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USDA Commodity Costs and Returns (CAR) and Monthly Milk Cost-of-Production (COP): A 2016 Data Product Review and Proposals for Change

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UNIVERSITY OF MINNESOTA

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The authors were appointed by the U.S. Department of Agriculture (USDA), Economic Research Service (ERS), as an external committee to review the USDA Commodity Costs and Returns and Monthly Milk Cost-of-Production estimates produced by ERS. William Lazarus served as chair. Other authors are listed alphabetically. We wish to express appreciation for the helpful support of William McBride and the other ERS staff.

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Copies of this publication are available at http://ageconsearch.umn.edu/.

USDA Commodity Costs and Returns (CAR) and Monthly Milk Cost-of-Production (COP): A 2016 Data Product Review and Proposals for Change

EXECUTIVE SUMMARY

Recommendations

Based on the Data Product review, the panel recommends the following actions:

Near-term

- Add the costs and returns reports to the Crop Production Practices portion of the ARMS data tool. Set it up to allow viewing of multiple columns on the screen at one time if possible.
- Drop the monthly milk cost-of-production estimates.
- For the between-survey years, smooth the estimates retroactively to minimize the jarring jumps that sometimes occur. Use an approach that incorporates the annual price indices, in effect smoothing the quantities.
- Review the corn silage pricing in the regional dairy estimates to see if 1) the surveyed market prices are representative of all dairy farms and 2) they are in line with comparable corn grain prices and differences in harvesting and storage costs of silage and grain.

Longer-term

- Redouble efforts to obtain feedback from stakeholders such as producers and private consultants in addition to the academic perspective represented on this committee.
- If the monthly milk cost-of-production estimates are continued, refine the indexing method to reflect the cost shares of a more detailed list of feeds, and possibly do separate estimates for the higher-cost region (CA and the northeast) and the lower-cost central part of the U.S.
- Review the estimation procedure for unpaid labor, including procedures for computing both the quantity and price of unpaid labor.
- Compare the CAR machinery costs with information available from custom rate surveys currently done by state extension staff, and with a NASS national custom rate survey if that effort moves to completion.
- Review the information generated by the major university farm record systems on a regular basis as a way of identifying possible improvements in the CAR methodology. Also, investigate ways of obtaining feedback on-line from the data user community.
- Investigate alternative data sources and methods to ensure that the spatial variability of input prices is reflected in the estimates whenever possible.

- Enhance the documentation of the CAR data by adding material including a discussion of economic cost concepts, a more detailed description of how CAR estimates are set between surveys, links to the commodity costs and return questionnaires, and measures of the variability of the estimates such as coefficients of variation.

Discussion

The committee was generally complimentary about the estimates. The recommendations are mainly tweaks rather than wholesale changes. Perhaps the most significant change recommended is to drop the monthly milk estimates. We realize that there may be stakeholders who would strenuously oppose dropping them, but we do not see a clear purpose for them.

The data provided on monthly downloads and page views seems to indicate wide use of the estimates. A few of the commodities such as oats are not used very often. However, it is difficult to determine the ultimate impacts of those downloads. That is, a given user may be just one individual producer, or it might be an extension educator who then conveyed the information to hundreds or thousands of producers.

Valuing items such as corn silage that are produced internally rather than being purchased on most farms is a difficult issue. On the face of it, the current approach of valuing homegrown inputs based on an average of actual prices paid by purchasing farms when market data are unavailable seems reasonable. However, responses about purchases of corn silage are from only a small percentage of all dairy farms. We don't know what percentage of the total corn silage needs on those farms was actually purchased, and it was not possible to reflect regional price differences. The per-ton value for 2010 was much higher than the average of values that producers in at least one state (Minnesota) assigned to their corn silage in that year. The Minnesota value was from a non-random sample of farms but it did represent a large percentage of the state's cows. Since corn silage and corn grain are close substitutes as a dietary energy source and since an alternative use for silage corn is to harvest it for grain, it is suggested that the survey-based corn silage value be compared to a value related to corn grain with adjustments based on the differences in harvesting and storage costs for corn grain and silage.

The committee felt that more feedback from stakeholders would be useful. The committee is made up of academics who use the estimates, but it would also be useful to obtain more feedback from other stakeholders such as producers and private consultants. Face-to-face meetings around the U.S. may be the best way to obtain such feedback. It might also be possible to obtain more feedback from users who access the ERS website, without violating users' privacy. The generic popup feedback from on the website now is not very user-friendly.

The estimates of unpaid labor cost do not appear consistent between the livestock and crop estimates. The unpaid labor cost estimates for small dairy enterprises also seem inconsistent

with producers' revealed preferences for that enterprise. The costs are so high that producers must either have seriously over-estimated profitability when they made the decision to milk cows and are now stuck milking cows, or else their motivation must have been for something other than profit-maximization.

We saw a few places where the machinery cost calculations could be updated or tweaked, but nothing major. We understand that discussions are underway for a possible future national custom rate survey that would be useful for setting payment rates for programs such as the Environmental Quality Incentives Program. We encourage ERS to collaborate with the other agencies to make that happen, because the data would be useful for benchmarking the CAR estimates, and evaluating cost estimates made using the aging machine cost formulas.

We would encourage the CAR staff to regularly monitor the summary reports from the major university farm record systems such as Minnesota's FINBIN, the Kansas Farm Management Association, and the Illinois Farm Business Farm Management system as closely as possible given staff time constraints. Even though the participants are not a random sample, in some cases they represent a large enough share of producers that their summary statistics probably still provide some useful information about the population.

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USDA Commodity Costs and Returns (CAR) and Monthly Milk Cost-of-Production (COP): A 2016 Data Product Review and Proposals for Change

INTRODUCTION

USDA's Commodity Cost and Return (CAR) Estimates data product is considered a core data product at the Economic Research Service (ERS) and is regarded as the "gold standard" for a product of its kind in the world. This data product was reviewed during the pilot of the recently established ERS Data Product Policy Recommendations and Standards (DPPRS) process to ensure that ERS provides high quality, objective statistics and data on the food, agricultural, and rural sector. A noteworthy comment about the CAR estimates project was that it had not been externally reviewed for several years. Specifically, it was part of the CNSTAT review of the Agricultural Resource Management Survey in 2006-07, but its methods and operations had not been examined since they were converted to those recommended by the AAEA task force on CAR estimation beginning in 1995. This meant that the product had not been reviewed for about 20 years, double the 10 year timeframe recommended for the review of ERS data products as described in the DPPRS.

With the introduction of the 2014 Farm Bill's Margin Protection Program for Dairy Producers (MPP-Dairy) in September 2014, the monthly milk cost-of-production estimates have undergone increased scrutiny. USDA now reports two different national average estimates of dairy feed costs each month, including FSA's estimate used in MPP-Dairy calculations and the ERS estimate of total feed costs. Differences between the two estimates have led to concerns that MPP-Dairy does not fully cover feed costs in the dairy safety net program. Despite being reviewed as recently as 2011, ERS management felt that the monthly milk cost-of-production estimates project would benefit from an in-depth review in order to better respond to the increased scrutiny precipitated by the introduction of MPP-Dairy.

Scope of Review

The specific tasks of the committee were to: a) review the methods and data sources used by ERS in constructing USDA's commodity cost and return accounts; b) evaluate the current dissemination of the accounts and their components, in view of user needs; and c) provide guidance to ERS managers and the CAR team on potential improvements for methods, data, and dissemination strategies.

Process

The decision to hold this review originated with an earlier ERS internal review by a committee chaired by Mitch Morehart. That committee had identified six criteria of interest: Purpose, utility, objectivity, transparency, integrity, and accessibility.

The review process centered on two workshops held at ERS, the first on October 19, 2015. The workshop agenda focused largely on a presentation about the methods and data sources presented by William McBride, with additional comments by Mir Ali. The following discussion was organized along the lines of a set of questions provided by McBride, so much of the notes and recommendations are inserted below the related questions below. The second workshop, held on May 16, 2016, focused on issues raised by the set of questions, responses of the panel, and comments made by ERS.

