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# rBST, Federal Dairy Policy, and the Future of the U.S. Dairy Industry*

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# rBST, Federal Dairy Policy, and the Future of the U.S. Dairy Industry

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The debate over rBST leading up to the time when this technology was approved for commercial use (in February, 1994) and continuing still has been one of the most protracted and contentious in the agricultural sciences in modern times. It is a topic that has been intensely researched by animal scientists, veterinary scientists, medical scientists, and social scientists. Yet scientists and policymakers alike have been frustrated by interest groups who ignore or discredit findings that have met accepted scientific standards, and who support agendas that meet less rigorous standards or even questionable standards. These interest groups feel that the scientific community has misled the public, or obfuscated on its responsibilities to serve the public, or become tainted in some way by private industry with a stake in the manufacture and sale of rBST. These same groups see serious human or animal health risks, serious social repercussions, or other problems attendant to the use of this technology, and have been incensed at scientists and/or policymakers who, in their view, fail to give these issues primacy.

Our purpose here is not to prolong the debate nor to discredit particular views, but rather to review as objectively as possible the facts about the consequences of rBST use as we know them and as revealed by available scientific evidence. For this purpose, we draw exclusively on the evidence presented by authors in a recent compendium (Hallberg, 1992), in a report prepared by British economists (Bent and Buckwell, 1993), and in a study conducted by the Executive Branch of the U.S. Government (1994). Collectively these reports represent the most recent and comprehensive review of findings concerning rBST use. We will organize this review around seven topical areas in an effort to provide background for the final section of the paper which focuses on the policy implications of rBST use.

## Is rBST Safe?

### To Humans from Milk and Dairy Product Consumption

There is no evidence to date that milk produced from cows administered rBST is unsafe to drink or that products made from milk produced from cows administered rBST are unsafe to eat. Research results indicate that milk composition is generally far more sensitive to change in the cow's diet, state of cow health, inherent genetic factors, and environmental conditions than to rBST treatment (Kroger, 1992; Muller, 1992). The overall composition of milk over the lactation period is not substantially altered by treating cows with rBST (Muller, 1992). In summary, findings to date indicate that:

1. There are slight variations in milkfat and milk-protein content immediately after rBST treatment, which is common after any feed or metabolic adjustment.

2. Milkfat, protein, lactose, total solids, and solids-not-fat percentages are unaffected by rBST treatment over a full lactation period and are not different from those of milk from nontreated cows.

3. Milk-ash or mineral content, specifically phosphorus and calcium contents, are not altered by rBST treatment.

4. The meat derived from rBST-treated cows tends to have a lower fat content, but is otherwise identical to that from untreated cows.

5. A slight shift in the casein, whey protein, and nonprotein nitrogen fractions in milk produced from rBST-treated cows has been observed in some experiments. This does not affect milk quality, but may affect cheese yields from milk.

6. rBST treatment has no effect on the relative proportions of short-, medium-, and long-chain fatty acids.

7. No changes in free fatty-acid content have been noted from rBST treatment; therefore, no influence on off-flavor "rancidity" is anticipated, nor is vulnerability to oxidized flavor development.

Because of public interest in this issue, FDA's Center for Veterinary Medicine took the unprecedented step of authoring a paper published in Science covering in detail the decision to authorize food derived from rBST-treated cows to be consumed by humans (Juskevich et al., 1990). These scientists summarized more than 120 studies that examined the safety of milk and meat from dairy cows treated with rBST. On the basis of this scientific evidence, FDA concluded that there are no human safety hazards associated with consumption of food products derived from dairy cows treated with rBST. FDA's position has been affirmed by external review groups including the National Institutes of Health, the Congressional Office of Technology Assessment, a Joint Expert Committee on Food Additives of the World Health Organization and the Food and Agricultural Organization of the United Nations, drug regulatory bodies of the European Union, and studies conducted by other countries including Canada and the United Kingdom (see U.S. Government, 1994).

To The Dairy Cow

The big concern here is with mastitis. The evidence suggests, however, that while there is a positive relationship between increased milk production per cow and the incidence of mastitis, rBST does not appear to alter that relationship (see Muller, 1994). Further, the incidence of mastitis is greatest during the early weeks of lactation, a time when cows are not to receive rBST treatment. The European Union's Committee for

Veterinary Medicinal Products is also satisfied that rBST treatment poses no health or ethical problems in dairy production (Bent and Buckwell, 1993).

To The Environment

No direct adverse environmental impacts are expected from rBST use since rBST itself is not persistent in the environment. Accidental releases into the water or soil pose no threat. The use of rBST does not produce harmful residues in milk, manure, or urine. The Office of Technology Assessment (1991) concluded that the gain in production efficiency attributable to rBST use would mean less feed, less fertilizer, less pesticide use, and fewer animals. With fewer animals, there would be less fecal waste, urinary nitrogen, and methane gas. This has been affirmed by Greaser (1992) and by Johnson et al. (1992). Thus the environmental impact of rBST adoption should be positive, not negative.

