

Zwick Center for Food and Resource Policy

Research Report No. 1

THE ANNUAL COST OF PRODUCING MILK IN CONNECTICUT: ESTIMATES FOR 2011

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December 19, 2012

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The authors are grateful for the information provided by Connecticut farmers, and for the support received from Commissioner Steven Reviczky, Dean Gregory Weidemann and Dr. Rigoberto Lopez. The assistance received from Ms. Linda Putnam, Dr. Wayne Knoblauch and Mr. Jason Karszes from Cornell University is also acknowledged. The study was partially funded by the Office of the CT Commissioner of Agriculture, the Zwick Center for Food and Resource Policy, and the Agricultural Food Research Initiative of the National Institute of Food and Agriculture, USDA, Grant # 2010-85211-20470.

Abstract

The average total cost of production for milk in Connecticut in 2011 is \$31.52/cwt, based on a sample of 39 state dairy producers. Additional total cost of production (COP) estimates are provided for different farm-size classes, ranging from \$26.05/cwt for the largest size class to \$35.76/cwt for the smallest. The most significant costs to CT dairies are feed and labor, which make up close to 60% of total COP and are primarily responsible for the variation seen in the projected 2012 monthly COP estimates. Monthly estimates of the 2012 CT COP for milk are based on the 2011 COP, which is adjusted using USDA NASS indices and CT production figures for the corresponding month. The estimated COP for milk in CT has increased in every month in 2012, from \$31.97/cwt in January to \$39.10/cwt in September. The Statistical Uniform Price (SUP) for milk in Hartford, CT decreased monthly for the first half of 2012 and increased in each month of the third quarter, resulting in a net increase from January to September. Given the monthly trends in COP and the SUP, the value of payments to CT dairy farms under CT Public Act 09-229 has increased month-to-month from \$6.95/cwt in January to \$12.71/cwt in September.

THE ANNUAL COST OF PRODUCING MILK IN CONNECTICUT: ESTIMATES FOR 2011

I. Background and Motivation

U.S. agricultural policies have come under considerable scrutiny with regard to their ability to encourage and support small-scale producers while maintaining a commitment to the large commercial farms that produce the lion's share of the country's food and fiber (CFRA, 2008; HSPH, 2012). Although some observers have argued that policy favors the latter group and does little or nothing to help the former, current trends suggest the contrary. "Over recent years the U.S. agricultural industry has seen a resurgence of small-scale farming and for the first time since the great depression, between 2002 and 2007, the U.S. farm count rose 4%, reversing the long-standing decline" (USDA, 2009 as quoted in the *Washington Post*). During the same period, the U.S. Census of Agriculture, which is conducted every five years by the National Agricultural Statistics Service (NASS), recorded a loss of 16,183,216 acres or 1.7% of the 938,279,056 total acres of U.S. farmland (USDA, 2009). In addition, decreases in the average farm-size suggest a shift toward small-scale farming; however, both the largest and the smallest farm-size classes are increasing as a proportion of total farms, and a continual loss in the proportion of farms in the 100-to-2000-acre range has been observed. It is the decline in these middle-sized farms that is responsible for the significant and continual reduction in total U.S. farmland.

The current trends in U.S. agriculture are also seen within the state of Connecticut. Average farm-size in the state is 83 acres, and a third of all farms have less than 50 acres; thus, Connecticut is dominated by small-scale farming (USDA, 2009; WLA, 2010). The 17% increase in CT farm numbers during the 2002–2007 period well exceeded the national average (4%), and is mainly attributed to new small-scale farms (USDA, 2009). Increased public interest in Connecticut farming has been observed over the same period, with as much as a 237% bump in agro-tourism, based on data collected in a recent survey of 101 farms (WLA, 2010).

As of 2007, the CT dairy industry had an average farm-size of about 600 acres, suggesting that many CT dairy farms are classified as middle-sized (USDA, 2009; NMAMA, 2007). During the same period, the dairy sector in the state decreased by 53 farms, from 193 in 2002 to 140 in 2007. This decline has continued reaching 124 farms in 2011 (NMAMA, 2002; NMAMA, 2007; NMAMA, 2011). Since 2002, Connecticut has seen a loss of about 4,500 acres of dairy land per

year, which represents 5.4% of the 83,000 acres held by the dairy industry in 2007 (USDA, 2009). Thus, the loss in dairy acreage is a major contributor to the estimated loss of farmland (cropland and farm woodland) in Connecticut during the period 1997–2007 (USDA, 2009).

Loss of farmland is a major threat to the agricultural sector. Once land is moved from agricultural production into an alternative use, it is not easily converted back (WLA, 2010). Because the supply of farmland is particularly limited, losses are unlikely to be offset by an increase in supply elsewhere; food security from local production is irreplaceable in much the same way (Lacy, 2006). Overall market conditions and pressure toward residential and commercial development are significant drivers of the continual loss of farmland (Platt, 1980; Lopez et al., 1988). In response to these forces, farmland protection agencies have worked to secure land for future generations of farmers through the purchase of development rights and other conservation programs (WLA, 2010). The ability to secure land through these programs can only go so far; thus, additional government policies must also play a role in the preservation of farms.

As described in Connecticut General Statute 22-26aa, “the conservation of certain arable agricultural land and adjacent pastures, woods, natural drainage areas and open space areas is vital for the well being of the people of Connecticut”.² One conservation strategy is to design policies that target agricultural enterprises with significant land requirements and/or holdings. Providing for such enterprises ensures the availability of land for future generations of farmers, as well as support for the current population by securing farm-related jobs. More general policies, such as CT Public Act 490, target the entire agricultural sector by allowing for a differential tax assessment for farmland at a lower agricultural use value. A justification for Public Act 490 is that the costs to municipalities associated with servicing agricultural land are low and, even with the reduction in tax revenues, municipalities enjoy a net public benefit from farmland. In contrast, the residential sector faces greater municipal service costs, which tend to be sufficiently higher than the associated tax revenues (CFBA, 2010).

In Connecticut, the dairy industry was responsible for the stewardship of 83,000 acres of farmland in 2007 (USDA, 2009). That same year, the industry contributed an estimated \$1 billion in statewide sales and generated 4,000 jobs (DECD, 2008; Lopez et al., 2010). Prior to the large drop in dairy farms during the early twenty-first century, a period of stability occurred from 1999

² Available online at: < <http://www.cga.ct.gov/current/pub/chap422a.htm#Sec22-26aa.htm> >.

to 2001, when the Northeast Dairy Compact was in effect, setting prices to ensure adequate returns to dairy farmers in the region (DECD, 2008). At other times, the price received by dairy farmers has been based on the market conditions for milk, which vary considerably, as can be seen in Figure 1.

The price received by farmers is measured as the statistical uniform price (SUP), which is the minimum price paid to dairy farmers based on the market order utilization of Class I, II, III, and IV milk. Soon after the Northeast Dairy Compact expired, the SUP began to decrease, and in 2003 it dropped below \$12.00/cwt in nominal terms (Figure 1). In real terms, i.e., adjusted for inflation, the SUP has decreased sharply since 1980 and has been highly volatile over the past decade. The SUP peaked at almost \$23/cwt in 2007, though as a result of the worldwide economic recession it dropped back down to 2003 levels in 2009. This sharp drop was compounded by major increases in feed prices. It has been noted that the worldwide economic recession has had a major negative effect on dairy farm profitability, a situation that is expected to remain critical over the foreseeable future (Thraen, 2008).

Given the challenges faced by dairy farmers in the state, the Food Marketing Policy Center at the University of Connecticut produced several reports from 2002 to 2008 on milk prices at the farm, wholesale, and retail levels. The center also hosted meetings with stakeholders and provided expert testimony at the state and federal levels.³ Much of the research focused on means to assist dairy farmers with the creation of state policies in CT and other New England states (Cotterill, et. al., 2007; Cotterill and Rabinowitz, 2007). Subsequently, the Connecticut state legislature passed Public Act 09-229 on July 1, 2009, to try to mitigate further declines in the dairy sector.

Connecticut Public Act 09-229 directs the Commissioner of Agriculture to provide payments to farmers when the federal milk pay price drops below a sustainable monthly cost of production (COP). As defined in the act, the "Federal pay price" is the northeast monthly SUP for milk in Hartford, CT, pursuant to the United States Department of Agriculture Northeast Federal Milk Marketing Order. The "minimum sustainable monthly cost of production" (MSC) is defined as 82% of the baseline cost of production for a New England state as determined by the United States Department of Agriculture's (USDA) Economic Research Service, or if such baseline is unavailable, a baseline determined by the Commissioner of Agriculture that is based

³ Publications available online at: <<http://www.zwickcenter.uconn.edu>>.

on the data and variables published by the USDA (P.A. 09-229 and 11-48). Current estimates for the monthly average COP for a New England state are developed from the National Agricultural Statistics Service (NASS) Agricultural Resource Management Survey (ARMS) for Vermont and Maine but not for the other New England states. However, concern has been expressed repeatedly over the differences between the Connecticut dairy industry and those of other New England states, and the accuracy of using a non-Connecticut COP estimate to apply the Connecticut law (Rabinowitz and Lopez, 2011 (OR #2)).

