



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

CORNELL
AGRICULTURAL ECONOMICS
STAFF PAPER

THE SOLIDS STANDARDS ISSUE

Robert D. Boynton

Presented at the Cornell University Conference
"Increasing Milk and Milk Product Consumption:
Issues for the 80's"

March 15, 1983
Hotel Syracuse
Syracuse, NY

April, 1983

No. 83-5

Department of Agricultural Economics
Cornell University Agricultural Experiment Station
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Cornell University, Ithaca, New York 14853

It is the policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age or handicap. The University is committed to the maintenance of affirmative action programs which will assure the continuation of such equality of opportunity.

PREFACE

The author would like to thank several people who contributed to the development of this presentation. Walter Spivey of the California Bureau of Milk Stabilization provided necessary data. C.B. Sheldon of the California Milk Advisory Board furnished data on the state's advertising expenditures. Leland Lockhart and William Rolf of California's Bureau of Milk and Dairy Foods Control offered useful information on California's standards enforcement and milk quality programs. Jay Gould of the League of California Milk Producers and William VanDam of Clover-Stornetta Farms, Inc. shared their insights on the issue of higher solids standards for fluid milk products. David Bandler of Cornell University's Food Science Department and William F. McDonald of United Dairy Industry Association provided information on the research literature dealing with consumer preference for high solids fluid products.

Anyone desiring a copy of this paper or having questions on the material contained herein should contact:

Robert D. Boynton
Associate Professor
Department of Agricultural Economics
Cornell University
359 Warren Hall
Ithaca, NY 14853-0398
(607) 256-7600

TABLE OF CONTENTS

	<u>Page</u>
Fluid Product Standards.....	1
The California Experience With High Solids.....	3
Consumption.....	3
Advertising.....	6
Milk Quality.....	7
Demographics.....	7
The Effect of Higher Solids on Sales.....	7
The Enforceability of Higher Solids Standards.....	10
Should the Federal Government Mandate Higher Standards.....	10
Solids Standards and Multiple Component Pricing.....	11
Concluding Comments.....	12
References.....	13

THE SOLIDS STANDARDS ISSUE

Robert D. Boynton

The issue is whether or not federal minimum solids standards for fluid milk products should be raised, or more specifically, whether or not to increase the minimum solids-not-fat (SNF) and total solids standards established by the Food and Drug Administration (FDA) for fluid milk products in interstate trade. Despite the fact that the Hayakawa Amendment specifying increased solids standards was not acted on in the last session of the Congress, the issue of increased solids standards is not dead. There appears to be considerable interest among dairy farmer cooperatives, some consumer organizations, and some members of Congress in increasing the minimum solids standards for fluid milk products.

I would like to address six questions related to the solids standards issue. First, what are the proposed standards changes? That is, what did the Hayakawa Amendment call for, and what did the National Milk Producers Federation (NMPF) offer as amendments to the Hayakawa plan. Second, have California's high solids standards led to increased consumption of fluid milk products in that state? Third, will more milk be sold in the United States if standards are raised? Fourth, are higher standards for fluid milk products enforceable? Fifth, should/must the federal government mandate higher standards? Lastly, what is the relationship between higher solids standards and multiple component pricing?

FLUID PRODUCT STANDARDS

Let's briefly consider the whole milk, lowfat and skim milk standards (Table 1). The current standards specified by the FDA call for 8.25% SNF in whole milk. Notice that California has an 8.6% standard and an overall or total solids standard of 12.2%. The Hayakawa Amendment, without changing the fat or SNF component, specified that total solids had to match the California level. In response, NMPF suggested that the SNF standard be increased to 8.75% and total solids to 12.0%. The concern that the NMPF had with the Hayakawa standards was that they were too wide open. First, the California Senator's plan allowed the total solids standards to be met by increases in either, or both, solids components. Second and perhaps most important, the Hayakawa Amendment did not specify the source of those added solids. NMPF's proposed amendment to the Hayakawa plan made sure that the higher solids would come in the form of higher SNF and that the source of those solids could not be lactose or other less nutritious solids or imported casein. Hayakawa apparently accepted NMPF's modifications.

