The New England Milk Supply, 1987 - 1998: A Graphical Summary

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Background

This is a study of changes in the supply of milk in New England during the first year of regulation of the New England milk market by the Northeast Interstate Dairy Compact, July 1997 to June 1998. The purpose of this study is to provide a historical perspective to aid in assessing and understanding the impacts of the Compact on New England milk supply. After establishment of the Compact regulation, observers of the New England milk market noticed an increased volume of milk produced in the region. However, how much of the increase is due to the Compact is not obvious. Many factors, including weather and prices of inputs, influence the quantity of milk produced. An examination of the variety of factors and their contribution is needed.

Methods

To understand the historical changes in the supply of milk in New England, we identified factors that are likely to influence milk production, developed procedures to examine the impacts of the Compact, and assembled a data set. We used two approaches to examine the data. First, we prepared a graphical summary of the data to show what has happened in recent years. The graphical analyses presented herein provide the historical context to better understand the changes in milk supply resulting from minimum price regulation under the Compact. For example, they show whether current values of variables such as milk prices or cow numbers during the first year of Compact price regulation differ from long-term trends. However, graphical analyses do not examine the impacts of the Compact on milk production controlling for a variety of factors simultaneously. To accomplish this latter objective, we constructed econometric models to help understand how and why changes in milk production occurred (see page 24 of this report). We also used the models to make projections of what would have happened during July 1997 to June 1998 in the absence of the Compact's pricing provisions.

The graphical and econometric studies are based primarily on data published by the New England Agricultural Statistics office in Concord, NH. In addition, Neil Pelsue, at the University of Vermont, and Steve Logan, at the National Agricultural Statistics Service, provided some data. Our data include a measure of milk supply, its two components –cow numbers and milk per cow—and seven factors that influence milk supply (Table 1). Most of the data were originally quarterly; some were monthly or annual. Most of the data were state level for the six New England states - Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. When state-level and New England data were not available we used data for a single state, preferably within New England. For many of our procedures we aggregated the data to quarterly or annual averages or totals. The data span the period from January 1987 to June 1998. For our annual aggregates, we used a July-to-June period to coincide with the July-June period of the first year of Compact regulation. We refer to these July-June periods by the calendar year at the end of the period, i.e., in June. For example, 1997 refers to the period from July 1996 to

June 1997. We also refer to the July 1996 to June 1997 and July 1997 to June 1998 periods as the pre-Compact and Compact periods, respectively. Milk prices in the data set include quality and over-order premiums, including the Compact premium.

The graphical summary provides a visual basis for comparing the Compact period to the recent past. The graphs show milk supply and 10 factors influencing it. Data for the graphs are in the Appendix. We prepared four types of graphs.

> Index graphs (e.g., Figure 1) of state-level quarterly milk production, and its two components, cow numbers and milk per cow, using July 1987 to June 1988 as the base period for indexing. With indexing, the quarterly values are expressed as a percent of the July 1987 to June 1988 average value. These graphs show seasonal patterns and trends in the six New England states.
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> Bar graphs (e.g., Figure 2) of July-June annual totals of milk production and its two components in their native physical measures, e.g., million pounds of milk, for 1996 to 1998. These graphs show the relative contributions of the six states to the New England milk market.
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> Predicted vs. actual graphs (e.g., Figure 3) of annual totals or averages of milk production its two components, and the eight variables influencing milk production. The predicted values are based on regression of the variables against the years (i.e., determined a trend). We used just the 1988 to 1996 observations in these regressions, so that we could see how the 1997 and 1998 observations differed from the prior trends. The graphs also show values one and two standard errors from the predicted values. Actual values in 1997 or 1998 more than two standard errors from the prediction are outside the historical range for the variables.
>
> Standardized-difference graphs (e.g., Figure 20) show differences between actual and expected values for 1996 to 1998 expressed in standardized terms – standard error or standard deviation. Variables having multiple-R values greater than 50% were considered to have trends. Their difference from expectation was measured as deviation from trend and converted to standard-error units. Variables having multiple-R values less than 50% were considered to not have trends. Their difference from expectation was measured as deviation from average and converted to standard-deviation units. These graphs show which factors fell outside their historical ranges in these three years. They also provide a means for assessing how representative 1997, to which the first year of Compact regulation is often compared, is of the recent past.

Results

Milk Production and Its Components

Figure 1 has indexes of milk production in the six New England states. The indexes use July 1987 to June 1988 as a base point, so the values in that period cluster around 100%. The indexes have a seasonal pattern, with highs generally in the second quarter and lows generally in the third quarter. Milk production declined in all six New England states from 1987 to 1990, probably as a result of the Dairy Herd Termination Program. Production continued to decline in

Rhode Island (RI) into 1993. Since 1990, production has grown somewhat in Vermont (VT) and New Hampshire (NH). Milk production in 1997 was higher in the northern New England states, and lower in the southern New England states, than in 1987. Overall, milk production in New England has grown slightly over the past decade. In 1998, milk production in VT was about 10% greater than in the 1987-1988 base period, and in RI it was about 20% smaller. The seasonal cycle makes examination of changes after the Compact challenging. They show that all states produced more milk in the first quarter of the Compact period than in the first quarter of the pre-Compact period. In the next three quarters, milk production in Massachusetts and Rhode Island was lower in the Compact period than in the pre-Compact period.

Figure 2 is a bar graph of milk production in the six states in the three last years in the data set - 1996 to 1998. Vermont contributes by far the greatest amount of milk to the New England milk supply, about 2.5 billion pounds. Rhode Island contributes a very small amount.

Figure 3 shows actual total July-June milk production in New England from 1988 to 1998 and a trend line based on the 1988 to 1996 data. Two additional pairs of lines, one and two standard errors (SEs) from the trend line, demarcate the range of values expected based on the 1988-1996 trend. Values above or below the expected-value range may indicate that something unusual has happened or is happening – extreme weather may have occurred, cause-and-effect relationships may be evolving or new policies may have been established[1].

Aggregate annual milk production in New England dropped in the late 1980's and has trended upward since then. The drop in the late 1980's was probably due to the Dairy Termination Program (DTP), which paid farmers to cull entire herds. Since 1990, when the last of the DTP herds were culled, milk production has moved back up and surpassed the pre-DTP level. The expiration of the DTP was a fairly significant change in the policy environment for dairy farmers. Had the trend line been based in 1990 rather than 1988, it would have been steeper and the expected-value range narrower. On the other hand, without the DTP production would probably not have dropped into 1990.

Total milk production was slightly above the trend line in 1996, at 4.56 billion pounds. It dropped slightly below the line in 1997, to 4.51 billion pounds, and then rose back above the line in 1998, to 4.63 billion pounds. The 50-million-pound decline in 1997 is less than half of the 120 million pound (or 2.7%) increase in 1998. Nevertheless, the amounts produced in all three years are less than one standard error away from the trend line. Thus, they are within the range observed during the last decade.

The number of cows in New England and the amount of milk each cow produces are the two key components of total milk production. Breaking changes in total production into these components provides insight into what causes changes in total production. Cow numbers are influenced primarily by farmers' decisions to expand or close their businesses, which depend on

[1] A limitation of this analysis is that it considers variables one at a time. Thus, when offsetting changes in variables occur—for example, an increase in milk prices and an increase in grain prices—the effects of these changes may not be fully reflected in changes in other variables such as milk production. Thus, they cannot be used to assess the causes of changes in the variables. In particular, the fact that a variable is within its historical range is NOT an indication that price regulation under the Compact had no impact on that variable. (See the next section of the report for a more complete discussion of this issue.)

economic conditions, such as milk and grain prices, and personal characteristics, such as age and wealth. Milk per cow is influenced partly by uncontrollable factors, such as weather, and partly by controllable factors, such as quantity of feed given, prevention of mastitis and provision of cow comfort.

Milk per cow per quarter has a seasonal pattern and has been increasing fairly steadily (Figure 4). Highs are often in the second quarter and lows in the third or fourth quarter. Over the 11-year period, milk per cow rose about 20%. Milk per cow has not grown as rapidly in Connecticut (CT) and RI as in the other states. It has grown more rapidly in VT and NH. Except in RI, only in one quarter in one state was milk per cow lower during the Compact period than in the corresponding quarter in the period prior to price regulation under the Compact. In RI milk per cow was lower in all four Compact quarters. Milk per cow per year is quite similar in all six states. It is slightly higher in CT and NH, and somewhat lower in RI (Figure 5).

From 1988 to 1998, the average annual milk per cow in New England rose steadily from 13,908 pounds per cow to 16,990 pounds – a 2.0% compound annual growth rate (Figure 6). The expected-value range is much narrower than for total milk production, indicating that growth in milk per cow has been very consistent. The smoothness of the growth suggests that relatively constant changes in production technology occurred during the period. In 1997 milk per cow was 16,594 pounds, 1.2 standard errors (SE) below the trend line. In 1998, it rose 396 pounds, or 2.4%, to 16,990. Although the growth in 1998 was slightly above the long-term average, milk per cow was still below the trend line, but now just 0.35 SE below. Unusually small growth in milk per cow in 1997 set the stage for stronger growth in 1998, as milk per cow recovered and approached the trend line. The 2.4% growth in milk per cow accounts for 89% of the growth in total milk production – most of the growth.

The number of milk cows in New England is the other principal component of total milk production. It is influenced by a variety of factors. Decisions to change herd sizes are influenced by expected profits from producing milk, capacities of facilities, and prices of cull cows and bred heifers, among other factors. Although cow numbers are managed, they are also subject to biological constraints. It takes two years to bring a calf into milk production. Although an individual farmer can buy cows to expand her herd quickly, the total regional herd may be much more effectively bound by this constraint. Dairy farmers often raise more replacements than needed to maintain their herd sizes, and can short cut the expansion process somewhat. Nevertheless, cow numbers tend not to change dramatically from year to year..