In response to the concerns over the application of the law and the need to develop a CT-specific milk COP, the Zwick Center at the University of Connecticut hosted a Dairy Summit in November 2011. At this summit, stakeholders⁴ discussed moving forward with the development of CT-specific COP estimates and reached a consensus that the most appropriate method requires data from CT dairy farmers. In order to obtain these figures, the Commissioner asked the Department of Agricultural and Resource Economics (DARE), the Zwick Center, and the Connecticut Cooperative Extension System within the College of Agriculture and Natural Resources (CANR) at the University of Connecticut to undertake a study to determine the COP for milk in the state.

II. Objectives

The primary objective of the study was to estimate the average COP for milk in Connecticut during 2011. Accordingly, the researchers were tasked with the following:

- To hold informational seminars with state dairy producers regarding the study;
- To collect production and cost data for 2011 from CT dairy farms that elected to participate in the study;
- To process and analyze the data collected from the participating farms to determine the average COP for the state;
- To adjust for statistical differences between the group of participating farms and the entire state, in order to produce a representative estimate of CT COP for milk in 2011; and
- To provide monthly estimates of the CT COP for milk in 2012 based on the 2011 COP.

⁴ Stakeholders included the CT and MA Commissioners of Agriculture, researchers and extension educators from the University of Connecticut and the University of Maine, representatives from the Connecticut Farm Bureau, Farm Credit East, and Agri-Mark, and dairy farmers from CT and MA.

III. Methodology and Data

Data collection was initiated following a letter from the Commissioner of Agriculture to state dairy producers describing the nature and importance of the project. The collection of 2011 production data from Connecticut dairy farms was conducted by College of Agriculture and Natural Resources (CANR) extension educators and a designated graduate assistant beginning in the spring and continuing through summer 2012. The tasks for the researchers included enrolling farmers to participate, collection of farm records, data verification, processing and analysis, and the preparation of this report.

Enrollment of farms was facilitated through several extension meetings across the state, and additional letters were sent from the Commissioner's office to encourage farmers to participate in the study. At these meetings, participating farmers set up an appointment time for data collection with a specific extension educator. Out of the 124 dairy farms in the state, 55 farms agreed to participate, and 43 completed the data collection process. The other 12 farms were either deemed ineligible because of missing data or did not complete the collection process.

The Cornell Dairy Farm Management Business Summary (DFBS) program was selected for data processing, and Cornell Cooperative Extension provided intensive training for the UConn team. Designed specifically for the collection and organization of dairy farm production records, Cornell's DFBS program maintains a 57-year track record of providing consistent data collection and analysis to farmers and researchers (DFBS, 2011).

Yearly farm records needed to complete the DFBS are exhaustive and include: beginning- and end-of-year balance sheets; a yearly labor summary; crop acres; capital sales and purchases; cow numbers; feed inventory; value of machinery and equipment; value of land and buildings; value of all other farm assets; and farm liabilities (DFBS, 2011). Box 1 describes the accrual accounting procedures that are used to reconcile expenses and receipts with total farm expenses.

A key consideration in selecting the methodology to estimate the CT COP was consistency with USDA guidelines. The USDA is clear with respect to the basis of such estimates, as indicated by the following passage:

The theoretical basis and accounting methods used for the most recent estimates of commodity costs and returns conform with standards recommended by the American Agricultural Economics Association (AAEA) Task Force on Commodity Costs and Returns. ...The Task Force recommended that the cost and return account be divided into operating costs and allocated overhead costs.

(Source: USDA Economic Research Service, <<http://www.ers.usda.gov>>)

The major recommendations from the AAEEA Task Force provided in the Commodity Costs and Returns Handbook (CCRH) are listed in Appendix A.

The Cornell methodology is consistent with the CCRH estimation methods; however, the classification of specific cost items differs from the one used by the USDA. Consequently, it is necessary to modify the standard Cornell reporting to be consistent with CCRH recommendations. Itemized expense categories used in the UConn analysis are included in Box 2. Other divergences between the standard CCRH recommendations and the practices followed in the Cornell methodology stem from whole-farm considerations; in particular, the mechanism by which the data are adjusted to account for only the dairy portion of the farm operation.

A dairy farm typically produces and sells goods other than milk, such as crops and livestock, and is therefore a multi-enterprise operation. Expenses that are incurred at the whole-farm level (e.g., utilities, management), which are referred to as general farm overhead expenses, need to be allocated to specific enterprises based on some predetermined method. In the case of dairy farming and the calculation of the COP for milk, one needs to allocate the overhead expenses between milk and all other enterprises. The CCRH recommendation is for the allocation of overhead expenses to be done during data collection based on information provided directly by the farmer, which is the practice followed by the USDA ARMS survey. However, the Cornell DFBS uses a different allocation method where all non-milk expenses are deducted from whole-farm expenses, resulting in the milk-related expenses from which the COP is calculated. Moreover, the DFBS methodology relies on the assumption that a farm's non-milk expenses are equal to its non-milk receipts. Thus, the milk-related portion of expenses is calculated by deducting non-milk receipts from total expenses (DFBS, 2011). The next step is to add machinery and building depreciation to the milk-only operating cost category to determine the purchased inputs cost of producing milk. Box 3 includes the full description of the Cornell DFBS method by which costs are determined.

Costs associated with certain dairy related inputs are determined indirectly, and such costs must be assessed using the best available value (described in Appendix A). Examples of such inputs are unpaid family and operator labor, the value of the operator's management, and the value of land, as well as other capital assets (CCRH, 1998). A list of standard alternatives for costing out each input is provided in Box 3.

The DFBS program allocates an interest charge (r) of 5% on equity capital to reflect the opportunity cost of land and other capital assets. This has been a long standing practice, which Cornell has found to yield a consistent estimate of the amount that could be earned in other businesses with similar risk in an economy with little or no inflation (Knoblauch, 2012). Unpaid family and operator labor is charged at \$2,994.60 per month, which is based on 230 hours per month of full-time equivalent work at a mean hourly wage rate of \$13.02 for agricultural farm-workers and laborers. This wage rate is reported by the BLS for Connecticut for May 2011 (http://www.bls.gov/oes/current/oes_ct.htm). The opportunity cost of operator labor and management used is the amount reported by farmers which is intended to represent the value of off-farm employment based on the operator's education, age and experience (Appendix A). All of these costs are then added to the costs of purchased inputs to determine the total cost of producing milk (Box 3).

Once data collection and verification was complete, the mean farm-size of the sample of 43 farms was compared to that of the entire state industry to determine the representativeness of the sample. Table 1 displays summary statistics for the state population of dairy farms as well as the CT study sample. The total number of farms in CT for 2011 is 124, with 19,000 cows and a total annual output of just under 3.5 million hundredweight (cwt) of milk. The representativeness of the sample to the actual population of farms is inferred from a comparison of the averages of these statistics. The average herd size in CT is 153 cows, with an average production of 184 cwt per cow and 28,166 cwt per farm. In comparison, the full sample of 43 farms has an average herd size of 216 with 192 cwt per cow and 45,202 cwt per farm. Thus, the full sample (43 farms) averages overestimate the population mean, and an adjustment is required.

One method for adjusting the sample to better represent the population is by statistical weighting. If the actual distribution of output for state producers is available, the sample may be weighted to accurately reflect the distribution of state output. Although additional data for state production were provided by the Department of Agriculture, these data was not used for this purpose because it was incomplete, primarily due to missing production information for periods when Public Act 09-229 payments were not provided to dairy farms.

Another method is to drop farms at either end of the distribution until the means coincide in value. This is the method used herein to adjust the sample of farms to better represent the state dairy industry, and to produce a representative estimate of the average COP for CT milk in 2011.

Following this process we drop the four largest farms (approximately 10% of the whole sample) leaving 39 farms (Table 1). By comparison, the average herd size for the 39 farms remaining in the sample is 150 cows, slightly less than the state average of 153 cows. The average output per farm for the sample is 29,093 cwt, slightly more than the state average of 28,166. Furthermore, output per cow in the sample is 187 cwt, compared to 184 cwt for the state. Overall, the number of farms, total cows and total output for the sample represents just under one-third of the dairy farms in CT, and the averages for key variables are now very similar.

Participation in comparable dairy COP studies for other states in the region include a lesser proportion of total state farms in their study sample. For instance, a 2010 Maine dairy COP study also had a total of 39 farms participating; however, this represents only 14% of the total Maine dairies (Kersbergen et al., 2011). The most recent iteration of the USDA ARMS Survey in 2010 included 14% of Maine dairy farms as well, with information collected from 45 of the state's 313 dairy farms; for Vermont, 126 of the state's 975 dairy farms were surveyed, representing 13% of the total VT dairies; and, for New York, information from 131 of the state's 4,831 total dairy farms was collected, representing 3% of total NY dairies in 2010 (NMAMA, 2010; USDA, 2011).

Additional summary statistics for the sample broken down by herd-size classes are provided in Table 2. The small herd size class, 25–99 cows, is found on 17 farms. The next class, 100–249 cows, is found on 14 farms. There are 8 farms in the large farm-size class, with 250–500 cows. An additional large-class size is provided for herds of 250+ (III*), which includes the values from the four largest farms in the full survey that were dropped to obtain the representative sample used to calculate the average COP for the state. The four largest farms are included in Category III* in order to provide a more accurate characterization of the costs for the largest state farms.