Some groups are concerned that rBST use will lead to increased concentrations of dairy animals which, in turn, will lead to intensified environmental and other conflicts near urban areas. Increased concentrations of animals brought about by the "industrialization of agriculture" clearly are accompanied by such conflicts. However, it is hardly just to criticize rBST or any other single technology or market development for bringing about the "industrialization of agriculture". This is a phenomenon that has been evolving over the past several years due to a combination of several factors. It will continue apace even in the absence of rBST adoption.

## How Much More Milk From The National Herd?

Early claims for increases in output per cow from rBST treatment (as much as a 40 percent increase) were grossly exaggerated. Most studies indicate that cows with low or medium production tend to show a higher proportional response to rBST treatment than do high-producing cows. A more reasonable projection appears to be that, on average, milk production per treated cow will increase by 1,800 pounds per year (as assumed by U.S. Government, 1994) -- in the neighborhood of a 12 percent increase over the 1993 average milk output per cow in the United States. Several factors, however, will condition this response: (1) quality of herd management, (2) quality and availability of feed, (3) the dosage level of rBST, (4) the time at which rBST is first administered during a cow's lactation cycle, (5) the age of the cow administered rBST, and (5) the body condition and general health of the cow prior to the start of treatment and during treatment.

To determine the impact on aggregate U.S. milk supply, the rate of farmer adoption of rBST is, of course, critical. Since there is no reason to administer rBST during the dry period of the lactation, and most recommend not administering rBST until the ninth week after calving, at most 66.7 percent of the national dairy herd will be receiving rBST during a given year. We also know from past experiences that all farmers do not adopt a new technology at the same time. The technology adoption curve is generally considered to be S-shaped. We must, of course, guess at what year into the future the inflection point of this curve will occur and when the upper asymptote will be reached indicating that 100 percent of the farmers will have adopted rBST (i.e., at what point 66.7 percent of the national dairy herd is treated). A recent study (U.S. Government, 1994) assumed the following rBST cumulative adoption rates over the next 15 years:

| Marketing Year | Percent of Cows Receiving rBST |
|---|---|
| 1993/94 | 5 |
| 1994/95 | 17 |
| 1995/96 | 27 |
| 1996/97 | 30 |
| 1997/98 | 32 |
| 1998/99 | 34 |
| 1999/00 | 38 |
| 2000/01 | 43 |
| 2001/02 | 49 |
| 2002/03 | 55 |
| 2003/04 | 58 |
| 2004/05 | 60 |
| 2005/06 | 61 |
| 2006/07 | 62 |
| 2007/08 | 63 |

In Figure 1 we show a cumulative response curve that is based on the above data but smoothed somewhat to reflect the more typical response pattern of farmers to new technologies. Here also we extend the curve out to 2010.

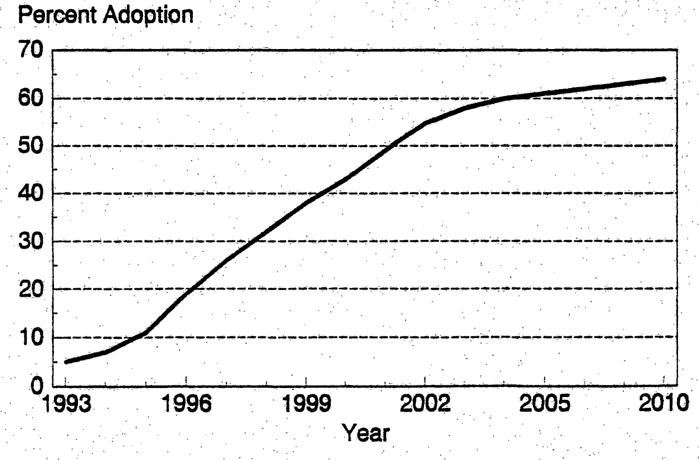


Figure 1. Expected Rates Of Adoption Of rBST To Year 2010.

Superior Management Will be Required

A common myth appears to be that all dairy farmers will need to do is inject their cows with rBST (a two-hour per year job to inject a cow at 14-day intervals beginning 65 days into the lactation and terminating 265 days into the lactation), then sit back and reap the benefits. Management is always one of the more important ingredients in the production process. This will be as true with rBST as with most other such technologies as Patton and Heald (1992) point out. Indeed a case can be made that managing the dairy operation when rBST is used will be even more important than is management now without rBST. Important issues here include calf and heifer management, managing the body-condition of treated cows, feeding management for the treated cow and for the cow before treatment begins, forage quality, management of the dry cow to be treated after calving, managing the calving interval, and managing for cow comfort. It is likely that only the superior managers will be able to take full advantage of this technology.