Except for the 1987-1990 period, i.e., during the Dairy Herd Termination program, the number of milk cows in New England has declined fairly gradually, to about 80% of their 1987-1988 levels (Figure 7). Cow numbers appear to be subject to seasonal influences in most states, although not as much in VT. The VT dairy herd has declined the least rapidly, to just under 90% of its 1987-1988 level. The most rapid declines occurred in Massachusetts (MA) and RI – to just under 75% of the base period. Most states had dips in cow numbers in the year before price regulation under the Compact. Cow numbers were essentially constant during July 1997 to June 1998; no state ended the Compact period with more cows than it had at the beginning of the period.

The distribution of cows in New England is very similar to the distribution of milk production there (Figure 8). VT has by far the most cows and RI the least. ME has a larger share of the cows than the milk. NH has a smaller share of the cows than the milk.

The number of cows in New England declined more rapidly during the Dairy Herd Termination Program – 1988 to 1990 – than it has since then (Figure 9). This decline in cow numbers accounts for the decline in milk production at that time. Between 1997 and 1998 the New England dairy-cow population grew slightly – from 271,100 to 272, 900 cows – about 0.3%. This growth in cow numbers accounts for just 11% of the increase in milk production at that time. Growth in the cow population in 1997went against the trend, but the 1998 cow population was only about one standard error above the trend line.

Figure 10 shows indexes of milk production and its two components for New England as a whole. The two components of milk production – milk per cow and cow numbers – offset each other to a large degree (Figure 10). The Dairy Termination Program (DTP) reduced cow numbers sharply and milk production not quite as much. Cow numbers have had periods of stability and of decline during the past decade. The expansion of the New England dairy herd occurred in the year prior to the beginning of Compact price regulation. Milk per cow is highly seasonal and rises steadily. The strongest growth in milk per cow between 1997 (pre-Compact period) and 1998 (Compact period) occurred in the last two quarters of 1998.

Since the end of the DTP, total milk production has risen, returning to its pre-DTP level in 1992. The seasonality of milk production is almost entirely due to the seasonality of milk per cow. During the Compact period, milk production was 2-3% above its levels in the corresponding quarters of the pre-Compact period (See also Appendix Table 1.).

Factors Influencing Milk Production

The components of milk production are influenced by both economic and natural factors. Among the chief economic factors are product prices for milk and cull cows, and input prices for cows, grain, hay, real estate and labor. Weather influences milk production directly through the response of cows to temperature and indirectly through the response of plants to both rainfall and temperature.

Since 1988 milk prices in New England have trended very slightly upward (Figure 11). The prices have more volatility than trend: year-to-year variation is greater than the upward movement over the period. Also, the expected-value range for milk prices is wider than the ranges of milk production and its two components. Milk prices vary proportionately more than milk production. The 1997 price is almost two standard errors (SE) above the trend, just barely within the historical range. The 1998 price, which includes Compact premiums, is just above the trend line. This does not indicate that the Compact had no impact on milk prices—the all milk price in the absence of the Compact would have been somewhat below the trend line. However, it does place the magnitude of the increase in price due to Compact regulation into historical perspective.

Beef prices determine the value of a cull cow. High beef prices have generally encouraged more aggressive culling. With low prices farmers have kept cows in their herds longer. Herds grow,

especially when the prices first fall, and farmers start to delay culling. Beef prices have historically followed a long-term cycle. They declined substantially during the period studied here (Figure 12). In 1997 and 1998, beef prices recovered somewhat, indicating that farmers had larger incentives to increase culling (reduce cow numbers) during the year prior to the onset of Compact price regulation.

Cows are an important capital asset in dairy farming. Prices of cows influence farmers' decisions to buy or sell cows. Low prices encourage buyers to buy and sellers to hold on to cows. Thus, low cow prices contribute to increases in herd sizes and milk production. Farmers' ability to expand herds quickly is constrained by the capacity of their facilities and the time it takes to build new facilities. Lags undoubtedly exist between changes in cow prices and changes in cow numbers. For most of the period studied, cow prices increased steadily (Figure 13). They started declining in 1995. In 1997 and 1998 they were completely outside the historical range, more than two standard errors below the trend line. Perhaps low beef prices had discouraged farmers from culling and reduced the demand for milk cows. Nevertheless, cow prices in 1997 and 1998 were quite low compared to recent experience and reduced the cost of expanding a dairy farm. This would provide incentives for herd expansion, and may in part explain the increase in cow numbers in New England during 1997.

Grain is the largest purchased component in the cost of production of milk. Milk production per cow is sensitive to the amount of grain fed. The amount of grain fed is sensitive to the price of grain and especially to the milk-grain price ratio. Responses to grain feeding have historically had a substantial lagged component. The amount of milk produced was strongly influenced by the amount of grain fed in the previous lactation. The introduction of BST has allowed farmers to reduce this response time. Grain prices played a key role in milk production in the pre-Compact and Compact periods. They declined from 1990 to 1995, then rose sharply to a new peak in late 1997, more than 2 standard errors from the trend (Figure 14). Two consecutive years of bad weather reduced grain stocks and triggered the rise in grain prices. This unusually high price undoubtedly contributed to the small growth in milk per cow that occurred in 1997. The prices fell sharply back into the expected range during the first year of the Compact, 1998.

The milk-grain price ratio moved even more dramatically, with grain prices playing the dominant role. Grain prices rose more sharply in 1997 than did milk prices, 9.5% versus 6.8%. The resulting decline in the milk-grain price ratio from 1.50 to 1.47 made feeding grain less profitable than it had been. In 1998, grain prices fell 12.4%, much more sharply than they had risen, while milk prices fell just 6.9%, about as much as they had risen. The price ratio rose to a favorable 1.54, encouraging more grain feeding and raising milk per cow. Grain and milk prices occupied different positions relative to their trend lines during these three years. Grain prices were farther from their trend line, i.e., their expected value, than were milk prices. In both 1996 and 1998, milk prices were just about on their trend line. Thus, changes in grain prices did more to change milk-grain price ratios than did changes in milk prices.

Hay is also a major component of the cost of production of milk. However, it is predominantly homegrown, rather than purchased. Nevertheless, hay prices are an indicator of the abundance of hay. Shortages of hay trigger three different responses. Farmers may buy hay to make up for the shortage, reduce the amount of hay fed per cow or reduce the number of animals (cows and young stock) on their farms. Impacts on milk production are likely even though most hay is

homegrown. Hay prices have more volatility than trend. They waved slightly upward from 1988 to 1996 (Figure 15). They rose precipitously in 1997 and 1998, due to bad weather and poor yields. The 1998 price level is well outside farmers' range of experience during the past decade. Higher hay prices over a period of time provide incentives for fewer cows and lower milk per cow.

The value per acre of real estate in New England dairy farms increased steadily and substantially during the 11-year period (Figure 16). Real-estate values in 1997 and 1998 are above the trend line, but within the historical range. High real-estate values discourage major expansions by making them more expensive. Investing and disinvesting in real estate respond more slowly to changes in the operating environment than do other changes in farm structure and operations. Although not shown in Figure 16, real estate prices increased much more rapidly in the southern New England states (MA, CT, RI) and this may explain a good deal of the decreases in milk production in those states during the past decade (Figure 1).

Agricultural wages have risen from about $4.70 per hour in 1988 to about $7.40 in 1998 (Figure 17). In 1998, wages were slightly more than 2 standard errors below the 1988-1996 trend line. Low wages reduce the cost of labor and make the use of more labor on a farm, either to expand the herd or intensify its management, more economical. The drift away from the trend line probably does not indicate the usual abundance of labor, however. It probably represents the decline in wage-rate growth in the whole economy beginning in the mid-1990's.

Two non-economic factors that influence milk production are precipitation and temperature. The relationship between precipitation and milk production is complex. Precipitation influences crop production directly, and through that milk production. These effects are lagged. Crops grown in one summer are fed into the following summer. Annual total precipitation is not a precise indicator of crop-growing conditions. Both quantity and quality of crop are sensitive to both amount and timing of rainfall. Both too much and too little rain can cause problems. The wide historical range for precipitation indicates that rainfall is more volatile than most of the variables included in this study (Figure 18). Rainfall levels in 1996, 1997 and 1998 were higher than most of the rest of the period, but still within one standard error of the trend. The unusually sharp increases in hay prices in 1997 and 1998 were probably due to excess moisture in these three years. The slight upward trend displayed may be due to the coincidence of low and high values, respectively, in the first and last years used to establish the trend, 1988 and 1996.

Average temperatures are not as volatile as precipitation (Figure 19). Temperatures in 1997 were quite normal and in 1998 quite warm, relative to the distribution of temperatures from 1988 to 1996, but only about 2 degrees Fahrenheit warmer and still within the historical range. Average temperatures also tend to mask short-term extremes (e.g., hot and cold spells) that may have an impact on milk per cow.

Assessing Deviations from Normal during the Compact Period

The many preceding graphs show the behavior of the milk supply and factors influencing it since 1988. The graphs show how the levels of the milk supply and its factors during the Compact period differ from those of the previous 10 years. However, they don't provide an opportunity to compare the factors and determine which differ most from historical experience.

Although it does not determine the effects of Compact price regulation on milk production, an examination of the extent to which key variables are consistent with historical patterns helps provide an appropriate context for consideration of the Compact's impacts. Thus, we can explore whether the Compact-period values are within the ranges observed during the last decade, and measure how far they are from the trend-line and mean values. These "distances" can be usefully expressed in standard-error or standard-deviation units. The typical distance of an average observation from its expected value is one standardized unit. Values more than two standardized units from the mean are uncommon based on the experiences of the last decade.

Many of the assessments of the impact of the Compact have been based on comparisons—particularly of milk production—of the 12 months immediately before and after the Compact was implemented. Whether the pre-Compact period is a good basis for comparison hasn't been shown. Further, such analyses tend to ignore the variety of factors that determine milk production, and how they changed from 1997 to 1998. The assessment method just outlined can also be used to determine how representative of the previous nine years the pre-Compact period was, and to examine changes that occurred from 1997 to 1998 in factors influencing milk production.