As a last component of data processing prior to estimating the COP, individual farm data are filtered using standard methods to remove outlier observations caused by reporting error or unique farm conditions that are not typical of the average dairy farm. Observations for standard inputs and receipts that fall outside of three standard deviations from the mean are omitted from the calculation of COP averages. At no time are more than two data points eliminated from a calculation, ensuring that at least 37 of the farms in the representative sample are used to calculate

the average for each cost category. Finally, the average annual COP is calculated using the averages of each cost category for the sample of state farms.

Monthly COP. Once the annual 2011 CT COP per cwt for milk has been estimated, monthly COP estimates for 2012 are produced and used to compute payment to farmers according to the provisions of the law.

The current method for estimating the monthly COP uses the 2011 annual NASS ARMS COP data for Vermont and Maine. The appropriate monthly NASS index value, based on U.S. average monthly prices paid for selected inputs, is applied to each of the cost categories. The NASS index value approach to estimating monthly COP was used by the Zwick Center for Quarters 2–4 in 2011 and Quarters 1–2 in 2012 (Rabinowitz and Lopez, 2011 and 2012; Zwick Outreach Reports 1, 3-7).

The Cornell DFBS and USDA ARMS methodologies are not a one-to-one match in terms of input categorization. Therefore, a direct replacement of the Vermont/Maine data with the Cornell-estimated COP is not possible for application of the monthly NASS indices. To address this issue, the Cornell cost categories are reclassified to best match the USDA cost categories, creating a UConn modified DFBS. The monthly NASS indices are then applied using the equations for the modified USDA methodology provided in Box 5.

The methodology for calculating the monthly COP for 2012 from the UConn annual 2011 COP using the NASS indices, described in Box 5, separates costs into two main categories, Total Operating Costs and Allocated Overhead, as well as their respective subcategories. Total operating costs include purchased and homegrown harvested feed, veterinary fees and medicine, bedding and litter, marketing, custom services, fuel, lube and utilities, repairs, other operating costs, government receipts and miscellaneous income, and interest on operating capital. Allocated overhead includes costs associated with hired labor, opportunity costs of unpaid labor and management, capital recovery of machinery and equipment (depreciation), opportunity cost of equity, taxes and insurance, and general overhead (see Box 2 for a full description of the subcategories). Each of these subcategories is associated with NASS prices paid indices, as outlined in Box 5. Monthly production estimates for CT dairy farms are also necessary to adjust the COP for seasonality in milk production and cost differences associated with that seasonality.

Data for national indices and CT production are obtained from the USDA National Agricultural Statistics Service (NASS) publications *Agricultural Prices* and *Milk Production*, also available via the QuickStats data product at <http://www.nass.usda.gov>. Each month NASS releases initial data estimates for the previous month that are used to estimate monthly COP. In subsequent months, as additional information for the NASS variables becomes available, the published data are often revised; therefore, the monthly COP estimates need to be revised accordingly. Given the Commissioner's need to determine if payments are necessary for dairy farmers for a given month, it is impractical to postpone payments until final data are released. Thus a one-month lag following the end of the quarter is recommended for generating monthly estimates, e.g., data for quarter 3 (July–September) should be provided at the end of October. Corrections to the monthly estimates as a result of updated NASS indices are provided in subsequent reports, and adjustments by the Commissioner of Agriculture can be considered if necessary.

IV. Results and Discussion

This section first presents the results for Connecticut along with a brief discussion of some key components. Next, the 2011 CT COP results and industry attributes are compared to those from Vermont and Maine. Differences between the methods of calculating the COP for milk are highlighted here, and results for New York are included for this purpose. The 2012 monthly COP results for CT, VT, and ME are then provided and discussed. Lastly, the 2012 monthly sustainable milk prices are calculated and compared to the statistical uniform price for Hartford to determine the value of payments to CT dairy farms under Public Act 09-229.

The results of the 2011 COP for CT are provided in Table 3. The average COP for the sample of 39 farms is \$31.52/cwt. This sample is further broken down into three farm classes based on herd size, and a fourth size class which includes the four farms dropped from the largest size class. The size classes are generated for farms with 25–99, 100–249, 250–500, and 250+ (III*) cows. The COP per hundredweight for each size class is \$37.10, \$26.84, \$28.39, and \$25.91, respectively. Feed and labor expenses are the greatest contributors to the COP and combined they make up more than 50% of the total COP, as seen in Figure 2. Total feed costs are estimated at 29% of the COP at \$9.65/cwt, and labor costs, accounting for 30% of the COP, are estimated at \$9.94/cwt for the representative sample.

Economies of scale are seen in the overall decrease in average COP from the smallest to the largest farm-size class. Total operating costs are observed to be more consistent across farm-size than total allocated overhead, which is a more significant driver of the scale economies (Figure 3). The pattern of decreasing costs with farm-size is observed for most input categories. It is worth noting that the higher opportunity cost of labor and management per cwt for smaller compared to larger farms is an important contributor to economies of scale (Figure 3).

The 2011 COP for Vermont and Maine from the NASS adjusted USDA ARMS Survey is \$32.61/cwt and \$37.45/cwt, respectively (Table 5). Of the three New England states, Connecticut, with 124 total farms and 19,000 cows, has the smallest dairy industry, the lowest cost of production (\$31.52/cwt), and the largest average herd size (153 cows) (Table 6). The dairy industries in Vermont and Maine are larger than Connecticut's, having 958 and 303 farms, and 134,000 and 32,000 cows, respectively. Vermont's average herd, with 140 cows, is slightly smaller than Connecticut's, whereas Maine's is considerably smaller, with an average herd size of 106 cows. The COP for VT and ME follow a similar pattern, where the Vermont COP is closer to Connecticut's at \$32.61/cwt, compared to Maine's at \$37.45/cwt. The greater COP for VT and ME may also stem partly from methodological differences. To elucidate this point, results for New York are included for three methods: the NASS Adjusted USDA ARMS Survey (Table 5), the Farm Credit East (Table 7), and the Cornell DFBS method (Table 8).

The New York dairy industry has a much smaller average herd size than CT, yet average COP is considerably less (Table 6), which is likely due to lower input costs stemming from pecuniary economies of scale at the input supplier level. The value of the estimated COP differs depending on the method used. The 2011 COP estimate for NY is largest for the NASS Adjusted USDA ARMS Survey method, with a value of \$27.05/cwt (Table 5) while Farm Credit East provides the lowest estimate, at \$17.95/cwt (Table 7). The Cornell DFBS estimates NY's 2011 COP at \$19.21/cwt (Table 8). A major difference between the first and the latter two methods is that both Farm Credit East and Cornell DFBS are elective programs. Participating farms have lower costs, on average, than those included in the USDA ARMS survey. This result is likely due to the fact that farmers are typically enrolled in the program for years, and are able to use the annual results in order to benchmark performance and decrease their COP. Furthermore, the Farm Credit method is designed to measure the cash operating expenses for the farm and it does

not include several allocated overhead expenses (e.g., the opportunity cost of labor and capital). Therefore, the Farm Credit COP estimates are lower than the other methods.

In addition, the UConn Modified DFBS are closer to the USDA results because of the one-time nature of the estimation, where farms have not used prior analysis to benchmark their performance. The 2011 FCE (Net) COP for New England dairy farms is \$19.72/cwt, with adjusted cash operating expenses of \$20.71/cwt (Table 7). Deducting the value for hired labor from the FCE adjusted cash operating expenses results in a value of \$17.65/cwt, which is close to the estimated operating expenses for CT at \$17.16/cwt (Table 3). Again, because of the larger average farm-size in CT than in the other New England states, and keeping in mind the relevance of economies of scale, costs in CT would be lower than for the average New England dairy farm.

The results for the 2012 monthly CT COP based on the NASS indices indicate a steady increase in the operating costs for milk production, with an increase observed in every month except February. The range in operating costs from January to September is \$17.04/cwt to \$23.16/cwt (Table 4). Allocated overhead costs are also increasing from month-to-month, with a range of \$14.93/cwt to \$15.94/cwt. The total cost of production follows suit with a range of \$31.97/cwt to \$39.10/cwt from January to September. Feed costs are observed to be a major driver of the increased COP and have risen steadily through the year, from \$8.24/cwt in January to \$13.61/cwt in September, which accounts for the majority of the increase in total operating costs. Similarly, the opportunity cost of unpaid labor and management is the most significant contributor to the increase in allocated overhead, ranging from \$6.89/cwt in January to \$7.31/cwt in September. Likewise, NASS adjustments to the VT and ME COP reveal the same general trends, because the NASS indices used are provided as a national value and are identical across states. Again, these trends are shown for CT in Table 4 and for VT and ME in Tables 9 and 10.

Table 11 includes the monthly results for the 2012 COP for CT, VT, and ME, as well as the calculated Minimum Sustainable Monthly Cost (MSC) of Production. The Table also shows the Statistical Uniform Price (SUP) for Hartford, CT, and the difference between the MSC and the SUP. This difference is used as the basis for Public Act 09-229 payments to CT dairy farms. As discussed, the COP for CT, VT, and ME has steadily increased through 2012, which also holds for the MSC. The SUP exhibits a net increase from January to September, after slightly decreasing month-to-month for the first half of the year followed by sharp increases in each month of the third quarter (Table 11). The net result of the behavior of the COP and the SUP is

an increase in the value of payments to CT dairy farms. The payment to CT dairy farmers ranges from \$6.95/cwt in January to \$12.71/cwt in September.

