Impacts of Fuel price, Supply/Demand, and Seasonality on Class I Milk Price Differentials

Subject Area: Marketing and Industrial Organization

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Abstract

The Class I price differentials for milk were established in 2000 and continue in use today. These differentials are to reflect transport and other factors that vary across space. Since 2000 some key factors have changed like fuel price and supply/demand locations. We examine how the differentials match up with the distribution of shadow prices in a spatial transport model. We find consideration of fuel costs and supply demand location shifts raises the magnitude of the differentials by about 75%. We also find that consideration of seasonality also affects the differentials. Collectively the results indicate that it may be desirable to revisit the policy determined price differentials.

Background

The U.S. average monthly milk price has shown extreme variability. This volatility is caused by the difficulty of balancing milk supply and demand in the short term since milk is produced every day and is perishable (Machester and Blayney, 2001; Shieds, 2009). To stabilize the milk price, the federal government developed Federal Milk Marketing Orders (FMMOs) authorized in the Agricultural Marketing Agreement Act of 1937. The FMMOs system is designed to provide both price support and market stability by establishing minimum prices handlers are to pay. Accordingly, FMMOs are designed to insure a sufficient quantity of Grade A milk supply with stable milk price.

The FMMOs affect milk pricing though a classified pricing system and revenue pooling[1]. Classified pricing differentiates milk according to milk usage product class. Milk used for

[1] Revenue pooling causes dairy farmers to be paid a weighted average price for all uses of milk in a particular marketing order. The revenue pooling system gives all dairy farmers in a certain marketing order area the same price plus also balances market power between them and milk handlers.

products are categorized by four classes under clauses 8(d) and 9(r) of the Dairy Industry Act S.N.S. 2000[2]. Generally speaking, Class I milk is used for packaged fluid milk products. Class II milk is used to produce soft manufactured dairy products such as yogurt and ice cream. Class III milk is used to produce hard manufactured dairy products such as cheese. Class IV milk is used to produce any product not included in the other classes such as butter and powder. Under the system, prices paid by handlers for milk used in Class II, III, and IV are based on U.S. average wholesale market prices for products belonging to each class as reported by the Agricultural Marketing Service (AMS). These class prices are identical for all locations across the U.S. market. On the other hand, the price for Class I milk varies by location as it involves the addition of a predetermined and fixed *Class I differential* for each county[3]. Raw milk is classified according to sanitary conditions; Grade A milk qualifies for fluid consumption and Grade B milk is only used for manufactured products. The main reason for the differentiated Class I price is to compensate dairy farmers for the additional costs of producing Grade A milk and then getting it to market. There are two primary reasons for the locational variation; they are set to allow deficit areas to attract Grade A milk from surplus areas to satisfy fluid milk demand, and to compensate producers for transportation costs. The Class I differential varies across the U.S with the range of $1.60 - $6.00 per cwt. Fluid processors in the region must pay the differential plus the higher of the Class III or Class IV milk price. The lowest differential is $1.60 per hundredweight (cwt) found in some areas in the Upper Midwest and California (which has an alternative differential structure). The highest differential is $6.00 per cwt found in

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[2] Class V milk occurs only when the Canadian Dairy Commissions has issued a permit under the Special Milk Class Permit Program. Thus, it is not considered in the milk classifications used in our research. The Canadian regulation is described on the website https://www.novascotia.ca/just/regulations/regs/dimilkcc.htm.

[3] Refer to the website for the current Class I price differential for each 3114 county. It is available at http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELDEV3101901 from United States Department of Agriculture – Agricultural Marketing Service (USDA-AMS).

southern Florida. Thus, fluid processors in southern Florida must pay at minimum prices $4.40 per cwt more to receive Grade A milk than those in some Upper Midwest regions. This study examines the adequacy of the Class I price differentials.

Motivation

The vast majority of the Class I price differentials currently being used was established in January 1, 2000. Since then, there have been only slight adjustments of differentials in the Appalachian Marketing Area (FO5), Florida Marketing Area (FO6) and Southeast Marketing Area (FO7) that occurred in May, 2008[4]. However, there have been significant changes in local supply, local demand and transportation costs which are potentially key factors determining the spatial value of milk. We examine each of these below.

In terms of milk supply, there have been geographic shifts in location. Milk production is moving to the western U.S. This has been caused by lower average costs of milk production in the west that have occurred for a variety of organizational and climatic reasons (USDA-ERS, 2012). The standard deviation of percent change from 2000 to 2012 in lower 48 states milk production is 42%, which indicates that regional milk supply has experienced a striking change since 2000. The first panel of Table 1 shows the share of milk production for 48 continental states in 2000 and 2012, and the difference (as a percentage change) between two time periods. Idaho experienced the largest increase in supply share followed by California, Texas and Michigan. These four states produced 30.3% of US milk in 2000 and 36.9% in 2012. On the other hand, the production share in Pennsylvania decreased from 6.7 % to 5.3 % during the period.

