EVALUATION OF THE BASE-EXCESS PLAN FOR LEVELING SEASONAL MILK PRODUCTION: CASE EXAMPLE OF MARYLAND

Allen M. Prindle

Abstract. Seasonal incentive plans, such as the base-excess plan, have been initiated to encourage producers to shift their production to be more similar to seasonal consumption patterns. The effectiveness of the seasonal incentive plan was evaluated by examining Maryland milk production data for the period 1966-78. The analysis indicated that month-to-month variation in milk production has increased in recent years, and suggests that current seasonal incentive plans be evaluated to encourage dairy producers to shift their production schedules.

INTRODUCTION

Dairy economists and industry leaders have long been aware of seasonal variations in milk production and milk consumption. Traditionally, milk production has followed a seasonal pattern with highest production in the spring and early summer months responding to breeding habits and availability of feed, forage, and family labor. Fluid milk consumption traditionally has followed a seasonal pattern of low demand in the summer months resulting from preferences for non-dairy beverages during the summer and higher utilization of milk beverages in school programs during other seasons.

Various plans were initiated in the 1930's and 40's to provide dairy producers with an economic incentive to shift their seasonal production to be more in line with consumption patterns. Legislation establishing the Federal Milk Marketing Orders specifies that they "provide in the interest of producers and consumers an orderly flow of the supply thereof through its normal marketing season and avoid unreasonable fluctuations in supplies and prices" (U.S. Department of Agriculture, 1971, p. 2). Dobson and Salathe concluded that federal orders have reduced problems associated with extreme seasonal variation in milk production. They suggest this conclusion results from management practices, such as dry-lot feeding of dairy cattle, and from seasonal incentive plans, such as the base-excess and Louisville plans. The base-excess plan and the Louisville plan are currently operating in various Federal milk marketing orders throughout the U.S. (Shaw and Levine). The usage of the plans is shown in Table 1.

Production-consumption imbalances for various states in the Northeast were discussed in a recent publication by Smith, *et al.* Lasley and Sleight provided information on supply-demand balancing with data from plants in 21 states. Data on balancing milk supplies with demand for a region including parts of 6 states in Western U.S. was presented by Christensen, *et al.* These studies establish the extent of seasonal milk supply balancing required by the dairy industry and estimate the costs of performing this service.

The purpose of the research reported in this article is to evaluate the base-excess plan used in Maryland in terms of its effectiveness in leveling seasonal milk production in recent years. First the operation of the base-excess plan is examined. Then a discussion of the distribution of expected benefits of the base-excess plan is presented. Monthly milk production data for the period 1966-78 are then examined to determine if producers have responded to the price incentive plan by changing their seasonal milk production to a more uniform pattern which more closely parallels milk consumption variations.

Table 1
Federal Milk Marketing Orders with Seasonal Plans, January 1, 1977

Louisville Plan[a]	Base-Excess Plan
Central Illinois	Central Arkansas
Eastern Ohio-Western Pennsylvania	Fort Smith
Indiana	Memphis
Louisville-Lexington-Evansville	Middle Atlantic
New England	Nashville
New York-New Jersey	Oregon-Washington
Ohio Valley	Southern Michigan
Paducah	
St. Louis-Ozarks	
Southern Illinois	

[a]Also called "takeout and payback" plan.

THE BASE-EXCESS PLAN

The base-excess plan is currently operating in the Middle Atlantic marketing order, which includes all of Maryland, except Garrett and Allegheny Counties (USDA-AMS-Sec. 1004.2). Those two counties produce about five percent of Maryland's milk production (Maryland Department of Agriculture). The Middle Atlantic order also covers all of Delaware and the District of Columbia and parts of Virginia, Pennsylvania, and New Jersey. Milk producers in the Middle Atlantic order establish a "base" level of production, which equals their average daily delivery of milk during the period August through December (USDA-ARS Sec. 1004.92). The producer's base is then effective for 12 months beginning the following March (Sec. 1004.93.a), during which time the producer is paid a higher "base" price for milk which does not exceed his established base and a lower "excess" price for deliveries over his base.[1]

Data in Table 2 indicate 1978 base and excess prices for the Middle Atlantic marketing region. Base prices ranged from $1.27/cwt to $1.78 above excess prices in August and February, respectively. The "base" price, "excess" price, and "blend" price in the Middle Atlantic order are calculated by the market administrator each month and are based on formulas using Class I and Class II prices. Class I prices are a constant $2.78 per 100 pounds over the Minnesota-Wisconsin (M-W) price for manufacturing grade milk, adjusted to a 3.5 percent butterfat basis (USDA-AMS Sec. 1004.50(a)). This adjustment was based on a

Allen Prindle is Assistant Professor, Department of Agricultural and Resource Economics, University of Maryland. Maryland Agricultural Experiment Station Contribution Number

[1]Under the "Louisville" plan or "takeout and payback" plan, a portion of the receipts from the sale of milk is withheld from the producer in the seasonally heavy production season. Then, during the several fall or lower production months, a portion of the withheld amount is repaid to producers based on the milk production during the month.