V. Summary and Concluding Remarks

The objective of this study was to estimate the average COP for CT milk in 2011, which resulted in an estimated value of \$31.52/cwt (Table 3). Although data from only 39 of the 43 participating farms are included in the analysis of CT COP, the information from the four largest farms is not completely lost as they are used in the analysis for a class including the biggest operations. The average COP for milk is observed to increase with farm-size signaling the importance of economies of scale in dairy production, a relationship that is well established in the literature.

Moving forward, the 2011 annual COP can be the basis for estimating monthly costs accurately for a limited period of time. The previously used USDA ARMS data are from a survey that is conducted for dairy farms every five years. One of the criticisms of using the ARMS data, besides the fact that CT data are not collected by the USDA, is that the error in COP estimation becomes larger as the period from the most recent survey increases. This is partly because the adjustments rest solely on national indices which fail to account for regional or state specific variation over time. For this reason, a shorter interval between surveys is recommended for CT. Additionally, consideration should be given for the potential for state-specific cost shocks that deviate from the national averages reflected in the NASS indices when computing current monthly COP estimates. To achieve this, alternative price indices should be reviewed as a means for checking the validity of monthly COP estimates. Given the recent trends and the relative importance of purchased feed in the total COP for milk, it is recommended that monthly wholesale data on feed prices be collected from major wholesalers in CT and incorporated into the monthly COP estimates.

Even if the basis for projecting monthly costs is addressed, a decision needs to be made on how best to proceed with future annual COP baseline estimates. Using the Cornell DFBS offers the opportunity for farmers to participate annually in a data-entry process that provides an additional benefit to individual farms, i.e. the ability to track the year-to-year progress of the farm and to benchmark against similar participating producers in CT and other states. Farmers who are proactive in this sense will work to become more profitable by allocating their costs more

efficiently. This annual data-entry process, however, is duplicative for farmers that are already participating in the Farm Credit East system and thus may be viewed as unnecessary. Ultimately, policy makers need to address several questions, including the following:

- How often should the data for CT be collected, and in how much detail?
- What are the benefits and concerns with the Modified Cornell DFBS method, i.e., its information requirements, and the ability to benchmark and track year-to-year farm performance? It should be noted that NYS DOAG and Cornell Cooperative Extension provide DFBS at no charge to NY dairy farmers on a yearly basis.
- Would it be desirable to develop an arrangement through cooperation with industry service providers such as Farm Credit East that can leverage existing farm-industry relationships? In considering this option one must carefully reflect on the confidentiality requirements of Farm Credit regulations.

Regardless of the frequency in yearly COP estimation, the most recent estimates available will be used to determine payment to CT dairies when the MSC falls below the SUP. The purpose of this study, and the estimation of the CT COP for milk, was to ensure that policy makers are provided the best information available in order to base policy decisions and to apply Public Act 09-229. Given the results for the 2011 CT COP, prospective payments have increased in every month during 2012 to the point where the calculated payments to dairy farms exceeds the available funds for the program. The long-term success or failure of the program to mitigate further declines in farm numbers and thus maintain the current size of the CT dairy industry remains an open question, and while beyond the scope of this research, is worthwhile for future consideration.

In comparison to the CT program, Maine uses a “Tier Program” to establish price supports at increasing levels of production, or tiers, which is consistent with the notion that smaller farms have higher per cwt costs of production. Payments are based on the differential between the base price and the target price specific to the tier or cumulative production (in terms of pounds of milk) of the farm (Kersbergen et al., 2011). Evidence suggests that Maine’s Tier Program might have helped in keeping farms in production, given that the relative loss in farms has been lower than in the neighboring states of New Hampshire and Vermont during the period 2004–2010 (Drake, 2011, as referenced in Kersbergen et al., 2011).

In CT, dairy farmers have welcomed state support during the recent downturn in milk prices and profitability. Direct interaction with participating farmers has been constructive as they have expressed many of their concerns, hopes, and appreciation for the ongoing policy efforts. At the same time, the lack of participation of many farms in the state has been a source of concern.

Table 1. Comparison of the CT Dairy Industry and the Sample of Participating Farms, 2011

	Number of Farms	Total Cows	Total Output (Cwt)	Average Herd Size	Average Output per Farm	Average Output per Cow
					-----Cwt of Milk-----	
Connecticut	124	19,000	3,492,650	153	28,166	184
Full Sample	43	9,294	1,943,668	216	45,202	192
Representative Sample	39	5,858	1,134,627	150	29,093	187
Representative Sample as a % of CT Industry	32%	31%	32%	-----	-----	-----
Source: CT DFBS Survey, 2012; NASS 2012 < http://www.nass.usda.gov >; NMAMA 2011 < http://www.fmmone.com >						

Table 2. Connecticut Dairy COP Study Summary Statistics, 2011				
Herd Size Class (cows)	Number of Farms	Total Cows	Share of Cows	Average Herd Size
I (25-99)	17	1,000	17%	59
II (100-249)	14	2,369	40%	169
III (250-500)	8	2,489	43%	311
III* (250+)	12	5,925	-----	494
Representative Sample	39	5,858	100%	150
Herd Size Class (cows)	Total Output (Cwt)	Share of Output	Average Output per Farm	Average Output per Cow
<u>Cwt of Milk</u>				
I (25-99)	178,439	16%	10,496	176
II (100-249)	467,680	41%	33,406	196
III (250-500)	488,509	43%	61,064	196
III* (250+)	1,297,550	-----	108,129	209
Representative Sample	1,134,627	100%	29,093	187
* Herd size class III values include data from the four largest farms that were collected with the survey but not included in the analysis.				
Source: CT DFBS Survey, 2012.				

**Table 3. Milk Production Costs per Cwt for Connecticut, 2011
(UConn Modified DFBS Method)**

Item	Connecticut Adjusted Average	Farm Herd Size Class			
		I (25-99)	II (100-249)	III (250-445)	III* (250+)
Operating costs:					
Feed--					
Purchased feed	8.61	9.05	8.07	8.60	8.40
Homegrown harvested feed	1.04	0.83	1.02	1.99	1.87
Total, feed costs	9.65	9.88	9.09	10.59	10.27
Other--					
Veterinary and medicine	1.50	1.61	1.52	1.23	1.18
Bedding and litter	0.26	0.31	0.25	0.18	0.25
Marketing	1.30	1.43	1.25	1.10	1.10
Custom services	0.53	0.24	0.67	0.89	0.53
Fuel, lube, and utilities	2.13	2.53	1.83	1.83	1.82
Repairs	2.17	2.73	1.80	1.62	1.69
Other operating costs	0.67	0.58	0.85	0.57	0.47
Gov't Receipts and Misc. Income	(1.37)	(1.74)	(1.20)	(0.93)	(1.18)
Interest on operating capital	0.32	0.33	0.32	0.29	0.41
Total, operating cost	17.16	17.90	16.39	17.38	16.54
Allocated overhead:					
Hired labor	3.30	2.96	3.51	3.67	3.54
Opportunity cost of unpaid labor and management	6.64	11.18	2.73	3.81	2.71
Capital recovery of machinery and equipment	1.05	1.12	1.30	0.51	0.77
Opportunity cost of equity (5%)	1.96	2.41	1.68	1.54	1.12
Taxes and insurance	0.95	1.15	0.83	0.75	0.65
General farm overhead	0.46	0.37	0.41	0.72	0.58
Total, allocated overhead	14.36	19.20	10.45	11.00	9.37
Total costs listed	31.52	37.10	26.84	28.39	25.91

* Herd size class III values include the four largest farms dropped from the study sample.

Source : CT DFBS Survey, 2012.

Table 4. Connecticut Monthly Milk COP: January–September 2012

Item	Jan	Feb	March	Apr	May	June	July	Aug	Sept
-----Dollars Per Cwt-----									
Operating costs:									
Feed--									
Purchased feed	8.24	8.03	8.60	8.65	9.02	10.41	11.61	12.63	13.61
Homegrown harvested feed	1.16	1.13	1.20	1.22	1.29	1.21	1.25	1.29	1.33
Total, feed costs	9.41	9.16	9.79	9.87	10.31	11.62	12.86	13.92	14.94
Other--									
Veterinary and medicine	1.52	1.43	1.46	1.46	1.50	1.55	1.57	1.62	1.65
Bedding and litter	0.26	0.25	0.26	0.25	0.26	0.27	0.27	0.28	0.28
Marketing	1.31	1.31	1.31	1.31	1.32	1.33	1.33	1.33	1.33
Custom services	0.56	0.53	0.54	0.54	0.55	0.57	0.58	0.59	0.60
Fuel, lube, and utilities	2.11	2.03	2.18	2.16	2.09	2.00	2.02	2.22	2.35
Repairs	2.23	2.10	2.16	2.16	2.22	2.27	2.30	2.37	2.41
Other operating costs	0.68	0.64	0.66	0.66	0.68	0.70	0.71	0.73	0.74
Gov't Receipts and Miscellaneous Income	(1.39)	(1.30)	(1.34)	(1.33)	(1.37)	(1.42)	(1.43)	(1.47)	(1.50)
Interest on operating capital	0.34	0.32	0.33	0.33	0.34	0.34	0.35	0.36	0.37
Total, operating cost	17.04	16.46	17.36	17.42	17.89	19.24	20.54	21.94	23.16
Allocated overhead:									
Hired labor	3.43	3.23	3.30	3.26	3.34	3.43	3.46	3.57	3.64
Opportunity cost of unpaid labor and management	6.89	6.48	6.64	6.55	6.71	6.88	6.96	7.17	7.31
Capital recovery of machinery and equipment	1.10	1.04	1.06	1.08	1.11	1.14	1.16	1.19	1.21
Opportunity cost of equity	2.03	1.91	1.96	1.95	2.00	2.05	2.07	2.14	2.18
Taxes and insurance	0.99	0.94	0.96	0.96	0.98	1.00	1.01	1.05	1.07
General farm overhead	0.47	0.45	0.47	0.47	0.48	0.49	0.49	0.52	0.53
Total, allocated overhead	14.93	14.04	14.39	14.27	14.61	14.99	15.16	15.63	15.94
Total costs listed	31.97	30.50	31.75	31.68	32.50	34.24	35.70	37.56	39.10