In addressing questions regarding the design and use of the CAR survey, it was noted that the survey design is made up of distinct phases:

a. Objectives of the CAR survey and reporting
b. Definition of commodity production enterprise
c. Identification of population to be surveyed
d. Constraints on commodities and variants to be surveyed
e. Decisions on which commodities to survey and how frequently
f. Sampling method
g. Identification of critical production and price parameters
h. Design of survey questions and constraints on the number and type of questions
i. Statistical analysis of results to identify means, variances, and other statistics
j. Assembly (analysis) of survey responses into a commodity enterprise CAR estimate
k. Reporting/presentation of survey derived commodity enterprise CAR estimates including methods, documentation, explanation, caveats, etc.
l. Assembly (analysis) and reporting of interim (between surveys) commodity enterprise CAR estimates
m. Analysis and reporting of special studies using the CAR data and estimates
n. Occasional review and revision of the above

QUESTIONS TO THE REVIEW PANEL

The questions formulated by McBride fell generally into three categories: 1) program design and management, 2) technical methods, and 3) communication with stakeholders. Specific questions and related discussions were as follows:

A. Project Design and Management

1) <u>Does the project include the appropriate number and types of commodities that our stakeholders would like to see? What are the reasons for adding or dropping specific commodities?</u>

The committee consensus is that the number and type of commodities that are currently included in the CAR estimates is appropriate. There is no strong support for adding or deleting commodities from the program at this time.

Criteria for inclusion were: 1. Whether or not mandated by Congress and 2. Important in terms of acres or gross value of production so that CAR for commodities that compete for resources with the mandated commodities are reported.

The number of commodities and their variants that are surveyed, and the frequency of those surveys, seem to be constrained heavily by the resources (people) available to conduct the work and presumably, the capacity of NASS to include the questions in their surveys. It seems implicitly evident that priority is given: a) the commodities of the greatest economic significance to the US and major agricultural regions of the US, b) the commodities receiving the greatest policy and program attention from the federal government, c) the major commodities experiencing rapid change, and d) the commodities providing special funding support to be included in the CAR program.

Most of the commodities included are program crops, and tobacco was the last crop dropped.

One way that the estimates are used is as input into case farms used for research and extension in Texas and Indiana. Use of the peanut, rice, cotton, and wheat estimates in extension work were mentioned specifically. The estimates are used in undergraduate teaching. Ontario Ministry of Agriculture staff use them for comparing the U.S. and Canada. The historic corn and soybean estimates were used recently to compare long-term trends, while the dairy estimates by size were helpful in evaluating robotic milkers.

Once a commodity is chosen to survey, states to survey are chosen by ranking the states by acreage of the crop, or livestock inventory, and including those above some threshold (roughly 90% of coverage). It was suggested that commodity value might be a better measure to rank by than acreage or head.

The questions raised about which estimates are reported mainly concerned reporting estimates of a commodity under various technologies. It was mentioned that more meaningful estimates would be those for irrigated and dryland acreage of a crop, particularly in areas where there is a large portion of acreage of each type. Also, it was mentioned that the new rice hybrid seed technology was sufficiently different from the old technology with regard to yield and production costs that it could be treated as a different enterprise. In regions that are not dominated by either (acreage is close to 50/50 irrigated/dryland) the composite cost and returns numbers are less meaningful (cotton in the Prairie Gateway, for example).

In order to report estimates for commodities under various technologies, the committee is in favor of adding the costs and returns data as part of the Crop Production Practices portion of the ARMS data tool that allows for custom queries of the data at:

http://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices/tailored-reports-farm-structure-and-finance.aspx

This tool can be used as a way to present more disaggregated cost and return estimates. Including a costs and returns report in the tool gives users the option to generate custom cost and return tables by specified categories (such as dry and irrigated land). The tool also provides data users with information about the Relative Standard Error (RSE) of the mean estimates which would address the issue raised in question C6. Incorporating the CAR data into the ARMS data tool has the advantage of using an existing structure on the ERS web page that allows users to generate customized data queries and RSEs, minimizing the time and effort that would be needed to develop a new tool or publication outlet. Also, it incorporates the CAR data into a system that includes the production practice and technology data that are collected with and that underlie the CAR estimates.

Adding the crop CAR to the tool is straightforward. ERS should also consider what would be involved with putting the livestock CAR into the tool once the crop data are evaluated.

2) Should the time between commodity surveys be adjusted? Currently the schedule varies by commodity, for example with less time between corn surveys and more time between surveys of crops with relatively less acreage and cow-calf surveys. Is this appropriate?

The committee did not express a strong opinion about the time between surveys and how it was determined. There was a concern expressed that cow-calf production, a relatively high value commodity, should be surveyed more often because of its overall economic importance to a large and diverse producer group. Also, web use statistics for commodity spreadsheets were examined (see section A4 below) and the cow-calf spreadsheet was most often downloaded among livestock commodities (121 times per month on average). These factors suggest that ERS should be considering a more frequent cow-calf survey. Cow-calf enterprises are popular in Kansas even though many producers are small, and so could be done more often. Value of production may also be something to consider in addition to acreage, as a measure of importance for deciding on the frequency of commodity surveys.

The committee did provide support to using the rate of technical and structural change in commodity production as a basis for determining the frequency of commodities in the survey rotation, as is currently done. The committee also mentioned that an advisory committee could be used to evaluate these changes as a basis for commodity rotation decisions. ERS agrees that the process of choosing the length of time between commodity surveys should be examined and more formal rules, such as classifying commodities into groups defined by the target interval between surveys, should be considered.

If the primary output of the CAR survey is an estimate of a specific point on the production function for that commodity, perhaps disaggregated by size, type, and region; then frequency of surveys might be driven by the rate of change in the quantities and types of inputs consumed to produce a unit of the commodity, again by size, type, and region. If the point on the production function as characterized by quantities and types of inputs and outputs isn't changing, then updated prices applied to the existing quantities will be sufficient. Perhaps some advisory committee or similar structure can be used to provide assessment of structural and technological change to assist in identifying need for updated surveys.

3) Should we be setting monthly milk cost-of-production estimates given the limitations of our data and the price indexes used to set these estimates?

There seem to be two questions here: 1) are monthly reports needed and if so, why (who uses them and for what purpose), and if so, 2) should the ERS CAR staff be responsible for generating them or should this analysis and reporting function be moved elsewhere or automated?

The committee felt that the monthly milk cost-of-production estimates can probably be dropped. We realize that there may be stakeholders who would strenuously oppose dropping them, but we do not see a clear purpose for them.

4) Should any of the products produced by the CAR data product be discontinued? If so, how should this be decided?

By "products" ERS means the various components/spreadsheets of the CAR data product, including 1) annual estimates for the most recent 2-years, 2) annual estimates recent history, 3) annual estimates historic, 4) monthly milk estimates, 5) annual milk estimates by state and size of operation, and 6) annual crop forecast estimates. This should have been made clearer in the question.

The web page view and download statistics show that the products are heavily accessed. The use of advisory panels or occasional user surveys may or may not be constructive here. General announcements of user opinion solicitations could be included in CAR estimate reports and web interfaces to seek feedback on occasion. We discussed possibly making inquiries to stakeholders regarding their interest in continuing the various products.

For the current crop spreadsheets, including the 2013-14 data, the average monthly downloads (May 2015-Feb 2016) are as follows: corn 665, soybeans 262, wheat 182, cotton 106, rice 87, grain sorghum 42, barley 38, peanuts 37, oats 32. Total for all crops - 1,451

For the current livestock spreadsheets, including the 2013-14 data, the average monthly downloads (May 2015 –Feb 2016) are as follows: cow-calf 121, milk 75, hogs (all) 48, hogs (farrow-to-finish) 24, hogs (feeder-to-finish) 16, hogs (farrow-to-feeder) 10, hogs (other) 11. Total for all hogs – 109, Total for all livestock - 305

For recent and historical crop and livestock cost and return spreadsheets, the average monthly downloads for the year March 2015-Feb 2016 are as follows: recent 1,153, historical 731.

For crop cost-of-production forecasts, the average monthly downloads for the period (June 2015-Feb 2016) are 50.

For monthly milk cost-of-production data product, the average monthly downloads for the year March 2015-Feb 2016 are as follows: National monthly milk cop 327, milk costs by state 215, milk costs by size 108.

Monthly average page views (as opposed to download counts mentioned above) for the CAR data product for the year March 2015-Feb 2016 are 4,291, up from 4,094 in the prior year.

Monthly average page views for the Monthly milk cost-of-production data product for the year March 2015-Feb 2016 are 979, up from 865 in the prior year.

