formula will work as long as there is a sufficiently powerful stocks snubber.

The key to making a cost of production formula work is a well constructed stocks snubber. USC analyzed this issue sufficient to conclude that normal stock ranges are as follows:

- Butter: 15 to 53 million pounds.
- NDM: 62 to 116 million pounds.
- Cheese: 427 to 491 million pounds.
- Butter/powder milk equivalent: 564 to 1,162 million pounds.
- Cheese milk equivalent: 4,214 to 4,846 million pounds.
- Total solids milk equivalent 4,779 to 6,009 million pounds.

The price adjustment factors associated with quantities outside this range would need to be established. For example, each time the total solids milk equivalent of stocks rose by over a certain number of pounds, the milk price would be adjusted downward by a certain number of cents per cwt. The number of adjustment intervals is arbitrary but the size of the adjustment could be based upon market expectations utilizing a stocks price flexibility, meaning that for each one percent increase in stocks, the price declines by a certain number of cents per cwt.

Many problems are presented by the absence of monthly costs of production and difficulty of obtaining accurate cost indicators other than feed. Utilizing representative farms as an analytical tool is a possibility. The existing representative farm models are annual and could be used to estimate monthly costs only if they were modified. Despite the existence of the stocks snubber, this option would give primary weight to costs of production. Therefore, it is doubtful that supply-demand conditions would be adequately reflected in the BFP. Moreover, the stocks snubber would likely have to be constantly adjusted raising questions regarding the long-life criteria. Then too, while producers understand costs, they have more problems understanding stocks and their relationship to price. Therefore, the cost of production option with a stocks snubber did not survive the step 1 criteria and was not analyzed in further detail. USC concludes that the feed cost snubber is a more workable option for reflecting costs changes.

**No BFP**

The final option category is to have no BFP. This option asserts that while Class I and II milk may still require regulation to assure orderly marketing, the price for milk used for manufacturing would be unregulated -- it would be set by competitive market forces. We analyzed two options that fall in this category:

- Pricing components with no BFP.
- Pooling differentials with no BFP.

Both of these options merit discussion in light of the Step 1 criteria (Table 9).

**Pricing Components With No BFP.** In this option, the government does not set a minimum price for milk used for manufacturing. Government's role instead sets uniform minimum component prices/values presumably based on transaction or exchange/spot market prices. It then audits plants to provide assurance that producers are properly paid consistent with the established component pricing procedure. It is, of course, still possible to calculate a benchmark price per cwt of milk for manufacturing which could be used to evaluate the performance of this option and could also be used as a mover for Class I and Class II pricing.

Component pricing is not new to FMMOs. Eleven FMMOs had component pricing provisions incorporated into the order provisions in January 1996. (Agricultural Marketing Service, May 1995). In addition, there are many industry component pricing programs.

The steps and assumptions made by USC in valuing the three major milk components include:

(1) The value of protein is assumed to be 1.32 times the price of cheese. That is, the yield of cheese is assumed to change by 1.32 pounds for each 1.0 pound change in the protein content of milk.

(2) The value of milkfat is 1.1 times the price of butter. That is, the yield of butter is assumed to change by 1.1 pounds for each 1 percent change in the fat content of milk.

(3) The value of solids other than protein is assumed to be 8.7 times the price of NDM minus the price of protein from (1) above times 3.2, divided by 5.4, the composition of

**Table 9. Evaluation of No BFP Options Relative to Step 1 Criteria.**

| Options | Criteria | | | |
|---|---|---|---|---|
| | Long Life | Understandable | Geographically Uniform | Reflect Manufactured Milk Market |
| Pricing components with no BFP | Yes | ? | Yes | Yes |
| Pooling differentials with no BFP | Yes | ? | No | ? |

solids other than fat or protein. The effect of this step is to subtract the value of protein from the price of NDM to determine the value of all nonprotein-nonfat solids.

Utilizing these component values, the value of 3.5 percent butterfat milk having 3.15 percent protein that is used for manufacturing would be computed by summing the values derived from the following three steps:

(1) Protein value times 3.15.

(2) Milkfat value times 3.5.

(3) Other solids value times 5.4.

Table 10 indicates the application of these procedural steps over the period 1991-95 with the resulting value of milk for manufacturing. Figure 18 compares this value of milk for manufacturing with the M-W and adjusted M-W prices. The benchmark component price per cwt would be reduced if a make allowance were added. This was not necessary for this interim report because a: (1) minimum component prices/values are set in this option, (2) BFP is not actually established for this alternative, and (3) our primary interest was in price movements not level.

Applying the step 1 criterion, pricing milk components with no BFP would have a long life. Its understandability is debatable and, therefore, warrants a question mark. However, with increased use of component pricing in FMMOs, an increasing number of producers are developing an understanding of this type of pricing option. With no BFP, pricing components with no BFP would not result in a geographically uniform BFP. However, the procedure for pricing components could be uniformly applied to assure fair producer treatment. The option would reflect the value of milk for manufacturing in that the price received by producers would

Table 10: Derivation of the Value of Milk for Manufacturing From Component Values With No BFP