Source : Based on CT DFBS Survey, 2012, and updated using current per cow and production input indexes. <<http://www.ers.usda.gov/Data/CostsAndReturns/monthlymilkcosts.htm>>

**Table 5. Milk Production Costs and Returns per Cwt Sold, by State, 2011
(USDA ARMS Survey Method, NASS Adjusted)**

Item	All States*	New York	Vermont	Maine
Operating costs:				
Feed--				
Purchased feed	8.08	7.56	8.73	11.07
Homegrown harvested feed	4.82	5.72	6.49	5.98
Grazed feed	0.09	0.17	0.21	0.13
Total, feed costs	12.99	13.45	15.43	17.18
Other--				
Veterinary and medicine	0.77	1.10	0.77	1.06
Bedding and litter	0.23	0.42	0.45	0.88
Marketing	0.22	0.28	0.36	0.30
Custom services	0.54	0.73	1.02	0.71
Fuel, lube, and electricity	0.83	0.97	1.36	1.89
Repairs	0.56	0.69	0.89	1.28
Other operating costs	0.00	0.01	0.01	0.01
Interest on operating capital	0.01	0.01	0.01	0.01
Total, operating cost	16.15	17.66	20.30	23.32
Allocated overhead:				
Hired labor	1.49	1.47	1.28	2.38
Opportunity cost of unpaid labor	2.11	2.58	4.30	4.49
Capital recovery of machinery and equipment	3.34	4.28	5.31	5.88
Opportunity cost of land (rental rate)	0.02	0.02	0.06	0.03
Taxes and insurance	0.18	0.28	0.40	0.43
General farm overhead	0.59	0.76	0.96	0.92
Total, allocated overhead	7.73	9.39	12.31	14.13
Total costs listed	23.88	27.05	32.61	37.45
*All States values include: CA, FL, GA, ID, IL, IN, IA, KS, KY, ME, MI, MN, MO, NY, OH, OR, PA, TN, TX, VT, VA, WA, and WI.				
Source: Based on USDA's 2010 Agricultural Resource Management Survey of milk producers and updated using current per cow and production input indexes. < http://www.ers.usda.gov/Data/CostsAndReturns/monthlymilkcosts.htm >				

Table 6. Comparison of CT, NY, VT, and ME Dairy Farms, 2011

State	Number of Farms	Total Cows	Total Output (Cwt)	Average Herd Size	Average Output per Farm	Average Output per Cow
					-----Cwt of Milk-----	
Connecticut	124	19,000	3,492,650	153	28,166	184
New York	4,759	610,000	110,571,130	128	23,234	181
Vermont	958	134,000	25,050,350	140	26,149	187
Maine	303	32,000	5,852,340	106	19,315	183
Source: NASS 2012 < http://www.nass.usda.gov >; NMAMA 2011 < http://www.fmmone.com >						

**Table 7. Milk Production Costs per Cwt Sold, for New York and New England, 2011
(Farm Credit East Method)**

Item	New York <i>381 farms</i>	New England <i>151 farms</i>
Feed	6.40	7.80
Labor	2.93	3.06
Interest	0.54	0.48
Marketing	0.87	0.88
Crop	1.30	1.22
Other	6.71	7.28
Adjusted Cash Operating Expenses	18.75	20.71
+ Depreciation	1.37	1.23
+Family Living	0.70	0.65
Total Costs	20.82	22.59
- Non-Milk Income	(2.87)	(2.87)
Net Cost of Production	17.95	19.72
Source: "2011 Northeast Dairy Farm Summary," Farm Credit East, Enfield, CT. Print.		

**Table 8. Milk Production Costs per Cwt Sold, for New York, 2011
(Cornell DFBS Method)**

Item	New York <i>190 farms</i>
Dairy grain and concentrate	6.17
Dairy roughage	0.35
Nondairy feed	0.00
Professional Nutritional Services	0.01
Total Feed Expense	6.53
Crop expense	1.09
- Crop sales and gov't receipts	0.54
Net Feed and Crop Expense	7.08
Hired labor	2.75
Operators and family labor	0.84
Total Labor Expense	3.59
Machine repairs, fuel and hire	2.24
Machinery depreciation	0.84
- Gas tax refunds and custom work	0.06
Net Machinery Expense	3.02
Replacement and expansion cattle purchases	0.14
- Sales and inventory growth	1.50
Net Cattle Purchases	(1.36)
Milk marketing costs	0.88
All other livestock expense excluding purchases	2.39
Net Livestock Expense	3.27
Real estate repairs, rent and taxes	0.87
Building depreciation	0.54
Total Real Estate Expense	1.41
Interest paid	0.48
Interest on equity	1.32
Total Interest Expense	1.80
Other operating and misc. expenses	0.82
- Misc. income	0.42
Net Misc. Expenses	0.40
Total Cost of Producing Milk/Cwt	19.21
Source: Cornell DFBS, 2011, < http://dyson.cornell.edu >.	

Table 9. Vermont Monthly Milk COP: January–September 2012

Item	Jan	Feb	March	Apr	May	June	July	Aug	Sept
-----Dollars Per Cwt-----									
Operating costs:									
Feed--									
Purchased feed	8.26	8.18	8.75	8.73	8.92	10.10	11.30	12.16	12.91
Homegrown harvested feed	7.20	7.10	7.52	7.62	7.85	7.25	7.48	7.65	7.79
Grazed feed	0.23	0.23	0.24	0.25	0.25	0.23	0.24	0.25	0.25
Total, feed costs	15.69	15.51	16.51	16.60	17.03	17.59	19.03	20.06	20.96
Other--									
Veterinary and medicine	0.77	0.74	0.76	0.75	0.75	0.76	0.77	0.79	0.79
Bedding and litter	0.45	0.43	0.44	0.44	0.44	0.45	0.45	0.46	0.46
Marketing	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37
Custom services	1.07	1.02	1.05	1.04	1.04	1.05	1.06	1.08	1.09
Fuel, lube, and electricity	1.33	1.30	1.39	1.37	1.30	1.22	1.23	1.34	1.40
Repairs	0.90	0.86	0.89	0.88	0.89	0.89	0.90	0.92	0.93
Other operating costs	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Interest on operating capital	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total, operating cost	20.60	20.24	21.43	21.46	21.83	22.34	23.84	25.04	26.01
Allocated overhead:									
Hired labor	1.31	1.26	1.29	1.26	1.26	1.27	1.29	1.31	1.32
Opportunity cost of unpaid labor	4.41	4.22	4.32	4.23	4.24	4.27	4.33	4.41	4.43
Capital recovery of machinery and equipment	5.47	5.26	5.38	5.42	5.44	5.50	5.60	5.68	5.71
Opportunity cost of land	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Taxes and insurance	0.41	0.40	0.41	0.40	0.40	0.40	0.41	0.42	0.42
General farm overhead	0.99	0.95	0.99	0.98	0.98	0.99	1.00	1.04	1.05
Total, allocated overhead	12.66	12.13	12.44	12.35	12.38	12.49	12.68	12.91	13.00
Total costs listed	33.26	32.38	33.86	33.81	34.21	34.83	36.52	37.96	39.00

Source: Based on USDA's 2010 Agricultural Resource Management Survey of milk producers and updated using current per cow and production input indexes.

<<http://www.ers.usda.gov/Data/CostsAndReturns/monthlymilkcosts.htm>>

Table 10. Maine Monthly Milk COP: January–September 2012

Item	Jan	Feb	March	Apr	May	June	July	Aug	Sept
-----Dollars Per Cwt-----									
Operating costs:									
Feed--									
Purchased feed	10.86	10.17	11.76	11.13	11.71	12.75	14.65	15.47	15.82
Homegrown harvested feed	6.88	6.41	7.34	7.05	7.49	6.65	7.04	7.07	6.93
Grazed feed	0.15	0.14	0.16	0.15	0.16	0.14	0.15	0.15	0.15
Total, feed costs	17.89	16.71	19.26	18.33	19.37	19.55	21.85	22.70	22.90
Other--									
Veterinary and medicine	1.10	1.00	1.10	1.03	1.07	1.04	1.09	1.09	1.05
Bedding and litter	0.91	0.83	0.92	0.86	0.89	0.87	0.90	0.90	0.86
Marketing	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31
Custom services	0.77	0.70	0.77	0.72	0.75	0.72	0.76	0.76	0.73
Fuel, lube, and electricity	1.91	1.77	2.05	1.91	1.87	1.69	1.75	1.87	1.88
Repairs	1.35	1.22	1.35	1.28	1.32	1.28	1.33	1.33	1.29
Other operating costs	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Interest on operating capital	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total, operating cost	24.27	22.54	25.79	24.46	25.60	25.47	28.00	28.97	29.04
Allocated overhead:									
Hired labor	2.53	2.29	2.53	2.35	2.43	2.35	2.45	2.45	2.37
Opportunity cost of unpaid labor	4.78	4.32	4.78	4.43	4.58	4.43	4.62	4.62	4.47
Capital recovery of machinery and equipment	6.29	5.70	6.31	6.03	6.24	6.06	6.33	6.31	6.11
Opportunity cost of land	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Taxes and insurance	0.46	0.42	0.46	0.43	0.45	0.43	0.45	0.45	0.44
General farm overhead	0.98	0.89	1.00	0.94	0.97	0.94	0.98	1.00	0.98
Total, allocated overhead	15.08	13.64	15.12	14.22	14.70	14.25	14.86	14.85	14.39
Total costs listed	39.34	36.18	40.91	38.69	40.30	39.72	42.86	43.82	43.43

Source: Based on USDA's 2010 Agricultural Resource Management Survey of milk producers and updated using current per cow and production input indexes.