[4] Refer to the website http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5067132 for detailed information.

Regional demand for dairy products has also changed. The second panel of table 1 indicates the share of dairy product demand as a function of population. The last column shows the difference between change in demand share and change in supply share during the period. There we see Minnesota, Pennsylvania, and Florida are top 3 states where the demand share increase was more than the supply share increase. On the other hand, Idaho, California, and Michigan experienced a supply share increase in excess of the demand share increase. The range of the differences in 48 continental states is from 1.1% in Minnesota to -2.4 % in Idaho. These shifts indicate that potentially the relative regional value of milk in 2012 might have shifted from what was appropriate in 2000.

The other key factor that would cause spatially differentiated milk values is transportation costs. These costs have risen substantially since 2000 and as such would increase the price differential between regions of excess supply and those of excess demand. In particular, even though there are many considerations underlying transportation rates, the fuel cost is still a leading factor and has increased greatly recently (Figure 1) more than doubling since 2000.

Milk production and product demand also shows seasonal variation due to breeding patterns and weather conditions, especially excessive heat and humidity (Hahn, 1999). This implies perhaps a need for seasonality in the class I differentials.

Objectives

This research investigates the impacts of the altered supply, demand, and fuel prices on the locational milk value and embodied price differentials between 2000 and 2012. Also, we examine the impact of both milk production and dairy product consumption seasonality on milk values. Lastly, we examine the effect of some other order features introduced to reduce spatial differences of milk values and facilitate the movement of plant milk between markets namely the Transportation Credit Program (TCP).

Literature Review

The concept of Class I regional differentials was initially introduced in 1960 (French and Kehrberg). Christ (1980) compared the hauling cost to move Grade A milk to the Class I price differential structure. He concluded that Class I price differentials were in need of an increase to promote regional movement of milk. Subsequently, many researchers analyzed the impact of Class I price differentials using spatial programming models such as the Dairy Market Policy Simulator (DAMPS) and Interregional Competition model (IRCM) (Novakovic et al, 1980, Cox and Jesse, 1995). A representative study of this type is that done by Pratt et al. (1998) using the U.S. Dairy Sector Simulator Model (USDSS). The USDSS (Pratt et al., 1997) is a spatially detailed model of the U.S. dairy industry. It has different locations for milk supply, processing, and consumption; milk supply represented by 240 locations from a multi-county aggregate set of counties, dairy product consumption represented by 334 specific locations, and 622 potential processing locations. The model has decision variables related to where to locate the plants and how much dairy product to process at each location. The model uses fat and solids-non-fat to account for the balance between input and output at plants level. Pratt et al indicated there were needed refinements to their work as the simulated surface values from the model did not fully reflect the actual situation due to a mismatch between the real locations of processing points (not optimal) and the simulated optimal points. The impact of seasonality on the Class I differentials was examined in the Southeastern area of U.S. (Testuri et al., 2001), but it has not been done across the U.S.

Model and Economic Theory

To examine the pricing surface and the effects of the supply, demand and transport cost shifts, we developed a linear programming model representing the US dairy sector. It represents raw milk supply at the crop reporting district level, fluid milk processing, dairy product manufacturing including intermediate and final products, consumer demand, and transportation including of raw milk, finished products, and intermediate milk products. The model minimizes the total costs associated with transport and processing of raw milk and milk products.

The model is disaggregated into 303 regions in 48 continental states following National Agricultural Statistical Service (NASS) crop reporting districts. To see the effect of seasonal variation of supply and demand, our model consists of 12 months in 2012 with fixed supply and consumption. Dynamic elements of the dairy sector are represented by the carryover of available dairy private stocks, such as butter, cheddar cheese, italian cheese, and non-fat dry. Raw milk supply is classified into Grade A, Grade B, and unregulated milk since each type of milk is entitled for different usages. Raw milk is classified into Class I to Class IV. The model includes total 23 dairy products: Class I product (fluid milk), Class II products (yogurt, cream, ice cream, sour cream, cottage cheese, skim milk, dry cottage whey, cottage whey), Class III products (including cheddar cheese, Italian cheese, condensed skim milk, condensed whole milk, cheddar whey, mozzarella whey), and class IV products (including butter, non-fat-dry, powder, whey butter, butter milk, dry but milk). It also considers two blended/mixed products. Ice cream mix is used to produce ice cream, and cottage cheese dressing is utilized to make cottage cheese. They are made by blending several products and raw milk. There are 9 different kinds of dairy plants and 15 representative processes.

