Zwick Center for Food and Resource Policy

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Comparison of Dairy Farming in Connecticut, Vermont, and Maine for Purposes of Determining the Appropriate Cost of Production Benchmark for Connecticut

Prepared for the Connecticut Commissioner of Agriculture

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Executive Summary

In the New England region, the U.S. Department of Agriculture only reports milk cost of production (COP) for Maine and Vermont. Basing Connecticut dairy support payments on USDA COP data for a New England state complies with Connecticut Public Acts 09-229 and 11-48. In the past two years, Vermont has served as the benchmark for this program.

The objective of this report is to compare cost of production (COP) and dairy farming characteristics in Vermont and Maine in order to assess the suitability of using one or both New England states as a reference for Connecticut milk COP. To this end, this report compares 2010 USDA milk COP for Vermont and Maine, analyzes secondary data on dairy farming in these states and Connecticut, and conducted phone interview with expert dairy economists in New England and the USDA.

Based on the USDA COP for 2010, the major COP differences between Vermont and Maine can be summarized as follows:

- Maine total COP is 38% higher than the one for Vermont ($31.49/cwt v. $22.77, or $8.42/cwt difference).
- Higher feed costs in Maine, accounting for $1.96/cwt, or 22.5% of the total cost difference.
- Higher hired labor cost in Maine, accounting for $1.25/cwt, or 14.5% of the total cost difference.
- Higher opportunity cost of unpaid (family) labor in Maine, accounting for $2.70/cwt, or 31% of the total cost difference.
- Higher capital recovery cost of machinery and equipment in Maine, accounting for $2.24/cwt, or 25.7% of the total cost difference.

Based on secondary data analysis and expert opinions, the following are the drivers of the differences:

- *Economies of scale and the smaller size of Maine farms* result in higher operating and overhead costs in Maine than in Vermont and likely in Connecticut. Connecticut's average size of dairy farms are similar to Vermont's but approximately 50% larger than Maine's, either by output or herd size. The smaller size of farms in Maine results in higher cost per unit for family labor and machinery and equipment charges.
- *Transportation cost that increase the procurement cost for inputs, particularly purchased feed in Maine*. Relative to Vermont or Connecticut, Maine is unique in its inability to obtain feed given its geographic location and distribution of farms. .

- *Agricultural wages are reportedly higher in Maine than in Vermont or Connecticut,* While the cost of living is the highest in New England for residents, Maine farm wages are nearly 18% higher than in Connecticut and about 20% higher than in the New York areas bordering Vermont. This would result in higher cost for hired labor for two otherwise identical farms.
- *A higher proportion of organic farms in Maine than in Vermont or Connecticut.* Another factor resulting in higher COP in Maine v. Vermont is a higher percentage of organic cows (12.18% v.
- 4.57%). In 2006 (the last year reported), Connecticut had 250 organic cows, amounting to only a 1.32% of the total milk produced. It seems that organic milk production has nearly faded in the state.

Another mitigating factor that does not affect cost of production directly but allows higher-cost farms to operate is the fact that Maine is the only New England state outside a Federal Milk Marketing Order, whereby the state program has established price support programs at a much higher level than those set by Federal policies.

This report grew out of a concern or opinion by some farmers that Maine's COP should be the New England reference for the Connecticut state program that up to now (for two years) has relied on Vermont COP. At a time of record high milk prices and also challenging cost of feed and energy, this concern is understandable. However, the preponderant evidence and expert opinion indicate that while Connecticut neither looks like Vermont nor Maine, Vermont's COP is a more appropriate reference for Connecticut than Maine's.

While a transition to Connecticut COP is the most appropriate course of action in the medium term, in the interim it is appropriate and advisable to maintain Vermont as the benchmark for the state's dairy support program and to preserve the program's integrity and adequate funding when milk prices go bust, which will likely be the case by either a supply response to current high milk prices or a negative demand shock.