Table 2 shows the lowfat milk standards. Again, notice that a major difference between the current standards and the ones NMPF proposed is in the SNF component--raising it from a minimum of 8.25% to a minimum of 10%. This matches

TABLE 1. MINIMUM WHOLE MILK STANDARDS

	F.D.A.	CALIF.	HAYAKAWA (proposed)	N.M.P.F. (proposed)
FAT	3.25	3.4	3.25	3.25
SNF	8.25	8.6	8.25	8.75
TOTAL SOLIDS	[11.5]	12.2	12.2	[12.0]

TABLE 2. MINIMUM LOWFAT MILK STANDARDS

	F.D.A.	CALIF.	HAYAKAWA (proposed)	N.M.P.F. (proposed)
FAT				
Low	0.5	1.9	0.5-1.0	0.5-1.0
High	2.0	2.1	1.0-2.0	1.0-2.0
SNF	8.25	10.0	8.25	10.0
TOTAL SOLIDS				
Low	[8.75]	[11.9]	11.0	11.0
High	[10.25]	[12.1]	12.0	12.0

TABLE 3. MINIMUM* SKIM OR NONFAT MILK STANDARDS

	F.D.A.	CALIF.	HAYAKAWA (proposed)	N.M.P.F. (proposed)
FAT	≤ 0.5	≤ 0.25	≤ 0.5	≤ 0.25
SNF	8.25	9.0	8.25	9.0
TOTAL SOLIDS	[8.25]	[9.0]	9.25	9.25

* except as noted

the current California standards. The skim or nonfat milk standards are shown in Table 3. NMPF proposed to raise the SNF standard to 9.0% from the current FDA minimum of 8.25%.

THE CALIFORNIA EXPERIENCE WITH HIGH SOLIDS

What can be learned from the California experience with higher solids standards? It seems as though every time this issue comes up, regardless of what side of the issue one is on, California is cited as the basis for making a decision on the wisdom of raising the solids standards nationwide. In this section of the paper California's consumption characteristics will be examined first. Then I will suggest that any favorable consumption trends one sees in California could be explained by several factors besides the state's high solids standards.

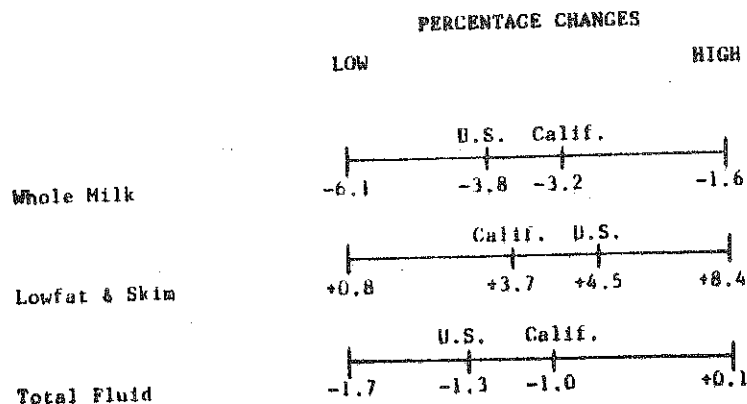
Consumption

Let's first consider per capita consumption trends in California. Figure 1 shows per capita consumption of fluid milk products in 1980--for the U.S., California, and for the particular region with the highest per capita consumption in 1980 (composed of aggregations of federal milk marketing order areas). For all 5 fluid product categories, California's per capita consumption exceeded the U.S. average. However, there was always at least one other region of the country that achieved higher per capita consumption in 1980 than California.

In Figure 2, for these same five fluid products, the ten year change in per capita consumption of fluid milk products in pounds is shown. Again, the U.S. average, the California performance, and that region of the country that had the most favorable change in per capita consumption in that ten year period are arrayed. Notice that California's performance exceeded the U.S. average, however, once again there is always one region of the country that registered better per capita consumption changes than did California.