The objective function is to minimize total costs, consisting of (1) assembly cost to ship Grade A, Grade B, and unregulated raw milk, (2) processing cost to make dairy products, and (3) distribution cost to transfer intermediate products between plants as well as to ship final products to consumers. The set of constraints can be broadly classified into six groups. First, there are raw milk supply/demand balance constraints at the level of farmers and plants. Second there are constraints that balance intermediate and final products at the processing plants. Third there are blending constraints on ice cream mix and cottage cheese dressing. Fourth there are final product demand constraints at the level of consumers, and milk stock storage locations. Fifth there are stock balance constraints that require that the stock of previous month plus added stock minus released stock in current month must be equal to the amount of stock in current month. Sixth, there are plant capacity constraints restricting the maximum amount of manufacturing.

Figure 2 represents raw milk and milk product movement in the model. It shows the raw milk movement and use from farms to plants. Since Grade A milk can be used for all classified dairy products, it can be used as Class I or downgraded to a lower class level. Grade B milk is only used for manufactured products (Class III and Class IV). Unregulated milk can be used for fluid milk as well as Grade B milk. Some milk is shipped to a supply plant which in turn reships the milk to other processing locations.

In terms of intermediate products, some dairy products produced in a plant do not move directly to consumer areas but rather are transferred to another plant in order to be used to make other products. For example, excess cream from a fluid plant can be transferred to a sour cream plant. At the plant level, the amount of product output must be greater than or equal to the shipped amount to consumers and another plant. At the consumer level, the amount of product demand plus the added to stock in the month must be less than or equal to the amount of distributed product plus the released from stock in the month.

The variables at the plant level are based on input-output volume ratios so for example a given amount of milk yields low fat milk and cream in fixed proportions. The only exception is for ice cream and cottage cheese where a blending problem is included based on the amount of characteristic components (solids, fat etc) with a maximum on whey content. Raw milk and dairy products can be shipped from departure to arrival regions subject to maximum distance limits on how far they can move.

The output from the model gives information on optimal raw milk shipment, distribution of milk products, and the amount of dairy product produced by each location. More importantly, the model provides the marginal values of milk at each location. These values, the shadow prices, are an indicator of milk values that are consistent with the optimized solution. A shadow price on one unit of milk at handler's location 'A' can be interpreted as follows: if a handler at location 'A' obtained one more unit of milk, then the entire cost involved with distribution of raw milk and dairy products will be changed in a way that objective function will reduce by the amount equal to the shadow price. This concept is consistent with economic theory on how prices are determined in a competitive market (Samuelson, 1952). Even though the shadow price from the constraint on fluid milk plants cannot indicate the absolute value for Class I differentials, the relative shadow price between different regions can represent the relative Class I price differentials across the regions. Therefore, the simulated shadow price values can provide information regarding price differentials between geographic locations.

Data and Method

Data for raw milk production, plant capacity, and production costs were obtained from the USDA/AMS/Dairy program. The raw milk production data covered three categories, Grade A, Grade B, and unregulated for the geographic level of each 303 NASS districts as of May 2012. Also, the plant capacity was collected according to class of plant by NASS districts. In order to see the impact of seasonality, we estimate the production for other months in 2012 based on the published USDA data on variation in 23 states[5].

Since there is no available survey or published data for consumption at the level of states or NASS districts, we calculate the amount of consumption for each NASS district multiplying per capita US level consumption for each product[6] by population in each NASS district with an assumption of the constant per capita consumption across the U.S. To incorporate the seasonality of consumption, we use the monthly data for estimated total U.S. sales of fluid milk from USDA-AMS[7]. Also, they calculated commercial disappearance[8] of cheddar cheese, Italian cheese, butter, and nonfat dry by month. For other products we cannot get available data, we use monthly U.S. production data as a proxy for consumption data[9] with an assumption that monthly production of products roughly matches monthly consumption. To see how much the spatial milk values are changed during 12 years, we collect and use the year 2000 data from the same source as we collect the year 2012 data.

[5] Data were from USDA-ERS, http://www.ers.usda.gov/data-products/dairy-data.aspx#.UnnT_vkU_V8.
In the case of states not in the data set, we use an average of monthly production from adjacent states.

[6] Data were from the data set *Dairy products: Per capita consumption, United States (Annual)*

[7] Data were from http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5097493&acct=dmktord.

[8] Commercial disappearance was derived from (production + beginning stocks + imports – ending stocks)

[9] Data were drawn from http://www.ers.usda.gov/data-products/dairy-data.aspx#.UnnT_vkU_V8.