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By Adam N. Rabinowitz and Rigoberto A. Lopez[1]

1. Introduction

In a recent report, the Zwick Center at the University of Connecticut provided a report to the Commissioner of the Connecticut Department of Agriculture that includes estimates of the milk cost of production (COP) for Vermont during the months of April, May, and June 2011.[2] These results were ultimately met with claims by some dairy farmers that Maine, not Vermont, should be considered as the New England state most comparable to the dairy cost structure in Connecticut. Note that to comply with Connecticut Public Act 11-48, the Commissioner of Agriculture must provide financial assistance to Connecticut milk producers during times when the federal milk pay price falls below a minimum sustainable monthly cost of production. To determine whether payments are made to Connecticut dairy farmers, the COP is based on a New England State using USDA data. The USDA has only estimated COPs for Maine and Vermont and only provide adequate data for analysis of these two states, thus these are the only two New England states to be considered to determine payment to Connecticut dairy farmers. The Commissioner of Agriculture has since requested that the Zwick Center assess the similarities and differences of the COP in Vermont and Maine to determine the suitability of using Maine as

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[2] Rabinowitz and Lopez (2011).

a determinant for the Connecticut milk COP. This process has involved analysis of USDA-based estimates of COP for Vermont and Maine, secondary data, and phone interviews with dairy experts in New England and the USDA.[3]

2. Comparison of USDA's 2010 Cost of Production in Vermont and Maine

In analyzing the differences between Vermont and Maine, it is first useful to understand the differences in the COP that are fueling the debate regarding the appropriate New England state with which to compare Connecticut COP. Table 1 shows the USDA annual average COP breakdown for 2010 for both Maine and Vermont, with calculated differences between the two.

The 2010 average annual COP for Maine is $31.49/cwt, compared to Vermont's $22.77/cwt. This comes to an $8.72/cwt difference between the two New England states. To understand why such a large difference exists, one can look at the breakdown of operating costs and allocated overhead.

- Operating costs are $2.31/cwt higher in Maine. In total, operating costs account for 26.5% of the cost difference.
    - Higher *feed costs* in Maine account for $1.96/cwt or 22.5% of the cost difference.
    - $1.64/cwt or 18.8% of higher Maine costs are for *purchased feed*.
- Allocated overhead is $6.41/cwt higher in Maine. In total, allocated overhead accounts for 73.5% of the cost difference.
    - *Hired labor* is $1.25/cwt higher in Maine (14.3% of the cost difference)

[3] These experts include William McBride from the ERS-USDA, Bob Wellington from Agri-Mark, Tim Drake from the Maine Milk Commission, and George Criner and David Marcinkowski from the University of Maine.

- O*pportunity cost of unpaid labor* accounts for 31% of the cost difference, or $2.70/cwt.

Table 1. USDA 2010 Average Cost of Production for Maine and Vermont

Item	Maine	Vermont	Difference
	Dollars per cwt sold		
Operating costs:			
Feed--			
Purchased feed	8.60	6.96	**1.64**
Homegrown harvested feed	1.98	1.67	0.31
Grazed feed	0.15	0.14	0.01
Total, feed costs	10.73	8.77	**1.96**
Other--			
Veterinary and medicine	1.07	0.93	0.14
Bedding and litter	0.39	0.44	-0.05
Marketing	0.34	0.29	0.05
Custom services	0.34	0.49	-0.15
Fuel, lube, and electricity	0.89	0.84	0.05
Repairs	0.92	0.62	0.30
Other operating costs	0.01	0.00	0.01
Interest on operating capital	0.01	0.01	0.00
Total, operating cost	14.70	12.39	2.31
Allocated overhead:			
Hired labor	3.15	1.90	**1.25**
Opportunity cost of unpaid labor	5.71	3.01	**2.70**
Capital recovery of machinery and equipment	6.11	3.87	**2.24**
Opportunity cost of land (rental rate)	0.05	0.05	0.00
Taxes and insurance	0.54	0.39	0.15
General farm overhead	1.23	1.16	0.07
Total, allocated overhead	16.79	10.38	6.41
Total costs listed	31.49	22.77	8.72

Notes: A) This table was developed by updating data from the 2005 Agricultural Resource Management Survey of dairy operations using 2010 prices and milk production figures.
B) "Other operating costs" denotes costs for third party organic certification
C) "Capital recovery..." includes housing, manure handling, and feed storage structures, and dairy breeding herd.