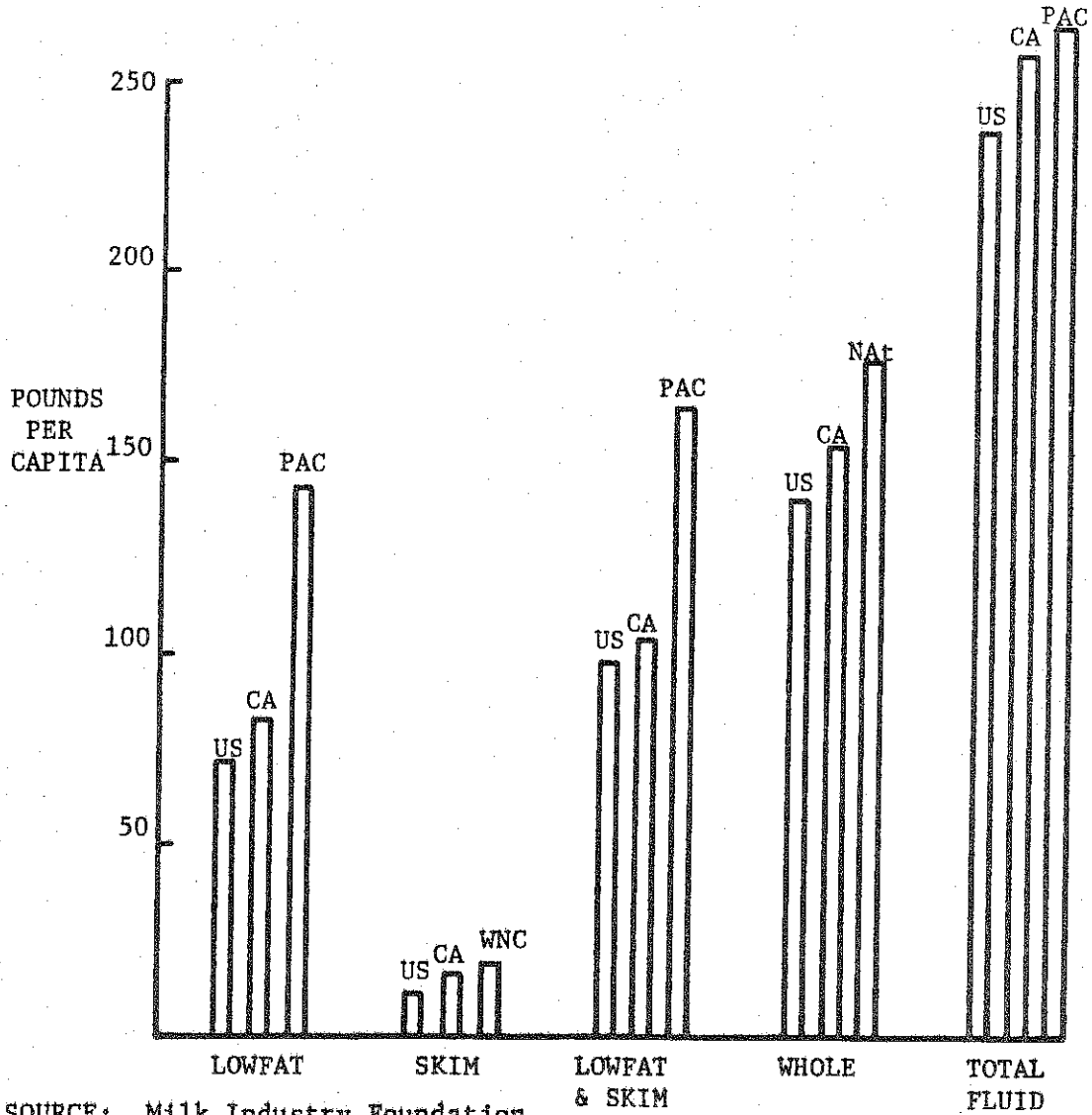
Taking one final look at consumption patterns in California, Figure 3 shows annual percentage changes in per capita consumption for the five year period 1975 to 1980 and looks at three classes of fluid products: whole milk, lowfat and skim, and all fluid products. On a percentage basis, once again California's