Table 2
Base and Excess Prices, Mid-Atlantic Marketing Area, 1978

	Base Price	Excess Price	Base Minus Excess Price
	—Dollars per 100 pounds—		
January	10.65	8.89	1.76
February	10.75	8.97	1.78
March	10.71	8.99	1.72
April	10.71	9.10	1.61
May	10.71	9.08	1.63
June	10.75	9.10	1.65
July	10.75	9.31	1.44
August	11.00	9.73	1.27
September	11.25	9.91	1.34
October	11.56	10.19	1.37
November	11.85	10.45	1.40
December	12.03	10.61	1.42
Average	11.06	9.53	1.53

Source: Mid-Atlantic Market Administrators Bulletin, Vol. X, No. 8, August 1979.

transportation charge and differences in costs of producing Grade A versus Grade B milk and has held constant at $2.78 since 1970. Class II prices have monthly adjustments to the M-W price as shown in Table 3 (USDA-ARS Sec. 1004.50(b)). Blend prices (also called "weighted average" prices) are reduced with lower Class I utilization rates, which are generally lowest during the May through August period. Base and excess prices depend on shares of milk receipts utilized for fluid use (Class I) versus manufactured products (Class II) in the market order (USDA-ARS Sec. 1004.61(b)).

The operation of the base-excess plan is designed to provide individual milk producers with financial or price incentives to shift their production to the base period or to level their production during the year. The incentives (or disincentives) result from (1) the monthly adjustments for Class II prices shown in Table 3, and (2) monthly changes in percentage of market milk utilized for Class I purposes. Price incentives are greater for producers to shift production patterns (1) when the spread between base and excess prices for any month is the greater, (2) when the seasonal variation in base and/or excess prices is the greater, and (3) when a larger portion of the milk produced in the order is sold for fluid consumption.

Table 3
Monthly adjustments to M-W Price for Order 4 Class II Milk Prices

Month	Amount
	Dollars per 100 Pounds
January	.05
February	.04
March	–.03
April	–.07
May	–.10
June	–.09
July	.05
August	.12
September	.08
October	.08
November	.08
December	.08

Source: USDA-AMS, Marketing Order No. 4, Sec. 1004.50(b).

Individual dairy producers (with perfect information) would schedule production such that they would maximize profits by responding to seasonal input and product prices. the base-excess plan operates to change milk prices month-to-month and therefore provides incentives for producers to shift toward months with higher product prices or away from months with lower product prices.

EXPECTED BENEFITS OF BASE-EXCESS PLAN

Operation of the base-excess plan is intended to benefit milk producers dairy processors and manufacturers, and consumers by providing a more uniform production pattern which would more closely follow the consumption pattern. These benefits, or potential benefits, would accrue to various participants in the dairy industry. Benefits from changes in the base-excess plan would not be shared equally by these participants. The following discussion indicates that the various participants would share rewards, but does not indicate estimates of such program changes.

Benefits to Milk Producers

Producers who shift production in response to price incentives or disincentives would expect to benefit from higher average prices for their annual milk production. Producers, however, would only expect to make the adjustment if it increased profits. Therefore, if additional costs are incurred because of a change in production scheduling which would be greater than the expected additional returns, no adjustment would occur. Many of the production inputs have seasonal price cycles or availability.

Benefits to the Dairy Processing Sector

The base-excess plan for pricing milk to Maryland producers was established to provide some benefit to dairy processors through leveling of production. The benefits to processors would result from a reduced excess processing capacity in fall and winter months, and therfore lower total and average costs of processing. In the long run cost savings may result from lower excess capacity in low production months (a fixed cost) and more efficient use of existing processing facilities. There may be some additional savings in assembly costs if everyday pickup from farms is not required. Milk producers may benefit indirectly from increased profitability of a processing cooperative if they later receive dividends from the cooperative.