The data provided on monthly downloads and page views seems to indicate wide use of the estimates. A few of the commodities such as oats are not used very often. However, it is difficult to determine the ultimate impacts of those downloads. That is, a given download might have been carried out by just one individual producer, or it might have been done by an extension educator who used the data in material that was then conveyed to hundreds or thousands of producers.

5) Should the annual publication dates of the data product be changed? Monthly milk publication dates?

There are time lags from the time when the survey is done to when ERS receives the data, and to when the data can be processed and estimates set. For example, estimates for 2015 are first released in May of 2016. ARMS commodity survey data for 2015 is enumerated during February-April of 2016, and received at ERS during August of 2016. With processing, the estimates are usually not available for release until the May 2017 release date, at which time estimates from the 2015 survey are released along with an update of the data for 2016. While the new 2015 data are being processed, data from the previous survey are used to set a temporary estimate for 2015.

The time lags cause a certain amount confusion among some users, who may miss the fact that the estimates released in a survey year are based on indexing from the previous survey rather than from that year's survey.

Web data indicate that page views have been highest in October during each of the past 2 years. The October release also provides more time to process the data in years that surveys are conducted, and more of the secondary data used for between-survey estimates are available by October. Dropping the May report was considered by the committee. However, that would mean that estimates for the previous year, for example 2015, would not be made available until October 2016 as opposed to May 2016.

The committee recommends that both the May and October reports be continued because the May reports are useful for making decisions related to crop production.

6) Once a new survey is done, should we be revising estimates back in time between the new and old surveys? That is, should we smooth out the estimates between surveys? If so, how could this be done?

The committee recommends that the CAR accounts be smoothed between surveys, conducting the smoothing one time for each survey base change. This should be done when new data are incorporated into the published estimates. We recognize that smoothing can take out sharp increases or decreases that can result from technical and/or structural change that occurs between survey base years. This process should be done retroactively on all data reported in the Recent Cost and Returns Spreadsheets. A hybrid approach is recommended that incorporates the annual price indices, in effect smoothing (i.e. linearly interpolating) the input quantities between surveys while maintaining the annual input price variation.

B. Technical Methods

1) Is the project using the best available methods for estimating production costs? If not, for which items should the methods be changed? What alternative methods should be used?

While the committee generally agrees that the survey approach used to set the estimates is the best available approach, several suggestions were made about modifying the approach and methods. The need and the opportunity may exist to produce special analysis and reports about distinctions between ERS CAR and other types of CAR samples and estimates (economic vs cash/tax accounting; population estimates versus self-selected sub-sample estimates; population estimates versus selective benchmarking estimates, etc.). That analysis could address stakeholder questions directly. The opportunity also exists to use other CAR type systems and expert opinion to inform the ERS CAR frequency of survey questions and to routinely update questions to reflect changes in technology and structure.

One modification to consider is to gain efficiencies by using the survey approach to collect data about multiple enterprises on a farm in one survey. The example given is collecting data on corn and soybean production costs in the same survey. An approach to collecting farm practice data from multiple enterprises is currently done by NRCS using the NRI points as the sample in the CEAP survey. This approach is possible for collecting CAR data on crops in phase 2, but would involve either significantly expanding the length of a currently long (about 40 page) questionnaire, or by deleting questions in order to focus the questionnaire almost exclusively on the data used in the cost and return estimates, omitting many of the production practice questions. Neither of these prospects are likely to happen given that either respondent burden would increase significantly with a longer questionnaire, or research and/or other data program questions in the ARMS would be deleted. The benefits of adopting such an approach include the ability to collect commodity CAR data more often and/or to shorten the time between

surveys of the same commodity. Also, these data would allow for the analysis of relationships between costs and returns of multiple crops on the same farm in the same year.

Concerns were raised about combining the irrigated and dryland enterprises of a given crop into one report. These really should be kept separate. It's like reporting a cash rent number when you have a mix of cash rent, share rent, and owned land. The cash rent number really doesn't mean anything when it's mixed with other methods of land control. While the mandate of the CAR project is to report the average costs-of-production under the various production practices, additional information could be made available about how costs differ on irrigated and dryland acreage of the same crop, and about cost variation associated with other production practices. Currently, the percentage of acreage irrigated is presented with the supporting information of each account. Further analysis of costs by specific practices could be reported in separate reports like the current Characteristics and Production Costs series. Also, see the discussion under Items A1 & C6 about incorporating a CAR report into the current ARMS data tool, where it will be possible to generate reports customized by characteristics such as irrigated vs. dryland.

It is suggested that ERS explore ways to check or reconcile the estimates with University Extension estimates from the major university farm record systems such as Minnesota's FINBIN, the Kansas Farm Management Association, and the Illinois Farm Business Farm Management system as closely as possible given staff time constraints (Illinois Farm Business Management Association 2016; Kansas State University Department of Agricultural Economics 2016; Center for Farm Financial Management and Northland Community and Technical College 2106). We note that the 1998 AAEA Task Force suggested formally integrating the CAR with the university record systems by selecting a probability sample of farm operators and encouraging those operators to participate in the record systems as a way to address the non-random nature of record system participation(Eidman et al. 1998). That formal integration has not happened to date, and we do not detect sufficient interest or resources to make it happen in the foreseeable future. Still, even though the record systems are non-random, they represent a large enough share of producers (for example, around 16 percent in the case of Minnesota FINBIN dairy enterprises) that their summary statistics probably provide some useful information about the population. Two specific items where the farm record summaries suggest that the CAR estimates need modification are dairy feed and unpaid labor. Data collected by the FSA or the Farm Credit System is another possibility that could be explored. However, reconciling differences between the survey estimates and University Extension data can be difficult because of the very different ways in which the data are generated and used from each source.

2) <u>Is the project using the best available data for estimating production costs? If not, for which items should the data be changed? What alternative data should be used?</u>

Potential Sources of Differences between the ERS Milk COP estimates and the possible true current milk COP – three issues:

Quantities and mixtures of inputs change with relative price changes

ARMS collects values of purchased feed but not quantities. They collect quantities of home-grown feed and value them. By only updating the costs every five years, changes in mixtures of feed, homegrown vs purchased feed, hired labor use, reproductive changes (e.g., sex sorted semen), and other technological changes are not directly accounted for. Since the opportunity cost approach is used to value homegrown feed items, shifts in the relative amounts of homegrown and purchased feed should have little impact on the ERS milk COP.

The Michigan State University Farm Business Analysis data would indicate that the mixture of purchased and homegrown feed has shifted in the past several years (Michigan State University Extension 2015). Higher feed prices in recent years has led to an advantage from home-grown feed resulting in a movement towards growing not only all forages but most concentrates if possible. From 1985 through 2006 growing corn was more expensive than purchasing it in most years while forages were profitable to grow rather than purchase. From 2007 through 2014 it was a preferable strategy to grow all grains if possible. The trend is less apparent for Minnesota farms in FINBIN. Grains were closer to a break-even proposition again in 2015. By collecting feed costs only every 5 years, it is difficult to capture these regime changes. (There is also a regional and herd size story here.)