FIGURE 3. AVERAGE ANNUAL CHANGE IN PER CAPITA CONSUMPTION BY REGIONS, 1975-1980



SOURCE: Milk Industry Foundation

FIGURE 1. 1980 PER CAPITA FLUID MILK PRODUCT CONSUMPTION*



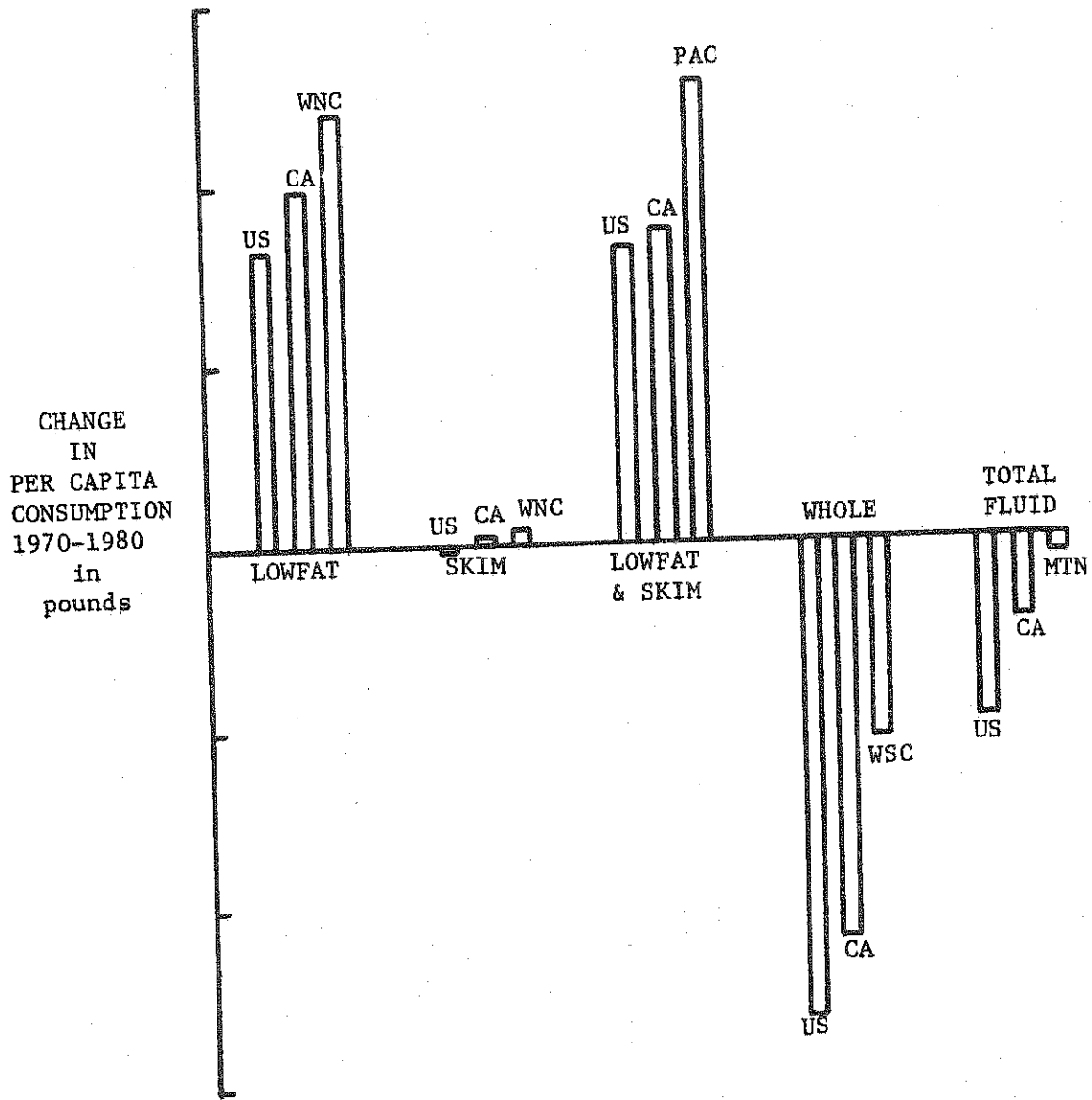
SOURCE: Milk Industry Foundation

* US = United States federal order average

CA = California average

PAC = Pacific federal order region; WNC = West North Central federal order region; NAT = North Atlantic federal order region

FIGURE 2. 10-YEAR CHANGE IN PER CAPITA CONSUMPTION OF FLUID MILK PRODUCTS*



SOURCE: Milk Industry Foundation

* US = United States federal order average
CA = California average
WNC = West North Central federal order region; PAC = Pacific federal order region;
WSC = West South Central federal order region; MTN = Mountain federal order region

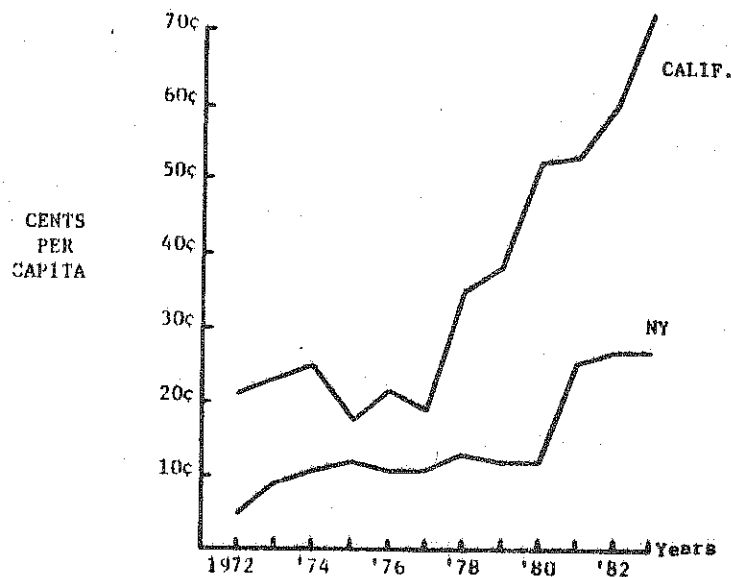
whole milk consumption performance lies somewhere between the U.S. average and the performance of the best region of the country. But, for lowfat and skim, California's 3.7% rate of gain on an annual basis was not as good as the U.S. average of 4.5% and was less than half the rate of gain achieved in the best region of the country. For total fluid product consumption, again California is slightly better than the U.S. average, but still in decline and still below the performance of the best region of the country.