<<http://www.ers.usda.gov/Data/CostsAndReturns/monthlymilkcosts.htm>>

Table 11. Connecticut, Vermont, and Maine Milk Cost of Production Estimates, Statistical Uniform Price, and Application of Public Act 09-229: January–September 2012

	January	February	March	April	May	June	July	August	September
	-----Dollars Per Cwt-----								
Total Cost of Production									
Connecticut	\$31.97	\$30.50	\$31.75	\$31.68	\$32.50	\$34.24	\$35.70	\$37.56	\$39.10
Vermont	\$33.26	\$32.38	\$33.86	\$33.81	\$34.21	\$34.83	\$36.52	\$37.96	\$39.00
Maine	\$39.34	\$36.18	\$40.91	\$38.69	\$40.30	\$39.72	\$42.86	\$43.82	\$43.43
Minimum Sustainable COP									
Connecticut	\$26.22	\$25.01	\$26.03	\$25.98	\$26.65	\$28.07	\$29.27	\$30.80	\$32.06
Vermont	\$27.27	\$26.55	\$27.77	\$27.72	\$28.05	\$28.56	\$29.95	\$31.12	\$31.98
Maine	\$32.26	\$29.67	\$33.55	\$31.72	\$33.04	\$32.57	\$35.15	\$35.94	\$35.61
Statistical Uniform Price									
Hartford, CT	\$19.27	\$17.99	\$17.54	\$17.10	\$16.69	\$16.48	\$17.16	\$18.30	\$19.35
Statistical Uniform Price Minus Minimum Sustainable Cost of Production									
Connecticut	-\$ 6.95	-\$7.02	-\$8.49	-\$8.88	-\$9.96	-\$11.59	-\$12.11	-\$12.50	-\$12.71
Vermont	-\$ 8.00	-\$8.56	-\$10.23	-\$10.62	-\$11.36	-\$12.08	-\$12.79	-\$12.82	-\$12.63
Maine	-\$12.99	-\$11.68	-\$16.01	-\$14.62	-\$16.35	-\$16.09	-\$17.99	-\$17.64	-\$16.26

Source: Total Cost of Production from Tables 4, 9 and 10; Statistical Uniform Price from the USDA Federal Milk Order No. 1 <<http://www.fmmone.com>>

Box 1. Accrual Accounting Method – Cornell DFBS

- Accrual expenses are cash expenses adjusted for changes in inventory, prepaid expenses and accounts payable. They are the total costs of inputs actually used in this year's business.
 - Changes in inventory represents feeds and supplies purchased this year but not used (positive change), and similar items purchased in a prior year and used this year (negative change).
 - Prepaid expenses are advance payments made for services and non-inventory items to be used in future years.
 - Changes in accounts payable reflect supplies/services used in this year's production but not paid for (positive change), and payments for production inputs used in a prior year (negative change).

- Accrual receipts represent the value of all farm commodities produced and services actually provided by the farmer during the year. Increases in livestock inventory caused by herd growth and/or quality, are included. Decreases in inventory caused by herd reduction are deducted. Changes in advanced government receipts are the amount by which government payments received for participating in a future year's program have changed from the previous to the current year. An increase requires a negative adjustment to cash receipts while a decrease is a positive adjustment. Changes in accounts receivable include the difference between the January milk check for December 2011 and the previous January's check, and other delayed payments.

- Cash receipts include the gross value of milk checks received during the year plus all other payments received for the sale of farm products, services and government programs.

- Equity capital is the farm operator/manager's owned capital or farm net worth, i.e. land, buildings, equipment, etc., which is used to determine the opportunity cost of the farm's assets or interest on equity capital.

Source: Cornell DFBS, 2011, <<http://dyson.cornell.edu>>.

Box 2. Cost of Production Categories – UConn Modified DFBS

- Operating Expenses:
 - Total feed costs are divided into **purchased dairy grain and concentrate**, **purchased dairy roughage** and all feed **purchased** for nondairy livestock to allow more thorough analysis of dairy herd feeding costs. Homegrown harvested feed includes crop expenses: the costs of fertilizer, lime, seeds, spray and other crop supplies; and, receipts from crop sales are deducted.
 - Livestock expenses include the cost of supplies and services directly associated with the care and maintenance of the dairy herd, such as veterinary and medicine, bedding and litter, milk marketing costs, custom services (i.e., breeding, boarding, rentals, and other professional services), and milking supplies. Receipts from custom services are deducted from the expenses. The purchase of replacement cattle is considered a herd maintenance expense while expansion livestock is not.
 - Machinery costs represent all the operating costs of using machinery on the farm, including: fuel, lube, and utilities and repairs. Gas tax refunds are deducted from fuel expenses. Ownership costs are excluded here. (Note: utilities are the farm share of utilities expenses, and are often included in the general farm overhead or other operating expense category).
 - Other operating costs are miscellaneous costs such as extraordinary one-time expenses.
 - Government receipts (and miscellaneous income) are deducted from expenses as reimbursement from government programs, and include CRP payments, feed grain program payments, etc. Funds used for capital projects should not be included as government receipts. Miscellaneous income can be funds for director fees or cost reimbursements for presentations, etc.
 - Interest on operating capital is interest paid on all farm indebtedness.
- Allocated Overhead:
 - Hired labor includes gross wages plus the farm share of social security, workers' compensation insurance, employee health insurance, and other employee benefits paid by the farm employer.
 - Opportunity cost of unpaid labor and management is described in Appendix A.
 - Capital recovery of machinery and equipment, depreciation of machinery and buildings are non-operating costs included in total expenses. Depreciation charges are based on those reported for income tax purposes.
 - Opportunity cost of equity is described in Appendix A, under *real opportunity interest*. This reflects the value of owned land, equipment, and livestock. The net value of livestock purchases and sales (expenses minus receipts) are included here as they reflect adjustments to the value of owned assets.
 - Taxes and insurance is the farm share of taxes and insurance expenses.
 - General farm overhead are any additional overhead costs such as licenses and fees.

Source: Cornell DFBS, 2011, <<http://dyson.cornell.edu>>.

Box 3. Cost of Producing Milk – Cornell DFBS Methodology

- The cost of producing milk has been compiled below using the whole farm method. The following steps are used in the calculations:
 - The cost of expansion livestock is added to total accrual operating expenses to offset any related inventory increase included in accrual receipts.
 - Accrual milk sales are deducted from total accrual receipts to get total accrual non-milk receipts, which are used to represent total non-milk operating costs. This assumes that costs equal revenues for non-milk costs.
 - Total accrual non-milk receipts are subtracted from total accrual operating expenses including expansion livestock to calculate the operating cost of producing milk.
 - Machinery depreciation and building depreciation are added to operating costs to determine the purchased inputs cost of producing milk.
 - The opportunity cost of equity capital, operator's labor and operator's management and the value of unpaid family labor are added to all other costs to obtain the total cost of producing milk. This cost includes all the operating, depreciation, and imputed costs of producing milk.

Source: Cornell DFBS, 2011, <<http://dyson.cornell.edu>>.

Box 4. Alternative Values for Selected Inputs

- Opportunity cost of land (and other owned equity capital):
 - Agricultural use value or market value (CCRH, 1998).
 - Rental rate from survey or other sources, i.e. DOAG.
 - A percentage of the fair market value for agricultural land.
 - Interest on equity capital (total capital assets including land).
- Unpaid family and operator's labor:
 - Average value reported by farmers (self-reported).
 - Wage rate provided by the Bureau of Labor Statistics.
 - A set wage rate for paid farm employees.
- Management:
 - A predetermined share of income, i.e. 5% of gross receipts.
 - Statistical relationship based upon herd size.
 - Opportunity cost of employment (self-reported), defined in CCRH, and included in Appendix A.

Box 5. Equations used to Estimate Monthly Milk Cost of Production

UConn = Average milk cost of production for 2011 as developed from the 2012 Cornell DFBS.