Since one of main considerations is to study the effect of transport costs and these depend on fuel price, we estimate the impact of diesel price on transportation cost per unit using the following equation.

$$Transportation\ cost\ per\ unit\ =\ distance * (\beta + \gamma * DieselPrice) + \alpha \qquad (1)$$

A transportation cost per unit consists of variable costs linearly increasing with distance and fixed costs independent of distance. Fuel costs, driver labor costs, and vehicle maintenance costs belong to variable factors, and we divide them into fuel costs ($\gamma * DieselPrice$) and other factors (β). Fixed costs (α) include rolling stock, handling costs, milk testing costs, truck replacement costs, and etc. The California Department of Food and Agriculture (CDFA) surveyed the hauling rate for each path conveying shipment across 13 subareas in California marketing order[10] twice a year from 2006 to 2013. We use that dataset in the estimation since it corresponds to the dimension and interests of our optimization model. For the diesel price data, we use the monthly average highway-diesel price from U.S. Energy Information Administration. The panel data set consists of 577 observations with 58 paths and 15 months[11]. From the equation (1), the following panel model is derived.

$$Rate_{it} = \alpha + \beta Dist_{it} + \gamma Dist_{it} * DieselPrice_{it} + u_i + e_{it} \qquad (2)$$

where $Rate_{it}$ is the transportation rate per hundredweight for an individual path i on month t, $Dist_{it}$ is the transport distance for an individual path i on month t, and $Dist_{it} * DieselPrice_{it}$ is a interaction term with distance and diesel price measured by dollar per gallon. Since each path

[10] The survey was performed twice a year (April and October) from 2006 to 2013. The data are available from, http://www.cdfa.ca.gov/dairy/uploader/postings/haulingsurveys/.
The dataset consisted of total pounds shipped, approximated size of loads, mileage range, average miles, and average rate per hundredweight.

[11] Although the panel is not balanced, the average number of observations for each route is almost 10. Thus, it allows estimation.

has different road conditions and slopes, the unknown path-specific term u_i is included in the equation, and e_{it} is the idiosyncratic error term. By using random effects approach[12], every parameter estimates are statistically significant at 1 % level and the transportation cost per 1 load (48,000 lbs) is derived from equation (2) as following.

$$Rate\ per\ full\ load\ =\ 134\ +\ Distance\ *\ (\ 1.603 +\ 0.325 * Diesel\ Price\ ) \tag{3}$$

These results indicate the fixed cost per truck is $134 per month, and variable cost of non-diesel inputs is $1.6 per mile. The most diesel related estimate indicates that if the diesel price per gallon increases by $1, then transportation cost of a full load (which is 48,000 lbs of milk) will increase by $0.325 per mile. Transportation costs per load including milk assembly, inter-shipment, and product distribution are calculated by the estimated equation (3)[13].

Results

In the data, 163 NASS districts have fluid milk plants. In the locations where the plants have small capacity less than 48,000 lbs (1 load)[14], the amount of capacity is added to the nearest location where a fluid plant is located, and three small capacity locations were removed. A left map in Figure 3 depicts a contour map of the current actual class I differentials at the 160 geographic locations for fluid processing represented as red circles. Since the purpose of study is to evaluate the spatial distribution of Class I differentials, the values are normalized in a way that a minimum value[15] is zero, and the range is from $0 to $4.4 in southern Florida. In the Figure 3 we depict the current and model generated average 2012 Class I differentials values based on

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[12] To determine the panel estimation approach, we ran the Hausman test and Breusch-Pagan Lagrange Multiplier tests, which led us to conclude that we should use the the random effects approach. Also we found that the test for homoscedasticity was not passed, and thus used the STATA option 'robust' to control for heteroscedasticity.

[13] Distance data for each path is derived from MPMileCharter with Microsoft MapPoint.

[14] There are three NASS districts less than 48,000 lbs capacity for fluid milk: MO20, NC90, and VA70.

[15] Minimum Class I differential is $1.60 at some NASS districts in Idaho and Montana.

2012 data. The estimated Class I differential in both cases increases from low values in the northwestern area to high values in the southeastern area showing that the model does a good job replicating the general pattern of Class I differential structure. However, compared to the actual structure, the model price differentials from the lowest to the highest values regions exhibit a greater range than those currently implemented by FMMO. The lowest valued area is Southern California (CA51), and other relatively low valued areas include Colorado, Montana, and Utah. Southern Florida (FL80), at $7.44 is the highest valued area, so the range of simulated differentials is $3 greater than that of actual differentials. Thus, we find that the differentials might need to be raised to reflect the increasing fuel prices as well as changing local demand/supply conditions.

We now use the model to examine the relative contribution of supply/demand shifts and fuel prices. To do this, we first simulate a case with only changing diesel prices from 2012 to 2000 data to see the effect of fuel prices. A left map of figure 4 is results based on diesel prices in 2000. It shows a similar pattern of spatial values with the simulated values from 2012 diesel price, but the total differential is much smaller than those with the diesel price increased with the highest value is $5.63 in FL80. The range of simulated differentials is only $1.23 greater than the range of actual differentials, $4.4. We conclude that it appears appropriate to increase the current Class I price differential structure to reflect the increasing fuel price.