Regardless of one's assessment of California's consumption performance, caution must be exercised in attributing performance to any particular factor. I would submit that there are at least three factors other than higher solids that might explain their consumption performance*--California's high rate of advertising, their strong milk quality program particularly at the farm level, and the state's favorable demographic characteristics in the last ten or fifteen years relative to other parts of the country. Each of these will be examined briefly in turn.

Advertising

Figure 4 depicts per capita expenditures on in-state advertising and promotion for the period 1972-1983 for California and New York state. Notice that on

FIGURE 4. PER CAPITA EXPENDITURES ON IN-STATE ADVERTISING & PROMOTION 1972-1983



SOURCES: California Milk Advisory Board.
Stavins and Forker.
NYS Promotion Order Budget, 1980-83.
Population estimates from Shahbazian and Brooks (California) and Dairy Industry Services (NY).

* Some students of the dairy industry claim that consumer prices for fluid milk products have been low relative to other parts of the country, further favoring high per capita consumption in that state. No comprehensive, reliable data were available to allow me to objectively evaluate this claim, however.

a per capita basis, California farmers' contribution to advertising exceeded New York's in every year with the discrepancy between the two states growing wider over the period. In 1983, California producers will spend on the average, 73¢ per person in the state on in-state advertising and promotion compared to New York State's 27¢ per capita. Since per capita media costs vary greatly from city to city the results achieved with a given per capita advertising level will also vary. Consequently, per capita advertising expenditures do not directly correlate with advertising effectiveness. Despite this potential difference between the two states, it seems likely that California has achieved greater advertising coverage than has New York over this 12-year period. This could easily explain all or part of any favorable consumption trends in California.

Milk Quality

Since 1969 California has required a recording thermometer on all Grade A bulk tanks. That recording thermometer is used by the tank truck driver to downgrade any milk not cooled quickly enough or kept at the required level. California's rule states that within two hours of completion of the first milking or four hours after the start of the first milking (whichever occurs first) the milk in the tank has to be below 50°F and at no time after that can the temperature of the milk rise above 50°F [Lockhart]. This and other quality control efforts in California plus their favorable climate and processors' long-time concern for milk quality have led quality experts to conclude that California's milk quality is among the highest in the nation. One might attribute all or part of any desirable consumption trends one sees in California to high levels of milk quality.

Demographics

Finally, demographics might also explain some of California's consumption performance. In general, California has a younger population than many of the other regions of the country. Also the percentage of its population which is nonwhite is lower than most other regions.*

THE EFFECT OF HIGHER SOLIDS ON SALES

If standards were raised in the manner suggested by NMPF to closely match those in California, would more milk be sold? Some would more specifically ask, would more SNF be sold? The first question that always comes up in this regard is the issue of taste. Will fluid milk products taste better and if so will consumers be willing to pay more for the improved products. Unfortunately, very little well-designed, objective research on consumers' taste preferences for high solids milk exists. Most of what is available has been done on either a very limited basis or was done many years ago. It would appear that consumers can detect taste differences when SNF test varies by one point or more and they prefer the higher solids product. In a 1963 Arizona study, 55% of surveyed consumers said they would be willing to pay up to 2¢ more per half gallon for this high solids milk [Hillman, Stall and Angus]. Total milk sales volume for the test and control distributors in the market experiment were unaffected. This maintenance of sales levels in the face of higher prices for the fortified

* While California has enjoyed a racial mix favorable to milk consumption, large numbers of Southeast Asian immigrants since 1980 will reduce the state's demographic advantage.

product in some stores lends some support to the improved taste hypothesis. Given the age of the study, its limited scope, and most importantly, its design (both high solids and regular solids products were available for purchase in each store), I am reluctant to assume that total fluid volume would remain unchanged in the face of nationwide, comprehensive fluid product price increases. I choose the conservative approach of assuming that no taste effect would obtain and that consumption of fluid products would respond according to the applicable demand elasticities and product price changes. To the extent that a taste effect would obtain, the analysis which follows represents pessimistic sales projections.