- *Capital recovery of machinery and equipment* is $2.24/cwt higher in Maine, accounting for 25.7% of the cost difference.

Overall, 93.5% of the cost difference between Maine and Vermont comes from feed costs, hired labor, opportunity cost of unpaid labor, and capital recovery of machinery and equipment. We discuss potential reasons for these differences and compare the Maine and Vermont conditions to Connecticut dairy farming in the next section.

3. Determinants of Differences in Costs of Production

From an economic perspective, the COP incurred by a firm can be explained by a cost function that relates the COP to the level of output, input prices, type and state of technology, and other environmental factors (Chambers, 1988). That is,

$$c = f(q, w, t, z),$$

Where c is the cost of production, q is the output level, w is a vector of input prices (feed, labor, capital, energy), t is the state of technology, and z denotes environmental factors. Thus, differences in c (or COPs) can be explained by differences in q, w, t, and z.

This report adopts the universally accepted framework of production cost functions to explain differences in COPs between Vermont and Maine dairy farms, with a comparison to Connecticut's dairy industry wherever possible.

3.1. Size and Economies of Scale

Economies of scale (or economies of size) occurs when the cost of production per unit (e.g., COP per unit of milk produced) *decreases* as output (q) or size of the operation expands. In terms of the above equation, economies of scale implies $\partial lnc/\partial lnq<1$; that is, the proportional

increase in costs is less than the proportional increase in scale of operation, leading to greater productivity and lower cost per unit for larger farms.

In New England (and elsewhere), there is ample evidence of strong economies of size in dairy farming. Figure 1 shows the COPs for alternative dairy farm sizes in 2010 provided by a Farm Credit East report (2011) for the Northeast. Figure 2 shows the COP for alternative dairy farm sizes in 2010 for Maine (Kersbergen and Anderson, 2011). In both studies, larger farm sizes, as measured by the number of cows, lead to significantly lower overall cost of production per unit of milk produced. Of particular significance are the depreciation of machinery and equipment and the opportunity cost of unpaid labor (family labor) which decreases significantly as the size of the farm increases. One should note, however, the increases in the Northeast (Figure 1) operating costs as farm size increases. These increases are a result of higher