NASSINDEX = Ratio of annual and monthly U.S. prices paid indexes for selected inputs. e.g. NASSINDEX(Concentrates) is the NASS Index for prices paid for concentrates; and NASSINDEX(Hay and forages) is the NASS Index for prices paid for hay and forages. The formula for each NASSINDEX input is:

$$\frac{2012 \text{ Current Month}}{2011 \text{ Annual Average}}$$

NASSMILK = Ratio of annual and monthly Connecticut milk production per cow on a daily average basis. The formula for each NASSMILK input is:

$$\frac{2012 \text{ Current Month Daily Average}}{2011 \text{ Annual Daily Average}}$$

Operating costs:

Total feed costs:

$$\text{Purchased feed} = \text{UConn(Purchased feed)} * \text{NASSINDEX(Concentrates)} * (1/\text{NASSMILK(Production)})$$

$$\text{Homegrown harvested feed} = \text{UConn(Homegrown harvested feed)} * \text{NASSINDEX(Hay and forages)} * (1/\text{NASSMILK(Production)})$$

Other operating costs:

$$\text{Veterinary and medicine} = \text{UConn(Veterinary and medicine)} * \text{NASSINDEX(Other farm services)} * (1/\text{NASSMILK(PRODUCTION)})$$

$$\text{Bedding and litter} = \text{UConn(Bedding and litter)} * \text{NASSINDEX(Farm supplies)} * (1/\text{NASSMILK(PRODUCTION)})$$

$$\text{Marketing} = \text{UConn(Marketing)} * \text{NASSINDEX(Other farm services)}$$

$$\text{Custom services} = \text{UConn(Custom services)} * \text{NASSINDEX(Custom rates)} * (1/\text{NASSMILK(Production)})$$

Fuel, lube, and utilities = UConn(Fuel, lube, and utilities) * NASSINDEX(Fuels) * (1/NASSMILK(Production))

Repairs = UConn(Repairs) * NASSINDEX(Farm repairs) * (1/NASSMILK(Production))

Other operating costs = UConn(Other operating costs) * NASSINDEX(Other farm services) * (1/NASSMILK(Production))

Gov't Receipts and Misc Income = UConn(Gov't Receipts and Misc Income) * NASSINDEX(Other farm services) * (1/NASSMILK(Production))

Interest on operating capital = UConn(Interest on operating capital) * NASSINDEX(Interest) * (1/NASSMILK(Production))

Allocated overhead:

Hired labor = UConn(Hired labor) * NASSINDEX(Wage rates) * (1/NASSMILK(Production))

Opportunity cost of unpaid labor = UConn(Opportunity cost of unpaid labor) * NASSINDEX(Wage rates) * (1/NASSMILK(Production))

Capital recovery of machinery and equipment = UConn(Capital recovery of machinery and equipment) * NASSINDEX(Farm machinery) * (1/NASSMILK(Production))

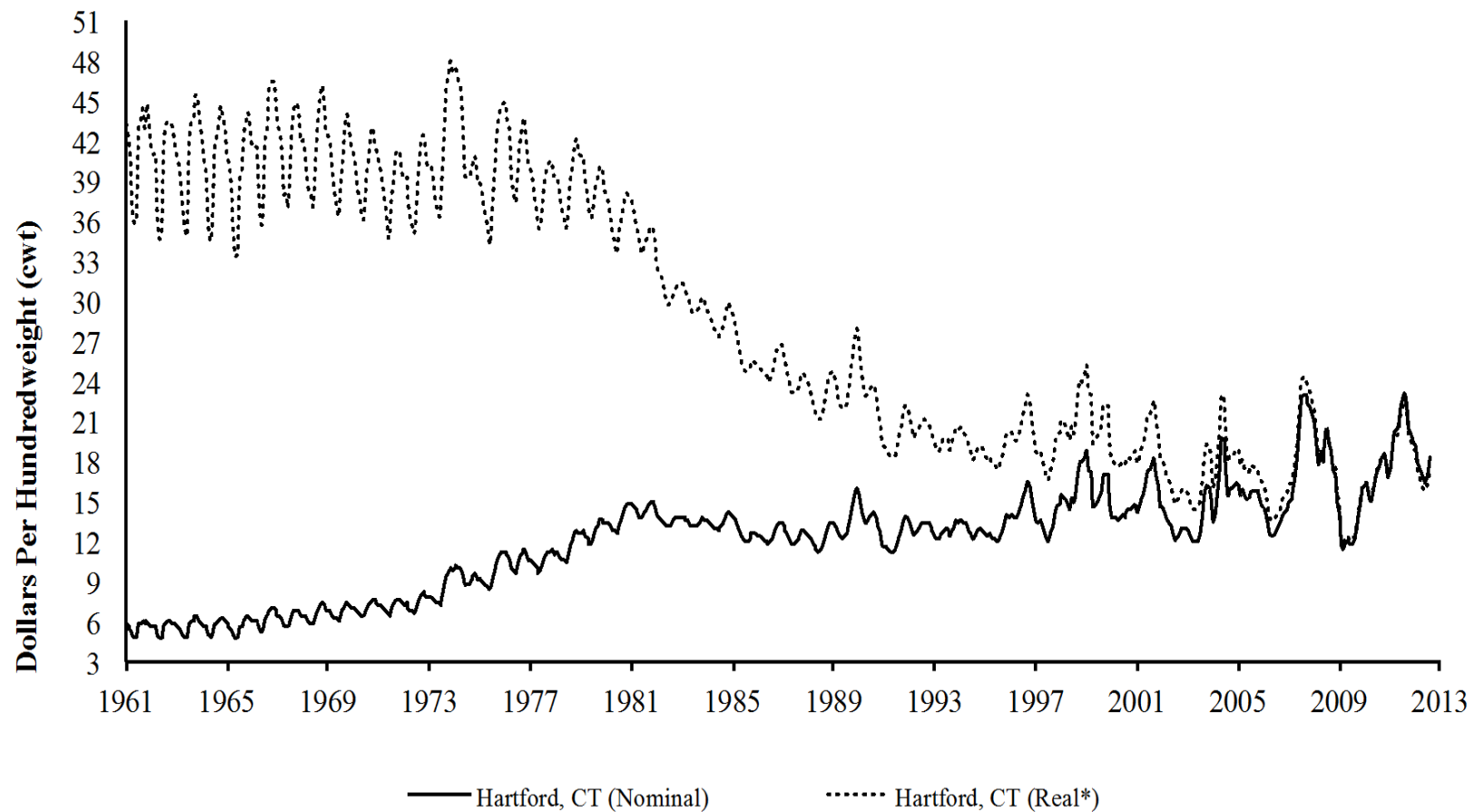
Opportunity cost of equity = UConn(Opportunity cost of land (rental rate)) * NASSINDEX(Rent) * (1/NASSMILK(Production))

Taxes and insurance = UConn(Taxes and insurance) * NASSINDEX(Taxes) * (1/NASSMILK(Production))

General farm overhead = UConn(General farm overhead) * NASSINDEX(Production items) * (1/NASSMILK(Production))

Source: Modified from <<http://www.ers.usda.gov/data-products/milk-cost-of-production-estimates/methods.aspx>>

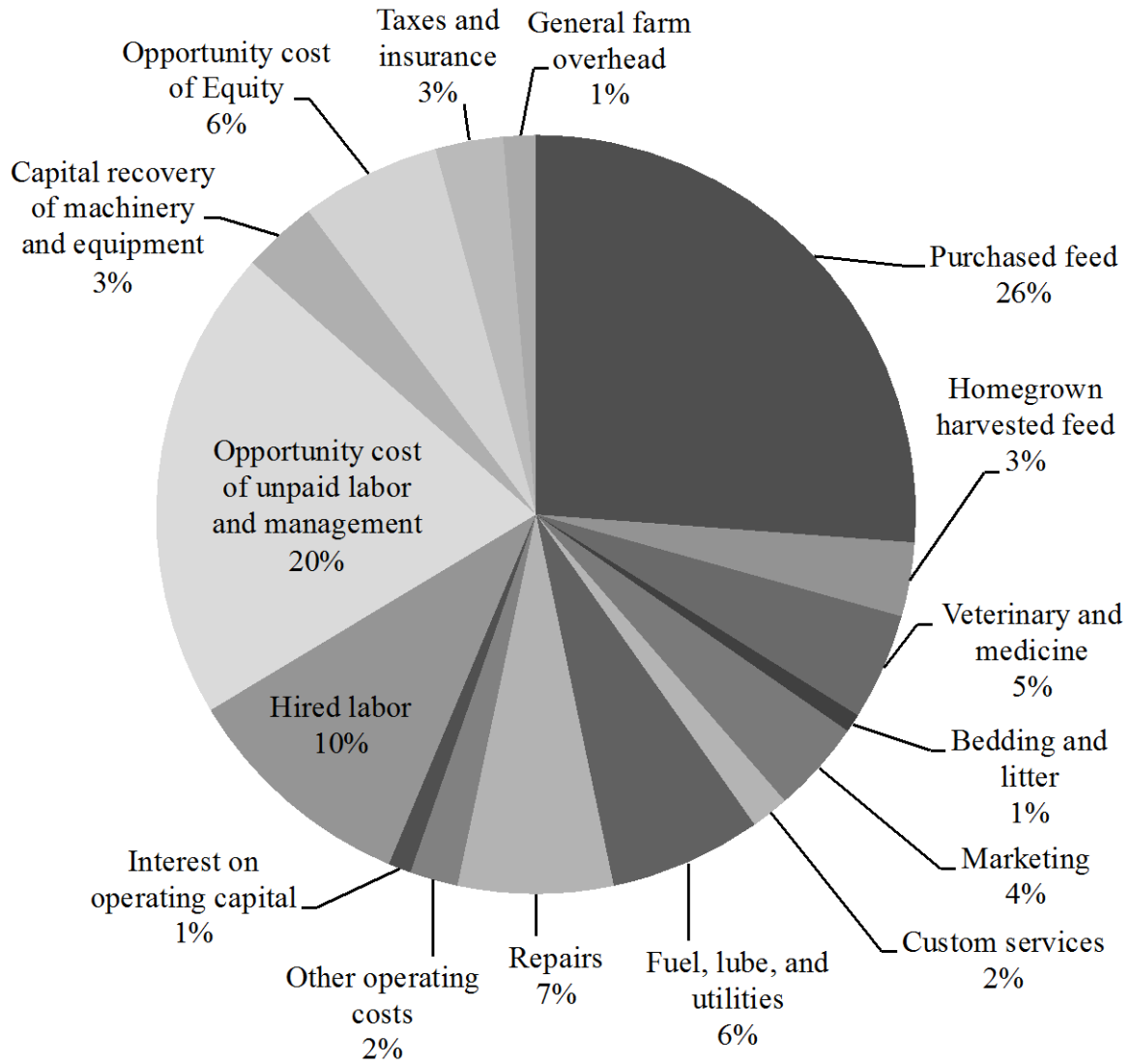
Figure 1. 50-Year Statistical Uniform Prices in Nominal and Real* Dollars Received for Milk by Month – Hartford, CT^