Let's first look at some estimates of cost and price changes for three fluid milk products as a result of increasing the solids standards. Cost estimates vary, but within a fairly narrow range we can estimate that whole milk would probably increase in ingredient cost about 1¢-2¢ a gallon, lowfat about 10¢-12¢, and skim milk about 2¢-4¢ (Table 4) [see Ballard and Vitaliano; Goold; Jacobson; Stammer]. Translating these ingredient cost changes into price changes proves to be difficult for at least two reasons. First, there are cost changes arising from the higher standards other than from changes in ingredient costs. There would be changes in labor costs and equipment costs and these are a bit more difficult to factor in [see Ballard and Vitaliano]. But perhaps the factor making the prediction of price changes most difficult is the pricing strategies used by retailers for fluid milk products. If one looks at the current price differentials between these three products in most retail grocery stores, one will find that the price differences are much less than would be suggested by differences in ingredient costs. That is, based on ingredient costs, lowfat and skim milk would be priced considerably less than they currently are relative to whole milk. Consequently, some have suggested that, faced with a mandatory increase in solids, wholesalers and retailers would simply maintain the current price differentials among these three products [Stammer]. If they did this, price changes for all three products would be minimal, equal to about what the whole milk price change would be. In the process, the processing and/or retail sectors would have to absorb most of the extra ingredient cost. Others have suggested pricing mix changes which result in a spreading of the ingredient (and other) cost changes over all three products.

What I have tried to do here is to look at some reasonably conservative price changes and some fairly dramatic price changes to hopefully bracket those that might occur. The own-price elasticities of demand used here for these three fluid milk products are those estimated by Boehm and Babb in a 1975 study. The short-run elasticities in the last column of Table 4 are typical of those found in other studies of fluid milk demand. The long-run elasticities are quite large and atypical for what we usually think to be the case with fluid milk products. I have chosen to use those long-run elasticities as an extreme measure of the price effect.

Table 5 shows the changes in total fluid sales volume, butterfat sales, and SNF movement as a result of these four combinations of minimum and maximum price changes and long-run and short-run elasticities. In the first column of Table 5 are the projected decreases in total fluid sales volume. Assuming the biggest price increase and using the long-run elasticity, fluid sales are expected to fall almost 8% over the 1981 levels; at the other end of the spectrum examined,

TABLE 4. ESTIMATED COST AND PRICE INCREASES FOR FLUID MILK PRODUCTS

	INGREDIENT COST CHANGE ESTIMATES -----per gallon-----	PRICE CHANGE ESTIMATES	OWN-PRICE ELASTICITIES	
			Long Run	Short Run
WHOLE	+1 - +2¢	+2 - +8¢	-1.7	-.38
LOWFAT (2%)	+10 - +12¢	+8 - +12¢	-1.33	-.55
SKIM	+2 - +4¢	+4 - +8¢	-1.82	-.12

TABLE 5. ESTIMATED CHANGES IN U.S. SALES OF FLUID PRODUCTS, BUTTERFAT AND SNF, COMPARED TO 1981 LEVELS ^{a/}

	CHANGE IN TOTAL FLUID SALES VOLUME (percentage)	CHANGE IN BUTTERFAT SALES ^{b/} (million lbs.)	CHANGE IN SNF SALES (million lbs.)
NO CHANGE IN 1981 SALES	-0-	-0-	+296.5
SALES DROP (MIN. PRICE CHANGE)			
LR	-3.5%	-27.7	+137.5
SR	-1.2%	-8.3	+241.9
SALES DROP (MAX. PRICE CHANGE)			
LR	-7.9%	-80.1	-49.7
SR	-2.3%	-21.2	+191.2

^{a/} California excluded

^{b/} Lowfat milk assumed to contain 1.068% butterfat on average and skim milk to be 0.304% fat. These figures were average tests of final products in 15-market Federal Milk Market Administrator Service Unit No. 1 study.

a fairly modest but still significant sales loss of 1.2% occurs with the smallest price change and the short-run elasticity. The long-run butterfat sales drop from the maximum price change would be about 80 million pounds compared to 1981, while in the short run with the minimum price change, the estimated loss in butterfat sales is just over 8 million pounds. These losses in butterfat sales result not from changes in the butterfat standards (because virtually no changes in the current FDA fat standards were proposed) but rather because total fluid milk consumption would go down.