Figure 1. Northeast COP by Herd Size, 2010

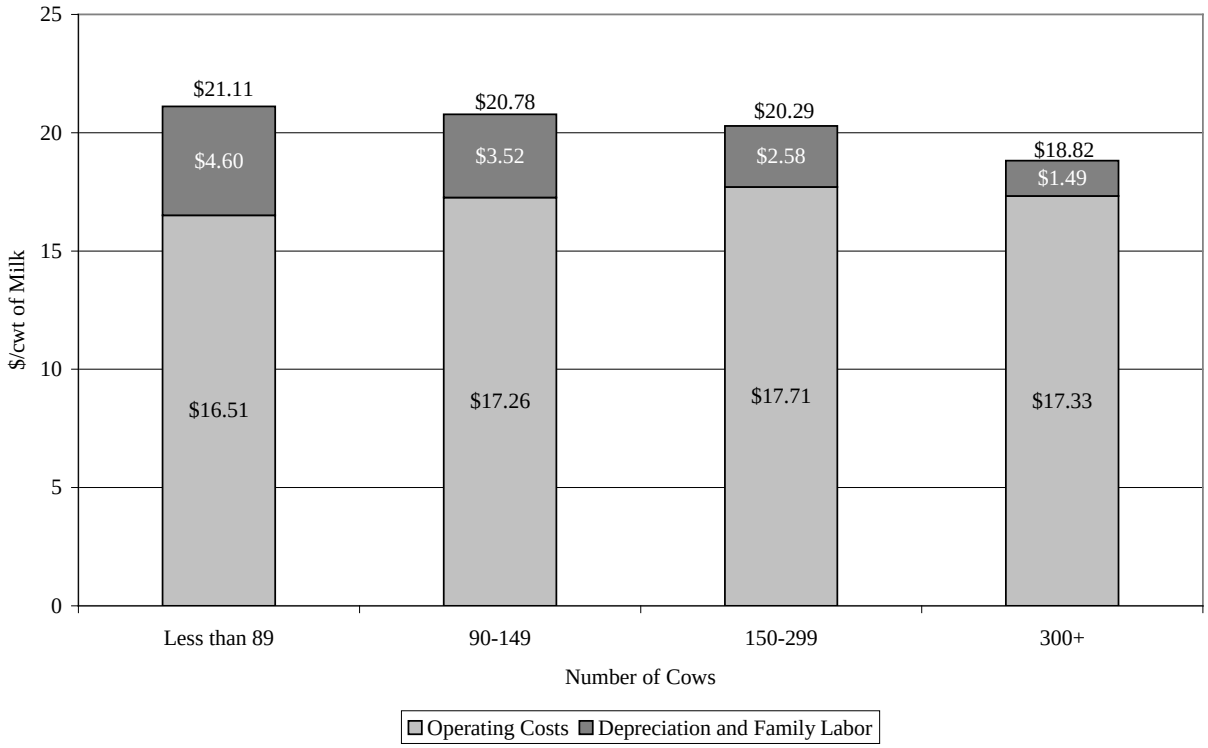
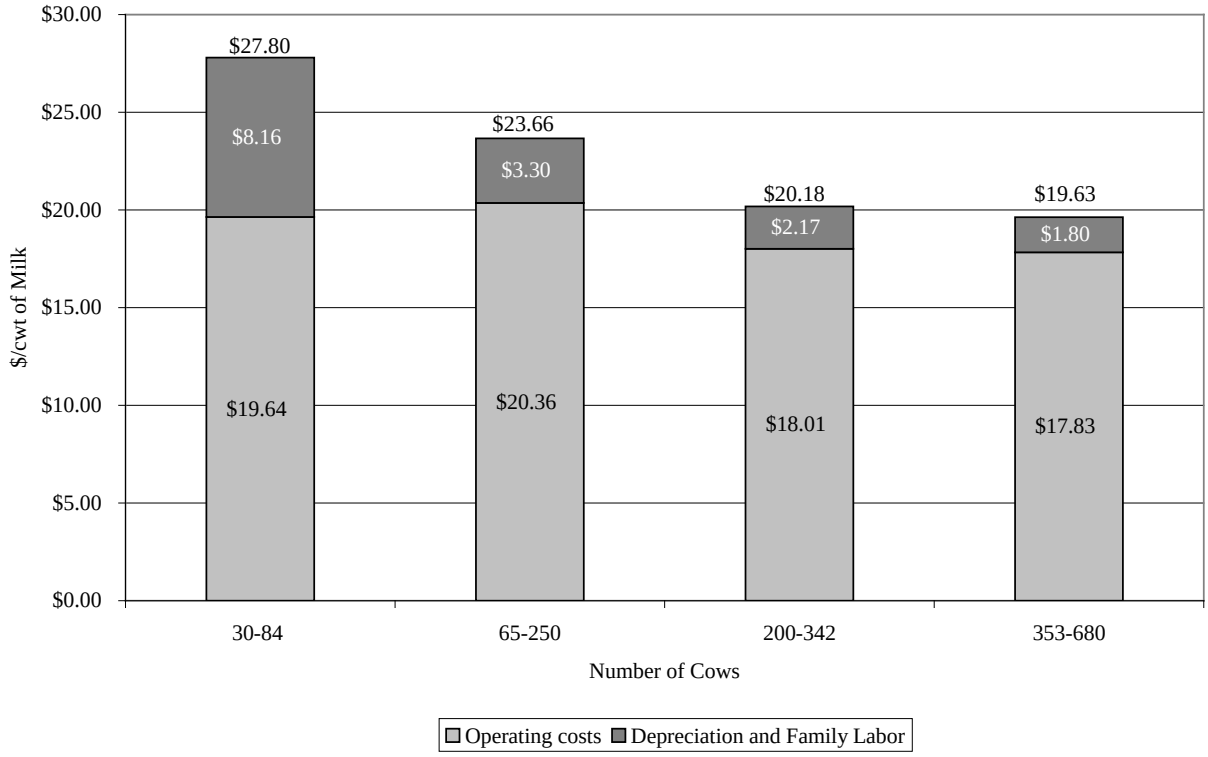


Figure 2. Maine COP by Herd Size, 2010



purchased feed and higher labor costs for larger farms, however, there are considerable economies of scale (lower costs for larger farms) for homegrown harvested feed.