Increase in Aggregate Milk Production Since Introduction of rBST

Although there are as yet few observations with which to estimate the impact of rBST introduction on the national milk supply, it is instructive to attempt to do so. For this purpose we estimated by ordinary least squares a regression equation for milk production per cow and for the number of cows using monthly data from January 1965 through November 1994 for the United States as a whole. In these regressions we include among those variables known to influence monthly milk production and cow numbers, a variable designed to capture the impact of rBST introduction in February of 1994. Production per cow and number of cows were divided by the number of days in the respective months so that regression coefficients (in particular, those on monthly dummy variables and the variable designed to capture the impact of rBST to date) were not influenced by the differing number of days in the month.

Production per cow per day lagged one month and lagged three months were used as independent variables in the "production per cow" equation to reflect a capacity constraint (and to help ameliorate the econometric problems associated with serial correlation of the residuals). Limited experimentation was done with other lag lengths or with other distributed lag forms. Similarly, the number of cows per day was lagged one month and three months and used as independent variables in the "cows" equation (again with limited experimentation with other lag lengths and distributed lag forms). Our assumption here was that, among other factors, farmers' decisions about the number of cows to keep in the herd today is a function, in part, of how many they had in the herd in the recent past (defined here as three months ago). The regression results are as follows:

*Production per Cow*

log(pdn/cow) = - 0.44050 - 1.08581*log[lag(pdn/cow)]
+ 0.23381*log[lag3(pdn/cow)]
+ 0.01556*log[lag3(mkfdpr)]
+ 0.08732*log(time) - 0.00009*(pasture)
+ 0.00341(feb) + 0.00740(apr) + 0.00959(may)
- 0.02031(jul) - 0.00538(aug) - 0.00346(sep)
- 0.01035(oct) - 0.00783(nov)
+ 0.00711(bst)

***R-square=0.9968. All coefficients are significantly different from zero at the 2 percent level or lower. The 'bst' variable was significantly different from zero at the 0.7 percent level).*** The variables used are defined as:

(pdn/cow) = Total U.S. milk production divided by total number of cows in the U.S. divided by the number of days in the month of that observation.
lag(pdn/cow) = pdn/cow lagged one month.
lag3(pdn/cow) = pdn/cow lagged three months.
lag3(mkfdpr) = Milk-feed price ratio lagged three months.
(time) = A variable taking on the value of '1' in 1950, '2' in 1951, '3' in 1952, etc.
(jan)-(dec) = Dummy variables for the respective months (having a value of 1 for the month in question and 0 in all other months).
(pasture) = Pasture condition index in Wisconsin for May, June, July, and August, and '0' in all other months.
(bst) = Dummy variable for the months in 1994 when rBST became available for commercial use (i.e., a variable having of value of 0 prior to March 1994, 0.333 in March-April 1994, 0.667 in May 1994, and 1 in all subsequent months).

Other independent variables attempted in this regression and producing coefficients not significantly different from zero include: current price of all milk wholesale, lagged price of all milk wholesale, current milk-feed price ratio, the remaining dummy variables for months of the year, and a dummy variable for the years of the Milk Diversion Program (i.e., 1984-85).

The pasture condition index is a subjective measure of pasture conditions obtained and published by National Agricultural Statistics Service, USDA. It was used here as a general proxy for not only the condition of pasture but for the quality of forage fed to cows. The index for Wisconsin was used in preference to indexes for Michigan, Minnesota, New York, or Pennsylvania partly because Wisconsin is the number one dairy state in the eastern part of the nation and partly because these variables did not produce significant coefficients when two or more were included in the same regression equation.

The pasture condition index for other states was not used here on the assumption that pasture conditions in other states would not vary significantly throughout the year or that other states were not important dairy states.

Our definition of 'bst' implies a slight upward sloping response curve over the period from March through September 1994. We experimented with several other forms of this response curve, including a flat response, but the form chosen appeared to fit the data best. We also attempted to fit an S-shaped rBST-response curve to the data, but the results were not statistically significant indicating it is yet too early to identify the inflection point on the adoption curve. We should point out, however, that all reasonable forms of the response curve indicated a positive response to rBST since its introduction.

All of the coefficients included here, except on the pasture condition index, have signs and magnitudes consistent with previous notions about milk supply response. The coefficient on 'time' implies an average annual increase in milk output per cow of about 2 percent. The coefficients on the monthly dummy variables are consistent with the known seasonal pattern of milk output per cow. The coefficient on the milk-feed price ratio suggests that the short run elasticity of milk production per cow with respect to the milk-feed price ratio is 0.016. The corresponding long run elasticity is 0.105. These estimates are well within the range of milk output-milk price elasticity estimates provided by other studies (see Kaiser et al., 1993).

Our hypothesis was that milk output per cow would increase as pasture condition increased primarily on the basis that superior pasture condition would mean that forage quality in general would increase. Clearly this was not confirmed by the results suggesting that more detailed analyses are in order here. It should be pointed out, however, that when the equation was reestimated with pasture condition removed, the other coefficients remained largely unchanged.