Most of the variables examined had definite trends during the 1987-1996 period. Some did not. We divided the variables into two groups, those with and those without trends. The criterion for having a trend was having a multiple-R value greater than 50% when the variable was regressed against years.

Seven variables had Multiple-Rs above the 50% threshold – beef price, cow numbers and price, milk per cow, milk produced, real-estate value per acre and agricultural wages (Figure 20). Two of the variables have values outside the expected range, both below their expected values. Cow prices are more than two SEs below expected values in both 1997 and 1998, and wages are more than two below in 1998.

Using trend lines as a basis for comparison, rather than the year 1997, we get a slightly different story. Although the amount of milk produced in 1998 was noticeably greater than the amount in 1997, 1998 production was not much farther from the trend line than 1997 production. Both were within one SE of the trend. The two components of milk production play different roles. In 1998, i.e., the period of price regulation under the Compact, cow numbers were above their trend line, contributing to over-trend total milk production. Figure 10 shows, however, that cow numbers were essentially stable during the Compact period. Low beef prices starting in 1996 set the stage for increasing cow numbers in 1997. Milk per cow, which has had the steadiest trend of all the factors, was substantially below the trend in 1997. Although it recovered noticeably in 1998, it was still below its trend. Thus, milk production slightly above the trend during the period of Compact price regulation resulted from cow numbers slightly above trend and milk production slightly below trend compared to historical experience.

The other five variables – grain, hay and milk prices, precipitation and temperature – had Multiple-Rs below 50% (Figure 21). For these variables, expected values were their means over the 1988-1996 period. Three of these variables – grain, hay and milk prices – were more than two standard deviations (SDs) above their means in 1997. In 1998, only one – hay price – was, but it was more than eight SDs above. Using means as expected values, rather than trend lines,

grain prices, again, show more asymmetrical movements and are farther from their expected values than milk prices were.

One way to assess whether the year prior to the beginning of Compact price regulation is a good basis for comparison with the Compact period is to determine how many of the variables being examined do not fall within the expected range. In the entire 1988-1996 period, only once was a factor influencing milk production more than two standardized units from an expected value. In 1990, the milk price reached $15.02 per cwt. The mean plus two standard deviations for milk prices was $14.93 (See Figure 11, too). In 1997, four of these variables – cow, grain, hay and milk prices – were more than two standardized units from their expected values. In 1998, three variables – cow prices, wages and hay prices – were that far out of their expected distributions. Both 1997 and 1998 presented New England dairy farmers with unusual operating environments. The year 1997 is not representative of the prior eight years and thus a more detailed examination of factors that changed from 1997 to 1998 is necessary to understand the impacts of the first year of Compact price regulation.

Table 2 is a summary of the factors influencing milk production and a crude assessment of the favorability of the operating environment for milk production. The levels of the factors were rated for favorability using standard economic relationships between prices and quantities (e.g., low input prices encourage production and low product prices discourage it) and inferring from hay prices that 1996, 1997 and 1998 were too wet. Counting the number of factors in each favorability rating and assigning a simple scheme of weights provides a method for calculating aggregate overall milk production favorability scores for the operating environment. The scores for 1996, 1997 and 1998, respectively were 1, 2 and –1. These results suggest that 1998, although the milk market was being regulated under the Compact, was not as favorable a year for milk production as 1997 was. Nevertheless, milk production did increase in 1998. That increase may be due to lags between changes in the environment in which dairy farms operate, adjustments that farmers make, and impacts on milk production.

Summary Points

- Total milk production, milk production per cow and cow numbers in New England in the first 12 months of Compact regulation (July 1997 to June 1998, the Compact period) were not significantly different than 1988-1996 trends. This does not imply that the Compact had no impact on milk production, but does place the impacts (examined in the next section of the report) into historical perspective.

- Cow numbers were above their historical trend during the Compact period, but they had actually increased most during the pre-Compact period. Cow numbers remained essentially constant during the Compact period.

- Milk produced per cow rose faster than the long-term average rate during the first year of Compact price regulation. However, it was still below its trend line based on 1988-96.

- Changes in grain prices between 1996 and 1998 contributed more to changes in the milk-grain price ratio than did changes in milk prices.

- Of the nine factors influencing the milk supply (beef, cow, grain, hay and milk prices, wages, real-estate values, and rainfall and temperature),
    - Only once was one of the factors more than two standard errors (SE) from its trend line in the entire 9 years from 1988 to 1996 – the milk price in 1990,
    - Four factors (cow, grain, hay and milk prices) were more than two SE or two standard deviations (SD) from their trend lines or means in 1997 (Table 2), and
    - Three factors (cow prices, hay prices and wages) were more than two SE or two SD from their expected values in 1998.
- An evaluation of the changes in milk production from 1997 to 1998 should account for changes in the key factors simultaneously. Because a number of factors differed from long-term trends, 1997 can be considered an unusual year. Thus, care must be exercised in comparisons of milk production in 1997 and 1998.

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Table 1. Variables Describing New England Milk Supply

Variable Examined	Level	Period	Source*
Measure of milk supply			
Milk production	State	Quarterly	NEAS
Components of milk supply			
Milk per cow	State	Quarterly	NEAS
Number of milk cows	State	Quarterly	NEAS
Factors influencing milk supply			
All-milk price received by farmers	State	Monthly	NEAS
Beef prices	New York	Monthly	NHP
Dairy grain prices	Vermont	Monthly	NHP
Hay prices	Vermont	Monthly	NHP
Total precipitation	State	Monthly	NOAA
Average temperature	State	Monthly	NOAA
Real-estate value per acre	State	Annual	NASS
Wages	Northeast	Quarterly	SL

***** *NEAS = New England Ag. Statistics. NHP = N H Pelsue. NOAA = National Oceanic and Atmospheric Administration. NASS = National Agricultural Statistics Service. SL = Steve Logan.*

Figure 1. Quarterly milk production as a percent of July 1987 to June 1988 average