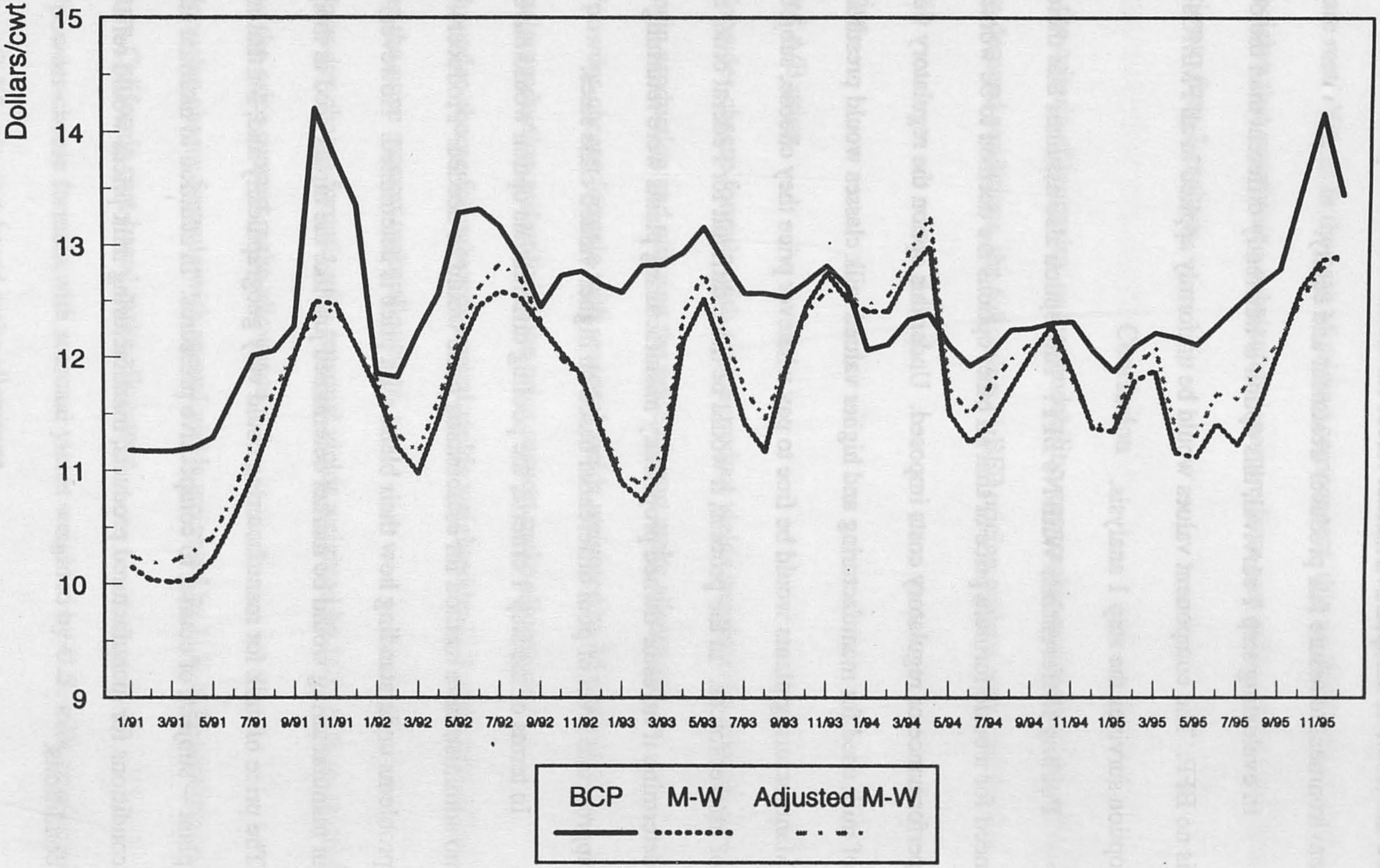
| Year | Month | Chedder Greenbay Cheese Exchange $/lb. | Grade AA Butter Price $/lb | NFDM Price $/lb | Cheese Price * 1.32 Protein Value | AA butter price * 1.1 Butterfat Value | NFDM*8.7 | Other Solids Value | Protein Value*3.15 | Butterfat Value*3.5 | Other solids Value*5.4 | Hauling Subsidies $/cwt | Benchmark Component Price (BCP) 1/ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | Jan | 1.0872 | 0.9725 | 0.8521 | 1.435104 | 1.06975 | 7.41327 | 0.51289767 | 4.5205776 | 3.744125 | 2.76964743 | 0.15 | 11.18435 |
| | Feb | 1.0875 | 0.9725 | 0.8513 | 1.4355 | 1.06975 | 7.40631 | 0.51140182 | 4.521825 | 3.744125 | 2.76156982 | 0.14 | 11.1675198 |
| | Mar | 1.0875 | 0.9725 | 0.8513 | 1.4355 | 1.06975 | 7.40631 | 0.51140182 | 4.521825 | 3.744125 | 2.76156982 | 0.14 | 11.1675198 |
| | Apr | 1.0875 | 0.9725 | 0.8536 | 1.4355 | 1.06975 | 7.42632 | 0.51504 | 4.521825 | 3.744125 | 2.781216 | 0.15 | 11.197166 |
| | May | 1.1190 | 0.9728 | 0.8612 | 1.47708 | 1.07008 | 7.49244 | 0.50286982 | 4.652802 | 3.74528 | 2.71549702 | 0.18 | 11.293579 |
| | Jun | 1.1788 | 1.0138 | 0.8888 | 1.556016 | 1.11518 | 7.73256 | 0.5006016 | 4.9014504 | 3.90313 | 2.70324864 | 0.15 | 11.657829 |
| | Jul | 1.2458 | 1.0325 | 0.9215 | 1.644456 | 1.13575 | 8.01705 | 0.50087105 | 5.1800364 | 3.975125 | 2.70470369 | 0.16 | 12.0198651 |
| | Aug | 1.3103 | 1.0325 | 0.9219 | 1.729596 | 1.13575 | 8.02053 | 0.45196778 | 5.4482274 | 3.975125 | 2.44062602 | 0.2 | 12.0639784 |
| | Sep | 1.3434 | 1.0554 | 0.9389 | 1.773288 | 1.16094 | 8.16843 | 0.45343789 | 5.5858572 | 4.06329 | 2.44856461 | 0.18 | 12.2777118 |
| | Oct | 1.3506 | 1.095 | 1.148 | 1.782792 | 1.2045 | 9.9876 | 0.77866647 | 5.6157948 | 4.21575 | 4.20479895 | 0.17 | 14.2063438 |
| | Nov | 1.3131 | 1.077 | 1.1068 | 1.733292 | 1.1847 | 9.62916 | 0.74229556 | 5.4598698 | 4.14645 | 4.00839604 | 0.16 | 13.7747158 |
| | Dec | 1.2667 | 1.0108 | 1.085 | 1.672044 | 1.11188 | 9.4395 | 0.74344713 | 5.2669386 | 3.89158 | 4.01461449 | 0.19 | 13.3631331 |
| 1992 | Jan | 1.2253 | 0.9193 | 0.9528 | 1.617396 | 1.01123 | 8.28936 | 0.56612596 | 5.0947974 | 3.539305 | 3.0570802 | 0.17 | 11.8611826 |
| | Feb | 1.1699 | 0.8625 | 0.9755 | 1.544268 | 0.94875 | 8.48685 | 0.64458044 | 4.8644442 | 3.320625 | 3.48073436 | 0.16 | 11.8258036 |
| | Mar | 1.1607 | 0.8625 | 1.018 | 1.532124 | 0.94875 | 8.8566 | 0.71887331 | 4.8261906 | 3.320625 | 3.88191587 | 0.2 | 12.2287315 |
| | Apr | 1.2741 | 0.8625 | 1.0589 | 1.681812 | 0.94875 | 9.21243 | 0.69647847 | 5.2977078 | 3.320625 | 3.76098375 | 0.19 | 12.5693166 |
| | May | 1.3398 | 0.8351 | 1.1573 | 1.768536 | 0.91861 | 10.06851 | 0.80167178 | 5.5708884 | 3.215135 | 4.32902762 | 0.17 | 13.285051 |
| | Jun | 1.3598 | 0.8125 | 1.167 | 1.794936 | 0.89375 | 10.1529 | 0.80165542 | 5.6540484 | 3.128125 | 4.32893926 | 0.21 | 13.3211127 |
| | Jul | 1.3706 | 0.8125 | 1.15 | 1.809192 | 0.89375 | 10.005 | 0.76647011 | 5.6989548 | 3.128125 | 4.13893859 | 0.2 | 13.1660184 |
| | Aug | 1.3795 | 0.8125 | 1.1162 | 1.82094 | 0.89375 | 9.71094 | 0.70616945 | 5.735961 | 3.128125 | 3.81331505 | 0.2 | 12.8774011 |
| | Sep | 1.3428 | 0.85 | 1.0511 | 1.772496 | 0.935 | 9.14457 | 0.63137869 | 5.5833624 | 3.2725 | 3.40944493 | 0.18 | 12.4453073 |
| | Oct | 1.2989 | 0.85 | 1.0801 | 1.714548 | 0.935 | 9.39687 | 0.71096662 | 5.4008262 | 3.2725 | 3.83921974 | 0.22 | 12.7325459 |
| | Nov | 1.2610 | 0.85 | 1.0913 | 1.66452 | 0.935 | 9.49431 | 0.75779018 | 5.243238 | 3.2725 | 4.09206698 | 0.16 | 12.767805 |
| | Dec | 1.2041 | 0.806 | 1.0925 | 1.589412 | 0.8866 | 9.50475 | 0.80338756 | 5.0066478 | 3.1031 | 4.33829284 | 0.2 | 12.6480406 |
| 1993 | Jan | 1.1675 | 0.7525 | 1.11 | 1.5411 | 0.82775 | 9.657 | 0.85917818 | 4.854465 | 2.897125 | 4.63956218 | 0.19 | 12.5811522 |
| | Feb | 1.1600 | 0.7525 | 1.1383 | 1.5312 | 0.82775 | 9.90321 | 0.90970364 | 4.82328 | 2.897125 | 4.91239964 | 0.19 | 12.8228046 |
| | Mar | 1.2140 | 0.7651 | 1.1333 | 1.60248 | 0.84161 | 9.85971 | 0.86032255 | 5.047812 | 2.945635 | 4.64574175 | 0.19 | 12.8291887 |
| | Apr | 1.3720 | 0.7825 | 1.1385 | 1.81104 | 0.86075 | 9.90495 | 0.747204 | 5.704776 | 3.012625 | 4.0349016 | 0.19 | 12.9423026 |
| | May | 1.3930 | 0.8025 | 1.1525 | 1.83876 | 0.88275 | 10.02675 | 0.75322145 | 5.792094 | 3.089625 | 4.06739585 | 0.21 | 13.1591149 |
| | Jun | 1.3200 | 0.7731 | 1.1286 | 1.7424 | 0.85041 | 9.81882 | 0.77148 | 5.48856 | 2.976435 | 4.165992 | 0.22 | 12.850987 |
| | Jul | 1.2385 | 0.78 | 1.0956 | 1.63482 | 0.858 | 9.53172 | 0.781872 | 5.149683 | 3.003 | 4.2221088 | 0.2 | 12.5747918 |
| | Aug | 1.2150 | 0.78 | 1.0934 | 1.6038 | 0.858 | 9.51258 | 0.79644 | 5.05197 | 3.003 | 4.300776 | 0.21 | 12.565746 |
| | Sep | 1.3450 | 0.78 | 1.0922 | 1.7754 | 0.858 | 9.50214 | 0.69470182 | 5.59251 | 3.003 | 3.75138982 | 0.19 | 12.5368998 |
| | Oct | 1.3450 | 0.78 | 1.108 | 1.7754 | 0.858 | 9.6396 | 0.71969455 | 5.59251 | 3.003 | 3.88635055 | 0.19 | 12.6718605 |
| | Nov | 1.3463 | 0.78 | 1.1264 | 1.77705 | 0.858 | 9.79968 | 0.74784 | 5.5977075 | 3.003 | 4.038336 | 0.18 | 12.8190435 |
| | Dec | 1.3138 | 0.7239 | 1.1273 | 1.73415 | 0.79629 | 9.80751 | 0.77422364 | 5.4625725 | 2.787015 | 4.18080764 | 0.2 | 12.6303951 |
| 1994 | Jan | 1.3000 | 0.6481 | 1.0976 | 1.716 | 0.71291 | 9.54912 | 0.73780364 | 5.4054 | 2.495185 | 3.98413964 | 0.19 | 12.0747246 |
| | Feb | 1.3049 | 0.6529 | 1.0989 | 1.722468 | 0.71819 | 9.56043 | 0.7360968 | 5.4257742 | 2.513665 | 3.97492272 | 0.21 | 12.1243619 |
| | Mar | 1.3623 | 0.6971 | 1.1047 | 1.798236 | 0.76681 | 9.61089 | 0.70118815 | 5.6644434 | 2.683835 | 3.78641599 | 0.21 | 12.3446944 |
| | Apr | 1.3928 | 0.6987 | 1.1076 | 1.838496 | 0.76857 | 9.63612 | 0.68235142 | 5.7912624 | 2.689995 | 3.68469766 | 0.22 | 12.3859551 |
| | May | 1.2431 | 0.6781 | 1.0847 | 1.640892 | 0.74591 | 9.43689 | 0.76109738 | 5.1688098 | 2.610685 | 4.10992586 | 0.22 | 12.1094207 |
| | Jun | 1.1914 | 0.6841 | 1.0606 | 1.572648 | 0.75251 | 9.22722 | 0.76268116 | 4.9538412 | 2.633785 | 4.11847828 | 0.22 | 11.9261045 |
| | Jul | 1.2553 | 0.72 | 1.0562 | 1.656996 | 0.792 | 9.18894 | 0.70664596 | 5.2195374 | 2.772 | 3.8158882 | 0.23 | 12.0374256 |
| | Aug | 1.2785 | 0.755 | 1.0653 | 1.68762 | 0.8305 | 9.26811 | 0.70322291 | 5.316003 | 2.90675 | 3.79740371 | 0.23 | 12.2501567 |
| | Sep | 1.3139 | 0.7574 | 1.0659 | 1.734348 | 0.83314 | 9.27333 | 0.6769848 | 5.4631962 | 2.91599 | 3.65571792 | 0.23 | 12.2649041 |
| | Oct | 1.3269 | 0.7575 | 1.0704 | 1.751508 | 0.83325 | 9.31248 | 0.67411898 | 5.5172502 | 2.916375 | 3.6402425 | 0.24 | 12.3138677 |
| | Nov | 1.2656 | 0.7575 | 1.071 | 1.670592 | 0.83325 | 9.3177 | 0.72214647 | 5.2623648 | 2.916375 | 3.89959095 | 0.24 | 12.3183308 |
| | Dec | 1.2091 | 0.702 | 1.0686 | 1.596012 | 0.7722 | 9.29682 | 0.76174211 | 5.0274378 | 2.7027 | 4.11340739 | 0.22 | 12.0635452 |
| 1995 | Jan | 1.2200 | 0.6548 | 1.0671 | 1.6104 | 0.72028 | 9.28377 | 0.75099818 | 5.07276 | 2.52098 | 4.05539018 | 0.23 | 11.8791302 |
| | Feb | 1.2780 | 0.7071 | 1.0711 | 1.68696 | 0.77781 | 9.31857 | 0.71278145 | 5.313924 | 2.722335 | 3.84901985 | 0.21 | 12.0952789 |
| | Mar | 1.2900 | 0.72 | 1.0777 | 1.7028 | 0.792 | 9.37599 | 0.71400545 | 5.36382 | 2.772 | 3.85562945 | 0.23 | 12.2214495 |
| | Apr | 1.2110 | 0.72 | 1.0756 | 1.59852 | 0.792 | 9.35772 | 0.77135564 | 5.035338 | 2.772 | 4.16532044 | 0.21 | 12.1826584 |
| | May | 1.2113 | 0.72 | 1.0684 | 1.598916 | 0.792 | 9.29508 | 0.75973615 | 5.0365854 | 2.772 | 4.10257519 | 0.21 | 12.1211606 |
| | Jun | 1.2526 | 0.76 | 1.0675 | 1.653432 | 0.836 | 9.28725 | 0.72659411 | 5.2083108 | 2.926 | 3.92360819 | 0.23 | 12.287919 |
| | Jul | 1.2503 | 0.8065 | 1.0669 | 1.650396 | 0.88715 | 9.28203 | 0.72741142 | 5.1987474 | 3.105025 | 3.92802166 | 0.24 | 12.4717941 |
| | Aug | 1.3037 | 0.85 | 1.0669 | 1.720884 | 0.935 | 9.28203 | 0.68640022 | 5.4207846 | 3.2725 | 3.70656118 | 0.24 | 12.6398458 |
| | Sep | 1.3774 | 0.881 | 1.0718 | 1.818168 | 0.9691 | 9.32466 | 0.63754953 | 5.7272292 | 3.39185 | 3.44276745 | 0.23 | 12.7918466 |
| | Oct | 1.4148 | 1.0274 | 1.0864 | 1.867536 | 1.13014 | 9.45168 | 0.63192087 | 5.8827384 | 3.95549 | 3.41237271 | 0.24 | 13.4906011 |
| | Nov | 1.4225 | 1.1 | 1.134 | 1.8777 | 1.21 | 9.8658 | 0.70130182 | 5.914755 | 4.235 | 3.78702982 | 0.23 | 14.1667848 |
| | Dec | 1.4191 | 0.8226 | 1.1761 | 1.873212 | 0.90486 | 10.23207 | 0.77050756 | 5.9006178 | 3.16701 | 4.16074084 | 0.22 | 13.4483686 |