Second, the model is simulated by altering local supply and demand data from 2012 to 2000 but leaving diesel prices at 2000 levels. The right map in figure 4 shows results. The results indicate the change in spatial patterns is significant. The area with the lowest spatial values is changed from CA51 to South Montana (MT70). FL80, the area with the highest milk value, decreases from $5.63 to $3.64 by almost $2. South Texas (TX90) increases the spatial value from $3.99 to $4.43, which is the highest value in the U.S. The range of spatial differentials is almost same as the range of current actual differentials, but the lowest area and highest area are different with the current structure.

Figure 5 shows the differences between the model differentials based on 2012 supply/demand data and those in use based on 2000 supply/demand data without a change in diesel price. This shows the impacts of supply/demand shifts only. The green shaded indicates areas where the differentials increase and the red shaded indicates areas of decreased differentials. The Eastern U.S. shows increased milk values especially in Florida where it rises by almost $2. On the other hand, differentials decrease in the western U.S., with largest change in South California ($1.85). The figure also includes the difference between change in demand share and change in supply share with green points indicating areas where the demand share increase was more than the supply share increase and red points indicate increasing the opposite. The general trend shows that green points are located in the eastern half of the U.S. where differentials increase. Overall we find that the demand/supply shifts have a substantial impact on spatial values, suggesting that the altered local demand/supply are important determinants of price differentials that could be considered if price differentials are to be altered.

Figure 6 shows the differences between the simulated average differentials based on 2012 data and the actual differentials at each fluid processing location chosen by the model. There are only 3 NASS districts showing negative differences, indicating that Northern Colorado (CO20), Southern Utah (UT10), and Southern California (CA51) are suggested negative adjustments of $0.12, $0.10, and $0.04, respectively. Southern Louisiana (LA90) has the largest positive difference, indicating that the actual differential should be raised by $3.97. Darker red colors indicate larger suggested increases and darker green colors indicate smaller suggested increases.

Alabama, Georgia, Louisiana, South Carolina, and Texas show relatively large differences more than $3, suggesting increased Class I differential values.

Figure 7 shows the results of seasonality across May and October, 2012. It shows that the magnitude of the differentials for October is almost 50 % more than those found for May across the U.S. It is caused by the seasonality of raw milk production and fluid milk consumption as shown in Figure 8. It indicates that the months with the extreme range of the estimated differentials correspond to the months with the raw milk surplus and deficit of fluid milk. The smallest simulated range is $5.78/cwt in April and the highest one is $11.76/cwt in September, which is almost two times that found in April. It implies that it may be desirable to alter the Class I price differential structure on a seasonal basis to reflect demand and supply shifts.

In addition to the above pricing analysis we examined the TCP program. Several federal order areas that are deficit in local raw milk production implement a TCP to subsidize hauling costs to attract raw milk from outside the marketing areas. The way it works is that the buyers of milk pay some fees into the Transportation Balancing Fund which is used to help pay for the extra milk during the deficit period. As of 2012, there are three federal order areas including Appalachian Marketing Area (FO 5), Florida Marketing Area (FO 6), and Southeast Marketing Area (FO 7)[16] that used the TCP. In order to analyze the impact of these TCP actions, we calculate credit rates for the eligible paths connected to those marketing areas, and then assembly costs are subtracted by the amount of assembly rates. The results are shown in the left map in Figure 8 which shows the estimated average Class I price differentials. There we find the range

[16] Credit rates are calculated by following rule *7 CFR 1007* of the Southeast Marketing Area (FO7)as discussed on http://www.fmmatlanta.com/FO%207%20Order%20Lang.html#1000.83.

of the differentials across the U.S. is reduced to $6.64/cwt from $7.44, compared to the results without TCP. The differences between results with TCP and those without TCP are shown in a right map in Figure 8 to see the impacts of the program on the milk values. Even though the program is implemented in only three marketing order areas in the model, its impact is appeared across the U.S. Class I milk values in Florida is decreased the most by $0.80/cwt, but those in Central Colorado (CO 60) is increased the most by $0.36/cwt due to the program. General trend indicates the program causes the values of regions representing high differentials to be decreased, and the values of regions representing low differentials to be increased. The results show the TCP program does facilitate the movement of milk to high utilization markets.

Conclusion

The analysis finds that there may be grounds to revise the FMMO Class I price differentials. We find that changes in fuel price and local supply/demand imply significant changes in the model based Class I differentials causing an overall increase. Also, we find seasonal shifts in supply and demand significantly impact the differentials and indicate that it may be appropriate to establish seasonally varying differentials. Finally, we find the Transportation Credit Program does affect the differentials reducing their range.