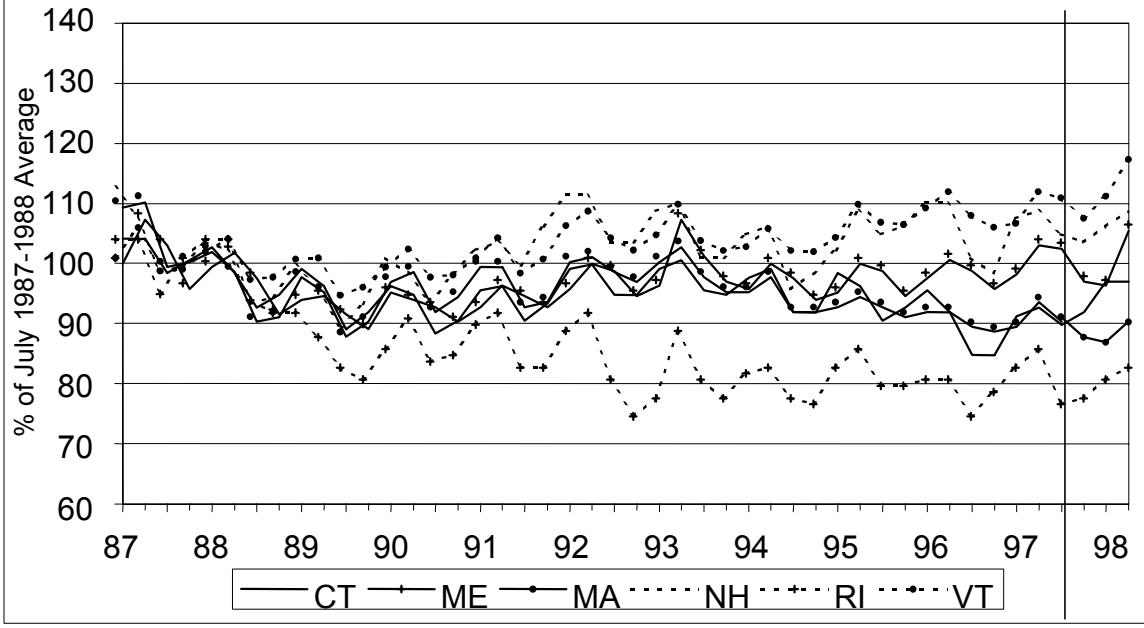

Figure 2. Annual milk production in New England states, July 1995 to June 1998

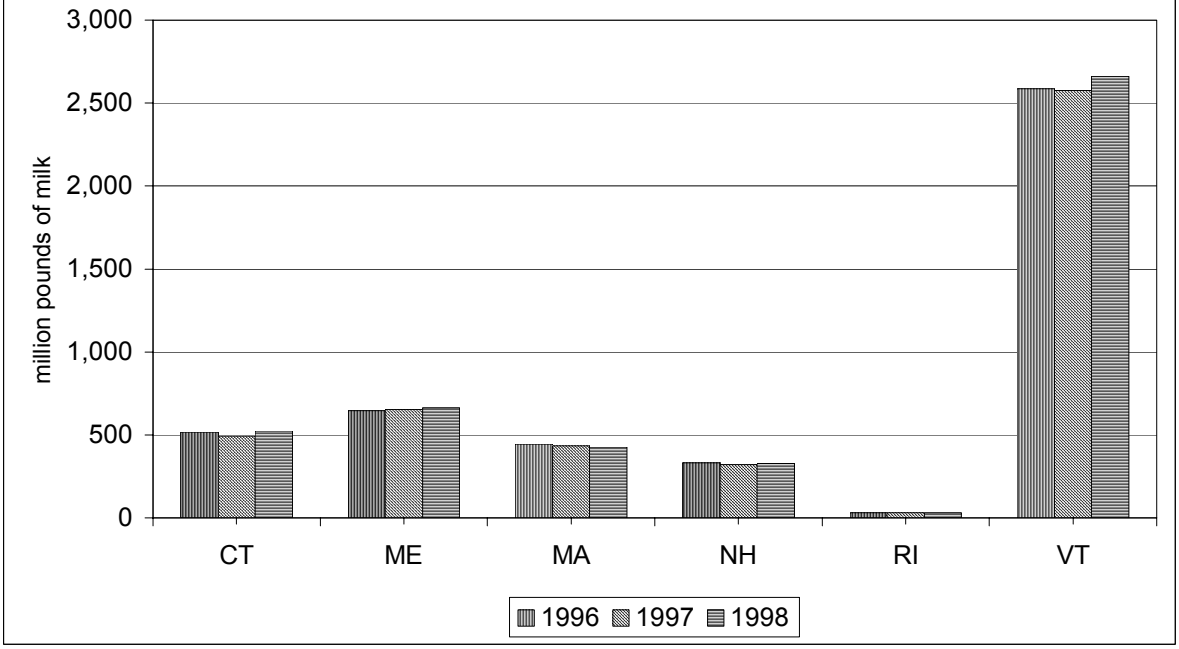

Figure 3. Annual Milk Production in New England, July 1987 to June 1998

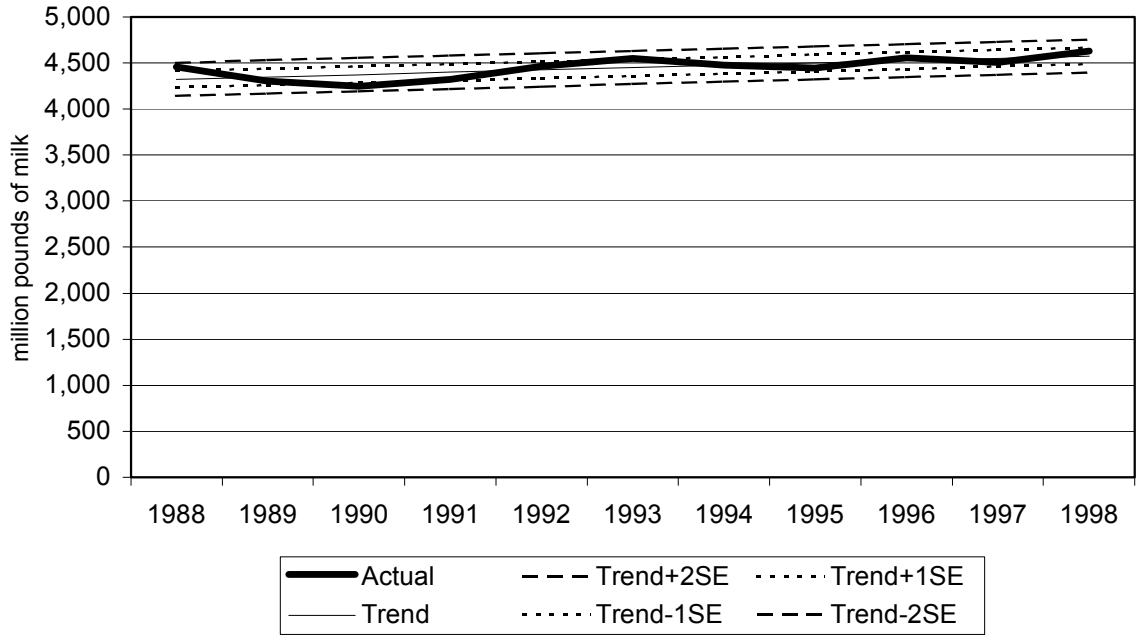

Figure 4. Quarterly milk per cow as a percent of July 1987 to June 1988 average

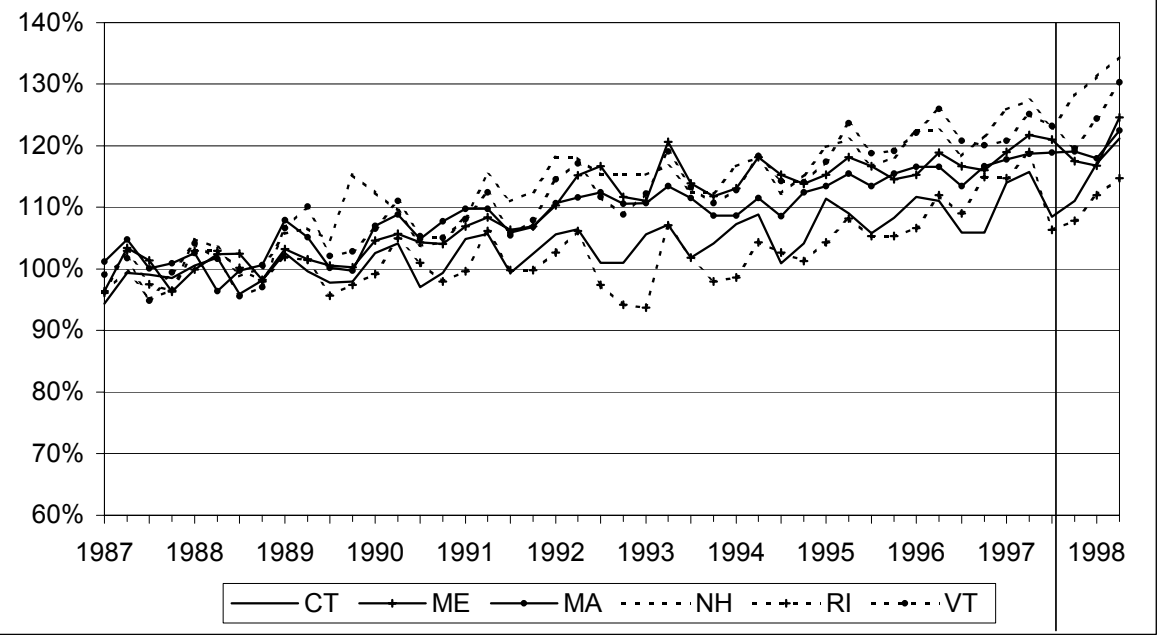

Figure 5. Milk per cow per year in New England states, July 1995 to June 1998

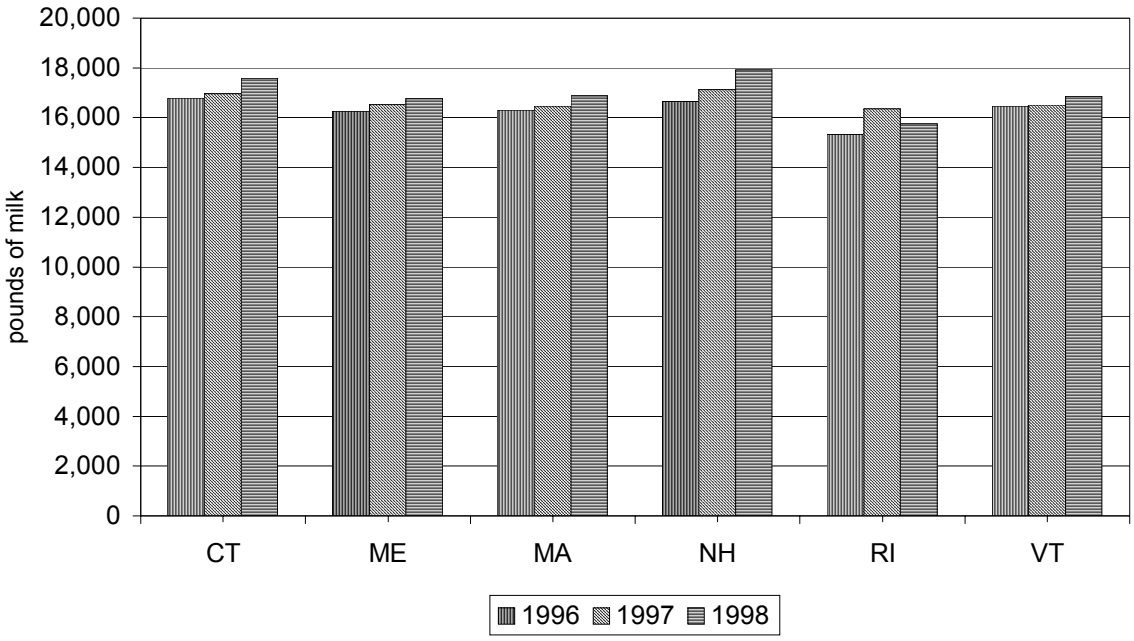

Figure 6. Milk Per Cow in New England, July 1987 to June 1998

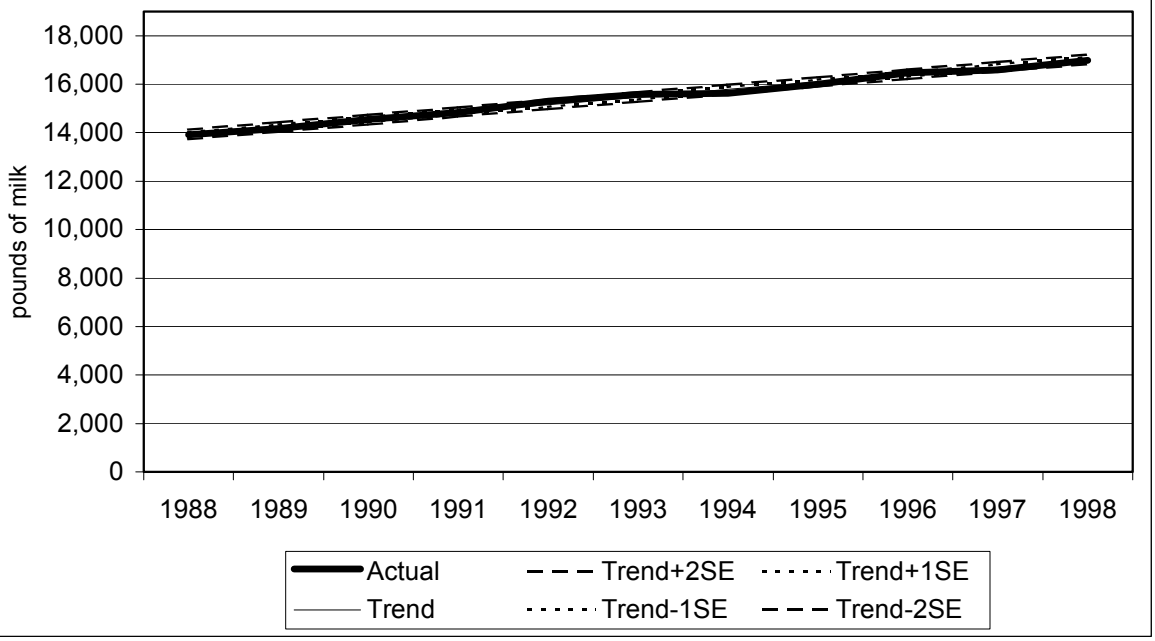

Figure 7. Milk cows in New England states, as a percent of July 1987 to June 1988 average