1/ **Basic Component Price Formula:**

1). Protein Price = Cheese Price * 1.32
2). Butterfat Price = AA Butter * 1.1
3). Other Solids Price = {(NFD milk *8.7) - (Protein Price * 3.2)}/ Other Solids Tests
4). Protein Value * 3.15
5). Butterfat Value* 3.5
6). Other Solids Value * 5.4

BCP = {(Protein Value *3.5)+ (Butterfat Value*3.5) + Other Solids Value * 5.4) + Hauling Subsidy}

**Figure 18: Comparison of Prices Generated by a Component Price Formula With no BFP With the M-W and Adjusted M-W Prices, January 1991 to December 1995.**



be the result of competitive market forces for all manufactured products in a supervised market environment to assure fair producer treatment and equity.

In evaluating step 1 survival, this option is inherently different than the others because there is no BFP. The component values would be uniformly applied in all FMMOs. Therefore, this option survives the step 1 analysis.

**Pooling Differentials With No BFP**. This option also assumes that there is no longer a need for a basic formula price or that all other options are deemed to be worse in terms of their performance or regulatory costs imposed. Under this option the regulatory tie between the price of milk used for manufacturing and higher valued milk classes would presumably be severed. Manufacturing plants would be free to pay whatever price they choose, subject to the constraint of market forces. In the process, it would be more difficult for Federal order auditors to determine if investor-owned proprietary manufacturing plants were returning to producers the appropriate level of pool differential based on higher-valued class sales.

In terms of the step 1 criteria, the pooling differentials option would have a long life because no administrative method for establishing price would be needed. Producers would have more problems understanding how their blend milk price is determined. However, the BFP price used in manufacturing would be market determined just like the inputs used in the production of milk. The price of milk for manufacturing could vary geographically and, for that matter, from plant to plant -- subject, of course, to competitive pressures. In addition to national supply demand conditions for manufactured products, manufacturing milk prices would reflect regional and local conditions.

In evaluating this option in terms of the step 1 criteria, it is questionable whether at least two of the criteria are met. Yet, as in the case of pricing components, this no BFP option involves a basic policy decision that represents a substantial departure from past policy. USC, therefore, moves this option to Step 2 analysis.

## Conclusion

Applying the criteria of longevity, understandability, geographic uniformity and reflecting national supply-demand conditions, the following 11 BFP pricing options survived the first analytical step:

- A/B price.
- Adjusted A/B price.
- Butter/powder-cheese formula with annual product yields weighted by Minnesota and Wisconsin production and utilizing the price support make allowance.
- Butter/powder-cheese formula with seasonal yields weighted by Minnesota and Wisconsin production and utilizing the price support make allowance.
- Butter/powder-cheese formula with annual yields weighted by U.S. milk production and utilizing the price support make allowance.
- Butter/powder-cheese formula with seasonal yields weighted by U.S. milk production and utilizing the price support make allowance.
- Butter/powder-cheese formula with annual yields weighted by U.S. milk production and utilizing a California cost-based make allowance.
- Butter/powder-cheese formula with seasonal yields weighted by U.S. milk production and utilizing a California cost-based make allowance.

- Butter/powder-cheese formula with seasonal yields weighted by U.S. milk production, utilizing the price support make allowance and a feed cost snubber.
- Pricing components with no BFP.
- Pooling differentials with no BFP.

Chapter 3 will subject these options to Step 2 analytical rigor within the constraint of available data.

# CHAPTER 3

# PERFORMANCE EVALUATION OF THE BFP OPTIONS

Chapter 2 narrowed the BFP options available for further analysis from 32 down to 11. The purpose of this chapter is to subject each of these 11 options to as much econometric analysis as is possible within the constraints of the data available for such analysis. Recognizing that there may be an interest in seeing how the options excluded in step 1 performed under the same analytical rigor, Appendix D provides the same detailed analytical results for all of the 32 options.

## Criteria

Chapter 1 set forth the three criteria utilized in the step 2 analysis. In summary form, these included:

- **Reflect national supply-demand conditions for manufactured products.** The extent to which the option reflects national supply-demand conditions for manufactured products was designed to isolate the effects of manufactured product stocks as a measure of supply-demand balance on the prices generated by each option.
- **Reflect changes in the value of milk used in manufacturing.** The extent to which the option reflects the value of milk for manufacturing was designed to measure how well processor receipts from manufactured products are reflected in the milk price for each BFP option analyzed. This was done sequentially to assess the combined impact of changes in cheese, butter and NDM prices as well as separately to obtain the effect of each product on the price of milk.

- **Provide price stability**. The extent to which the option generates relative price stability. This criterion arguably becomes a more important consideration in the absence of a price support program. Therefore, how much price variability each option generates was measured both in terms of price movements over time and the price changes resulting from shocks in stocks.

### Basic Analytical Procedure

Many different ways of evaluating the 11 BFP options were discussed and evaluated. The desire of the USC was to select an analytical procedure that could be applied uniformly across as many of the options as possible within the time constraints imposed by the decision process set forth by the Secretary. In addition, USC wanted a technique that would require few assumptions on how participants would perform under alternative BFP options. The procedure selected is referred to as vector autoregression (VAR). This procedure is designed to analyze the relationship of economic data over time, otherwise referred to as time series analysis. Although VAR is not the only time series methodology, it is a very flexible analytical tool.

VAR is particularly useful in this study because it allows consideration of feedback effects between milk prices and product prices. That is, it is well known that product prices affect milk prices. But logically, the price processors pay for milk also affects product prices. These interrelationships are considered utilizing the VAR technique. Moreover, utilizing VAR allowed us to analyze the reality that product prices not only affect milk prices this month but the next month and, perhaps, the following month. In addition, we use VAR to simulate the impacts of a change in important variables, such as manufactured product stocks, on prices over time. The basis for these predictions is the historical regularity between prices and stocks.

VAR can be utilized either in terms of levels or changes. For example, VAR analysis of levels could relate the price of milk to the price of products. Alternatively, VAR could be utilized to analyze just the impacts of changes in the price of milk on changes in the price of products which is referred to as first difference analysis. USC utilized the first difference approach because it more directly focuses, for example, on how the price of milk might be expected to change if the price of cheese changes or if cheese stocks change.[9] It is important to note that all stocks changes are measured in terms of total solids equivalent where the milk equivalent of milkfat is weighted by 40 percent and the milk equivalent of solids-not-fat is weighted by 60 percent.

Obviously, there is interest in the price level as well as in the impacts of price changes. As a point of reference, therefore, Table 11 presents the mean prices that were generated by each of the 10 of the 11 BFP options as compared to the M-W and the adjusted M-W series. It will be noted that the mean price levels range from $11.35 per cwt. to $12.45. These mean prices have relevance since, for example, if either A/B price series were implemented to set the level of price over time, the result would be increased production of milk, which over time would force the price back down. Alternatively, the BFP could be used as a price mover. In other words, the price of milk would change from the level at which it is implemented by the amount of change in the BFP. Our first difference analysis is of this latter type. No attempt was made to determine

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[9]As a check, USC did all analyses based on price levels. We found no difference in the results. Both analyses are included in Appendix D. In addition, we checked standard tests for nonstationary (Dickey-Fuller tests and augmented Dickey-Fuller tests) on levels and found each basic formula price candidate to be nonstationary in levels and stationary in first differences. These results favor using the first difference approach.

**Table 11. Mean Prices Generated by the BFP Options, 1991-95**

| Option | Price/cwt |
|---|---|
| | (dollars) |
| M-W | 11.72 |
| Adjusted M-W | 11.84 |
| Grade A/B | 12.44 |
| Adjusted Grade A/B | 12.68 |
| Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and price support make allowance | 11.38 |
| Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and price support make allowance | 11.38 |
| Butter/powder-cheese formula, annual yields weighted by US milk production and price support make allowance | 11.76 |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance | 11.75 |
| Butter/powder-cheese formula, annual yields and CA cost based make allowance with national production weights | 10.98 |
| Butter/powder-cheese formula, seasonal yields and CA cost based make allowance with national production weights | 10.98 |
| Butter/powder-cheese formula with a feed cost snubber | 11.24 |
| Price components with no BFP | 12.47 |
| Pooling differentials with no BFP | nd[1] |

[1]nd means "not determined"

the mean price under the no BFP option. As indicated in Chapter 2, the price for milk used in manufacturing would be market determined and would vary regionally.