*Number of Cows*

log(cows) = 0.04035 + 0.60191*log[lag(cows)]
+ (0.37602-0.009332*(dtp)+0.00714*[dtp*dtp])*log[lag3(cows)]
+ 0.008830*log[lag3(mkfdpr)]
+ 0.01367(jan) + 0.04833(feb) - 0.01101(mar)
+ 0.02739(apr) - 0.00941(may) + 0.02874(jun)
+ 0.01453(aug) + 0.02354(sep) + 0.00567(oct)
+ 0.02865(nov)

***R-square = 0.9964. All coefficients are significantly different from zero at the 2 percent level or lower.*** Variables used in addition to those defined previously are defined as:

| | |
|---|---|
| (cows) | = Total number of cows in the U.S. divided by the number of days in the month of that observation. |
| lag(cows) | = 'cows' lagged one month. |
| lag3(cows) | = 'cows' lagged three months. |
| (dtp) | = A variable having a value of '0' in all months prior to the introduction of the Dairy Termination Program in April of 1986, and in all subsequent months having the value one divided by the number of the month since the program was initiated (i.e., divided by '1' in April 1986, '2' in May 1986, ..., and '102' in September 1994). |
| (cowpr) | = Price of slaughter cows divided by the index of prices received by farmers for all commodities. |
| lag(cowpr) | = 'cowpr' lagged three months. |

Other independent variables attempted in this regression but producing coefficients not significantly different from zero include: current price of all milk wholesale, all milk wholesale price lagged three months, current milk-feed price ratio, current and lagged slaughter cow price deflated by the index of prices received by farmers for all commodities, the dummy variable for time, and the remaining monthly dummy variables not shown in the regression equation including the variable designed to capture the impact of rBST since its introduction. When the 'bst' variable was included in the regression, its coefficient was negative (in fact, it was -0.0019 implying a decrease in cow numbers of 0.44 percent as a result of rBST use by November 1994) but significantly different from zero at only the 8 percent level. Since this did not meet our (arbitrarily chosen) 5-percent significance level, this variable was dropped from the regression.

Again these results are consistent with previous research on supply analysis for the U.S. dairy industry. As expected, the coefficients on 'dtp' are highly significant indicating that the Dairy Termination Program was effective in eliminating some cows from the national herd. Given the definition of 'dtp' and the estimated value of the coefficients on the 'dtp' variables, it will be seen that there was a rapid and early response to the Dairy Termination Program but that its impact dampened out fairly rapidly. The coefficient on the milk-feed price variable indicates a short-run elasticity of number of cows with respect to the milk-feed price ratio of 0.0088 which is near that estimated by Kaiser et al. (1993). The coefficients on lag(cows) suggest a long run milk-feed price elasticity of 0.4.

*Summary of Regression Results*

The results generated here indicate that introduction of rBST has indeed been associated with a slight increase in milk production per cow (0.55 percent in the first two months after introduction, 1.1 percent in the third month, and 1.65 percent in subsequent months), but with no change, or at best a slight decrease, in cow numbers. We are not surprised to find no response on cow numbers at this early date, nor are we surprised at a positive output per cow response. If recent reports in the popular press that 7-10 percent of the nation's dairy cows are being treated with rBST are correct, and if we can expect a 10-12 percent increase in milk production from treated cows, the percentage increases derived from the regression results would appear to be quite reasonable. It is clear from these results that introduction of rBST has already had a significant and positive impact on milk production in this country.

## What Will Happen to Milk Prices and Profits?

### Conceptual Ideas

In the short run and for the early adopters of rBST, profits per cow will rise as total revenue per cow increases more than do total costs (Greaser, 1992). This is possible because in the early stages of rBST use, not enough farmers will be using the technology to cause significant changes in the overall market price of milk. In the longer term, when a majority of all dairy farmers have adopted rBST and the market adjusts to the increased production efficiency and rightward shift in the aggregate supply schedule, market price will fall because consumers will be unwilling to purchase, at current prices, the increased quantity of milk placed on the market.

Conceptually, the long-run price impact of rBST adoption can be viewed with the aid of Figure 2. Here the curve labeled D represents the industry demand schedule and shows how consumers can be expected to respond to alternative prices. The curve labeled S represents the industry supply schedule and shows how producers can be expected to respond to alternative prices. The point at which these two curves intersect identifies the equilibrium price, P, and the equilibrium quantity, Q. The curve labeled S' in Figure 2 suggests how the supply schedule can be expected to shift after 100 percent of the producers have adopted the technology. The position of this new supply curve reflects the fact that at any given level of industry production, say Q, farmers are still willing to produce that quantity even if price falls below P, because the new technology enables them to produce at lower cost. The new long-run equilibrium price and quantity (P' and Q', respectively) are given by the intersection of this new supply curve with the demand curve. We have constructed Figure 2 to show a greater percentage change in price than in quantity. This is consistent with the general assumption based on empirical analyses that the demand for milk in the long run is highly inelastic (in the range of -0.08 to -0.20) while the supply of milk in the long run is much more elastic--approaching unitary elasticity in some regions of the country.