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Figures

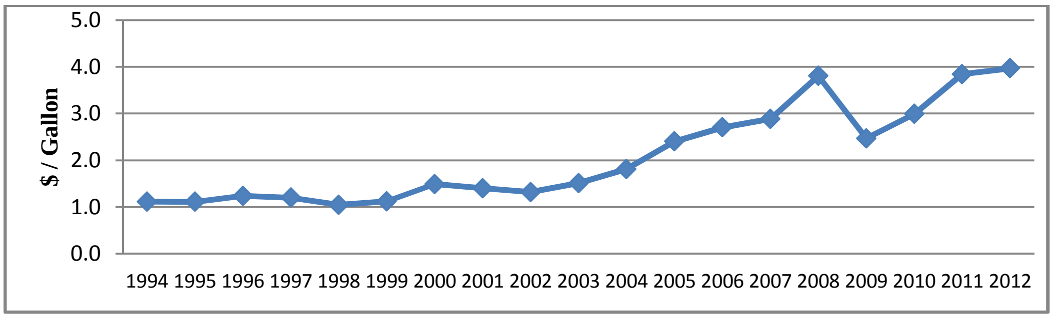

Figure 1. Average U.S. Diesel Price from 1994 to 2013
Source: U.S. Energy Information Administration

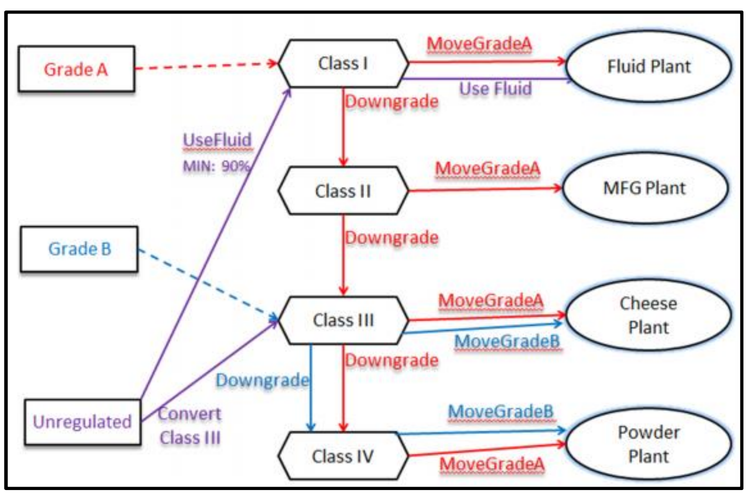

Figure 2. The representation of Raw Milk Assembly

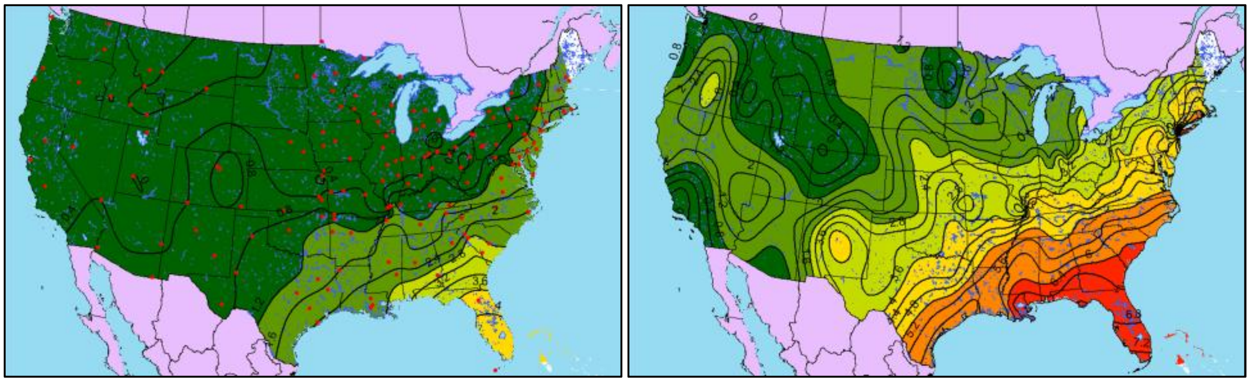

Figure 3. Normalized Actual Class I Differentials (Left) and
Simulated Class I Differentials based on 2012 data (Right) ($/cwt)