One of the issues raised about the CAR data was the lack of information to reflect spatial variability in the estimates, primarily during the non-survey years. Over time NASS has cut back on their prices paid reporting. Starting in 2015 they no longer report input prices, but rather price indexes for inputs only. Also, those price indexes are reported only at the U.S. level, not regionally. Since only U.S. price indexes are available, the update of the U.S. and regional estimates does not reflect the spatial variability of input prices. The committee supports investigating the use of indexes built from NASS farm production expenditure per farm estimates for various types of production inputs as a way of reflecting spatial variability in the off-survey estimates. Changes in annual expenditures per farm of each item would reflect both input price and quantity changes. These data are published at the regional level, and for some states. They are published in early August each year for the previous year. If the expenditure data are used in the CAR estimates, they could not be used in the CAR release in May, but would be available for the October release. An example from the most recent release of these data for the West region is shown below:

Farm Production Expenditures by Farms Reporting, Average per Farm, and Total – West Region: 2013 and 2014

[For definitions of terms used in this table, see Terms and Definitions. Totals may not add due to rounding]

Expenditure	Farms reporting		Average per farm		Total expenditures	
	2013	2014	2013	2014	2013	2014
	(percent)	(percent)	(dollars)	(dollars)	(million dollars)	(million dollars)
Livestock, poultry and related expenses	23.7	24.8	10,842	15,390	3,430	4,820
Feed	47.3	50.4	40,367	40,134	12,770	12,570
Farm services	88.6	91.2	37,048	46,360	11,720	14,520
Rent	27.6	25.3	14,288	15,134	4,520	4,740
Agricultural chemicals	34.3	35.1	9,515	11,654	3,010	3,650
Fertilizer, lime and soil conditioners	38.3	42.3	13,877	15,900	4,390	4,980
Interest	26.0	27.4	5,943	6,641	1,880	2,080
Taxes	97.2	99.3	6,859	7,791	2,170	2,440
Labor	34.0	35.6	47,732	51,628	15,100	16,170
Fuel	78.0	77.3	10,179	10,664	3,220	3,340
Farm supplies and repairs	72.4	73.9	14,414	16,028	4,560	5,020
Farm improvements and construction	49.5	49.0	11,443	12,835	3,620	4,020
Tractors and self-propelled farm machinery	12.4	11.8	5,563	6,418	1,760	2,010
Other farm machinery	11.8	12.5	2,560	3,193	810	1,000
Seeds and plants	29.5	30.6	9,989	9,323	3,160	2,920
Trucks and autos	13.6	14.4	2,560	3,640	810	1,140
Miscellaneous capital expenses	2.1	2.4	506	607	160	190
Total farm production expenditures	100.0	100.0	243,686	273,340	77,090	85,610

Another option would be to use the all version ARMS data to build a separate set of indexes that reflect not only the spatial variability by region, but the ARMS data could also be disaggregated by commodity producers to more closely reflect the changes made by producers of targeted crops in each region. Using public data, like the NASS expenditure data, to build these indexes would make it easier to point data users to the specific data used to construct the index, rather than creating the unpublished ARMS data to build the index. This creates greater public transparency on how between-survey estimates are constructed.

Allocation and accrual issues with the milk COP

We recognize that most farmer accounting systems are whole-farm and not enterprise-based. Allocating whole-farm costs is the primary challenge of enterprise CAR accounting, and varies significantly by input. Unless true enterprise accounting is used, it is difficult to establish feed quantities that went to the milking herd, heifers, beef steers, etc. Also labor, management, overhead, machinery and equipment costs are difficult to allocate. Accrual adjustments refers to properly accounting for inventory changes, prepaid expenses, deferred income, etc. Most farms are reasonably competent at tracking cash flow but not accounting for accrual adjusted expenses or separating out the milking herd enterprises.

Cover crop costs

USDA commodity accounts begin counting inputs for crop production at the point following the harvest and removal of the previous crop from the field. This would capture the costs of seeding a cover crop planted after harvest of the preceding crop, but not those costs if the cover crop was seeded into the previous crop. It is suggested that the questionnaire wording be changed slightly to make sure to count any cover crop that was planted before removal of the previous crop but with the intention of benefiting the target CAR commodity. The percentage

of the major crop acreage planted to cover crops is currently small, based on anecdotal reports, but is growing partly due to water quality policy pressures.

Cover crop success may also be affected by residues from herbicides applied to the previous crop. That is not a problem with glyphosate, but resistant weeds may require shifts to other herbicides with longer residuals. Hence, when collecting cover crop data it might ultimately be worthwhile to include data on previous crop herbicides, although it is not clear how that would be done.

Machinery cost recovery and repairs

The mean whole-farm repair and capital purchase data summarized from the ARMS phase 3 survey are similar to the mean repair and capital recovery estimates made from the engineering formulas at the U.S. level. The committee discussed the idea of using the ARMS 3 data in place of the formula data, but the differences increase the more the data are disaggregated, and the whole-farm estimates are not good proxies for repair and capital costs at the observational level. Using these data would distort analyses of the distribution of costs. For example, farms in some years have zero repair and capital expenditure costs, while others have very high costs for these inputs in some years. Thus valuing capital and repair costs using actual expenditure data means that some farms could be low-cost or high-cost farms simply due to the year in which the survey was conducted.

Fertilizer costs

Regarding the indexing of crop costs for non-survey years, fertilizer costs for all crops are now indexed using the same NASS fertilizer prices paid index. That is problematic in that some crops like corn require a lot of nitrogen while soybeans do not. The committee recommends that these be adjusted by the weights of the components normally used to fertilizer a crop. NASS uses Bureau of Labor Statistics indices in addition to their own surveys for various NASS prices paid indices. BLS does break out fertilizer prices into nitrogenates, phosphates, and mixed fertilizers, while the ARMS phase 2 questionnaires ask for specific fertilizer types.

There was some discussion on sources of data which might be used in weighting irrigated and non-irrigated production costs for commodities, or using this data as a check with the irrigated/non-irrigated acreage split from the survey. Certified acreage data from FSA-USDA which separates irrigated from non-irrigated acreage for crops within states was suggested as a possible data source.

3) <u>With feed being such a large portion of livestock cost of production, what is your opinion about how feed is computed and reported in each of the data products?</u>

Feed cost estimation is a challenge. The most important number to include in livestock CAR is the cost of feed per unit of product produced. This number is endogenous to profit maximization conditional on ingredient and product prices and it is dynamic as ingredient prices

change daily. NRC has produced standardized diets in its Nutrient Requirements for (species) series of publications that may be long-term (decade) benchmarks.

The committee compared the CAR feed costs against averages in Minnesota's FINBIN, the Kansas Farm Management Association, and Illinois Farm Business Farm Management (FBFM) farm record programs. Most of the comparisons show USDA costs to be higher than those reported in state farm management record keeping programs. One reason for this may be that the USDA ARMS tries to represent all farms, while state record keeping systems includes only those farms that choose to participate. This self-selection may bias the comparisons because farms choosing to participate in the state programs may be more efficient, thus having lower costs, than the population in general. However, participation in some of the record systems is high enough and some of the differences are large enough that the committee questioned whether self-selection is likely to be the only explanation.

Feed cost estimates in the commodity CAR accounts are divided into: 1) purchased feed-computed as the total cost farmers report by indicating the proportion of the whole-farm cost that is for the targeted livestock commodity, 2) homegrown harvested feed-computed by valuing quantities fed by the targeted livestock commodity as reported in the ARMS times a state average market price (where available) of each feed item, and 3) grazed feed-computed by valuing the acres using for grazing by state average pasture rental rates. This precludes the need to collect quantity data on all the purchased feed items fed, which has been shown to be a very time-consuming and error-prone process.

Feed composition and therefore feed conversion are endogenous to the profit function via the 'best cost' feed formulation program and external prices for ingredients and product. They are therefore dynamic. It is worth mentioning that genetic improvement in livestock and other technological advances steadily improve feed conversion performance and thereby steadily reduce nutrient excretion rates in most commercial livestock enterprises. Increased market weights or output levels may result in increasing daily excretion levels and worse feed conversion rates over time. Historically, average feed conversion improved on net as the profit maximizing solutions included more technological (efficiency) gains than effects of increases in market weight /output levels per animal. Total Factor Productivity has definitely been increasing as ERS reports (including the CAR program) have illustrated. Some systemic changes also occur: shift to more complete feed being manufactured in very large mills, substitution of fat for some corn as energy source, substitution of specific amino acids for crude protein (soybean meal), substitution of enzymes such as phytase for phosphorus, substitution of DDGs for soybean meal. An occasional special survey of diets could be useful to capture these shifts and would also be useful to WAOB balance sheet and forecast estimates. Livestock industries, corn and soybean commodity organizations and large ingredient handling companies (Cargill, etc.) and futures traders may find these estimates useful. The special surveys could also be designed to capture seasonal variation in diets by region.

Comments specific to livestock species:

Swine feed costs

The Iowa State swine enterprise budgets provide an example of a useful benchmark just by imposing a defined corn/soymeal/other diet and feed conversion that is updated with market prices for those inputs. These budgets are based on a specified ration that may be more cost efficient than the average for the producer population and may omit certain feed items not part of a typical ration costing approach, such as starter feed, milk replacer, and other feed additives.

Dairy feed costs

The feed price index used to adjust feed prices is for forages and hay prices only. If the monthly milk cost-of-production estimates are continued, then the committee recommends refining the indexing method to reflect the cost shares of a more detailed list of feeds, and possibly do separate estimates for the higher-cost region (CA and the northeast) from the lower-cost central part of the U.S.