Proponents of higher minimum solids standards argue that some of the nonfat dry milk powder building up at a rapid rate in government warehouses could be used to fortify fluid milk products. As the data in the last column of Table 5 suggest, under most conditions more nonfat dry milk could be used commercially if the solids standards were raised, but at the expense of fluid and butterfat sales. The magnitude of the extra movement of SNF could be considerable but not of a magnitude sufficient to quickly reduce the current government stockpile. To put this in perspective, the largest change in SNF sales shown in Table 5 is just under 300 million pounds or a little less than a quarter of the current government stockpile. (This would be expected to obtain if the price effect was exactly offset by the taste effect, resulting in no change in sales from the 1981 level.) When no taste effect is assumed, the extra SNF sales are, of course, even less. Notice that in the case of the largest price increase and using long-run elasticities, sales of total non-fat solids actually decline rather than increase over the 1981 situation.

THE ENFORCEABILITY OF HIGHER SOLIDS STANDARDS

In 1982, the solids content of fluid milk products was studied in fifteen federal order areas in the central U.S. [Fed. Milk]. Among other things, it was discovered that 53% of the whole milk sampled did not meet the minimum butterfat requirement. Also, the SNF test of final fluid products was less than the test of producer milk in all of the nonfortified products tested. Finally, it was found that from 23% to 86% of the studied handlers in these 15 markets produced fortified products which did not meet their own fortification claims (based on comparisons with the test of the producer milk used). It would appear that there is some reason for concern regarding compliance and enforcement.

Apparently California has tighter control. Staff in their state agency responsible for standards enforcement believe they are getting about 85-90% compliance on fluid milk products [Lockhart]. They likely do a number of things a bit better than they are done in the rest of the country. On an unannounced basis, products are sampled and tested from every plant in the state at least four times every six months. The penalties for violations are apparently fairly effective. In my opinion, if mandatory higher standards are an idea whose time has come, the enforceability issue should not hold up the implementation of higher standards. It would appear that enforceability can be improved to the point where compliance is not a serious problem. Undoubtedly, this will be a more costly process than the current one.

SHOULD THE FEDERAL GOVERNMENT MANDATE HIGHER STANDARDS

I would like to address this issue apart from the question of any economic gains or losses. That is, regardless of the changes in sales of nonfat dry milk, butterfat, or total fluid products, does it make sense for the government

to mandate higher standards. There are at least three points to make in this regard. First, in some ways this is a philosophical question which turns on the issue of free markets and government intervention. Do we want to rely on the market to determine the product mix available or is it necessary for the government to mandate the type of products that are offered for sale? Related to this of course, is the freedom issue. Should consumers be free to choose from a variety of products or should fairly high minimum standards be mandated so that some consumers are not able to exercise their option to buy a lower solids product if they wish? Obviously, there is no simple answer to this question, but it is important to recognize that for some the issue turns on this question.

The second issue here is nutrition. Does it make sense to mandate better nutrition? To some it does but to others it does not. Unless the change in tastes is strong, it would appear that less fluid milk products would be sold. For some, the increase in price will cause them to stop purchasing fluid milk products. Will the aggregate level of nutrition in this case really be heightened by higher solids?

The third point--and it is related to the other two--is the question of market failure. That is, has the market failed to give consumers the kinds of products they really want? I would only offer this observation. In the period from 1969-1981, the percentage of fortified lowfat and skim milk products sold in federal order markets fell from 76% to 20% [MIF, p.35]. That is, the market was offering fortified lowfat and skim products but consumers support for them waned. This suggests to me that the market had a chance (and still does) to support high solid products but perhaps consumers do not prefer those products or at least do not prefer them enough to pay the required premium.

I am aware that there might be reasons to think that the market would have some difficulty supporting high solids milk, namely milk's homogeneous nature and the concomitant problems of informing consumers of product differences (establishing unique fluid product identities) in what is, in most localities, a very competitive environment. Notwithstanding these potentialities, the market did support high solids products well at one time, but these products lost ground due to the rising cost of fortification ingredients. To me this does not suggest market failure.

To this point the discussion has been at a very aggregate or general level. It might be well therefore, to point out that in all likelihood there is a market for high solids fluid products. Properly segmented and developed, fortified products could likely be effectively (read, profitably) marketed to that consumer segment desiring rich or gourmet-type products (as Borden's is apparently attempting to do now with their lowfat line). Creative marketing can be expected to turn up such opportunities and such aggressiveness is badly needed in fluid milk markets.