**Limitations of VAR**

The VAR technique is not without controversy. Economists often prefer to set up a structural model based on economic notions of how the world ought to operate. Such models generally assume that firms maximize profits and consumers maximize satisfaction. VAR makes no such assumptions. Instead, it takes the data for what it is and analyzes the relationships over time, based upon past experience.

While USC considers the VAR approach to be appropriate for this study, it can only provide a rough guide to how the BFP options would be expected to perform in the future. Simulating over a short past time period (1991-95) is not the same as asking how would the world be different if another BFP option were in place. That is, the path of prices and stocks would have been affected by the change in policy. While less likely, the stocks/price relationships could also change.

Therefore, it is important not to put too much emphasis on any individual statistic or result. Further, some of the statistical differences probably are not economically significant. However, when one BFP option performs consistently better than another, greater reliance can be placed on the results, particularly when supported by common sense reasoning.

## Results of Performance Evaluation

**Reflection of National Supply-Demand Conditions**

As implied by the preceding discussion, the methodological considerations in measuring how well the BFP options respond to national supply-demand conditions for milk used for manufacturing are complex. USC utilized changes in the combined total of public and private sectors of manufactured product stocks (measured in total solids equivalent) as the indicator of supply and demand conditions. Stocks of butter, NDM and cheese reflect the residual of the interaction of both supply and demand forces as processors make decisions on what share of their production they can profitably sell or store for future sale. In contrast with the past, government storage has declined in importance over the period 1991-95 to the point where they are currently nonexistent (Figures 19-21). This has happened because reductions in the milk price support level have made the Commodity Credit Corporation (CCC) a relatively unattractive market compared with private sector sales or storage. We isolated the critical turning points for this change in policy as being May 1992 and November 1994. These critical turning points were accounted for in the VAR analysis by isolating the effects of stocks on the price of milk before and after these turning points.

Four statistical procedures were used to determine the extent to which the BFP options reflect supply-demand conditions as compared to the M-W and adjusted M-W series (Table 12). Each procedure measures the effect of a 248 million pound total solids milk equivalent increase or decrease in stocks on price (this number reflects on average one standard deviation shock in stocks over the study period). These measures could be applied to all of the options except pooling differentials with no BFP.

- **Was there an inverse relation between stocks and the BFP?** That is, when stocks were increased, did the milk price decline? The answer was yes for all of the options except the Grade A/B and adjusted Grade A/B options. That is, both A/B series prices

Figure 19: Monthly Total, Government and Commercial Manufactured Dairy Product Stocks Measured in Milkfat Equivalent, 1991- 1995.

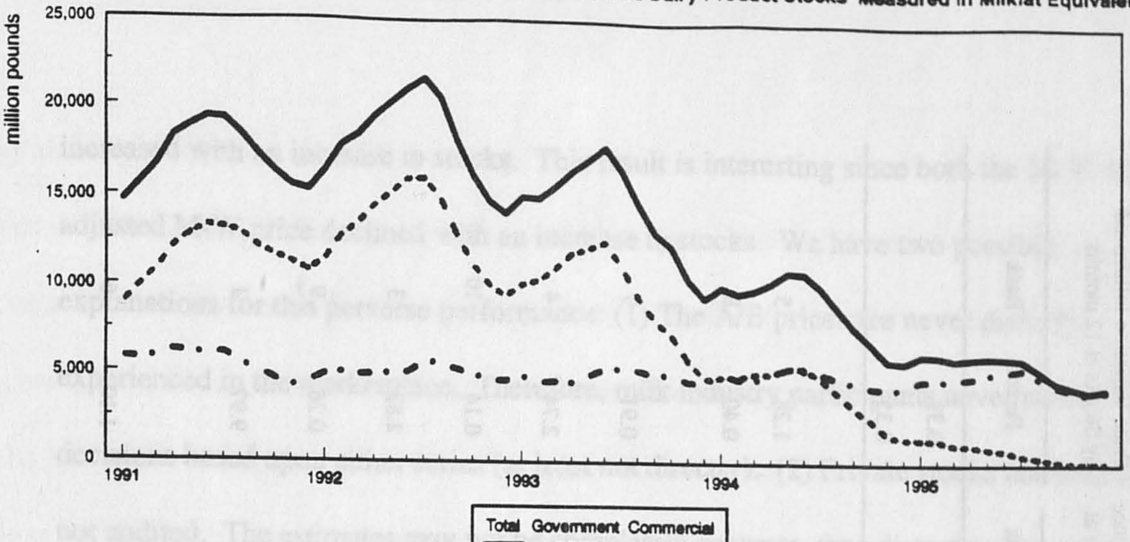



Figure 20: Monthly Total, Government and Commercial Manufactured Dairy Product Stocks Measured in SNF Equivalent, 1991- 1995.

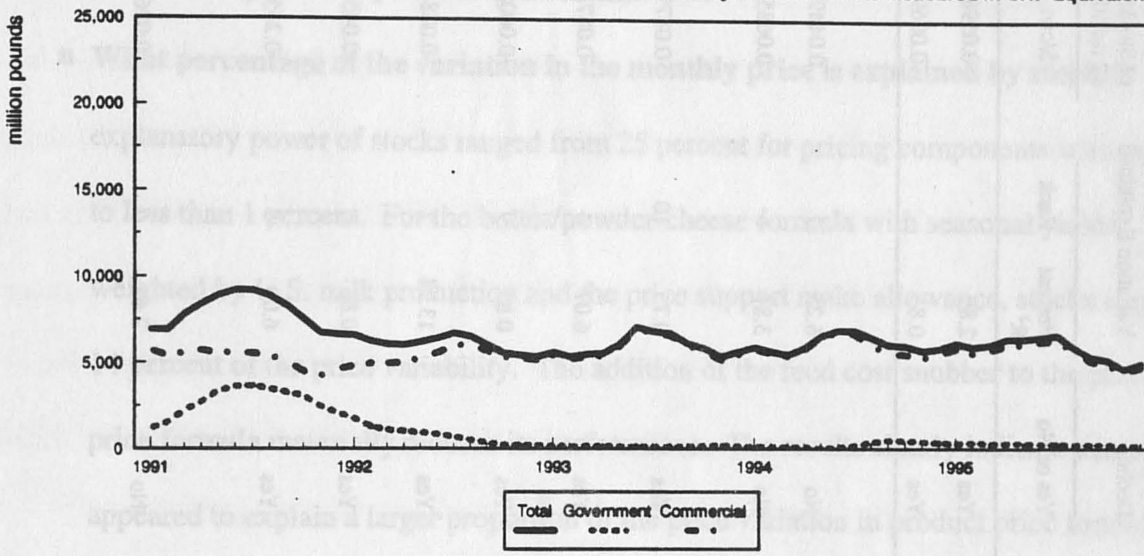



Figure 21: Monthly Total, Government and Commercial Manufactured Dairy Product Stocks Measured in Total Solids Equivalent, 1991- 1995.

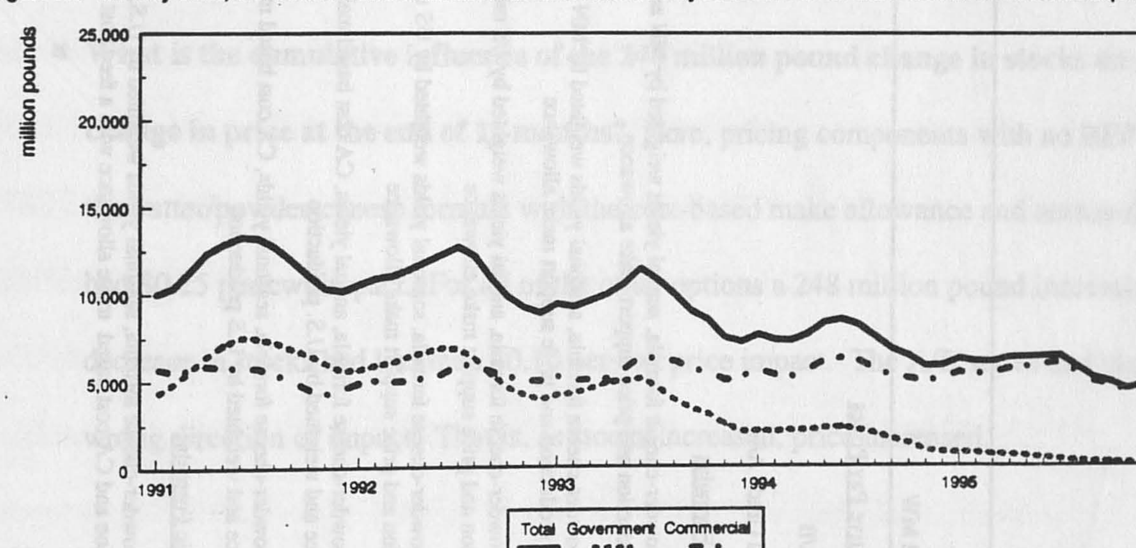


**Table 12: Statistical Measures of the Extent to Which BFP Options Reflect National Supply and Demand Conditions, 1991-95.**

| Option | Price Decline | Percent of the Price Variation Explained | | Cumulative Influence of Stocks on Price at 12 months | | Price Variation Influenced by Stocks at 12 months | |
|---|---|---|---|---|---|---|---|
| | Yes or No | Percent $R^2$ | Rank | $/cwt | Rank | Percent | Rank |
| MW | Yes | 2.89 | | -0.0598 | | 0.39 | |
| Adjusted MW | Yes | 0.85 | | -0.0069 | | 0.35 | |
| Competitive Pay Prices | | | | | | | |
| Grade A/B | No | 6.25 | 3 | 0.0449 | 9 | 1.28 | 5 |
| Adjusted Grade A/B | No | 3.81 | 6 | 0.0685 | 10 | 0.40 | 8 |
| Product Formulas | | | | | | | |
| Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and price support make allowance | Yes | 0.75 | 10 | -0.0879 | 4 | 0.91 | 7 |
| Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and price support make allowance | Yes | 6.07 | 4 | -0.0875 | 5 | 2.74 | 4 |
| Butter/powder-cheese formula, annual yields weighted by US milk production and price support make allowance | Yes | 0.85 | 9 | -0.0008 | 7 | 0.14 | 10 |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance | Yes | 13.74 | 2 | -0.0881 | 3 | 2.83 | 3 |
| Butter/powder-cheese formula, annual yields, CA cost based make allowance and weighted by U.S. production | Yes | 0.86 | 8 | -0.0450 | 6 | 0.26 | 9 |
| Butter/powder-cheese formula, seasonal yields, CA cost based make allowance and weighted by U.S production | Yes | 6.00 | 5 | -0.2450 | 2 | 9.97 | 1 |
| Economic Formulas | | | | | | | |
| Butter/powder-cheese formula, seasonal yields weighted by U.S. production and CA cost based make allowance with a feed cost snubber | No | 2.67 | 7 | 0.0269 | 8 | 1.10 | 6 |
| No BFP | | | | | | | |
| Price components with no BFP | Yes | 28.82 | 1 | -0.2517 | 1 | 7.62 | 2 |
| Pooling differentials with no BFP | nd | nd | | nd | | nd | |

nd means "not determined"

increased with an increase in stocks. This result is interesting since both the M-W and adjusted M-W price declined with an increase in stocks. We have two possible explanations for this perverse performance: (1) The A/B prices are never directly experienced in the marketplace. Therefore, milk industry participants never make decisions based upon either series (at least not directly). (2) Private stocks are estimated, not audited. The estimates may not be completely accurate, thus distorting the outcome when the explanatory power is quite small.