The committee notes John Newton's criticism that the concentrates index is based on cottonseed and soybean meal, while homegrown feeds are indexed using hay prices. Corn is not directly represented in either. The ARMS dairy questionnaire asks for quantities of corn and other individual feeds fed that were either purchased or homegrown.

One suggestion for improving the monthly dairy feed indexing is to disaggregate the homegrown feed expense into at least two categories: one representing corn and other feed grains, and the other representing hay and forages. Then, index the corn category using the feed grains index.

It is proposed that the indexing technique be refined using feed cost shares. Cost shares estimated from the 2010 ARMS dairy data corresponding with the published NASS feed cost indexes are:

Purchased feed:

35% Complete feeds

15% Feed grains

27% Hay/forages

23% other (mostly protein items)-Concentrates

Homegrown feed:

20% Feed grains

80% Hay/forages

Using these percentages as fixed weights for each month, along with the published monthly indexes for each feed category, the proposed procedure would be to construct a weighted purchased feed and weighted homegrown feed cost index and use these to set the feed costs each month. The Hay/forages index would still be used to set the Grazed feed cost each month.

It is proposed that the feed cost estimates be adjusted for each month back to the 2010 survey year. Also, since NASS changed their indexing base from 1990-92=100 to 2011=100 and discontinued the 1990-92=100 index base, ERS would redo all the monthly milk cost of production estimates using the 2011=100 indexes.

The NASS feed cost indexes and their various components are shown in the table below. The 2011=100 index base includes roughly the same items in each index, although this information has not yet been published.

Table 3.13. Relative Weights of Items for Indexes of Prices Paid by Farmers Including Interest, Taxes, and Wage Rates (Base Price Period 1990-92)

COMPONENT / SUBCOMPONENT	RELATIVE WEIGHT	COMPONENT / SUBCOMPONENT	RELATIVE WEIGHT
	Percent		Percent
CONSUMER PRICE INDEX (C.P.I.)	19.0	FERTILIZER	4.7
PRODUCTION	65.6		
		Mixed Fertilizer	2.0
FEED	11.1	09-23-30	0.05
Complete Feeds	4.9	10-10-10	0.08
Beef Cattle Feed, 32-36%	0.44	10-20-20	0.04
Dairy Feed, 16%	0.83	10-34-00	0.31
Dairy Feed, 32-38%	0.34	11-52-00	0.28
Hog Feed, 38-42%	0.24	13-13-13	0.06
Hog Feed, 14-18%	0.24	16-20-00	0.06
Broiler Grower	1.42	17-17-17	0.04
Chick Starter	0.34	18-46-00 (DAP)	1.05
Laying Feed	0.68	19-19-19	0.07
Turkey Grower	0.34	Nitrogen	2.0
Feed Grains	2.0	Nitrogen Solution, 32%	0.77
Barley	0.06	Urea, 45%	0.51
Corn, Shelled	1.64	Anhydrous Ammonia, 81-82%	0.70
Sorghum, Grain	0.26	Potash and Potassium	0.7
Oats	0.04	Superphosphate, 44-46% P205	0.26
Hay/Forages	1.2	Muriate of Potash, 60% K20	0.40
Hay Baled, Alfalfa	0.76		
Hay Baled, Other	0.46	AGRICULTURAL CHEMICALS	3.4
Concentrates	1.8	Herbicides	2.1
Cottonseed Meal, 41%	0.16	2,4-D	0.56
Soybean Meal, 44%	1.62	Butylate (SUTAN)	0.32
Supplements	1.2	Cyanazine (BLADEX)	0.39
Bran	0.53	Trifluralin (TRELAN)	0.47
Corn Meal	0.29	Pendimenthalin (PROWL)	0.21
Molasses, Liquid	0.29	Glyhposate (ROUNDUP)	0.20
Stock Salt, Plain or Iodized	0.11	Insecticides	0.8
		Carbaryl (SEVEN)	0.15
LIVESTOCK AND POULTRY	8.2	Phorate (THIMET)	0.10
Feeder Cattle	6.39	Terbufos (COUNTER)	0.15
Feeder Pigs	0.66	Synthetic Pyrethroid	0.15
Milk Cow Replacements	0.66	Methyl Parathion	0.16
Poultry	0.54	Fonofos (DYFONATE)	0.09
Broiler-Type Chicks	0.35	Fungicides / Other	0.3
Egg-Type Chicks	0.19	Captan	0.09
		Maneb	0.04
SEED	2.7	Fosethyl-AL (ALIETTE)	0.01
Field Crops	2.5	Copper Hydroxide	0.06
Seed Corn, Hybrid	1.10	Chlorothalonil (BRAVO)	0.09
Rice	0.04	Gibberellic Acid	0.09
Wheat	0.41	Naphthalene Acetamide	0.09
Cottonseed	0.13		
Peanuts	0.10	FUELS	3.0
Soybeans	0.49	Diesel Fuel, Bulk Delivery	1.60
Potatoes	0.17	LP Gas, Bulk Delivery	0.35
Grasses and Legumes	0.3	Gasoline, Unleaded, Service Station	1.05
Ryegrass, Annual	0.10	Tall Fescue	0.06
Bluegrass, Kentucky	0.02		
Alfalfa, Certified	0.07		

Valuing items such as corn silage that are produced internally rather than being purchased on most farms is a difficult issue. On the face of it, the current approach of valuing it based on an

average of actual prices paid by purchasing farms seems reasonable. However, the responses are from only a small percentage of all dairy farms (around 15 percent). We don't know what percentage of the total corn silage needs on those farms was actually purchased, and it was not possible to reflect regional price differences. The $53/ton value for 2010 was much higher than the average of values that producers in one state (Minnesota) placed on corn silage in that year, $30/ton. The $30/ton value was from a non-random sample of farms but it did represent around 16 percent of the state's cows. In the future, it is suggested that the survey-based corn silage value be compared to a value related to corn grain with adjustments based on the differences in harvesting and storage costs for corn grain and silage, since an alternative use for silage corn is to harvest it for grain.

There could be some issues regarding feed costs for cow/calf production that should be examined more closely as well. Some of the same procedural improvements may be applied to all livestock commodities.

FINBIN comparisons for 2010

The 2010 CAR purchased feed cost for Minnesota was $4.16, homegrown feed $6.66, and grazed feed $0.11, for a total of $10.93/cwt. The $6.66/cwt homegrown feed cost consists of feed grains $2.09, hay $1.69, and silage and green chop $2.88. NASS calendar year average prices used in the CAR for Minnesota in 2010 were corn $3.63/bu, alfalfa hay $115/ton, and other hay $75/ton. The silage price was $53/ton, which was a national average based on 203 conventional dairies that reported purchasing silage. Forty three organic dairies reported purchasing silage with an average price of $94/ton.

The FINBIN system contains actual feed quantities and expenses reported by participating producers for 55 different feedstuffs. The FINBIN numbers for dairy plus replacement heifers in 2010 are purchased feed $3.88 and homegrown feed $4.58 for a total of $8.50/cwt, $2.43 less or 78% of the CAR value. The homegrown feed is 54% of the CAR number for homegrown and grazed feed. FINBIN does not classify feedstuffs as purchased vs. homegrown. We assume that corn, corn silage, alfalfa hay, and alfalfa haylage are homegrown, with protein and complete feeds purchased. Forty eight percent of the "other" category is assumed to be purchased and the rest homegrown.

Feeds included in FINBIN are also intended to be valued at annual average market prices. The FINBIN corn price charged to the dairy enterprise was $3.73/bu. For alfalfa hay, FINBIN charged $101/ton. FINBIN charged a corn silage price of $30.20/ton, which is 8.04 times the corn grain price. The average FINBIN cost/ton of purchased feed was $384/ton. Of that, the "protein, vitamins and minerals" category averaged $429/ton while complete ration averaged $363.

When the 2010 CAR corn silage price of $53/ton is plugged into the 2010 FINBIN quantities in place of the $30.20 FINBIN price, the total feed cost/cwt increases 12%, from $8.50 to $9.52/cwt, an increase of $1.02/cwt. The difference in prices thus accounts for 42% of the $2.43 total feed cost/cwt difference between FINBIN and CAR.