Table 2 presents the number of producers, total milk production, and the average daily output per dairy farm in Maine, Vermont, and Connecticut.

Table 2: 2010 Number of Producers and Milk Production

State	Number of Producers	Milk Production (Pounds)	Average Daily Output per Farm (Pounds)
ME	317	575,214,000	4,979
VT	978	2,491,759,000	6,983
CT	127	352,122,000	7,572

Source: Rasmussen (2010).

The average output per Maine farm is thus just less than 5,000 pounds per day. Compared to Vermont, Maine has about 2/3 fewer producers than Vermont's 978. As expected, the total milk production in Vermont is much higher at about 2.5 billion pounds in 2010; however, this equates to an average of just less than 7,000 pounds of milk per farm per day in Vermont. The average farm produces about 2,000 pounds more milk per day in Vermont than in Maine, this can be explained by the difference between the size of farms in these two states' dairy industries. Maine has many smaller farms, which partially explains the higher COPs.

Connecticut has its own unique situation with respect to the number of producers and output. Connecticut has relatively few farms, with 127 in 2010 that produced a total output of 352 million pounds of milk. Both the number of producers and total milk production are far less in Connecticut than in both Vermont and Maine. However, when one considers the average output per farm, Connecticut averages about 7,500 pounds per day per farm, which is 50% more than Maine and also higher than Vermont. Under the same intuitive analysis as before, these data indicate that Connecticut has larger farms, or at least more similar to the composition of farm sizes in Vermont. One would thus expect feed prices in Connecticut to be more similar to Vermont, at least from a farm size perspective.

Another means of comparing farm size is based on the average herd size for each state. Table 3 shows the total number of dairy cows and the average herd size.

Table 3. Total Number of Dairy Cows and Average Herd Size by State

State	Total Cows	Average Herd Size
ME	33,000	104
VT	135,000	138
CT	19,000	150

Source: Matthews (2010).

Maine has a total of 33,000 cows for an average herd size of 104. Consistent with our previous findings on farm size based on production, the average herd size in Maine is smaller than that of Vermont farms, which average 138 cows, and Connecticut farms that average 150 cows. These data add further evidence that Maine dairy farms are smaller in size resulting in higher overall costs of production as compared to Vermont and by inference Connecticut. This conclusion has been supported by discussions with dairy experts in New England.

3.2. Input Prices

An input cost per unit of output are comprised of two components: input quantity (which relates to economies of scale and technology) and input price. In addition, input availability and producer cost is important. Given the COP differences between Vermont and Maine, the input prices of interest are (1) purchased feed; (2) hired labor, (3) opportunity cost of unpaid labor (family labor), and (4) capital recovery of machinery and equipment. While the ideal data to compare dairy input prices in Maine v. Vermont (and Connecticut) are not available, in this section we present some proxy data and reasoning with the above caveat.

3.2.1. *Feed Price and Procurement*

While farm sizes in Connecticut would be similar to those in Vermont and thus result in similar economic conditions in obtaining feed costs, one argument that has been presented to equate Connecticut feed prices to Maine's is the geographic location of farms in the region. In particular, it has been suggested that Maine and Connecticut farms are at farther points from rail lines, resulting in similar transportation costs for purchased feed. In other words, feed cost price differentials between different states reflect mainly transportation cost differences.

One geographic disadvantage for Maine is their northern boundary of Canada and eastern boundary of the Atlantic Ocean. This limits transportation of feed to traveling either across

lower New Hampshire or up through Massachusetts. In fact, in speaking with one expert in the northeast we were told that often one considers a transportation premium over the Boston feed price when looking for estimates for Maine.

In Connecticut, the majority of the farms are located in the northern half of the state. Primary access of feed would come through either New York from the west or Massachusetts from the north. If estimating Maine feed costs considers a premium over the Boston price, no such premium would exist when moving feed from the Midwest/New York to Connecticut. Connecticut is, however, restricted to the south by the Long Island Sound border and the eastern border of Rhode Island offering no real opportunities for feed delivery from these directions.