- **What percentage of the variation in the monthly price is explained by stocks?** The explanatory power of stocks ranged from 25 percent for pricing components with no BFP to less than 1 percent. For the butter/powder-cheese formula with seasonal yields weighted by U.S. milk production and the price support make allowance, stocks explained 14 percent of the price variability. The addition of the feed cost snubber to the product price formula materially reduces its performance. The results clearly indicate that stocks appeared to explain a larger proportion of the price variation in product price formulas when weighted by U.S. production.

- **What is the cumulative influence of the 248 million pound change in stocks on the change in price at the end of 12 months?** Here, pricing components with no BFP and the butter/powder-cheese formula with the cost-based make allowance and seasonal yields had \$0.25 per cwt impact. For all of the other options a 248 million pound increase or decrease in stocks had less than \$0.10 per cwt price impact. The A/B series had the wrong direction of impact. That is, as stocks increased, price increased.

- **What percentage of the monthly BFP price variation is explained by variation in stocks at a 12 month horizon?** Three of the options stand out in this case as having large proportions of their variability explained by changes in stocks. The butter/ powder-cheese formula with seasonal yields and a cost-based make allowance weighted by U.S. production had 10 percent of its variation explained by changes in stocks and pricing components with no BFP had 7.6 percent explained. The remaining options explained less than 3 percent of the variation.

VAR could not be applied to the pooling differentials with no BFP option because we had no market determined prices to analyze in the absence of a BFP. Arguably, the price for this option could come out approximately the same as the A/B prices in the Minnesota-Wisconsin region. But in the absence of regulation, it would not be uniform. This makes analysis much more complex. Presumably, with less uniformity there would be a somewhat lower reflection of national supply-demand conditions but such a conclusion is based on common sense reasoning as opposed to empirical analysis.

Three important conclusions arise from this analysis:

- Pricing components with no BFP performed consistently better than any of the other options. It is believed that this better performance is a result of the way the component values are derived under this BFP option. The protein prices are derived from the weighted monthly average 40# block cheese price, butter from the weighted monthly average Grade AA butter price and the value of other solids as a residual of the nonfat milk (NFD X yield minus the protein value divided by 5.4 pounds of other solids). Since cheese prices, butter prices, and nonfat dry milk prices each respond to stock levels (as cheese stocks start building, cheese is offered on the National Cheese Exchange, and cheese prices decline, and so does the protein value), component values likewise respond immediately to changes in product prices. Therefore, the full impact of these product price changes are reflected in component values and are not impacted by annual yields weighted by MN and WI or by U.S. milk production, as is the case for the product price formulas.

- The two butter/powder-cheese formulas with seasonal yields performed equally well.
- The A/B pricing options do not respond to an increase in stocks as expected based on economic logic. That is, as stocks increase prices increase, which is contrary to our expectation. This is viewed by USC as a substantial strike against the A/B options.
- The addition of a feed cost snubber on a product price formula substantially reduces the extent to which the formula reflects national supply and demand conditions.

**Reflection of the Value of Milk for Manufacturing**

When product prices change, the BFP should adjust reflecting both the magnitude of change in product prices and the share of the product's sales in the mix of manufactured products. VAR was utilized to measure the proportion of variation in the BFP for each option that is explained by the prices of cheese, butter and NDM. Sequentially, it was found that cheese prices have the largest price impact for all options, followed by butter and then NDM. Table 13 provides two related methods for measuring the extent to which the BFP options reflect values of milk for manufacturing:

- **The proportion of BFP variability in price changes explained by all three products.** The combination of cheese, butter and NDM explained from 21 percent to

**Table 13: Statistical Measures of the Extent to Which BFP Options Reflect the Values of Milk for Manufacturing as Measured by Changes in Product Prices, 1991-95.**

| Option | Proportion of BFP Price Variation Explained by | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | All Products | | Cheese | | Butter | | NFDM | |
| | Percent R-bar Squared | Rank | Percent R-bar Squared | Rank | Percent R-bar Squared | Rank | Percent R-bar Squared | Rank |
| MW | 26.29 | | 27.97 | | -1.37 | | -1.63 | |
| Adjusted MW | 20.89 | | 22.56 | | 9.33 | | -2.74 | |
| Competitive Pay Prices | | | | | | | | |
| Grade A/B | 26.01 | 6 | 25.39 | 6 | 4.07 | 5 | -2.88 | 7 |
| Adjusted Grade A/B | 20.57 | 7 | 25.65 | 5 | 2.53 | 7 | -2.93 | 8 |
| Product Formulas | | | | | | | | |
| Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and price support make allowance | 27.23 | 4 | 26.68 | 4 | 7.05 | 2 | -2.85 | 5 |
| Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and price support make allowance | 25.13 | 8 | 28.05 | 3 | 3.86 | 6 | -2.88 | 6 |
| Butter/powder-cheese formula, annual yields weighted by US milk production and price support make allowance | 26.46 | 5 | 24.12 | 8 | 6.67 | 3 | -2.71 | 3 |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance | 24.18 | 9 | 24.81 | 7 | 1.41 | 8 | -2.77 | 4 |
| Butter/powder-cheese formula, annual yields, CA cost based make allowance and weighted by U.S. production | 41.47 | 3 | 35.20 | 1 | 6.28 | 4 | -4.53 | 10 |
| Butter/powder-cheese formula, seasonal yields, CA cost based make allowance and weighted by U.S. production | 44.39 | 2 | 28.67 | 2 | -4.42 | 10 | 3.68 | 2 |
| Economic Formulas | | | | | | | | |
| Butter/powder-cheese formula, seasonal yields weighted by U.S. production and CA cost based make allowance with a feed cost snubber | 5.18 | 10 | 1.42 | 10 | -3.33 | 9 | -3.03 | 9 |
| No BFP | | | | | | | | |
| Price components with no BFP | 57.83 | 1 | 23.08 | 9 | 32.09 | 1 | 11.24 | 1 |
| Pooling differentials with no BFP | | | | | | | | |

58 percent of the BFP price variability. Pricing components with no BFP performed best in reflecting product values by having 58 percent of its variations explained by product prices. The butter/powder-cheese options with the California cost-based make allowance had 41-45 percent of variation explained by product prices -- substantially higher than most of the remainder of the options which generally explained about 25 percent of the variability. As might be anticipated, for the cost-snubbed product formula product prices explained only 5 percent of the BFP price variability.

- **Proportion of price variation explained by individual products**. The results for the sequential explanatory power of product prices are robust in the sense that with one exception, the product formulas with the California cost-based make allowance and the pricing component with no BFP options have a consistently strong relationship between the product prices and the computed milk price. The exception is the relationship between the pricing components option and the price of cheese, where the variation explained in the milk price is only 23 percent. In this case, butter prices explain more of the variability than cheese. The reason is that the price of butter has been more volatile than cheese prices (ranging from $0.70 to $1.12 per pound). In the competitive pay price options and product price formula options cheese, butter and nonfat dry milk yields are weighted by either MN and WI production or by national production. Cheese by far gets the greatest weight. But with the component price option, there are no weights, simply a price per pound of component derived from one pound of product (cheese, butter and nonfat dry milk).

USC would expect the pooling differentials with no BFP to reflect the value of milk for manufacturing on a regional basis as determined by regional product receipts and competitive conditions. As a result, the relationships to national product price levels would be less direct. Thus the expectation would be poorer performance than the competitive pay prices. However, this expectation is not based on empirical analysis.

The conclusion the USC draws is that product price formulas with a cost-based make allowance and pricing components with no basic formula price generally do the best job of reflecting product values in the price of milk. Competitive pay prices consistently rank in the lower half of the options. The feed cost snubbed product price formula performed the poorest in reflecting product values. This should not be surprising since the addition of feed costs logically would be expected to reduce the relationship of product prices to milk prices.

**Stability of BFP Options**

With milk prices being more unstable in the 1990s, and in the absence of a support price after 1999, greater attention might logically be given to the amount of price variation experienced by each option. Two statistical measures were utilized to measure stability (Table 14):

- **The standard deviation of the milk price over the period 1991-95 measures the amount of unexplained price variability about the mean.** The range in standard deviation was from $0.66 to $0.95/per cwt. The least variability was experienced by butter/powder-cheese formulas with annual yields weighted by U.S. production and utilizing the California cost-based make allowances. Pricing components with no BFP experienced the second largest level of price variability. Butter/powder-cheese formulas

**Table 14: Statistical Measures of the Extent to Which BFP Options Generate Prices that are Stable**

| Option | Price Stability of Option | | | Price Stability at 12 Months | |
|---|---|---|---|---|---|
| | Mean | Standard Deviation | Rank | Standard Deviation | Rank |
| MW | 11.72 | 0.8086 | | 0.4487 | |
| Adjusted MW | 11.84 | 0.7285 | | 0.4264 | |
| Competitive Pay Prices | | | | | |
| Grade A/B | 12.44 | 0.8919 | 8 | 0.4889 | 4 |
| Adjusted Grade A/B | 12.68 | 0.8449 | 5 | 0.4747 | 3 |
| Product Formulas | | | | | |
| Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and price support make allowance | 11.38 | 0.8631 | 6 | 0.5467 | 6 |
| Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and price support make allowance | 11.38 | 0.9502 | 10 | 0.6208 | 9 |
| Butter/powder-cheese formula, annual yields weighted by US milk production and price support make allowance | 11.76 | 0.8425 | 4 | 0.5467 | 7 |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance | 11.75 | 0.9298 | 9 | 0.6168 | 8 |
| Butter/powder-cheese formula, annual yields, CA cost based make allowance and weighted by U.S. production | 10.98 | 0.8138 | 3 | 0.4552 | 2 |
| Butter/powder-cheese formula, seasonal yields, CA cost based make allowance and weighted by U.S. production | 10.98 | 0.8901 | 7 | 0.4959 | 5 |
| Economic Formulas | | | | | |
| Butter/powder-cheese formula, seasonal yields weighted by U.S. production and CA cost based make allowance with a feed cost snubber | 11.24 | 0.7725 | 2 | 0.6873 | 10 |
| No BFP | | | | | |
| Price components with no BFP | 12.47 | 0.6646 | 1 | 0.4459 | 1 |
| Pooling differentials with no BFP | nd | nd | | nd | |

nd means "not determined"

with seasonal yield adjustment and the price support make allowance generally had higher levels of price variability.