The higher alfalfa hay price accounts for another six cents of the difference. The CAR corn grain price was less than the FINBIN price while the differences in the other hay prices varied. They offset some of the corn silage price difference. When all of the 2010 CAR prices are multiplied times the 2010 FINBIN quantities in place of the FINBIN prices, the total feed cost/cwt increases 10%, from $8.50 to $9.39/cwt, an increase of $0.89/cwt. The difference in all of the prices thus accounts for 36% of the $2.43 total feed cost/cwt difference between FINBIN and CAR.

Feed quantities in FINBIN were 85 pounds DM of homegrown feed and 18 lb DM of purchased feed in 2010, based on the classification mentioned above, for a total of 103 lb DM/cwt. If I assume the feed grains are corn and the "silage and green chop" is all corn silage, and that the hay is divided into alfalfa and other hay in the same proportions as in FINBIN, and if I assume some reasonable dry matter percentages, the CAR homegrown feed quantities implied are 94 lb DM/cwt.

Producers filling out ARMS may be assuming higher purchased feed prices than that price, but dividing by that price and assuming 90% DM, the CAR pounds of purchased feed DM/cwt is around 20. Total pounds of feed DM/cwt is then 114 lb. The FINBIN total amount is of 94 lb would then appear to be 82% of the CAR amount.

FINBIN comparisons for 2014

For 2014, the CAR purchased feed cost was $7.13, homegrown feed $9.44, and grazed feed $0.11, for a total of $16.68/cwt. I indexed the 2010 CAR prices to 2014 using my calculation of the average monthly NASS Minnesota prices so I could compare them to the FINBIN prices paid. I used the alfalfa hay price to index both types of hay, and used the corn grain price to index the silage price. That gives me estimated 2014 CAR prices of $3.96/bu for corn, $162/ton for alfalfa hay, $106/ton for other hay, and $58/ton for corn silage.

The average price charged for corn for the dairy plus replacements enterprise in FINBIN was $3.80/bushel. The average price charged for dairy feed alfalfa hay was $166/ton. The average price charged the dairy enterprises was $37.40/ton, or 9.8 times the corn grain price charged. The average price for protein, vitamins and minerals charged the dairy enterprises was $450/ton. The average price for complete ration was $424/ton.

The FINBIN numbers for dairy plus replacement heifers in 2014 are purchased feed $6.54 and homegrown feed $5.51 for a total of $12.05. The homegrown feed is 58% of the CAR number for homegrown and grazed feed. The FINBIN total feed cost is 72% of the CAR value. Forty two percent of the "other" category is assumed to be purchased and the rest homegrown, based on a review of the individual feedstuff codes used in FINBIN.

So, the homegrown feed cost difference seems fairly large and widened slightly between the 2010 survey year, and 2014.

If I assume the feed grains are corn and the "silage and green chop" is all corn silage, and that the hay is divided into alfalfa and other hay in the same proportions as in FINBIN, and if I

assume some reasonable dry matter percentages, the CAR homegrown feed quantities implied are 94 lb DM/cwt compared to 103 lb DM/cwt in FINBIN.

Producers filling out ARMS may be assuming higher purchased feed prices than that price, but dividing by that price and assuming 90% DM, the CAR pounds of purchased feed DM/cwt is around 34. Total pounds of feed DM/cwt is then 128 lb. The FINBIN total amount is 109 lb, which would then appear to be 85% of the CAR amount.

Possible explanations for the CAR-FINBIN differences

The one CAR price that stands out as different from FINBIN is the $53/ton silage price compared to the $30.20/ton FINBIN price. The CAR corn, and hay prices seem reasonable and in line with the FINBIN prices charged in 2010. My impression is that not very many dairy farms purchase corn silage, except for rare emergency situations so those purchase prices might not be a good measure to value all corn silage. Most raise it on-farm. If corn needs to be sold or purchased, every effort would be made to harvest that corn as grain so as to minimize transportation costs. If I am correct on that, then a better way to value corn silage might be to value the grain at grain prices and then add or subtract the difference in harvesting and hauling costs between grain and silage.

For example, the revenue/A for corn grain in Stearns County, MN in 2010 was $552 at $3.63 and the 152 FINBIN average yield for that county. It cost around $9/A more to chop corn silage than to combine corn. Based on my cost estimates, the equivalent breakeven corn silage revenue would be $561/A. Assuming an 8:1 ratio of corn silage to grain yield, the equivalent corn silage price/ton would be $29.51/ton. It might also cost more to haul and store the silage than to haul, dry, and store the grain, so that difference might increase the silage breakeven price to somewhat more than the $30/ton charged in FINBIN in 2010, but it is hard to see how those additional hauling and storage costs would be enough to raise the breakeven price to the $53 used in the CAR calculations.

Another possible explanation for the difference in feed costs between FINBIN and CAR is self-selection bias in the FINBIN numbers, since FINBIN participation is voluntary and participants are considered to be better managers and larger operations than for Minnesota overall. There were 408 Minnesota dairy farms in FINBIN in 2014, with an average herd size of 179 cows for a total of 73,195. The NASS estimate of all dairy cows in Minnesota in 2014 was 460,000, indicating that the FINBIN numbers represent 16% of the dairy cows in the state. The overall state average herd size reported in the 2012 Census of Agriculture was 98 cows, so the FINBIN average herd size is almost twice the overall state average.

Another possible explanation is differences in the way the questions are phrased about livestock feed in ARMS versus in the FINAN software used for FINBIN. However, the questions appear fairly similar in each. It is useful to check the balance of beginning homegrown feed inventories plus crop yields against fed amounts plus ending inventories. It is not known how diligently the balances are checked for ARMS. There might be more incentive to check them for

FINBIN since the instructors are calculating both crop and livestock enterprise summaries from the data, and producers are paying for the service. Both ARMS and the FINAN software (used to calculate the FINBIN data) have places to record crop production as well as amounts fed. Storage losses can be significant for hay and silage, so they should be considered. Both ARMS and FINBIN value homegrown feeds at market values in theory, but a certain amount of judgment is required to choose the values to use in the actual calculation and data entry, since prices fluctuate on a daily basis.

A check revealed some anomalies in the 2014 farm-level FINBIN data which could be another factor. Instructors enter feed quantities and costs, not per-unit prices. Prices of the protein, vitamins and minerals category implied by dividing cost by quantity, varied from $105/ton to $2,026. Complete ration and corn both had one entry at a zero value. Alfalfa hay had two. Aside from the zero entry, complete ration varied from $12.79/ton to $14,484. Corn ranged from $0.57/bushel to $11.50. The cost numbers are regarded as probably more accurate than the quantity ones. With 408 total farms, it seems unlikely that these extreme values would have affected the averages very much, but that is not known for sure.

Kansas and Illinois Comparisons

For Kansas, the CAR total feed cost was $10.08/cwt in 2010 and $14.09 in 2014. Those numbers compare to the Kansas Farm Management Association dairy averages of $10.27/cwt in 2010 and $12.77 in 2014. The Kansas association numbers are thus 2% higher than the CAR numbers in 2010, but are only 91% of the CAR number in 2014. The Kansas association feed costs appear much closer to the CAR estimates in both years than for Minnesota.

The 2014 Illinois Farm Business Farm Management (FBFM) report is another benchmark to compare the ERS milk feed costs against. The report text suggests that feed is valued at something close to annual average market prices. The Illinois report has a couple limitations. First, there were only a small number of dairy farms covered – 65 farms. Also, the report doesn't include as much detail as the other reports discussed above (referring specifically to Table 15 on p. 18). The per-cwt costs are also calculated not by dividing by pounds of milk sold, but by converting cull cow sales to pounds of milk equivalent and adding those pounds to the pounds of actual milk sales as the divisor. Based on the numbers in that table, I estimate that actual milk sales might be around 83.55% of the milk-equivalent pounds that they used. That would convert the feed cost of $10.95/cwt in the table, to $13.10/cwt of actual milk sales. The ERS state report for 2014 shows a feed cost of $15.47/cwt for Illinois, so the FBFM number is 84.7% of the ERS cost, which again seems like a fairly large difference.

4) Unpaid labor - Is our method of using non-farm wages earned by farm operators the most appropriate way of valuing it? Should farm wages be used instead?