*Values based on January 2011 dollars; ^Hartford, CT price set at the U.S. price during the period 1981–1998.

Source: Gould, B.W. <<http://future.aae.wisc.edu/tab/prices.html>>; BLS <<ftp://ftp.bls.gov/pub/special.requests/cpi/cpi.txt>>

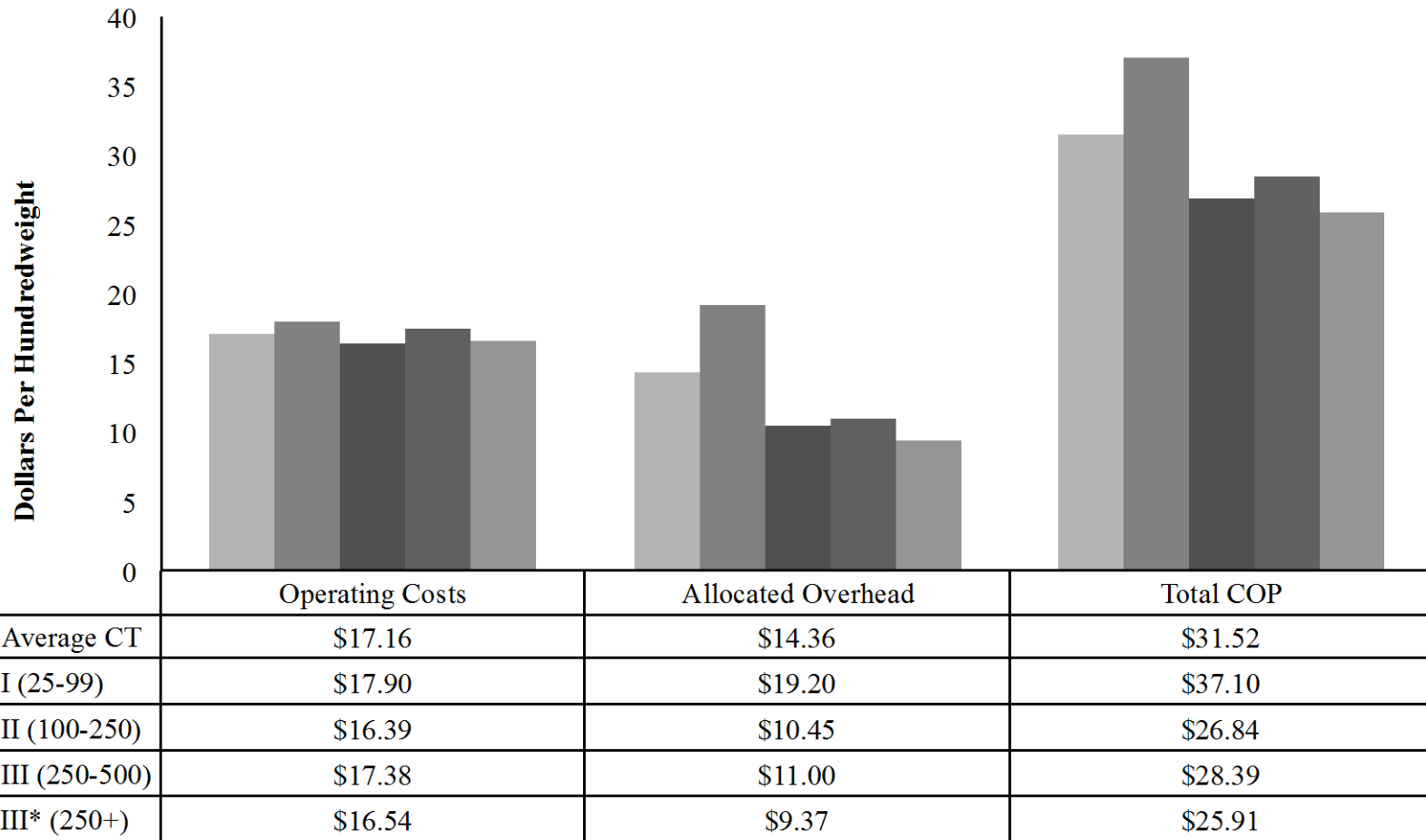
Figure 2. Connecticut Dairy Farm Cost of Production (2011): Share of Input Expense*



*Excluding the deduction for Government Receipts and Miscellaneous Income.

Source: Total Cost of Production from Table 3.

Figure 3. Connecticut Operating Cost, Allocated Overhead, and Total COP for Milk by Farm Herd-Size Class (2011)



Source: Operating Costs, Allocated Overhead, and Total Cost of Production, Average and by Farm-size Class from Table 3.

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Appendix A. Selected AAEA Recommendations and Definitions from the CCRH

- *The Task Force recommends that when there are active markets for a given factor of production and there are no constraints on factor use, the preferred value to use for all CAR estimation is the current market price (or compensation) of that specific factor.*
- *The Task Force recommends that market-determined costs of inputs should be used when they are available and that other methods should attempt to reflect what the market solution would be if it existed. In general, the cost of purchasing inputs from off the farm as opposed to their on-farm production cost should be used in pricing these inputs to other on-farm activities. Similarly, custom rates for machinery should be used when markets for these items are well established and custom operations can be performed in a timely manner.*
- *The Task Force recommends that where CAR estimates are developed for purposes of comparing the profitability of enterprises, costs of fixed assets common to two or more of these enterprises remain unallocated except when required for a specific purpose.*
- *LAND: The Task Force's preferred measure of the cost of land used in agricultural production is the cash rental rate where a significant proportion of the agricultural land is farmed under cash rental tenure.*
 - Regardless of the method chosen for estimating user costs of land, it is imperative that appropriate adjustments be made to account for nonagricultural factors in value and/or cost; differentiation between land area directly devoted to production enterprises and land associated with the farm firm unit; and shared returns/costs associated with tenure arrangements, marketing agreements or contracts, and government program participation.
- *REAL OPPORTUNITY INTEREST: imputed interest charge reflecting real income foregone as a result of investing in the current enterprise. The beginning value of the capital asset multiplied by the opportunity interest rate (iV_0) is called the opportunity cost of holding the asset and reflects compensation to the owner of the asset for the funds tied up in the asset over the period.*

- **LABOR:** *The Task Force recommends that hired labor with no ownership claims and related purchased services be valued at the wage rates (regular or piece rate) plus fringe and other benefits for contract farm labor.*
- Compensation for the operator of the firm is based on opportunity cost of off-farm work, or the return available in the next best alternative use of his time and effort. For example, the operator of a farm has an implicit cost of his farm hours that is the opportunity costs associated with the nonfarm use of these hours. The opportunity cost for the operator of a farm firm who also has the skills and experience equivalent to a factory worker is the going wage for manufacturing workers in the area.
 - A custom operation is defined as the joint hiring of machinery, labor, and in some cases, purchases of materials to perform a production operation. Examples of crop operations are fertilizer application, and preparation, seeding, spraying, cultivating, harvesting, and hauling. Typical custom livestock operations are feed mixing, sheep shearing, and manure hauling and spreading. Custom operations could include all, none, or several of the tasks performed in the production of the product. Examples where all tasks are custom include custom crop farming or custom feedlots for finishing cattle. The charges for custom operations are commonly called custom rates.
 - There are situations where local farmers do custom work for their neighbors, receiving some nonpecuniary benefits in lieu of, or in addition to, charging only what is necessary to cover their variable costs... Small crop, livestock, and dairy operations often cannot justify a large investment in agricultural machinery and equipment when both the money and the use of the capital items are limited. In these situations, it is more economical for small farm operators to rely on custom operations instead of owning the equipment and performing the activities themselves. At the same time, some small operators may have access to low cost equipment that would not be suitable for a larger operator.

Source: AAEA Commodity Cost and Returns Estimation Handbook

< <ftp://ftp-fc.sc.gov.usda.gov/Economics/care/AAEA/PDF/AAEA%20Handbook.pdf> >