In considering the geographic location of farms there is reason to believe that Vermont does have easier access to feed via New York with the large number of farms in New York and thus the large amount of product already moving through that region. This would result in feed costs for Vermont that are relatively lower than for Maine due to transportation cost differences. That said, it is not apparent that Connecticut is as restricted as Maine. In fact, a number of experts in the region opined that Maine is rather unique in its inability to obtain feed given its geographic location and distribution of farms. Connecticut does not have that same level of restriction and thus one would not expect Connecticut feed costs to be as high as Maine since transportation costs would not be as significant.

A related point that was discussed throughout this process, yet we have no data for analysis due to time and financial considerations, are infrastructure differences. There is consensus that the isolation of Maine has led to limited available resources such as equipment dealers, banks, and milking supply dealers. Many of these items are obtained from New York, resulting in higher transportation costs to obtain these services/goods in Maine compared to

Vermont or Connecticut. These limitations in infrastructure combined with the smaller size farms in Maine are reasons for higher capital recovery costs for machinery and equipment. Connecticut does not present with the same limitations.

3.2.2. *Hired Labor*

Another major difference between the Vermont and Maine COP comes in the costs for hired labor. One New England dairy expert opined that the cost of living is higher in Maine. In addition, the rural labor markets of Maine demand higher labor rates are characterized by a much lower proportion of immigrant labor.

A variable that can offer insight on hired wage costs is the annual mean wage for farm workers of farm animals from the Occupational Employment and Wages data of the Bureau of Labor Statistics. Table 4 shows the annual mean wage for May 2010 for Maine, Connecticut, and other New England and Upstate New York areas. No state or local data exists for Vermont so we include border state areas surrounding Vermont.

Table 4. Annual Mean Wage for Farm Workers of Farm Animals

State	May 2010 Wage
ME	$28,580
NH	$21,600
Albany-Schenectady-Troy, NY	$24,110
MA	$24,040
CT	$24,250

Source: U.S. Bureau of Labor Statistics, Occupational Employment and Wage Data for SOC Code 452093

The average annual wage for farm workers of farm animals in Maine is $28,580, as shown in Table 4. Connecticut has a much lower annual wage of $24,250. Without data for Vermont we examine the surrounding states of Massachusetts and New Hampshire, which have May 2010 wages of $24,040 and $21,600 respectively. Bordering Vermont to the west is New

York, however, given the size of New York it is more appropriate to focus on areas closer to Vermont such as Albany-Schenectady-Troy region, where the average wage was $24,110. The data presented here indicates a reasonable proxy for Vermont wages are in the $21,000-24,000 range, significantly less than Maine and consistent with the COP estimates for hired labor presented in Table 1. Connecticut COP for hired labor is thus expected to be either in line with or slightly higher than Vermont's.

3.2.3. *Opportunity Cost for Unpaid Labor (Family Labor) and Machinery Costs*

Both family labor and machinery costs are to a large extent fixed so that spreading them over more units (q) results in lower costs per unit of milk produced. In the use of family labor, supervisory labor in particular is much higher for smaller size farms such as the ones' in Maine. Figure 2 illustrates that for very small farms (30-84 cows) family labor cost were $8.16/cwt while the unit cost decreased to $1.80/cwt for farms with 350-680 cows in 2010 in Maine.

3.2.4. *Presence of Organic Farms*

Organic dairy farming is another area for consideration. As of 2006 Connecticut had only 250 organic milk cows, compared to 3,898 in Maine and 6,450 in Vermont. While Vermont has an absolute greater number of organic cows, its organic herd as a percentage of total herd size in the state is far lower than Maine's. Table 5 presents these data for 2006-2008.

Table 5: Organic Milk Cows per State and Percent of Total Milk Herd

State	2006		2007		2008	
	Organic Cows	Percent of Total Milk Herd	Organic Cows	Percent of Total Milk Herd	Organic Cows	Percent of Total Milk Herd
ME	3,898	12.18%	4,115	12.47%	4,047	12.26%
VT	6,450	4.57%	10,200	7.29%	12,260	8.76%
CT	250	1.32%	--	--	--	--

Source: Greene and Slattery (2010).