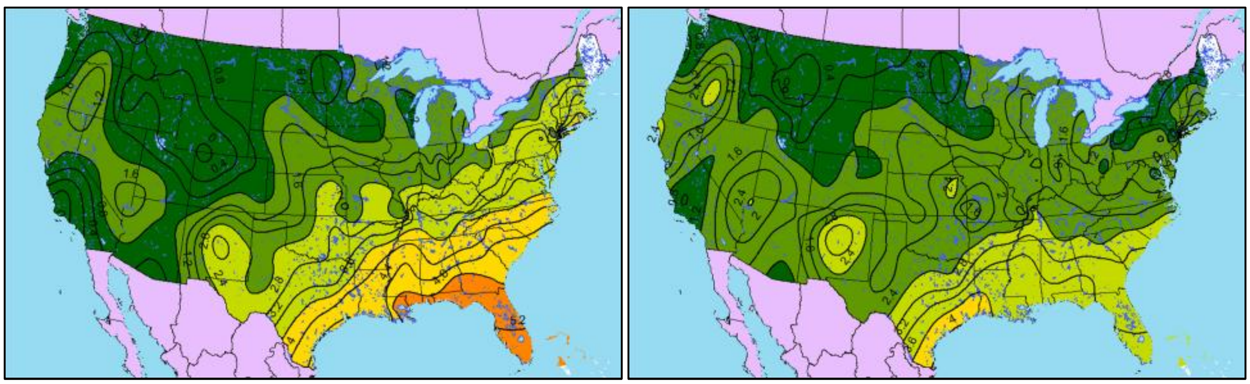

Figure 4. Simulated Differentials based on 2000 diesel price and 2012 supply/demand data (Left) and
Simulated Differentials based on 2000 diesel price and 2000 supply/demand data (Right) ($/cwt)

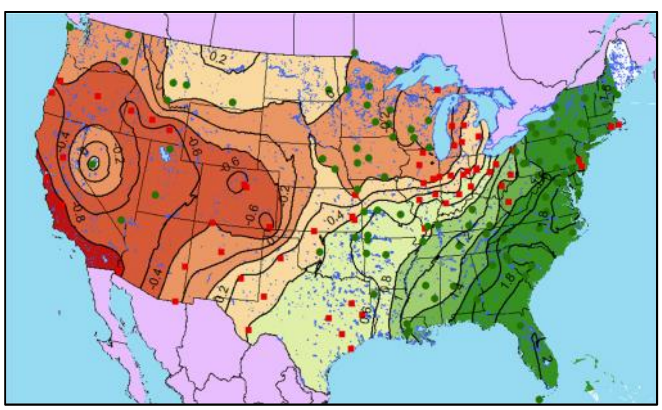

Figure 5. Differences between results from 2012 local supply/demand – results from 2000 local supply/demand
Given 2000 diesel price ($/cwt, red = –'s, green = +'s, and white = less than $0.40)

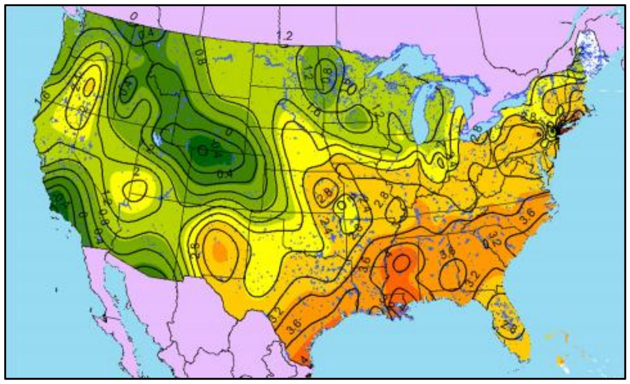

Figure 6. Differences between Simulated based on 2012 data – Actual Class I Differentials ($/cwt)

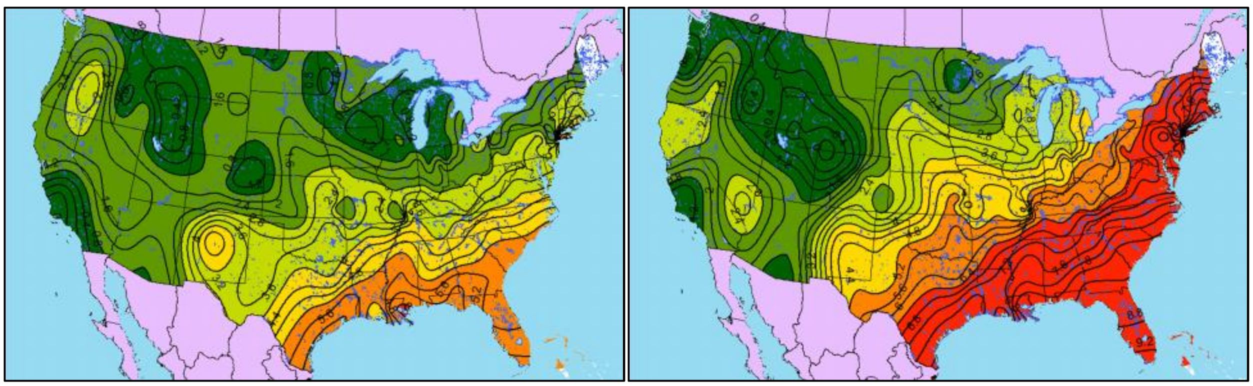

Figure 7. Simulated Class I differentials for May, 2012 and October, 2012 ($/cwt)