- **Price variability at 12 months.** Based upon the VAR results between the first differences of each candidate price and the first differences of milk stocks, we can measure the uncertainty in price differences at successive months into the future. One would expect a stable price formula to show lower variability in first differences as we look 12 months into the future. The range in standard deviation was from $0.45 per cwt to $0.69. Pricing components with no BFP experienced a standard deviation of about $0.45 per cwt, but several options were in the $0.45 to $0.50 per cwt range.

The pooling differentials with no BFP option would be expected to be less stable than any of the other options because government presumably provides, at least, short-run price stability and greater regional uniformity in prices. This expectation, however, is based on common sense reasoning, not empirical analysis.

USC draws the conclusion that some of the BFP options indeed are more stable than others. More sophisticated options having cost-based make allowances appear to have a particularly favorable price stabilizing effect. Perhaps this is because the option itself incorporates key values within the price that would otherwise have to be revealed in the marketplace as potentially destabilizing factors.

## Conclusion

Table 15 summarizes the results of the Step 2 analysis by ranking each BFP option by each of the three criteria and their subcomponents. Table 16 boils these rankings down by weighting each of the criteria equally. While small differences in these ranks may not be meaningful from

**Table 15. Ranking of BFP Options by Step 2 Criteria**

| BFP Option | National Supply-Demand Conditions | | | | Value of Milk for Manufacturing | | | | Stability | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Price Decline | Variation Explained | Cumulative Influence | Cumulative Variation | All Products | Cheese | Butter | NDM | Overall | At 12 Months |
| Grade A/B | N | 3 | 9 | 5 | 6 | 6 | 5 | 7 | 8 | 4 |
| Adjusted Grade A/B | N | 6 | 10 | 8 | 7 | 5 | 7 | 8 | 5 | 3 |
| Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and price support make allowance | Y | 10 | 4 | 7 | 4 | 4 | 2 | 5 | 6 | 6 |
| Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and price support make allowance | Y | 4 | 5 | 4 | 8 | 3 | 6 | 6 | 10 | 9 |
| Butter/powder-cheese formula, annual yields weighted by US milk production and price support make allowance | Y | 9 | 7 | 10 | 5 | 8 | 3 | 3 | 4 | 7 |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance | Y | 2 | 3 | 3 | 9 | 7 | 8 | 4 | 9 | 8 |
| Butter/powder-cheese formula, annual yields, CA cost based make allowance with national production weights | Y | 8 | 6 | 9 | 3 | 1 | 4 | 10 | 3 | 2 |
| Butter/powder-cheese formula, seasonal yields, CA cost based make allowance with national production weights | Y | 5 | 2 | 1 | 2 | 2 | 10 | 2 | 7 | 5 |
| Butter/powder-cheese with cost snubber | Y | 7 | 8 | 6 | 10 | 10 | 9 | 9 | 2 | 10 |
| Price components with no BFP | Y | 1 | 1 | 2 | 1 | 9 | 1 | 1 | 1 | 1 |
| Pooling with no BFP | nd[1] | | | | | | | | | |

[1] nd means "not determined."

**Table 16. Mean Rankings for BFP Options by Step 2 Criteria**

| BFP Option | National Supply-Demand Conditions | Value of Milk for Manufacturing | Stability | Sum of Mean Ranks |
|---|---|---|---|---|
| Grade A/B | 5.7 | 6.0 | 6.0 | 17.7 |
| Adjusted Grade A/B | 8.0 | 6.8 | 4.0 | 18.8 |
| Butter/powder-cheese formula, annual yields weighted by MN and WI milk production and price support make allowance | 7.0 | 3.8 | 6.0 | 16.8 |
| Butter/powder-cheese formula, seasonal yields weighted by MN and WI milk production and price support make allowance | 4.3 | 6.5 | 9.5 | 20.3 |
| Butter/powder-cheese formula, annual yields weighted by US milk production and price support make allowance | 8.7 | 4.8 | 5.5 | 19.0 |
| Butter/powder-cheese formula, seasonal yields weighted by US milk production and price support make allowance | 2.7 | 7.7 | 8.5 | 18.9 |
| Butter/powder-cheese formula, annual yields, CA cost based make allowance with national production weights | 7.7 | 4.0 | 2.5 | 14.2 |
| Butter/powder-cheese formula, seasonal yields, CA cost based make allowance with national production weights | 2.7 | 3.3 | 6.0 | 12.0 |
| Butter/powder-cheese with cost snubber | 7.0 | 9.7 | 6.0 | 22.7 |
| Price components with no BFP | 1.3 | 2.3 | 1.0 | 4.6 |
| Pooling with no BFP | nd[1] | nd | nd | nd |

[1] nd means not determined

an economic perspective, this procedure and weighting suggests substantially superior performance for pricing components with no BFP, and for the butter/powder-cheese formulas that utilize a cost based make allowance. While not based on empirical analysis, USC would expect the pooling differentials with no BFP to perform more like the competitive pay price options than either the product price formulas or pricing components with no BFP.

an economic perspective, this procedure and weighting suggests substantially superior performance for pricing components with no BFP, and for the butter/powder/cheese formulas that utilize a cost based make allowance. While not based on empirical analysis, USC would expect the pooling differentials with no BFP to perform more like the competitive pay price options than either the product price formulas or pricing components with no BFP.

# CHAPTER 4

# APPLICATION OF RESEARCH RESULTS

The charge to the USC was to analyze alternative BFP pricing procedures for use in FMMOs. In doing so, we narrowed the options to those that meet the criteria considered to be consistent with the objectives of the AMAA and have the potential for being understood. However, we explicitly avoided the issue of political acceptance.

USC was not charged with coming up with a recommendation on which alternative performed best in terms of the criteria set forth by the Committee. The reality is that none of the options performed perfectly. There are tradeoffs that exist among the options. Some of the tradeoffs are inherent in the AMAA. For example, the AMAA asserts that order prices should both reflect current economic conditions and be stable. If an alternative is more responsive to supply-demand conditions, it is likely to be more unstable. These tradeoffs are not always explicit in our analyses in that they involve consideration of the degree of reliance to be placed on markets versus regulations.

In narrowing down the options, USC feels that it has learned much that USDA and industry interest groups should find useful in arriving at a decision and in drafting regulations for its application. The purpose of this chapter is to present its findings and conclusions regarding the procedures to be followed in applying whatever alternative is adopted.

## Minimum Pricing

The AMAA sets minimum prices. While enacted a half century ago, regulatory experience indicates that minimum pricing allows latitude for market forces to operate while providing stability, orderliness and a reflection of national supply and demand conditions. In other words, USC concludes that the framers of the AMAA acted with considerable wisdom and insight which should be taken seriously in designing a substitute for the M-W price series.

Minimum pricing means that the BFP should not be the price paid for milk used for manufacturing all the time nor, for that matter, on most of the product most of the time. This conclusion is particularly relevant in the current policy environment where, in the absence of an effective price support program, the market needs to be able to clear. Moreover, this BFP decision needs to look to the future where, in year 2000, under the 1996 Farm Bill, there is no milk price support program. It is also consistent with today's dominant political philosophy that less market regulation is preferable.

In the short run, if BFP is set too high under FMMOs, the market will not clear. More than likely, the excess stocks of manufactured products will end up in the hands of cooperatives that process the majority of the production. The producers who own these cooperatives would bear the immediate brunt of any decision that had the effect of setting the price of milk above the market clearing price. Over time, pressures would build for cooperatives to put the stocks on spot markets such as National Cheese Exchange or the Chicago Mercantile Exchange. If a product formula was used, the price to producers would fall and be reflected to producers in the price of milk within a month. If a competitive pay price is used, the producer price would likely decline more gradually as lower margins are reflected in less competition for the available milk supply.

Clearing the market is assured if product prices are free to fall to the point where supply and demand are equal. For the options that survived to Step 2, the market would most readily clear under the following conditions:

- If there was no BFP, the product prices would be free to fall to the point where supply and demand were equal for each product after stocks began to build.
- If a butter/powder-cheese formula was adopted, the mix of products processed would shift as margins tightened on the product experiencing the buildup in stocks. Concurrently, pressures would develop to lower the price of milk -- particularly for those plants producing products for which stocks are building. As long as the BFP was set based on minimum product price levels, the market clearing process could be expected to occur relatively rapidly, but not as fast as if there was no BFP.
- With a competitive pay price applying to butter, NDM and cheese, economic forces would clear the market in much the same manner as with a product price formula. However, with a higher competitive pay price, the pace of adjustment would be slower.
- An economic formula with a cost of production snubber could impede the short-run market clearing process if feed costs were rising while product prices were falling. Such short-run conditions are possible in perishable product markets where feed costs are volatile. Over time, the market would clear but not as rapidly. Some might view this as reflecting current market conditions. Others might argue that it provides a more gradual adjustment to a new equilibrium.