Two recent publications have examined seasonal and operating milk reserves and have calculated costs of balancing supply with demand for fluid milk (Lasley and Sleight, Christensen, *et al.*). Both publications emphasize that when a milk processor obtains his milk supply tailored to his needs, the processor receives value and would be willing to pay premiums for that service. Babb, *et al.* included the value of balancing seasonal milk supplies in the amount of over-order payments in various market orders.

Benefits to Consumers

A leveler milk production pattern throughout the year would have ultimate benefit to consumers through lower prices for manufactured dairy products. This would be the result if cost savings are passed on to the consumers by processors.

Consumers would also benefit in marketing areas where Class I milk supplies would not, without the leveling process, meet fluid milk sales in some seasons. In this case, with increased production in the fall and winter months, consumers would not be required to pay the additional costs of transporting fluid milk into the area during the low production months.

ANALYSIS OF MONTHLY DAIRY PRODUCTION TRENDS

In this section, trends in monthly milk production are examined by comparing daily production rates of a month with that of the month with the highest rate to examine whether fluctuations in daily production rates have declined over the period. State-wide monthly data for Maryland are used to examine this question (Maryland Department of Agriculture).

It is recognized that year-to-year and month-to-month variations in daily milk production rates could result from a number of factors including weather, forage quality and availability, price of milk, input costs and alternative enterprise opportunities. Breeding practices also influence seasonal production.

Daily milk production has historically been highest in May. Figure 1 indicates seasonal production cycles for 1966 and 1978 by comparing the average production rate of a month with that of May, the month of highest production rates.

Figure 1 indicates that milk production was more uniform in 1966 than in 1978, contrary to the objectives of the base-excess price incentives program. A more complete examination of these relationships follows, with examination of data for the period 1966-78.

Graphically, a level production pattern would be represented as a horzontal line at 100 percent, as indicated in Figure 1 by line CC'. For each month that daily production is below the production rate of May (or other high production month), excess processing capacity may exist, and producers receive a lower average price for their production under the base-excess plan. Production levels below the rate in May may be shown graphically by line BB' or BB") in Figure 1. The area above line BB' (or BB") and below CC' represents a graphic approximation of excess capacity in the processing sector, assuming level Class I sales. It is recognized that Class I sales are not constant throughout the year, but seasonal incentive plans which reduce the wide variation in daily production rates would be evaluated as preferred to situations of wide swings in production rates.

To make year-to-year comparisons related to monthly milk production, a numerical measure of the area JBB'D ÷ JCC'D in Figure 1 was developed. The measure may be denoted as

$$I = \sum_{i=1}^{12} 1/12 \cdot M_i = 1/12 \cdot \sum_{i=1}^{12} M_i$$

where I = measure of levelnes of milk production for year (percent),

M_i = index of month i's daily production compared to daily production in the month of highest daily production.

The variable M is calculated as the daily milk production in month i divided by the daily milk production in the highest production month of the year, times one hundred. Therefore M is less than 100 for each month except the high production month when M equals 100.

Measures of levelness were calculated by the equation above for the years 1966-78, and shown in Table 4.[2] The data indicate than 1970 was the year with the highest measure of levelness (most level production). The only year that May did not have the highest monthly milk production rate was 1970. In that year production rates were higher in August and September than in May. Minor changes in the operation of the base-excess program operating in Maryland were initiated in August, 1970 with the marriage of three orders into the current Market Order No. 4. These changes included (1) a change from a July-December base forming period to the current August-December period, (2) a change from the March-June or April-June payout period to the current 12-month period beginning the following March. The possible impact of an unusual weather pattern in 1970 was not investigated.

The data in Table 4 suggest a generally declining trend, indicating that month-to-month daily milk production has not been leveling off. A statistical test of this observation was conducted by estimating the following regression equation:

$$I = 95.16 - \underset{(2.24)}{0.26}\ TIME \qquad R^3 = 0.31$$

$$F^{1},11 = 5.02$$

$$D.W. = 1.53$$

where I = index of measure of levelness and

TIME = trend variable with 1966 = 1, 1967 = 2, . . . , 1978 = 13.

The coefficient in parenthesis is the t-statistic and indicates that the trend is statistically different from zero at the 5 percent level of significance. The statistical results provide support to the observation that month-to-month variation in milk production has not been reduced in the period 1966-78.

Table 4
Measure of Levelness for Maryland Milk Production, 1966-78

Year	Measure of Levelness
1966	94.5
1967	92.7
1968	94.0
1969	95.5
1970	97.1
1971	94.8
1972	91.7
1973	91.4
1974	93.3
1975	91.0
1976	93.6
1977	91.9
1978	91.5

CONCLUSIONS

The conclusion that seasonal variation in daily milk production has not declined has important implications for policymakers interested in providing economic incentives for Maryland's dairy producers to shift their daily milk production within the year to more closely follow consumption patterns. It seems to suggest that current incentives are not effective in encouraging dairy producers to alter their production.