When will this long run equilibrium be achieved? Obviously we cannot know for certain because we do not know the rate at which farmers will adopt the technology. Our best guess at the moment is provided by the assumptions made in the previous section--that is, in about 2010. Are we on the predicted course to date? The analysis of the previous section would suggest we are right on target.

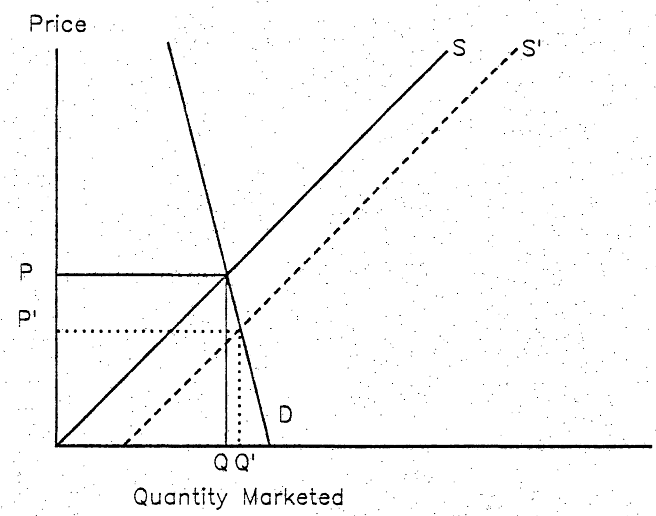


Figure 2. Long-Run Consequences of Adoption of Output-Increasing Technology.

## The Theory Does Work in Practice

Since 1950, milk yields per cow have increased at a compound rate of 2.5 percent per year (see next section). This should have supported a substantial reduction in the real price of milk since 1950 as can be verified by an examination of the data. It is obviously difficult to estimate what the price of milk would be today had there not been this much growth in productivity due to a variety of technological innovations (both mechanical and biological). Based on a regression of the price of milk on the price of feed and wage rates with time varying parameters[1], we deduce that the farm-level price of milk in 1993 would have been 3.29 times higher than it in fact was in 1993 had we frozen technology at the 1950 level. Obviously this translates into substantial savings in food costs for the consumer since milk and dairy products constitute about 13 percent of the market basket of foods.

## Have Milk Prices Declined Since Introduction of rBST?

To determine definitively whether milk prices have changed since introduction of rBST requires a complex statistical analysis. The supply side as well as the demand side

[1]The estimated regression was of the form: pmilk = a + (b1 + b2*time)*prfeed + (c1 + c2*time)*prlabor where time='1' in 1950, '2' in 1951, etc. To estimate what the price of milk would have been in 1993 with 1950 technology, we used the estimated equation to calculate 'prmilk' assuming 1993 values for 'prfeed' and 'prlabor' and the 1950 value (i.e., '1') for 'time'.

of the market must be modeled and all relationships must be estimated simultaneously. While this is not difficult conceptually, the data requirements are extensive. All this is beyond the scope of the present paper.

An alternative, albeit less satisfactory approach, is to estimate a simplified "reduced form" equation for milk price using, for example, the data obtained for the previous analysis. More specifically, one can estimate by ordinary least squares the equation with milk price (at the farm or at the retail level) as the dependent variable on the major exogenous variables of the system including the dummy variable for rBST as defined above as well as monthly dummy variables. When such regressions are run, we find that the regression coefficient on rBST is negative but not significantly different from zero whether we use as the dependent variable the price of milk at the farm, the farm level milk-feed price ratio, the price of all milk wholesale deflated by the index of prices received by farmers for all commodities, **or** the index of retail price of fresh whole milk deflated by the Consumer Price Index. This analysis appears to confirm that rBST has not yet had a significant impact on milk prices at either the farm level or retail level. This is consistent with our initial hypothesis that there has not yet been a sufficient number of producers adopting rBST to cause a rightward shift in the aggregate supply function great enough to significantly impact market price.

## Is rBST Size-Neutral? What Will Happen to Small Dairy Farmers?

Bovine somatotropin is a size-neutral technology in the sense that farmers with small herds will benefit as much on a per-cow basis as will farmers with larger herds so long as managerial ability is equal. This, then, leads to the general conclusion that all farmers will eventually adopt this technology in their search for greater unit profits. As has been true in the past, innovative farmers will be the first to adopt rBST. As other farmers find that their neighbors' profit levels rise, they too will adopt this new technology, albeit with some delay, as they strive to increase profits. In the longer term, however, as more and more dairy farmers adopt the technology, milk prices will fall (see Figure 2) and thus per-cow profit rates will fall. Because of the reduced milk prices and profit rates in the longer term, at least some of the smaller dairy farmers can expect to be squeezed out of business because they will not be able to produce the volume of milk and thus aggregate net income necessary to provide a standard of living satisfactory to the farm family. The farm family now barely getting by with a 40-cow dairy herd will not be able to generate enough income from that 40-cow dairy herd to maintain the farm family's standard of living after the majority of our dairy farmers have adopted rBST and the market finds a new, lower equilibrium price. Smaller dairy farmers will either be forced to get out of dairy production and into something else, or add to their herd in order to keep their volume up so that their family's standard of living is maintained. Thus, while the purist among economists might argue this technology is size-neutral, in fact it is not!