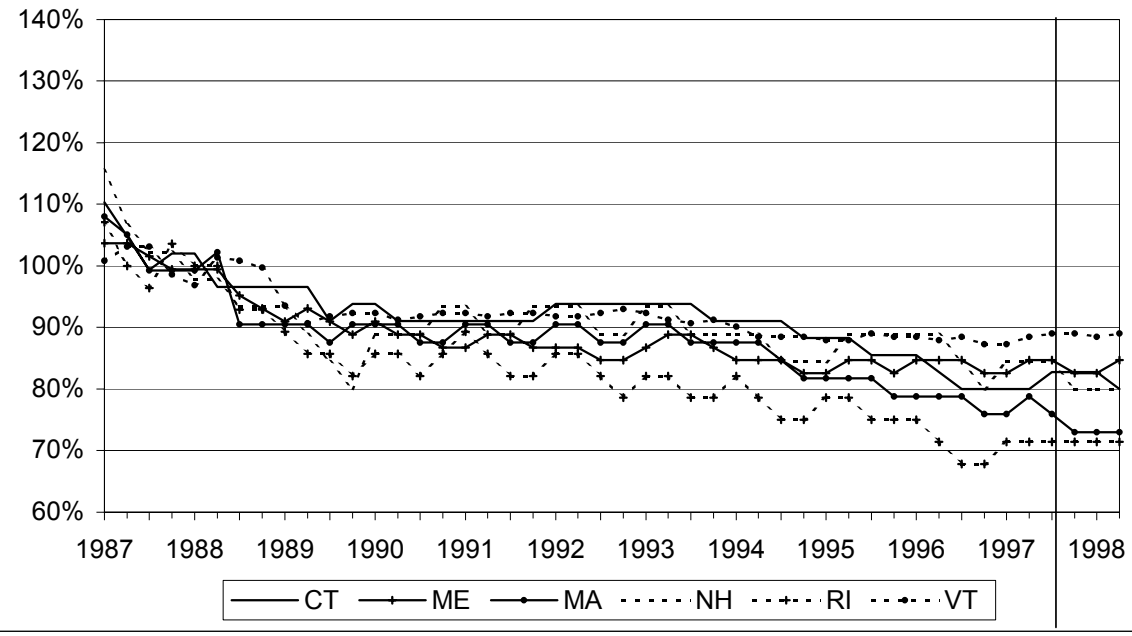

Figure 8. Milk cows in New England states, July 1995 to June, 1998

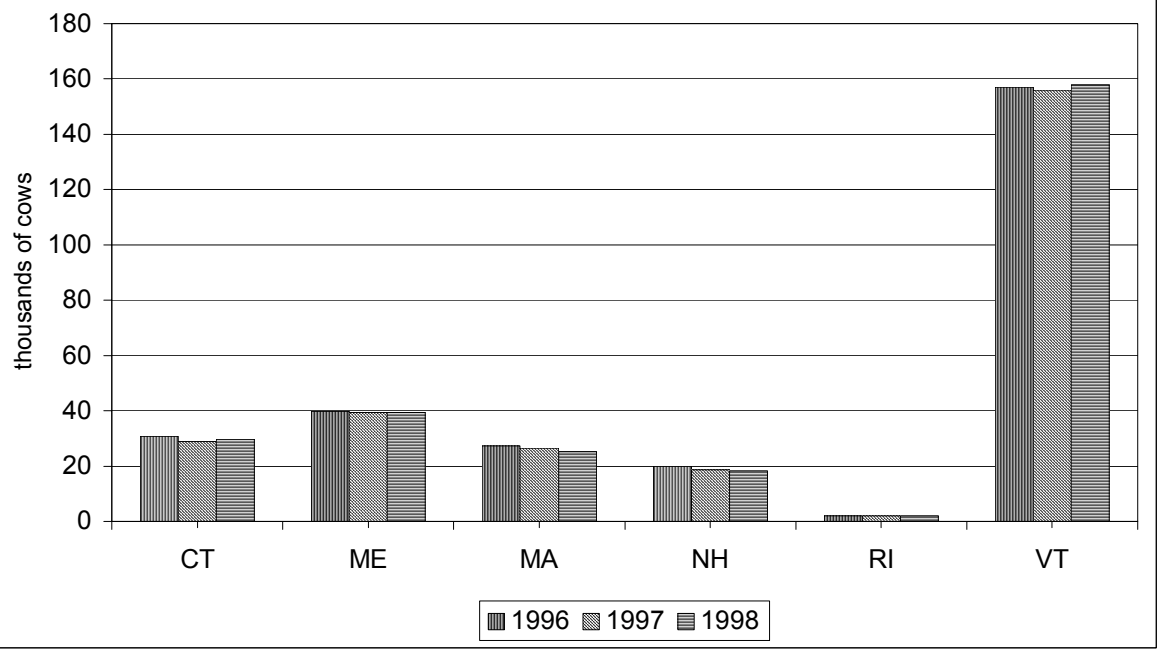

Figure 9. Milk-cow Numbers in New England, July 1987 to June 1998

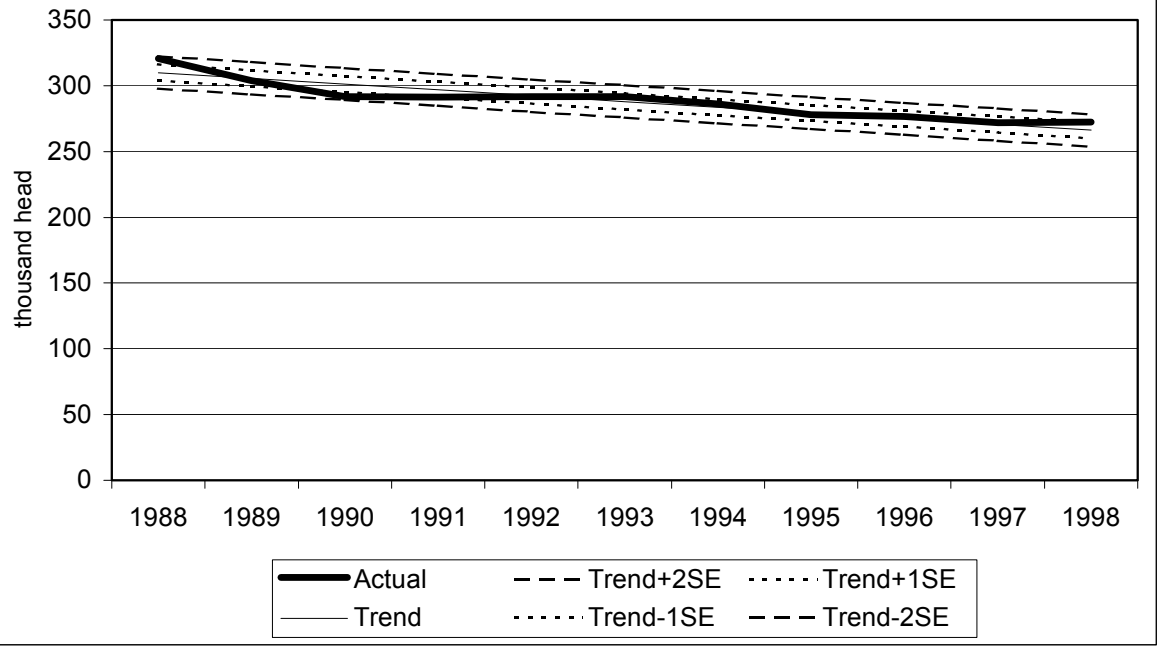

Figure 10. Quarterly milk production, milk per cow and cow numbers, as a percent of July 1987 to June 1988 averages