Existing incentives provided by the base-excess program may currently be insufficient to encourage leveling of milk production. therefore alternatives may be examined which would result in a more uniform production schedule for Maryland dairy producers. Such a plan could (1) include a higher spread between base and excess prices within a particular month or (2) provide wider variation in base and/or excess prices from month-to-month. This could be accomplished by a higher base price or a lower excess price. A higher base price would provide a positive incentive for

[2]Monthly data are available from the author.

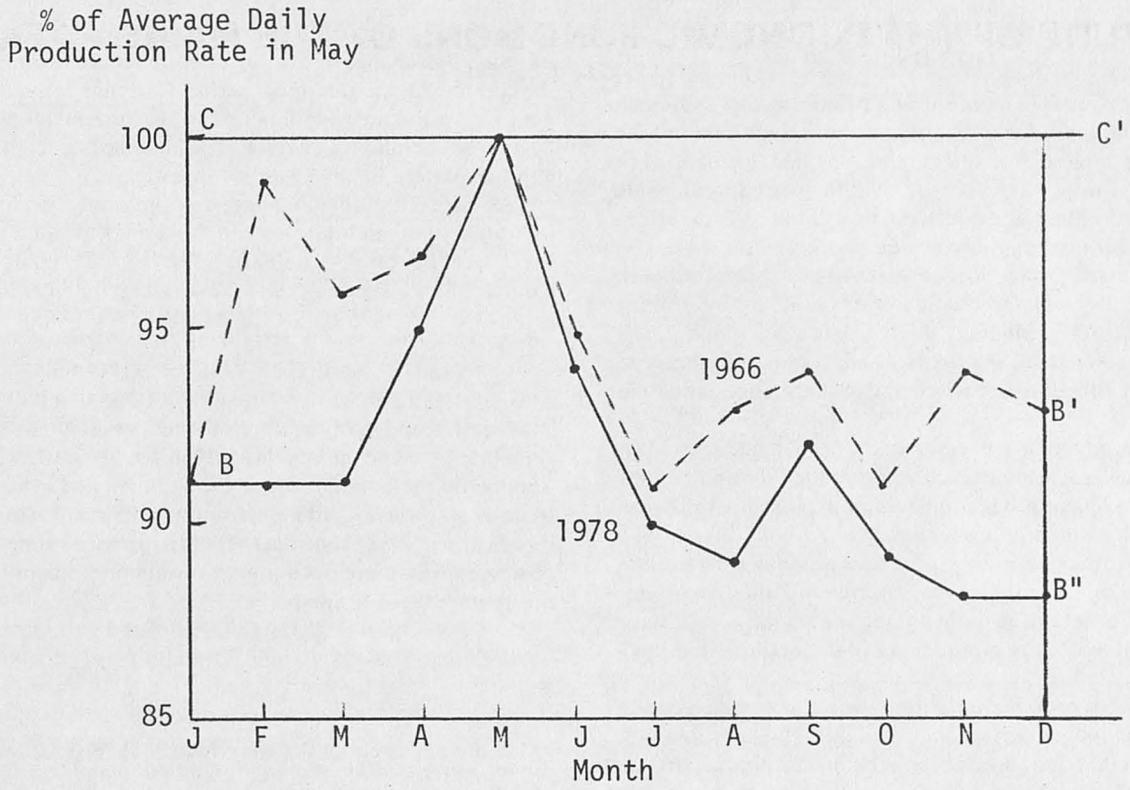

Figure 1.
Index of Daily Milk Production Rates as a Percent of May Production Rate, Maryland, 1966 and 1978

individual farmers to produce a larger volume of milk in the base-forming months of August through December. A lower excess price also would encourage more level production, and could be accomplished through adjustments for the Class II price as presented in Table 3. Changes in the seasonal utilization of dairy products are beyond the control of policy makers concerned with seasonal imbalances of milk supply and demand.

Although the data presented in this paper represent those for Maryland as a case study, it is expected that the data represent what has been occurring throughout the Middle Atlantic Milk Marketing Order.

If a more uniform milk production pattern could lead to considerable cost savings resulting from reduced excess manufacturing capacity and/or from delaying or eliminating the fixed costs of constructing new capacity, such savings could be used as a source of funding to provide price incentives to producers to level their production. Such savings could also be passed along to consumers in the form of lower prices for dairy products.

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