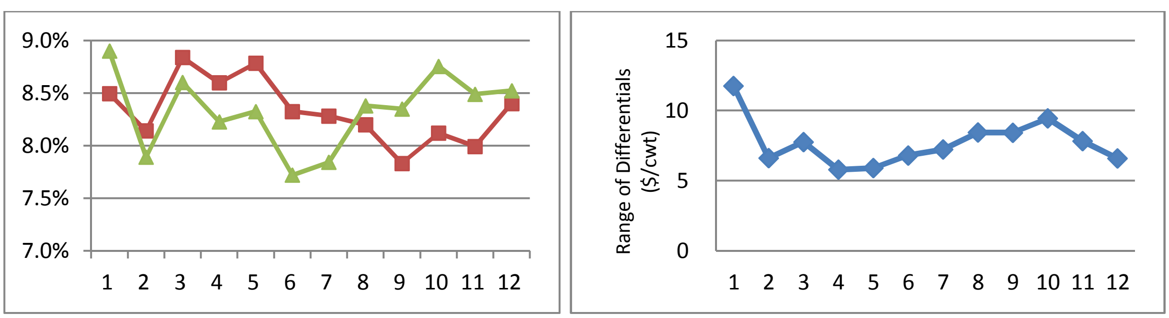

Figure 8. Monthly variation of milk production (Red) and fluid milk consumption (Green) in 2012 (Left) and Range of estimated Class I price differentials (Right)
Source: USDA-ERS and USDA-AMS (2012)

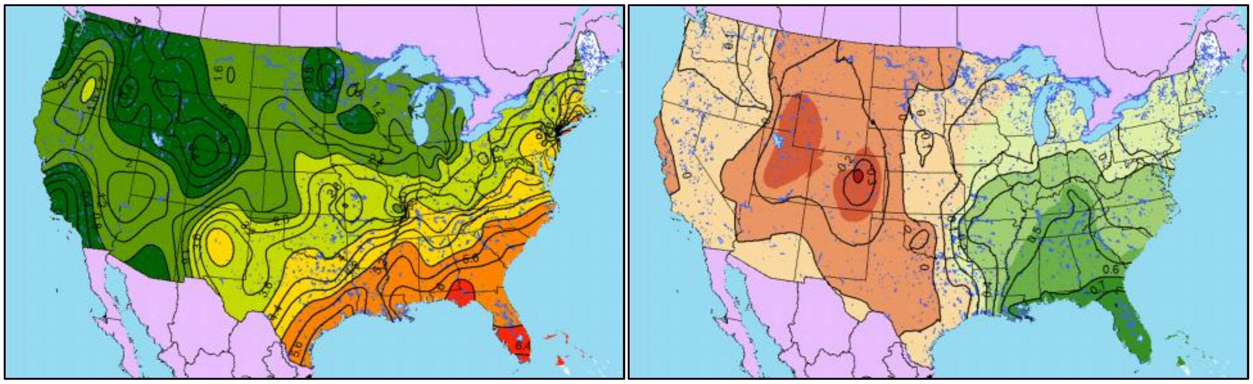

Figure 9. Simulated average Class I differentials with TCP (Left) and Difference between results with TCP and those without TCP (Right) ($/cwt)

Table

Rank	Share of milk production				Share of Population				Diff. of (B) and (A)	
	State	2000	2012	Diff. (A)	State	2000	2012	Diff. (B)	State	(B) - (A)
1	ID	4.30%	6.77%	2.47%	TX	7.47%	8.37%	0.89%	MN	1.10%
2	CA	19.22%	20.88%	1.66%	FL	5.73%	6.21%	0.48%	PA	1.08%
3	TX	3.40%	4.79%	1.40%	AZ	1.84%	2.11%	0.26%	FL	0.77%
4	MI	3.35%	4.44%	1.09%	GA	2.93%	3.19%	0.25%	MO	0.58%
5	NM	3.12%	4.07%	0.95%	NC	2.88%	3.13%	0.25%	NC	0.49%
44	KY	1.01%	0.56%	-0.46%	PA	4.40%	4.10%	-0.30%	TX	-0.50%
45	NY	7.13%	6.59%	-0.54%	IL	4.45%	4.14%	-0.31%	NM	-0.93%
46	MO	1.35%	0.70%	-0.65%	OH	4.07%	3.71%	-0.36%	MI	-1.47%
47	MN	5.66%	4.53%	-1.13%	MI	3.56%	3.18%	-0.38%	CA	-1.58%
48	PA	6.65%	5.27%	-1.38%	NY	6.80%	6.29%	-0.51%	ID	-2.42%

Table 1. The Share of milk production and population by 48 states from 2000 to 2012
Source: USDA-ERS for milk production and U.S. Bureau of the Census for population