We remind you, however, that there are still in this country over 1.12 million farms (45 percent of the 2 million farms in total) grossing $20,000 or less annually from the farm operation, and 0.25 million (12 percent of the total) grossing between $20,000 and $39,999 annually from the farm operation. Some of these farms are dairy farms. A gross income of $20,000 or even of $40,000 is clearly not enough to provide a farm family a standard of living comparable with that of other families in the United States. Why do these small farmers stay in business? They are resilient and do not want to give up the farm way of life. They are willing to give up larger incomes possible in other activities, knowing full-well that they are earning a lower return on their investment than are other individuals. They are able to supplement their farm income with income from nonfarm jobs (part-time or full-time) held by the farm operator and/or the operator's spouse. They see limited alternatives to their present agricultural enterprises. They do not have the skills needed to take advantage of available alternatives in the nonagricultural sector. In sum, there are a variety of reasons why small farmers stay in business even though the handwriting is on the wall.

### Larger Concentrations of Dairy Cows on Fewer Dairy Farms

Milk production per cow has increased from an average of about 5,200 pounds per year in 1950 to nearly 15,400 pounds per year in 1993, over the entire United States (see Figure 3). All this has happened, by the way, at the same time that there has been a strong downtrend in the ratio of milk prices to farm wage rates (Figure 3) or to the general level of prices in the United States. How has this been possible? Dairy farms that stayed in business adopted cost reducing technology and got bigger. Those that could not manage larger herds, or could not acquire larger herds got out. This, we can be reasonably assured, will continue to happen with or without rBST.

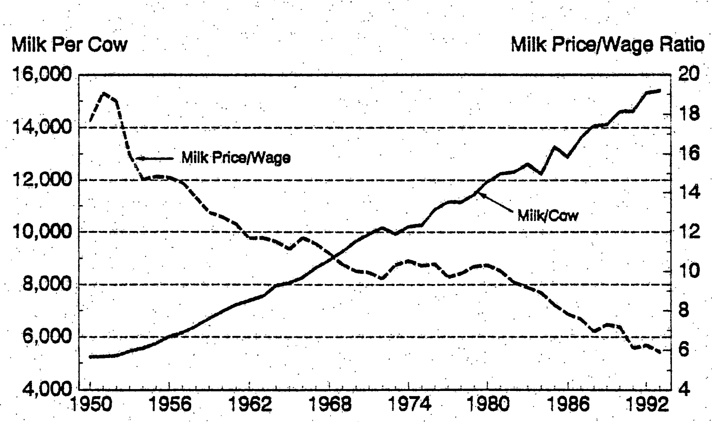


Figure 3. Milk Production Per Cow and Ratio of Milk Price to Farm Wage Rates in the United States, 1950-1993.

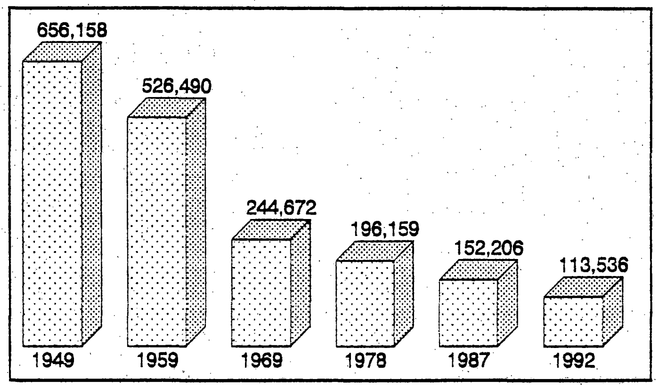


Figure 4. Number of Farms Having 10 or More Milk Cows in the United States, 1949-1992.

These trends seem to surprise many of us. Nevertheless, these are the facts. We had over 650,000 farms with 10 or more milk cows in 1950, but only 114,000 farms with 10 or more milk cows in 1992 (see Figure 4). Of those farms with 10 or more milk cows, only 2.6 percent had 50 or more milk cows in 1950 but 42.5 percent had 50 or more milk cows in 1992 (see Figure 5).

The point of this discussion is that one should not be too hasty in placing the blame for future structural changes in the dairy industry on rBST. Structural changes in dairy have been going on since the industrial revolution. It is a phenomenon that would go on, we feel quite certain, even had rBST been banned. One might well ask why now should we become so terribly concerned about this phenomenon -- why did we not raise the issue when special feed additives or mechanical milk-handling equipment or artificial insemination or any number of other types of output increasing technological developments became available to dairy farmers?