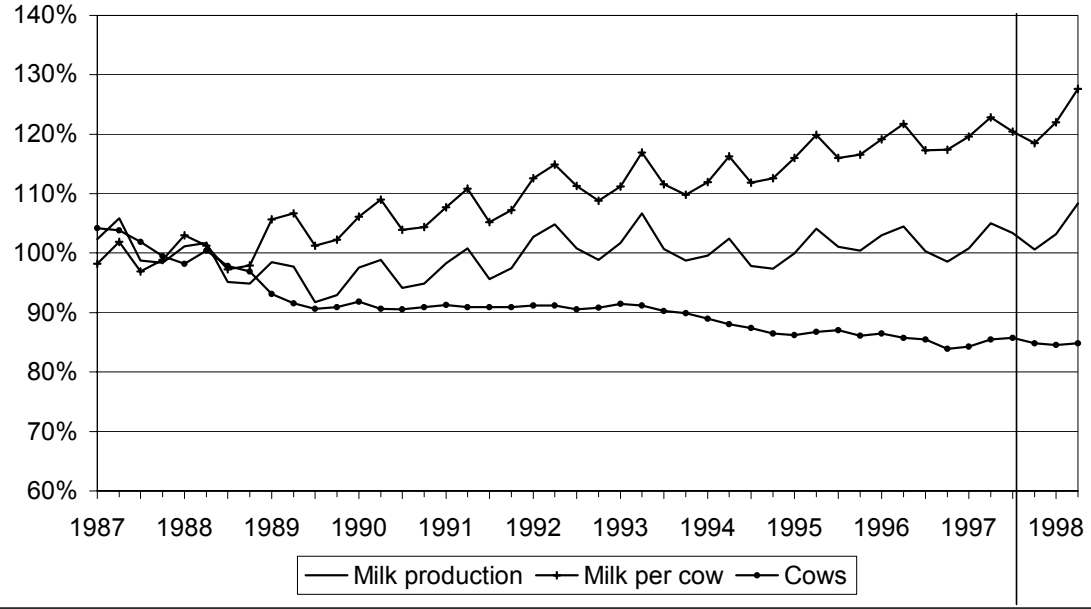

Figure 11. Milk Prices in New England, July 1987 to June 1998

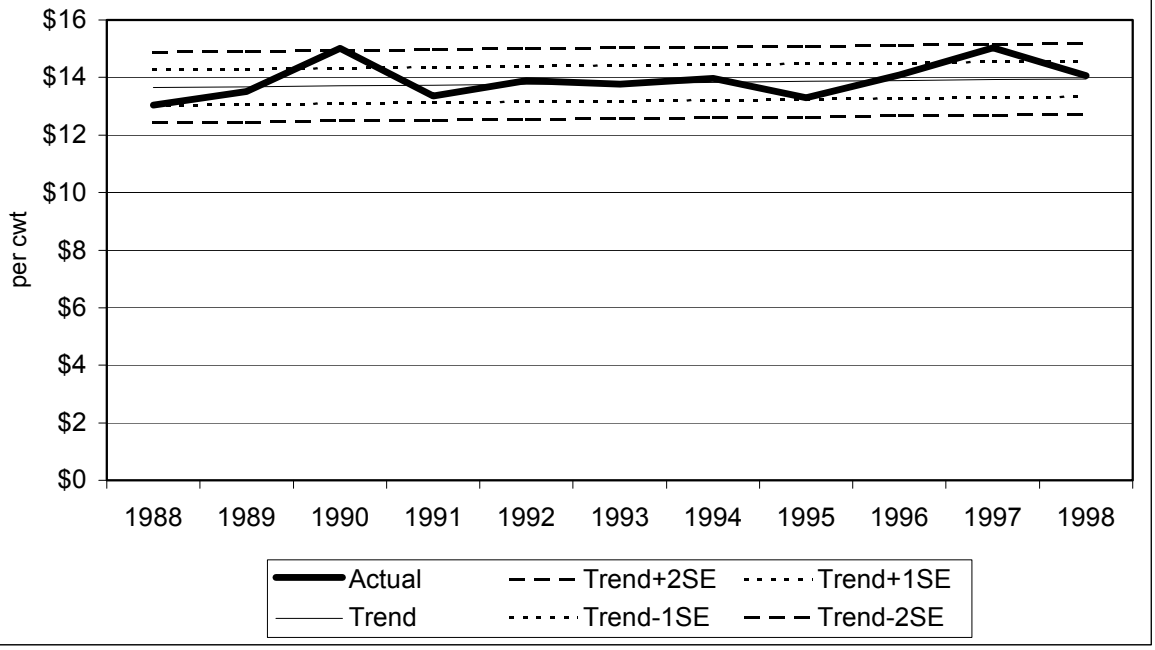

Figure 12. Beef Prices in New York, July 1987 to June 1998

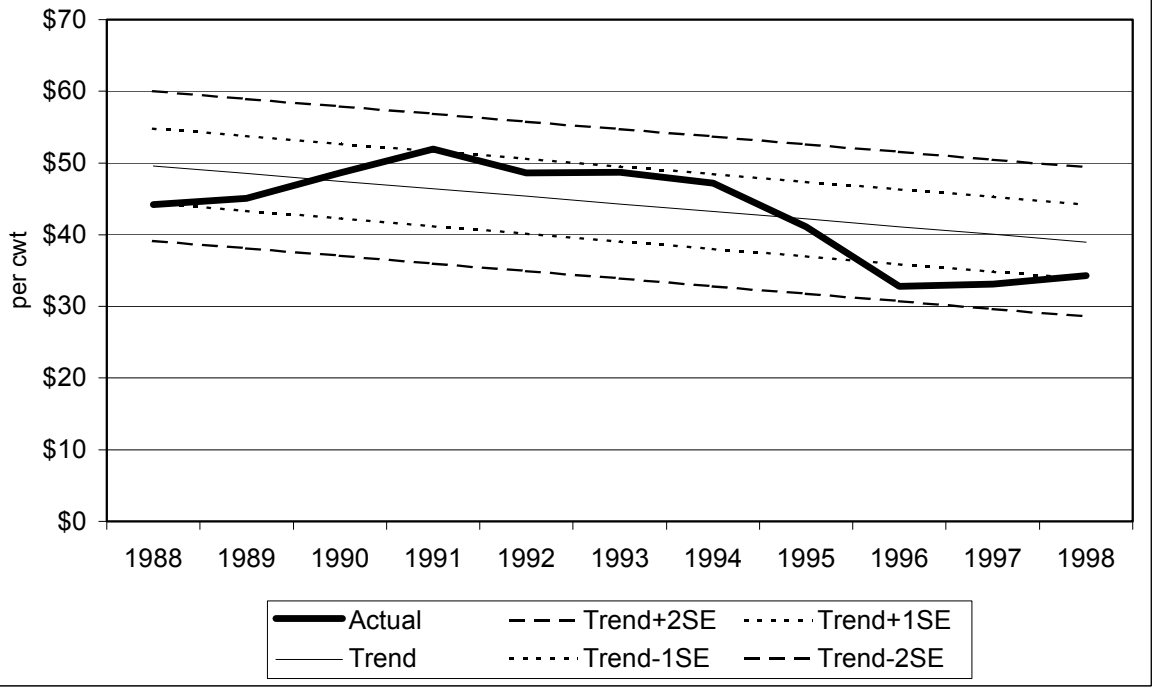

Figure 13. Cow Prices in New England, July 1987 to June 1998

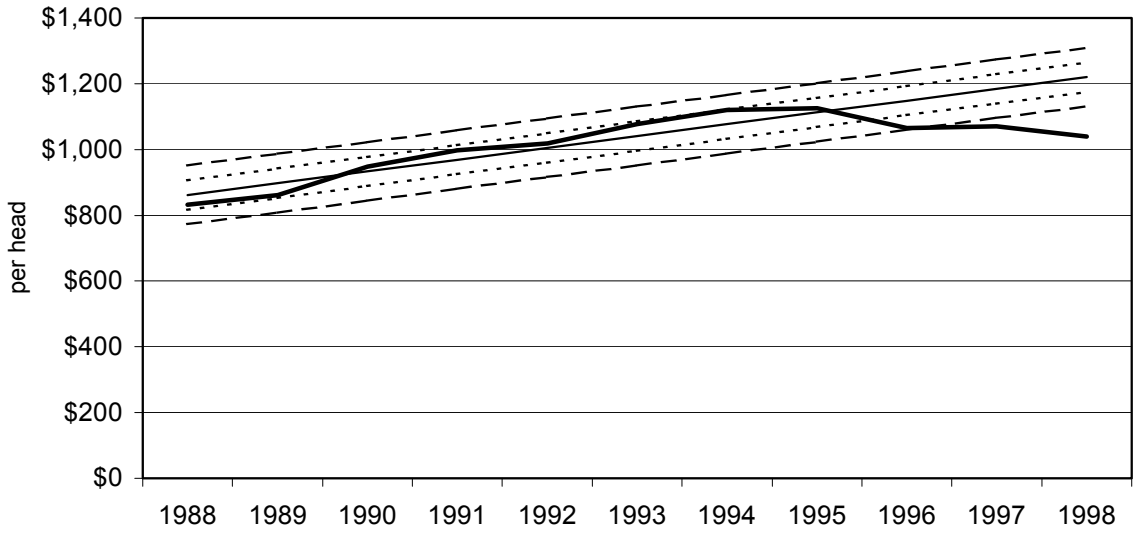

Figure 14. Grain Prices in New England, July 1987 to June 1998

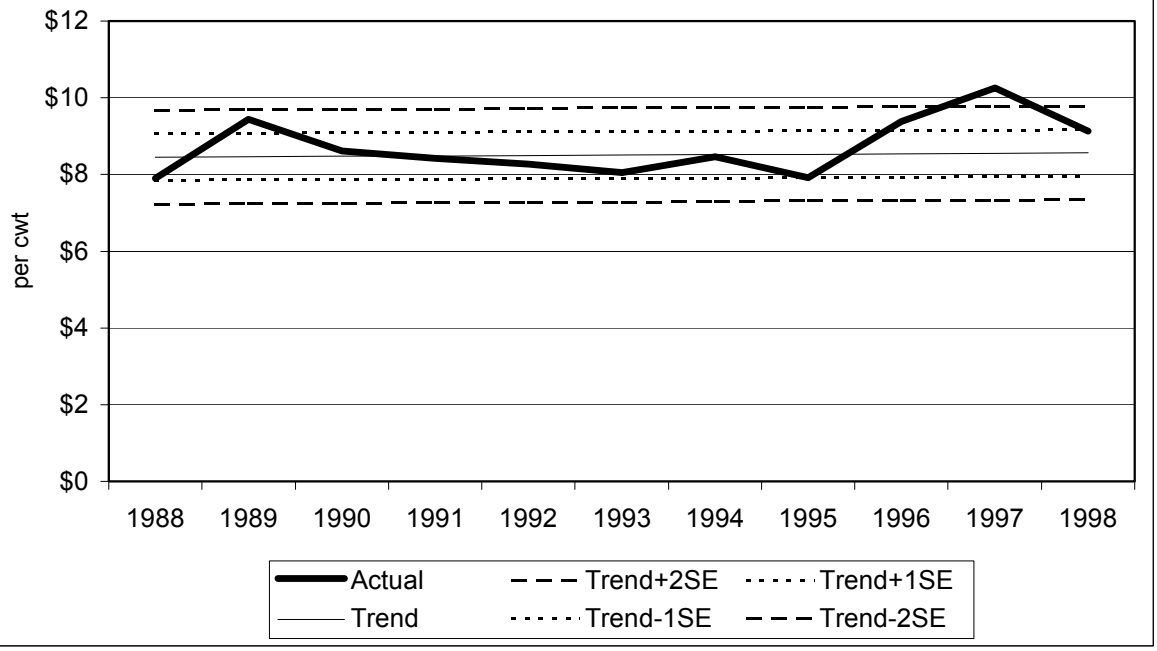

Figure 15. Hay Prices in New England, July 1987 to June 1998

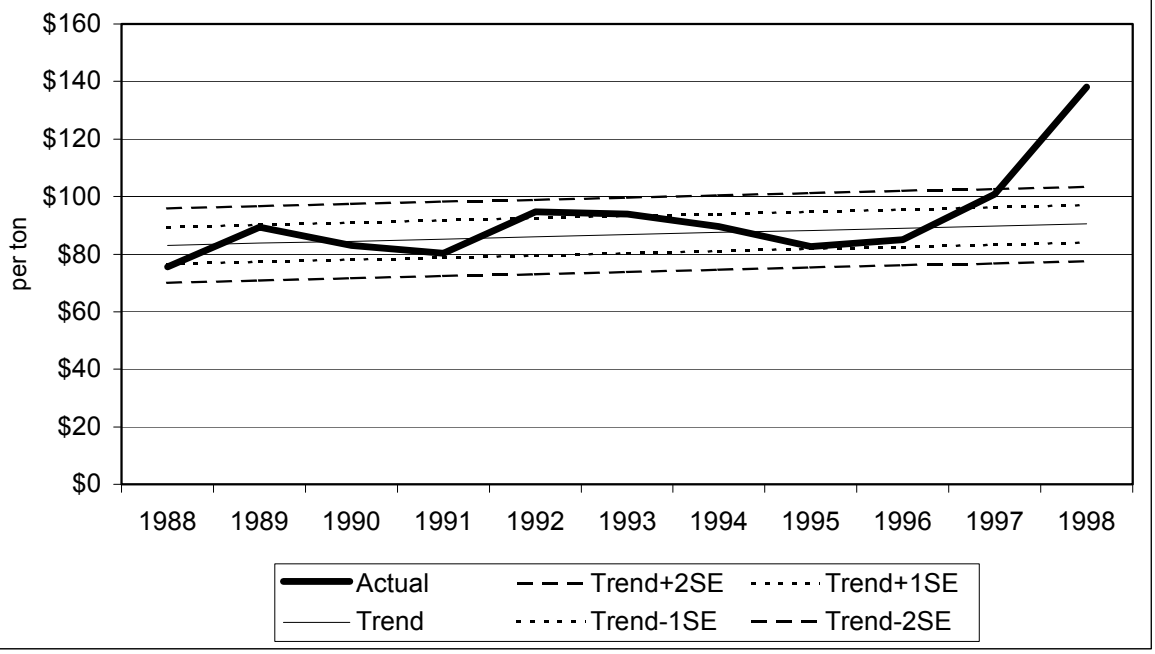

Figure 16. Real Estate Prices in New England, July 1987 to June 1998

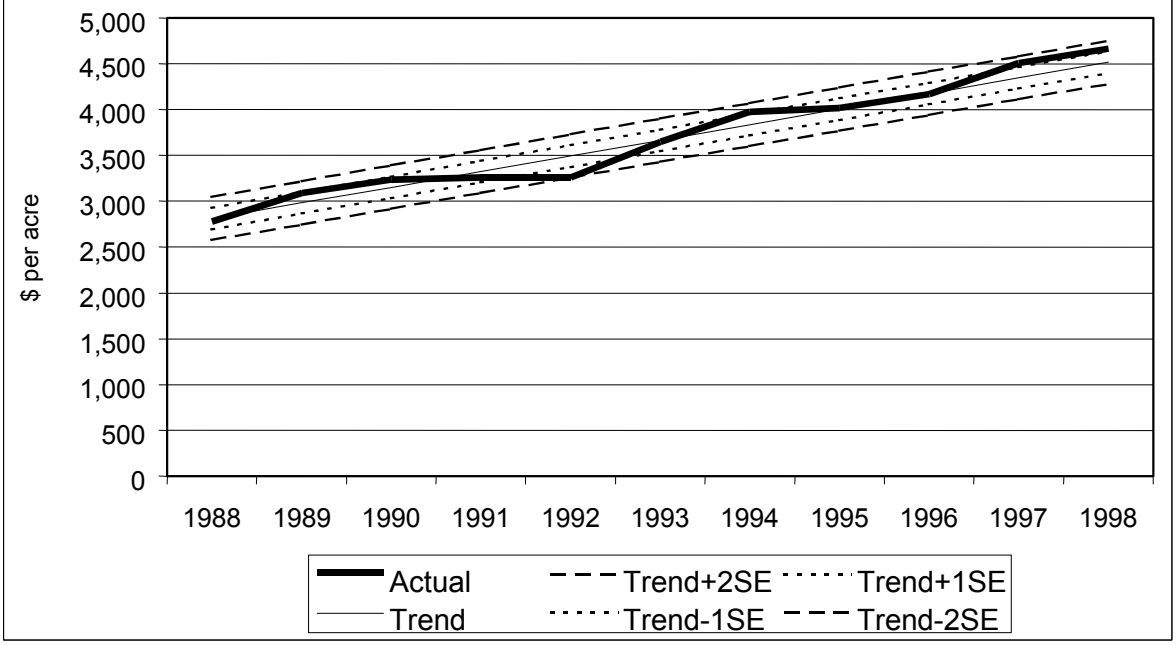

Figure 17. Wages in New England, July 1987 to June 1998

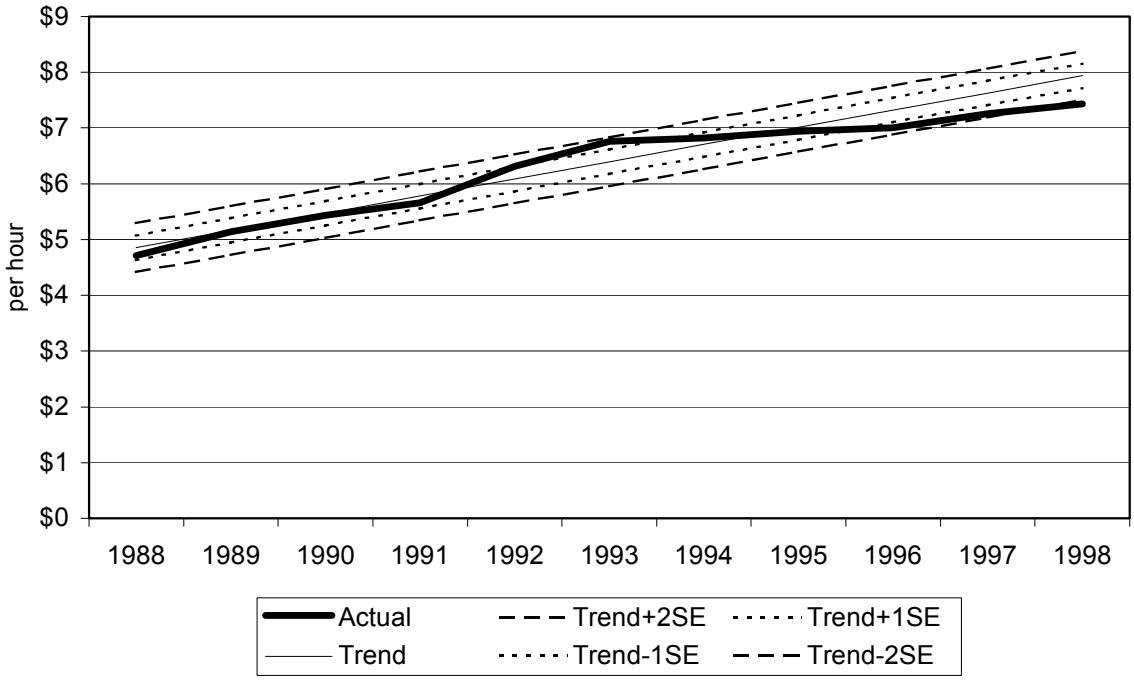

Figure 18. Precipitation in New England, July 1987 to June 1998