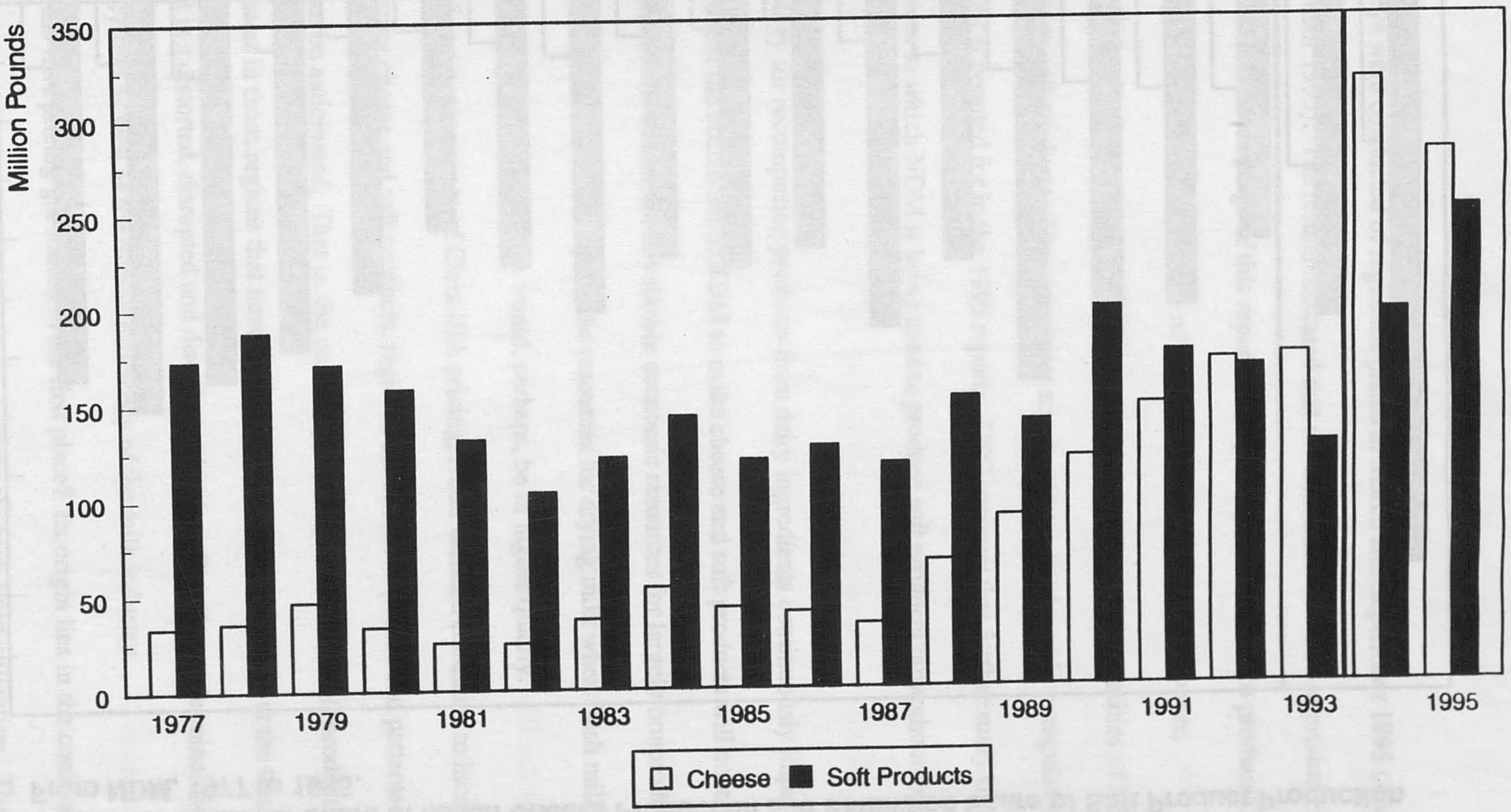
Minimum pricing reduces the need for the Secretary to fine tune the price of milk to reflect local or regional uniquenesses in a market setting that is national in scope. Regional price differentials for manufactured products, which may vary seasonally and over time, can be set by market forces. It would be unwise for USDA to attempt to encompass within the BFP all of the market cost functions. If, for example, there are market functions, the costs of which need to be covered to achieve the objectives of orderly marketing, it is preferable to handle them through a regulatory authority such as for market service payments. Several of the other application implications that follow relate directly to the issue of minimum pricing.

## Application to All Manufactured Products

If classified pricing is to be sustainable, it must be uniformly applied to all manufactured products. The current Class IIIA pricing system is undermining the Class II and Class III price by allowing milk to be manufactured into NDM at a lower price which, in turn, appears to be utilized in increasingly large quantities to make soft products and cheese.

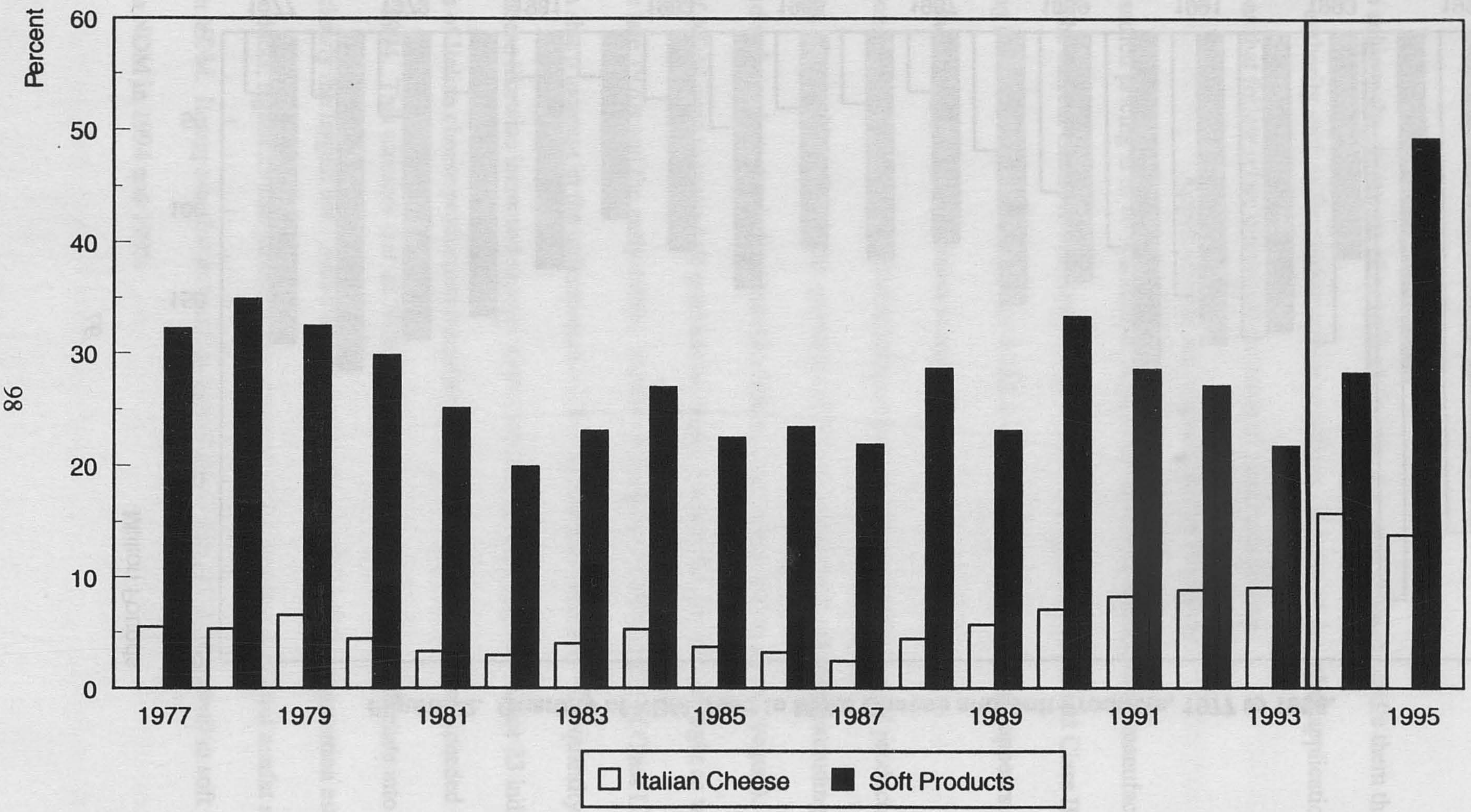
Data on the extent to which NDM is being utilized in Class II and Class III products is less than perfect. Figure 22 indicates the quantities of NDM used to make cheese (excluding cottage cheese) and soft products (including cottage cheese, sour cream, ice cream and yogurt). The quantity of NDM used to make soft products increases when milk supplies are tight as was the case in the late 1970s and the early 1990s. However, since the establishment of Class IIIA there has been a sharp increase in the utilization of NDM to make soft products. The quantity of NDM to make cheese likewise increased sharply after Class IIIA pricing began. Figure 23 indicates the proportion of Italian cheese production manufactured using NDM could have exceeded 15 percent in 1994. This assumes that all NDM used to manufacture cheese was made into Italian cheese -- clearly the largest use. Based on estimates of the nonfat solids composition estimates for soft products, figure 23 also provides an indication of the proportion of total nonfat solids that come from NDM. It suggests that as much as half of the nonfat solids contained in soft products came from NDM in 1994 and 1995.

**Figure 22. Quantity of NDM Used to Make Cheese and Soft Products, 1977 to 1995.**




Source: USDA/American Dairy Products Association

**Figure 23. Potential Share of Italian Cheese Production and Estimated Share of Soft Product Production From NDM, 1977 to 1995.**




Source: USC

FMMO surveys were conducted of regulated plants in March and September 1995 (AMS, March and September 1995). The results indicated that the utilization of NDM to produce Italian cheese is consistent with the findings of this report. The quantity of milk used to produce Class II products in FMMO regulated plants has been relatively stable since 1993. However, USDA/American Dairy Products Association data suggests that substantial quantities of NDM were used to produce soft products. These products apparently are produced in unregulated plants that were not accounted for in the 1995 reports. USC suggests that further study is needed to confirm the extent to which NDM is being used to produce soft products throughout the United States.

With technology for recomposing products from dairy ingredients continuously improving, it can be anticipated that the utilization of NDM to make cheese and soft products will continue to increase. The result is the utilization of valuable economic resources for largely nonproductive purposes. That is, it is inefficient to expend the resources for drying milk when fresh milk could be utilized to make the same product that would, perhaps, be of higher quality.

Moreover, if as a consequence of Class IIIA pricing, NDM demand continues to increase for use in manufacturing cheese and soft products, regional distortions in production patterns for these products can be anticipated. That is, the costs of producing cheese and soft products would tend to be the lowest in those regions that have direct access to NDM produced at the Class IIIA price. The result is a distorted, disrupted and disorderly circular effect that undermines the FMMO pricing system as well as the overall efficiency of the milk industry.