SOLIDS STANDARDS AND MULTIPLE COMPONENT PRICING

It seems to me that if either multiple component pricing or increased solids standards are to be mandated, they probably both should be. California raised their solids standards in 1962 and then in 1965 installed multiple component pricing for Class I milk. Multiple component pricing for the other classes came somewhat later. If either of these changes are made without the other, equity problems are likely to emerge and disorderly market conditions probably

are inevitable. If higher SNF are mandated, the nonfat solids standards should be set at or above the average test of producer milk, so that most handlers do not have to incur ingredient costs which are not recoverable in the wholesale/retail market.

It seems to me that if we leave this issue of solids and multiple component pricing to the marketplace, more and more cheese plants will implement multiple component pricing (butterfat and protein, for example) with the gains being divided between the parties. In fluid product markets, multiple component pricing is unlikely to develop voluntarily. Any handlers who successfully market high solids products will not likely share their gains with producers via multiple component pricing, however, farmers would benefit whenever handlers used nonfat dry milk powder or condensed skim milk to produce fortified products.

Fluid milk processors are understandably concerned about increasing the solids standards. Three reasons are frequently mentioned. First they are concerned about the inequities that would arise if standards were raised without multiple component pricing. For example, one handler whose farmers deliver him milk that is very high in SNF might not have to purchase any additional SNF to meet the minimum standards. Another handler who does not receive high solids producer milk would have to purchase additional solids in the form of condensed skim or nonfat dry milk powder. A second concern is that some processors, as a result of retail pricing strategies and consumer preferences, might be forced to absorb some of the extra ingredient costs from fortification, as was suggested earlier. Third, a number of the fluid processors are concerned about a drop in fluid sales volume upon imposition of higher standards. It seems that a well-designed multiple component pricing plan could relieve the equity concern of processors, however, the other two concerns would likely remain.

CONCLUDING COMMENTS

I have attempted to address a number of questions related to the solids standards issue. I believe it is a very important issue and one which will come up again, if not this year, then in the next few years. I think there are a number of things the industry should think about before pushing for higher solids standards. I would hope that the industry would not be persuaded to adopt higher standards because of the government's current stockpile of nonfat dry milk powder. This is not a quick way out of that problem. Moreover, what these changes might do in the long run to fluid markets must be carefully considered. Finally, I think caution is in order regarding any assumptions about the improved acceptance of higher solids products by consumers.

REFERENCES

- Ballard, Daniel A. and Peter Vitaliano. "The Impact on Product Cost of Increasing the Minimum Standards for Nonfat Solids in Fluid Milk Products," Selected paper at 1982 annual meeting of Southern Agricultural Economic Association, Orlando, Florida, February 1982.
- Boehm, W.T. and E.M. Babb. Household Consumption of Beverage Milk Products, Purdue University Agricultural Experiment Station Bulletin No. 75, March 1975.
- California Milk Advisory Board. Advertising and promotion data supplied at author's request by C.B. Sheldon, Program Director, Manufactured Products, March 1, 1983.
- Dairy Industry Services. New York State Dairy Statistics, 1981 Annual Summary, Department of Agriculture and Markets, Albany, New York.
- Federal Milk Market Administrator Service Unit No. 1. Composition of Fluid Milk Products in Selected Federal Order Markets, Overland Park, Kansas, June 1982.
- Goold, J. Minimum Component Standards Project for Fluid Milk, League of California Milk Producers, Sacramento, California, 1982.
- Hillman, J.S., J.W. Stall, and R.C. Angus. Consumer Preference and Acceptance for Milk Varying in Fat and Solids-Not-Fat, Technical Bulletin 153, Agricultural Experiment Station, University of Arizona, May 1963.
- Jacobson, Robert E. "Case For and Against Higher SNF Standards for Fluid Products," presented at 50th Dairy and Food Industry Conference, The Ohio State University, February 16, 1983.
- Lockhart, Leland. Bureau of Milk and Dairy Foods Control, California Department of Food and Agriculture, personal interview, March 1983.
- Milk Industry Foundation. Changing Patterns of Fluid Milk Sales, Washington, D.C., November 1982.
- Shahbazian, V.L. and Elton Brooks. California Dairy Industry Statistics - 1981, Bureau of Milk Stabilization, California Department of Food and Agriculture, Sacramento, California.
- Stammer, Richard. Staff paper on solids standards, Agri-Mark, North Andover, Massachusetts, November 23, 1982.
- Stavins, Robert N. and Olan D. Forker. Dairy Promotion in New York State 1963-1979, A.E. Res. 79-17, Cornell University, September 1979.