Unpaid labor – the livestock unpaid labor opportunity costs are arrived at by allocating from the whole farm amounts. The crop unpaid labor costs are arrived at by starting from the individual machinery operation hours. It was noted that the 2010 CAR total labor cost/cwt of milk for MN

is twice the FINBIN amount, while the 2014 CAR Heartland total labor for corn was only around one-third the FINBIN amount for the states in that region. It appears that the labor quantity and/or rate may be over-estimated for the small dairy farms. Perhaps overhead labor is under-estimated in the crop enterprises.

The use of non-farm wages to value unpaid labor in the CAR seems reasonable in general because farm operators can be expected to value their work time at least partially based on what they would be able to earn in an off-farm job. However, it is difficult to explain why producers are continuing to operate small dairy farms today if they really do value their time at the rates shown in the CAR estimates. In the 2010 estimates (the survey year) for the under 50 cow herd size, the opportunity cost of unpaid labor is $13.48/cwt while milk sold is only $17.59/cwt and total gross value of production is $20.08/cwt. The value of production less all costs is (minus) -$19.99/cwt. That is, the estimated value of unpaid labor is over three quarters of the milk value. Machinery and equipment capital recovery is a sunk cost that the producer would reasonably ignore when deciding whether to continue in business. However, that capital recovery cost is only $7.61/cwt for the under-50-cow farm size, so ignoring it still leaves the value of production less the other costs of (minus) -$12.38/cwt. One would need to both ignore capital recovery and assign a zero value to the unpaid labor in order to show a value of production less the other costs, of a positive $1.10/cwt.

The labor hours per cwt of milk estimated from the 2010 CAR are compared to hours for Minnesota farms in FINBIN for each size group below:

	CAR	FINBIN
Less than 50 COWS, hrs/cwt	0.604	0.34
50-99	0.257	0.24
100-199	0.153	0.20
200-499	0.070	0.21
Over 500		0.20
500-999	0.026	
1,000 OR MORE	0.007	

The wage rates charged on unpaid labor (greater than age 16) based on the ERS econometric equation (wage=f(age, education, location)), have wages increasing on average for each successive size group. The 2010 CAR rates per hour of unpaid labor are compared to the 2010 average rates for Minnesota dairy plus replacements enterprises in FINBIN. The FINBIN rates are an average over both paid and unpaid labor, for farms that reported hours of labor:

	CAR	FINBIN
LESS 50 COWS, $/hr	$19.21	$9.38
50-99	$20.35	$10.29
100-199	$21.26	$13.05
200-499	$22.42	$13.95
Over 500		$15.80
500-999	$23.45	
1,000 OR MORE	$24.34	

The equation was estimated on all ARMS farmers (not just dairies) who worked in off-farm employment, for the respondents to the 2010 dairy survey.

It is possible that the small dairy producers may be incorrectly including some crop production labor when they answer the ARMS survey questions regarding dairy herd labor, which could result in over-estimating the dairy labor hours. NASS will be doing cognitive testing in the future to determine if this has been an issue.

If the under-50 cow operations actually perceive that they are losing $19.99/cwt after all costs or $12.38/cwt considering that their dairy equipment has no market value, then it is not surprising that small dairy farms have been exiting. What is remarkable is that they are not exiting faster than they are. According to the 2012 Census of Agriculture, there were 34,333 farms with milk cow herds of under 50 cows, or 54% of all farms with milk cows.

We can only speculate whether the labor quantities or wage rates above over-estimate how much these farm operators work or the values they actually place on their labor. Some reasons why their labor might be worth less than $18.75/hour include:

- The cost of switching occupations may be too high, perhaps because the operators may be too old or lack the skills required to secure off-farm employment,
- Their local economy may be stagnating such that it is creating insufficient job openings to employ them,
- They may value their independence and lifestyle sufficiently that they are willing to accept low monetary returns on their labor, or
- Other family members may have off-farm employment that covers family living expenses so that the operator has the freedom to continue even without receiving a market return on their time.

One study that addresses the local economy rationale is Foltz[1], who found that for Connecticut dairy farms a higher local unemployment rate increased the likelihood of the farm continuing in

[1] Foltz, J. D. (2004). "Entry, Exit, and Farm Size: Assessing an Experiment in Dairy Price Policy." Amer. J. Agr. Econ. **86**(3): 594–604.

production between 1996 and 2001, during which the New England Dairy Compact was introduced and 20 percent went out of business.

Issues with using family living expenses as a proxy

Some state farm record systems use family living expenses as a proxy for the value of unpaid labor. However, in the case of small dairy farms, family living expenses may draw on at least two cash sources that are unrelated to unpaid labor use on the farm: 1) off-farm income, and 2) avoided capital asset replacement (or depreciation).

FINBIN whole-farm reports are available that can help to quantify those two cash sources. There were 24 Minnesota dairy farms with under $100,000 in gross revenue in 2010. A "dairy farm" is defined as a farm where at least 70% of gross revenue is from dairy receipts. It is necessary to draw on the dairy enterprise report to convert $100 in gross revenue to a number of milk cows. The gross margin/cow in the dairy and replacements enterprise was $2,947/cow, so $100,000 of gross revenue equals 34 cows if it is all dairy revenue. Those 24 Minnesota dairy farms with under $100,000 in gross revenue in 2010 averaged a $16,025 value of operator labor and management. Unpaid labor hours were 2,144, so dividing gives a value of $7.47/hour of unpaid labor.

It appears that nonfarm income contributes quite a bit of cash on these small dairy operations. Their family living and owner withdrawals were $23,068, or $7,043 more than the value of operator labor and management. Their total nonfarm income was $20,527, including personal wages and salaries of $15,924.

Avoided capital asset replacement does not appear to be a factor for these small dairy farms. They used $23,086 of cash for investments. Of that amount, $10,808 was for breeding livestock. Cull livestock sales were $3,847, for a difference of $6,961 that I assume is livestock depreciation. Another $10,265 of cash investment was for machinery and buildings with $2,016 for nonfarm assets.

Their depreciation averaged $3,944, so it looks like the operations are pretty well fully depreciated and so it is not really possible for them to avoid capital asset replacement or to "live off depreciation". The $6,961 in net breeding stock replacement plus the machinery and buildings total $16,889, which is larger than the $3,944 of depreciation although neither number seems very large.

The next larger FINBIN whole-farm group is the 109 farms with $100,001-$250,000 in gross revenue in 2010, equivalent to 35-85 cows. That group shows a similar pattern. Family living expenses are higher than the reported value of operator labor and management, apparently supported by nonfarm income.

Table 1. FINBIN data relating to the value of operator labor and management, family living expenses, depreciation, capital asset purchases and sales for the two dairy farm sizes.

	MN dairy farms with under $100,000 in gross revenue, 2010	MN dairy farms with $100,001-$250,000 in gross revenue, 2010
Number of farms	24	109
Approximate milk cows @ $2,947/cow	Under 34	35-85
Value of operator labor & mgmt	$16,025	$27,734
Unpaid labor hours/year	2,144	3,005
Value of labor/hour	$7.47	$9.23
Family living expenses & owner withdrawals	$23,068	$32,777
Total nonfarm income	$20,527	$17,783
Personal wages & salaries	$15,924	$11,774
Depreciation	$3,944	$8,277
Total investments from cash	$23,068	$35,202
Cull breeding livestock sales	$3,847	$8,277
Machinery, equipment & livestock purchases net of cull livestock sales	$16,889	$14,147

The state-level milk averages also show some interesting insights. Comparing the 2014 annual milk CAR for Minnesota with the 2014 FINBIN milk estimates for Minnesota, the CAR total labor cost is $5.79/cwt, twice the 2014 FINBIN number of $2.79/cwt. The 2010 CAR total labor cost was $3.65/cwt compared to FINBIN's $2.71/cwt for Minnesota in 2010. The 2010 FINBIN total labor cost for herds of less than 50 cows was $3.08/cwt compared to the CAR 2010 U.S. estimate of $13.48/cwt for herds of fewer than 50 cows. (The CAR estimates by herd size are not available at the state level.)

USDA has producers in the ARMS livestock versions allocate an amount of the reported whole-farm labor to the dairy enterprise, which is then valued using the estimated non-farm wage rate. One difference may be attributed to the representative sample used with the ARMS versus the self-selected sample for FINBIN. The FINBIN reported average value of operator labor and management for 2014 was $54,165/full-time operator.