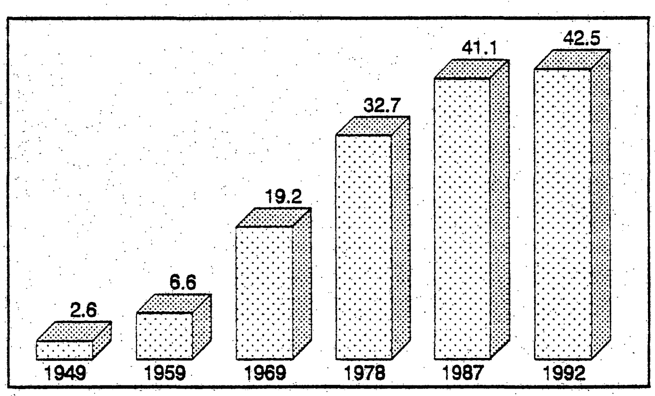


Figure 5. Percentage of Farms (with 10 or more milk cows) Having 50 or More Milk Cows in the United States, 1949-1992.

## Will rBST Use Lead to Dairy Surpluses?

When milk prices fall in response to increased rBST use, as we can surely expect them to do in the longer term in the absence of efforts by the federal government to prop them up, consumer demand for dairy products can be expected to increase at least somewhat. This, together with the fact that lower milk prices will result in lower supplies than otherwise would be the case, will mean that the market will clear without excessive surpluses at the lower price level. Thus, there is no reason to expect a flood of surplus products if the market is not distorted by irresponsible government price support policies.

But we do have price support legislation in dairy. Assume this price support legislation is maintained -- even if for no other reason than to ensure that there is a sufficient supply of dairy products which can be purchased by government agencies to satisfy our domestic and foreign food aid requirements. It is unreasonable to expect price supports to be maintained at the current level if milk production increases calling forth a decline in equilibrium market prices. Indeed, the 1990 Food and Agriculture legislation mandates that the milk price support should be adjusted downward or upward by between 25-50 cents per hundredweight depending upon estimated annual government purchases subject to the restriction that the support price cannot fall below $10.10 through calendar 1995. New legislation for 1995 will obviously need to revisit this policy and should probably reconsider the advisability of the $10.10 minimum. Nevertheless, there is already in place an automatic mechanism to adjust the price support level so as to prevent an accumulation of dairy surpluses.

## Regional Implications of rBST Use

Full adoption of rBST across all regions of the United States would be accompanied by very small changes in the market shares of the different regions--a change of 17.3 percent to 17.8 percent in the Northeast, 23.3 percent to 23.5 percent in the Upper Midwest, and 16.0 percent to 15.4 percent in the West Coast region (see Fallert and Hallberg, 1992). Those regions now enjoying a slight competitive advantage and that are nearest the large population centers will continue to enjoy a competitive edge as milk prices fall with rBST adoption. As milk prices fall relative to costs of transportation, the economic advantages of transporting milk long distances also fall. Consequently, those producers located nearest to consumers should be expected to supply somewhat more of their local fluid milk needs. This clearly works to the advantage of producers located near the large population centers in the eastern United States.

The above discussion assumes <u>all</u> regions adopt rBST. From popular press and industry discussions, particularly in the Upper Midwest, it appears there is the notion on the part of some that a given region (or a given country, for that matter) can adopt their own unique solution to the rBST issue, irrespective of the solution other regions adopt without impacting local dairy farmers' incomes or competitive position. On the contrary, the results of Fallert and Hallberg (1992) show that if producers in one region of the country were discouraged from using rBST while all other dairy farms in the United States adopted the technology, producers in the region of the ban would not only be subject to a price decline commensurate with the decline in prices nationwide, they will lose market share. The situation would be worse for producers in regions with low fluid consumption relative to total regional consumption, since it is more expensive to import fluid milk than it is to import manufactured dairy products.

## Policy Implications

### Dairy Farm Structure

It is clear that rBST is just one more technology like many preceding it that will encourage the consolidation of small and medium-sized dairy farms into larger and larger units. This is a continuation of a general trend of long standing in agriculture which has led to the exit of many small farms. It is a very complex trend to unravel. Tauer (1992) points out that " . . . we do not know to what extent small dairy farms will be affected by the introduction of [rBST]. It is ironic that we may not even know the answer with certainty after [rBST] becomes available, because of the complex interactions of the myriad of factors affecting farm size and production . . . ".

Consolidation of dairy farms into larger units would be a problem of economic significance if it meant that dairy farms were getting so large than one or a few were able to significantly impact the market--i.e., significantly influence price or aggregate quantities marketed. We do not see this as a problem anywhere in the country at the present time. Indeed, we do not see this as even a remote possibility for the foreseeable future.

The accumulation of large numbers of dairy animals in a single location may well lead to environmental conflicts locally. However, as argued before, we do not see this type of structural change leading to significant environmental problems nationally.