How did Class IIIA pricing get started in the first place? Its origin lies in the costs of performing the balancing function in markets having relatively high fluid utilization. These plants, primarily located in the Northeast and Southeast, maintained butter/powder plants to process supplies in excess of fluid (Class I) needs in the flush Spring months. As a result of the high costs of maintaining these facilities, there were petitions for either setting lower prices for milk used to produce butter and NDM or for service charges on milk used in Class I to pay for the higher costs incurred by balancing plants. USDA opted for a lower Class IIIA price during at least part of the year in selected markets. The other source of Class IIIA pricing in FMMOs was a desire to be competitive with California's NDM production. In the early 1980s California adopted generous make allowances to manufacturers as a means of manufacturing rapidly expanding supplies in California plants.

If the dairy industry is to maintain the classified pricing system, including FMMOs, it has to find a way to come to grips with the Class IIIA issue in the reform deliberations mandated under the 1996 Farm Bill. This can be done either by eliminating Class IIIA or by establishing a system of up-class charges of the difference between the Class IIIA and the Class III price for any NDM used to make cheese or soft products.

The former, eliminating Class IIIA, can be most easily and effectively pursued if the BFP is set at a minimum level or eliminated completely. These options allow the forces of competition, rather than administrative edict, to play a greater role in allocating supplies. The latter, establishing up-class payments, implies a considerably higher level of regulation. Moreover, any up-class pricing system for NDM would need to be applied on a national basis, including California. Without such a national application, there would be incentives for increased soft product and cheese production to be located in California. That is, if FMMOs imposed an up-class charge and California did not, it would be more profitable to manufacture products from NDM in California.

USC opts for no Class IIIA and a lower level of regulation with a minimum Class III price that applies to all manufactured products in all regions. In drawing this conclusion USC recognizes that in the long run the Class III price will need to be competitive with NDM traded at world market prices. Creating equity in the pricing of Class II products could require the elimination of Class III with a consequence of placing both soft and hard products in a single price class. The less desirable alternative involves a nationally applied up-class payment for NDM used in making cheese and soft products. Without one of these options, the Federal order system is not sustainable. If needed, a system of service payments to cover the costs of balancing is considered preferable to mandatory up-charges on NDM used to make cheese and soft products. The reason for this preference is that service payments force butter/NDM utilization to compete with cheese for the highest use value of raw milk.

Coming to grips with the Class IIIA issue requires that federal order and California state dairy policies be coordinated. It may not only require the elimination of Class IIIA and its California counterpart but also that all soft and hard products be part of the same Class. The movement back to a two-Class system will be a particularly relevant consideration as barriers to trade in dairy products are reduced. At that point, U.S. soft and hard product manufacturers will need to be in a position to compete with NDM traded at the world market price and with products made therefrom.

### Price Mover Versus Price Level

Throughout this report, the BFP options have been analyzed in terms of their ability to move the price of milk consistent with the requirements of the AMAA. Consistent price signals at the right time and in the right direction are more important than the absolute level of price in terms of reflecting national supply and demand conditions, stability and orderliness. In the short run this may be difficult for producers, who are trying to make a profit and survive, to accept.

USC concludes that from an operational perspective, it makes more sense to utilize the BFP as both a mover and a setter of the price. If the BFP is used as a mover but not a setter of the price, industry interests will always be second-guessing what the "right price" really is. That is, is it the price generated by the BFP or is it the price that the BFP is moving? This confusion itself will be a source of disorderliness.

If, however, it is decided that the BFP should only be a mover of Class III prices, it is desirable to pick a period of relative supply-demand balance and stability as a starting point for implementation. At that point in time, there is a decision on the appropriate starting price. The USC believes that the starting price should be relatively low, although not so low as to be destabilizing. This is a judgmental decision that requires economic input at the time of implementation.

### Prices Utilized

A flurry of controversy surrounds wholesale markets for dairy products. The basic concern relates to what economists refer to as "thin" markets. In these markets, price is based on a relatively small number of transactions. Such markets are suspect simply because of the small volume of trade and the potential for manipulation. Mueller *et al.* have asserted that price manipulation of the cheese market has occurred. Gardner has contested this finding. USC draws no conclusion with respect to these issues except to recognize that thinness does exist and that the perception of a problem can be as important as the existence of a problem.

For the futures markets to be used as the source of prices for the BFP requires that the futures price be based on a large volume of trading. This does not yet exist for all products, with futures prices being as suspect as spot market prices. Perhaps this suspicion is even greater for futures markets because of the lack of broad-based understanding of how they function.

Therefore, USC feels that the USDA should take steps to see that the manufactured product prices it reports are based on substantial volumes of market transactions. It, therefore, suggests that plant surveys of transaction prices for products need to be expanded. This is the case regardless of the BFP option chosen. That is, regardless of whether the BFP is to be set by a competitive pay price, a product formula, or there is to be no BFP, the USDA has a stake in providing the industry with transaction prices that represent a substantial share of the industry's volume of production. To protect the integrity of reporting, periodic audits will be needed.

To generate a minimum price, the specific prices that are utilized should represent the most efficient production areas that have a large volume of trading. For example, if a product formula is used, price surface maps developed by Novakovic et al suggest that the NDM, butter and buttermilk price might logically be established on the basis of West Coast sales. Cheese-whey and whey-butter prices might be established on West Coast sales or by a combination of West Coast and Wisconsin sales. Product specification should be uniform commercial sales of products without significant value added components.

The dairy industry should be receptive to expanded reporting of transaction prices. It is essential to allowing the Federal order system to operate in a competitive, trustworthy and orderly environment. If it is found that industry participants are unwilling to provide such information voluntarily, USDA should explore and test its authority to require reporting and to audit company price records.

**Bridging Prices**

Transaction price data may not be available on a timely basis for setting Federal order prices. This is definitely the case when competitive pay prices are utilized. In these instances, the choice for USDA is to either rely on spot market quotations or on reporting of transaction prices by a small number of large plants. Market quotes that are relied on make them a tempting target for possible manipulation of sales and prices by firms having an interest in the outcome.

Futures prices having a large volume of trading hold greater future potential because of participation by interests other than those within the dairy industry. Yet, futures markets may not yet be sufficiently developed. Therefore, USC concludes that there is need for greater emphasis on transaction prices even if it means obtaining a representative sample on a timely basis for bridging to generate the BFP price.

**Yields**

The importance of product yields other than butterfat is now widely recognized by the dairy industry. This reality is seen in our research results which indicate explicit consideration of yields leads to greater explanatory power in the BFP options analyzed.

USC concludes that USDA and the various industry components need to give even greater attention to yield issues in its pricing decisions. The industry would be well served by a pricing system that recognized and utilized product yields at all levels and on all products. In today's markets, our analysis clearly indicates that pricing incentives/rewards for nonfat solids/protein are at least as important as for butterfat. It also suggests the need for uniform component pricing provisions cutting across all FMMOs.

## Make Allowances

Make allowance issues are critically important if the BFP is to be determined by a product formula. Under the price support program, USDA did not give the make allowance the deserved level of attention. Certainly, this inattention will need to be remedied if a product formula is adopted.

USC analyses indicate that product formulas with cost-based make allowances tend to more accurately reflect the value of milk for manufacturing and generate a more stable milk price. It, therefore, concludes that if a product formula is adopted as the BFP, a formal system will need to be developed for determining manufacturing costs by product.

The California regulatory system has placed substantial emphasis on auditing plant costs to determine the appropriate make allowance. But, even in California, with audits that tend to run on an annual basis, changes in cost can be missed by several months. This suggests the need for a rather major auditing function by USDA. Rather than employing a large group of financial auditors operating continuously, consideration could be given to modeling and regularly updating a set of representative plants.

**Relation Between the Class III Price and Other Class Prices**

The issue of what, if any, relationship there ought to be between the BFP and the Class I and Class II prices was not a focal point for the USC. However, there are implications from this study for Class I and II prices.

First and foremost, the utilization of the Class III price as a mover of the Class I and Class II prices provides direct coordination among prices of the different Classes. This direct coordination is important because it sends an unambiguous market signal to producers when there is a change in overall industry supply and/or demand. For example, a surge in demand for cheese is expressed through a product price formula in a higher BFP which, if used as a mover of the Class I and Class II prices, results in a higher producer price and signals the need for increased milk production. Without such a direct tie, the need for increased production gets diluted by a flat Class I price or, worse yet, a declining Class I price.

Fluid processors who object to a direct tie between Class III and Class I do so on the basis of the impacts of incremental changes in the price of milk on their profits. This concern could be taken into consideration by moving the Class I price in increments and/or multiples of $0.11 per cwt -- there are 11.6 gallons in a cwt. While direct Class III price transmission would be muffled, the impact of a substantial supply or demand shock would be reflected in the Class I price, therefore, directly in the producer price. Presumably because of the potential for using NDM in Class II products, Class II prices would remain directly tied to the Class III price.

USC considered the alternative of utilizing a moving average linkage between the BFP and higher Class prices. With moving averages, short-term Class I or Class II price movements could be in the opposite direction. However, the magnitude of the movement would be substantially reduced even if the BFP price movement was substantial. Moreover, the result would be relatively small changes in the higher Class prices leading to even greater potential impacts on processor margins.

As indicated previously, even under the option of component pricing with no BFP, a mover for the Class I and Class II prices can be computed. This mover can be used to obtain coordination between manufactured product values and higher Class prices.

A second issue in the relationship between Class prices involves not getting the Class II price out of line with the NDM price. When this happens, NDM is used in making Class II products on an increasing basis. Either an up-charge or a small Class II differential (assuming no Class IIIA) can deal with this problem within FMMOs. However, the up-charge can lead to distortions in processing locations when all geographic regions are not covered by orders.

**Maintaining a Progressive Industry**

The most progressive markets are those where there is continuous pressure for adjustment to the highest level of efficiency. Absent government, progressiveness is engendered by competition. If regulation stifles competition, market performance declines.

These relationships underlie the minimum price philosophy espoused at the beginning of this chapter and within the AMAA. Given a choice, it is better that the order price be lower rather than higher. Such a strategy allows the market to operate in a manner that was intended by the framers of the AMAA which, in the view of USC, reflects substantial vision of the role of government in market regulation.

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