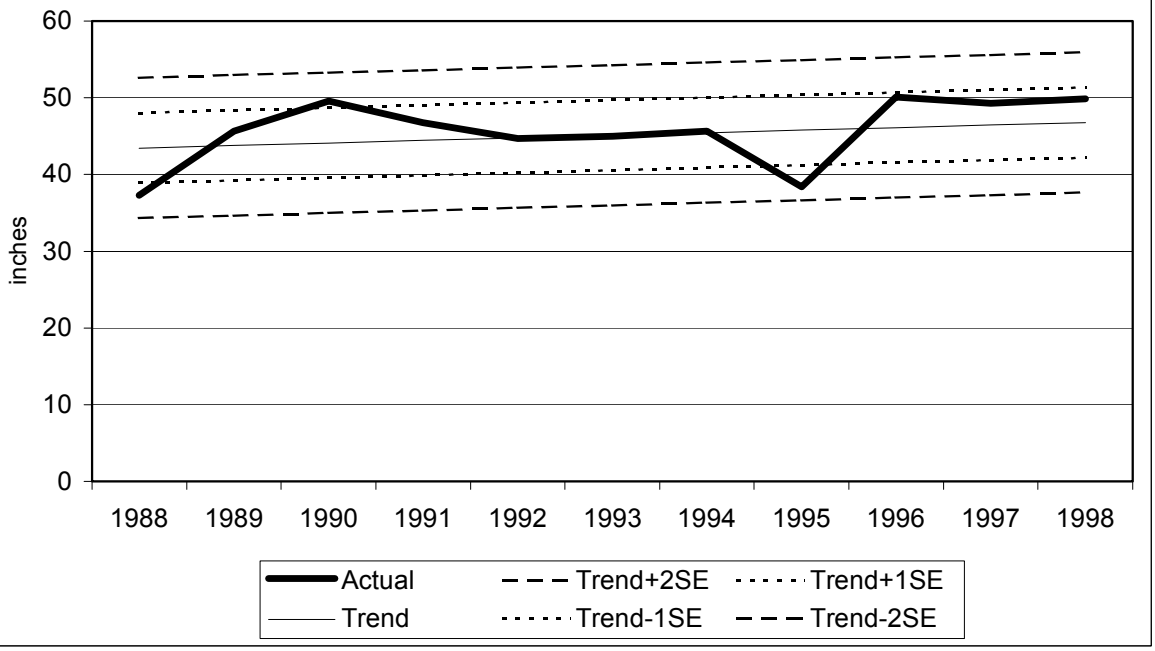

Figure 19. Temperatures in New England, July 1987 to June 1998

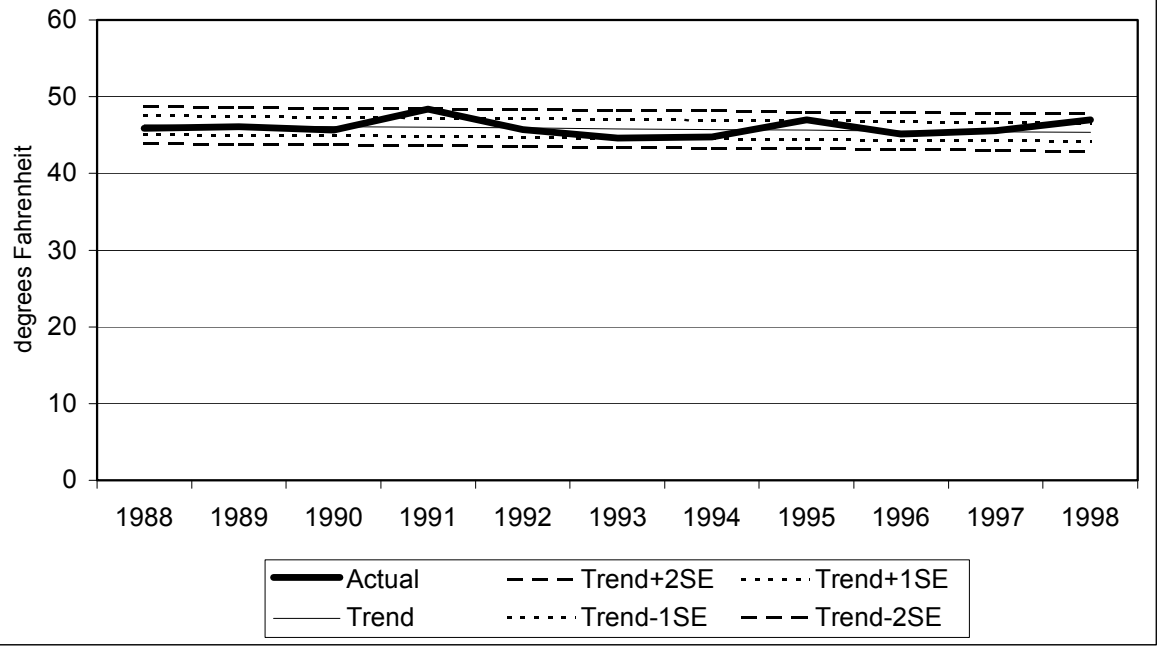

Figure 20. Differences between actual 1996-1998 values and predicted values based on 1988-1996 trends: Beef prices, cow numbers and prices, milk per cow, milk produced, real-estate values, and wages

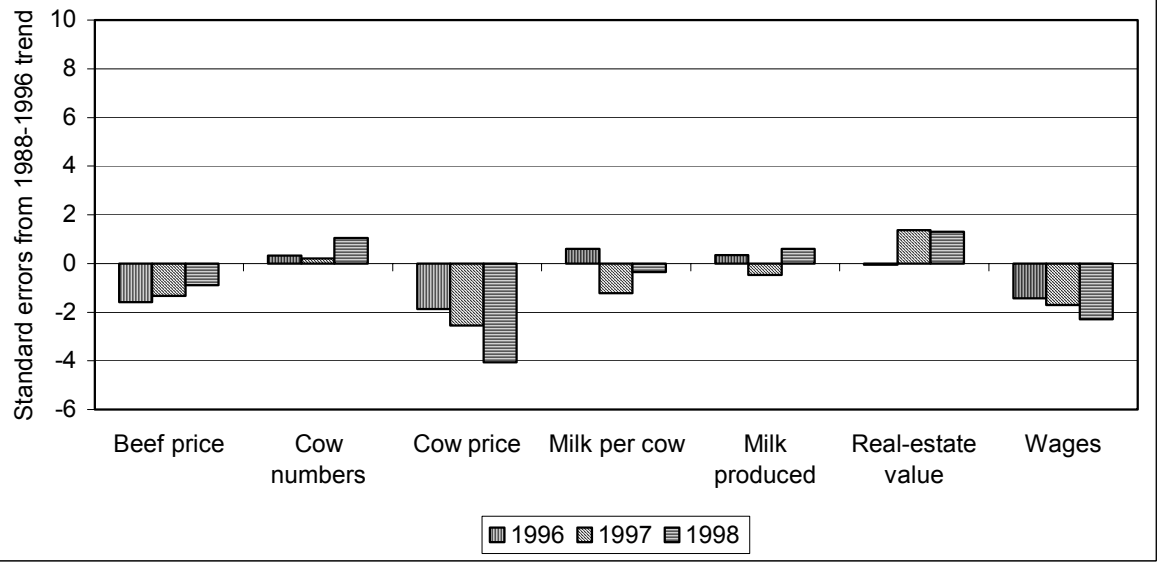

Figure 21. Differences between 1996-1998 values and 1988-1996 averages: Grain, hay and milk prices, rainfall, and temperature

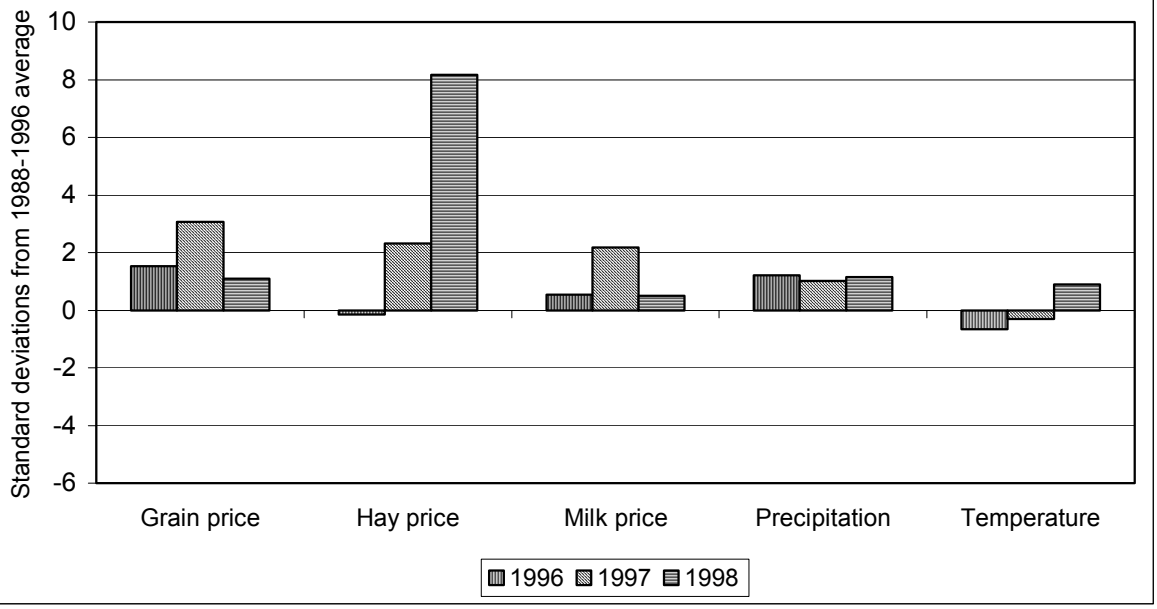

Table 2. Favorability of Factors Influencing New England Milk Production (Relative to 1988-1996)

Variable	Favorability of Factors														
	Very unfa-vor-able	Unfa-vor-able	Neu-tral	Fa-vor-able	Very favor-able	Very unfa-vor-able	Unfa-vor-able	Neu-tral	Fa-vor-able	Very favor-able	Very unfa-vor-able	Unfa-vor-able	Neu-tral	Fa-vor-able	Very favor-able
Standard deviations from mean or trend	-2 or less	-1 to -2	With-in 1	1 to 2	More than 2	-2 or less	-1 to -2	With-in 1	1 to 2	More than 2	-2 or less	-1 to -2	With-in 1	1 to 2	More than 2
Period	***July 1995 to June 1996***					***July 1996 to June 1997***					***July 1997 to June 1998***				
Cow numbers			X					X						X	
Milk per cow			X				X						X		
Beef price				X					X				X		
Cow price				X						X					X
Grain price		X				X						X			
Hay price			X			X					X				
Milk price			X							X			X		
Precipitation		X					X					X			
Temperature			X					X					X		
Real-estate value			X				X					X			
Wages				X					X						X
Count	0	2	4	3	0	1	2	1	2	2	1	3	3	0	2
Weights	-2	-1	0	1	2	-2	-1	0	1	2	-2	-1	0	1	2
Score	1					2					-1				