It is much more difficult to assess the social impacts of this type of structural change. Certainly, a reduction in numbers of farm families in a given rural region could conceivably lead to changes in social structures that may not be accommodated with modern communication and travel technologies. We should note, however, that at no time in the past has our government attempted to prevent a technology from being adopted on the basis of social considerations, and there would appear to be little reason for doing so now. Indeed, if our concern is with maintaining the viability of rural or farming communities, then it may be more productive to direct public funds to rural development efforts which provide part-time or full-time off-farm work for farm families (see Hallberg, 1992a) rather than to direct our efforts at preventing output-increasing and cost-reducing technological developments in farm and food production.

## Price Support Policy

As indicated above, we see no reason to expect rBST use to lead to greater accumulations of surpluses of dairy products in the long run if present policy is maintained. The present rather automatic adjustment of price supports in response to projected surpluses should be sufficient for the task. We can expect increased purchases in the short-run, however, as the adjustment process works itself out. Indeed the Executive Branch study group (U.S. Government, 1994) concludes that from FY 1994 through FY 1999, Federal Government costs of the dairy program can be expected to rise slightly as a result of the higher milk production levels. Offsetting this higher cost, however, would be a lower cost of domestic feeding programs as the retail price of milk and dairy products fall. Overall, the study group sees a potential net increase in government costs for FY 1994 through FY 1999, but a net reduction in each year subsequent to FY 1999.

## Consumer Education

Some consumer representatives contend that milk from rBST-treated cows is unsafe for human consumption. Based on available scientific evidence, this is a myth. If this myth persists as some early surveys suggest might be the case (see Smith and Warland, 1992 and U.S. Government, 1994), there may be a (short-run or permanent) leftward shift in the demand function for milk that will need to be factored into our analyses. If such a demand shift occurs, it would only change our conclusions about the magnitude of price impacts of rBST, not our conclusions about the efficacy of rBST, the safety of rBST, the rate of adoption of rBST, the accumulation of government surpluses of dairy products as a result of rBST adoption, etc.

We are inclined to believe, however, that the persistence of this myth is attributable to the fact that consumers are not provided with sufficient and sound information with which to make informed choices. It matters little how much scientific evidence can be marshalled to verify safety if consumers are not provided with this evidence, but rather are continuously bombarded with biased and less than fully revealing reactions from interest groups with special agendas. In the case of rBST these special agendas include arguments that rBST will: leave residues in milk and dairy products that are harmful to humans, cause increased incidences of mastitis, degrade the social structure of family farming, lead to serious environmental problems, give sanction to morally incorrect procedures for generation of living material in the laboratory, etc. To support our claim that special agendas drive responses from interest groups, we offer the following anecdote. In a lengthy response to a lengthy letter from a Member Services Director of a chapter of the National Association for Science, Technology & Society, the senior author suggested that the Director review the compendium cited earlier (Hallberg, 1992) so as to become informed about many scientific facts concerning rBST that he obviously had not considered. In a *second* lengthy letter, the Director wrote:

> Not having read your edited book, which you invited me to study thoroughly, you may easily decide not to read the balance of my letter.

Clearly the author of this letter was more interested in pushing his own agenda than in informing himself about the facts concerning rBST.

One solution to this problem is to require some of the milk checkoff funds now used for dairy product promotion programs to be used for full accounting of the known costs and benefits as well as unknown and potential costs and benefits of technologies like rBST, and to make this accounting available through a variety of sources including the popular press. Another solution would be to provide this information through a consortium of USDA and Experiment Station researchers. We made a modest effort in this direction with rBST via the compendium cited earlier (Hallberg, 1992). Unfortunately, this effort was not widely publicized nor was it succinctly summarized for popular consumption. For these and probably other reasons it was apparently not widely available to popular press editors.

Job Training

One of the performance criteria by which the agricultural sector has in the past been judged is its capacity to adopt new methods and practices so as to maintain its competitive edge and to provide consumers the benefits of cost-reducing technology. The U.S. agricultural sector must receive high marks for its efforts in this area, in spite of sustained government efforts to curtail production. If one subscribes to this performance criterion, then one must conclude that a most appropriate technology policy response for agriculture is to encourage adjustments so that resources (both human and physical) are employed in their best use. There are instances in which adjustments are difficult because assets are somewhat fixed in the short run, farm people do not have the skills needed for alternative employment, or alternative employment within or outside of agriculture is not readily available. If this is the case, a rational approach would be to develop policies aimed specifically at easing the adjustment process. This may take the form of job retraining, development efforts designed to create nonfarm jobs, farm-asset buyout programs, developing new viabilities in agriculture, etc. All this argues for continuing to strive for an economy that provides a wide range of alternative opportunities for those displaced by the type of technology under discussion here. This would contribute not only to general economic growth and progress, it would lessen the imperative to provide specific protection from a given technology.

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