Note that Connecticut data is only available for 2006. Maine has had a relatively stable number of organic cows (around 4,000 per year) which accounts for just more than 12 percent of the total milk herd. While Vermont has doubled the number of organic cows from 6,450 in 2006 to 12,260 in 2008, this still accounts for less than 9 percent of the total Vermont herd of dairy cows. The very large percentage of organic dairy farming in Maine (7.49% of milk sold is organic) is another reason for higher costs in that state compared to Vermont (2.44% of milk sold is organic) and Connecticut.

3.2.5. *Other Considerations*

A final consideration is the calculation of the minimum sustainable cost. As defined by Connecticut Public Acts 09-229 and 11-48, the minimum sustainable monthly COP shall be eighty-two percent of the monthly average COP for a New England state. One must consider how the 82 percent was determined and, given the history of using Vermont COP numbers, whether the methodology for determining the 82 percent is accurately applied to a Maine COP estimate. We expect the minimum sustainable monthly COP to be a short term cost that does not include opportunity cost for unpaid (family) labor, capital recovery of machinery and equipment, and opportunity cost of land. However, with 2010 annual average COP, as shown in Table 1, excluding these three categories of cost for Vermont results in 70 percent of the total cost. Excluding these same three categories from the Maine COP results in 62 percent of total costs. Excluding only the capital recovery of machinery and equipment and the opportunity cost of land results is 83 percent of the total Vermont COP and 80 percent of the total Maine COP. The bottom line is that the higher Maine COP would require a smaller percentage of total costs to determine the minimum sustainable monthly COP using estimates from Maine.

4. Concluding Remarks

At the request of the Connecticut Commissioner of Agriculture the Zwick Center has assessed the similarities and differences of the COP in Vermont and Maine to determine the suitability of using Maine as a determinant for the Connecticut milk COP. As part of this analysis we rely on secondary data sources and interviews with dairy experts in New England and the USDA. Our findings include:

- Higher feed costs, hired labor costs, opportunity cost of unpaid labor, and capital recovery of machinery and equipment account for 93.5% of the COP difference between Vermont and Maine.
- Maine has many smaller farms, relative to Vermont and Connecticut. As a result Maine farmers do not benefit from economies of scale, which results in higher overall costs.
- When considering average production and average herd size, Connecticut farms are very similar to Vermont farms.
- The geographic location and distribution of farms adds significant transportation costs for purchased feed in Maine. Infrastructure limitations also exist due to the limited number of dealers in-state and high transportation costs for equipment coming from New York. Connecticut does not appear to have the same level of restrictions as a result of the state's geographic location.
- Annual wages for farm workers (a proxy for hired labor) in Connecticut are the same or slightly higher than in Vermont but significantly lower than in Maine.
- We exclude the minimum sustainable monthly COP to exclude the opportunity cost for unpaid labor, capital recovery of machinery and equipment, and opportunity cost

of land. We do not currently have much data to provide a complete analysis for the higher costs reported in these categories in Maine relative to Vermont, however we do now that unpaid labor is less as farm size increases.

- Given the information we have, one possible explanation for higher costs for capital recovery of machinery and equipment are the limitations in infrastructure combined with the smaller size farms in Maine.
- If the eighty-two percent of the COP was designed using analysis of Vermont data that amount would be insufficient to determine the minimum sustainable price using a Maine COP.

Overall our analysis indicates that Connecticut has greater similarity to Vermont and thus given an absolute choice between Vermont and Maine COP, the Vermont COP is a more appropriate benchmark to be used for Connecticut.

As we recommended in our July 2011 report, it is important that the Commissioner of Agriculture consider a long term solution that properly measures Connecticut COP for dairy farms. To aid in that process we note a few items that should be considered.

1. Direct surveys of farmers can yield inconsistent and/or inappropriate cost categorization. This is an issue that has been discussed in Maine and noted to occur in other farm surveys including the USDA ARMS survey.
2. Maine is now using methodology from the Cornell University Dairy Farm Business Summary Analysis and is currently enrolling some of their farms in the Cornell program. Among the benefits of using this program is the use of a consistent COP methodology and the ability to provide education to farmers about their own financial situation.

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