It is possible that USDA under-estimates overhead labor on crop enterprises using the approach where total labor is built up from information collected about the component parts. It is difficult to ask about overhead labor as a separate component. However, with the allocation of whole-farm labor approach used for livestock enterprises there is concern that the amount of labor is overstated.

The CAR hired labor is taken directly from the survey. Producers are asked how much of farm wages and salaries, hired labor benefits, and contract labor are for labor used in the livestock enterprise. Between surveys, farm wage rates in the USDA Farm Labor publication are used to index the survey hired labor costs.

Hired labor is $1.08/cwt in the CAR and $1.84/cwt in FINBIN, for a $0.76/cwt difference. There is a greater difference in unpaid labor - $4.71/cwt in CAR compared with a labor and management charge of $0.95/cwt in FINBIN, for a $3.76/cwt difference.

How much of the unpaid labor difference is due to using different wage rates? If unpaid labor in CAR is valued using the BLS regional non-farm labor rate, then the hourly rates should not be very much different from in FINBIN. For May 2014, the mean all-occupations BLS rate is $23.23/hour, with a median of $18.30/hour. The annual mean is $48,310, implying that they assume annual hours of 2,080 hours/worker. In FINBIN, the annual mean value of operator labor and management is $53,419, with 2,275 hours reported, for an hourly rate of $23.48/hour. Those two numbers seem pretty close.

The difference in the milk labor cost may be due to larger and better-managed farms being over-represented in FINBIN. The 2014 Minnesota FINBIN labor costs were $2.79/cwt overall, $2.90/cwt for herds up to 50 cows, and $3.02/cwt for those over 500 cows. So, even the smallest FINBIN farms have labor costs of less than the overall average CAR cost. FINBIN also shows labor costs increasing with herd size rather than decreasing as in the CAR. In FINBIN, Minnesota dairy farms with 50 or fewer cows in 2014 made up 14% of the dairy farms but only 3% of the cows. Herds over 500 cows were only 6% of the farms but 33% of the cows. It is not clear how those distributional statistics compare with the CAR estimates, but in the 2012 Census of Ag, Minnesota dairy farms less than 50 cows were 43% of the farms and 12% of the cows. Those with 500 or more were 2% of the farms and 28% of the cows. Total labor costs in 2014 in the (U.S.) CAR milk estimates were $3.86/cwt overall. They were $15.05/cwt for farms with less than 50 cows and down to $1.82/cwt for those with 1,000 cows or more. A quick calculation suggests that the FINBIN Minnesota average labor cost might have been around 32% higher if the FINBIN herd sizes would have been distributed similar to the Census distribution instead. That still leaves most of the difference unexplained.

In contrast to Minnesota, the 2014 Kansas record system labor costs are higher than the Kansas CAR analogs. The 2014 milk CAR labor costs for Kansas are hired labor $1.36/cwt and unpaid labor $1.89/cwt for a total labor cost of $3.25/cwt. The Kansas Farm Management Association dairy averages for 2014 were $1.61/cwt hired and $2.63/cwt unpaid for a total labor cost of $4.24/cwt. The Kansas system values unpaid labor based on family living expenses. The higher Kansas total labor cost compared to the FINBIN $2.79/cwt may be due to smaller herd sizes in Kansas, because the Kansas association dairy farms averaged only 135 cows compared to an average of 179 cows for the Minnesota FINBIN farms.

Perhaps some of the FINBIN-CAR dairy labor cost difference is due to the way the labor information is collected in ARMS compared to FINPACK (FINBIN), but the differences in data entry are not very dramatic. Looking at unpaid labor, ARMS asks for hours/week by quarter, as shown in the first screen shot below. FINPACK asks for days worked and hours/day by month, as shown in the second screen shot:

Screenshots from the labor section of the 2010 ARMS dairy phase 3 questionnaire, pp. 22-23:

For items 15 and 16, please answer for each of the three-month periods during 2010.

	1st Quarter January, February, March, 2010	2nd Quarter April, May, June, 2010	3rd Quarter July, August, September, 2010	4th Quarter October, November December, 2010
15. On average, about how many paid and unpaid hours per week (*work and management time*) did–	HOURS/WEEK	HOURS/WEEK	HOURS/WEEK	HOURS/WEEK
a. you (*the principal operator*) work for this operation?	0828	0829	0830	0831
b. your spouse (*the principal operator's*) work for this operation? (*Even if your spouse is an operator, **include** his/her hours here.*)	0832	0833	0834	0835
c. other operators (*those persons responsible for the day-to-day management decisions for this operation*) work for this operation?	0836	0837	0838	0839
16. For the workers on this operation (excluding operators, custom hire, and contract labor), on average, for each of the three-month periods during 2010, about how many hours per week (work and management time) did–				
a. unpaid workers (*such as non-operator partners, family members, etc.*) work for this operation?	HOURS/WEEK 0840	HOURS/WEEK 0841	HOURS/WEEK 0842	HOURS/WEEK 0843

DAIRY ENTERPRISE LABOR

Next I have some questions about labor used on the DAIRY enterprise.

EXCLUDE CONTRACT LABOR.

17. I need your best estimate of the time spent doing work on the DAIRY enterprise in 2010 by you (*the operator*) and UNPAID workers. (***Exclude*** *labor used to produce feed for the dairy operation, such as field operations to produce corn silage and hay for dairy forage.*)

On the average, about how many HOURS PER WEEK did–

	1 Jan-Mar HOURS/WEEK	2 April-June HOURS/WEEK	3 July-Sept HOURS/WEEK	4 Oct-Dec HOURS/WEEK
a. you (*the operator*) work on the DAIRY enterprise during [*column*], **including** paid and unpaid hours?	1130	1131	1132	1133
b. unpaid workers (*such as partners, family members, etc.*) work on the DAIRY enterprise during [*column*], **including** unpaid hours only?	1134	1135	1136	1137

(i) What percent of the total number of hours worked by all UNPAID workers (*item 17b – **excluding** the operator*) in the dairy operation was performed by workers under 16 years of age? (*Estimates of labor costs for unpaid workers are based on off-farm wages, which are different for workers under 16 relative to those 16 and older.*)

PERCENT
1138 ___ ___ ___

EXCLUDE CONTRACT LABOR.

18. Now, I need your best estimate on the time spent doing work on the DAIRY enterprise in 2010 by PAID workers. (***Exclude*** *labor used to produce feed for the dairy operation, such as field operations to produce corn silage and hay for dairy forage.* ***Exclude*** *the operator's hours.*)

On the average, about how many HOURS PER WEEK did–

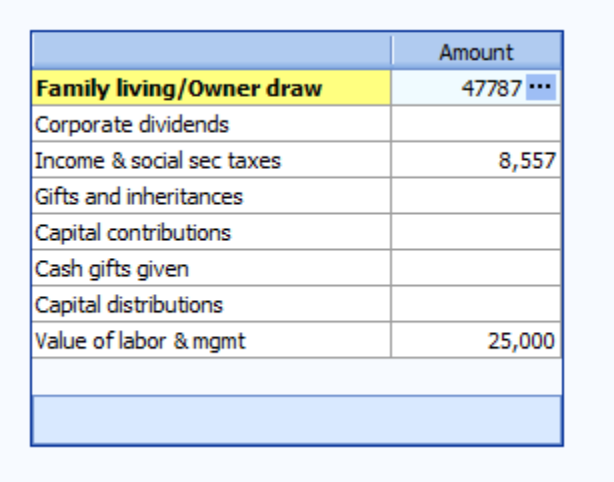
	1 Jan-Mar HOURS/WEEK	2 April-June HOURS/WEEK	3 July-Sept HOURS/WEEK	4 Oct-Dec HOURS/WEEK
a. full-time paid workers work on the DAIRY enterprise during [*column*], **including** only paid workers?	1139	1140	1141	1142
b. part-time or seasonal workers work on the DAIRY enterprise during [*column*], **including** only paid workers?	1143	1144	1145	1146

1 PER HOUR
2 PER DAY
3 PER WEEK
4 PER MONTH

	DOLLARS & CENTS	CODE
19. [*If full-time paid workers reported in item 18a, ask–*] What was the average wage paid to full-time workers?	1147 ___.___	1148
20. [*If part-time or seasonal workers reported in item 18b, ask–*] What was the average wage paid to part-time or seasonal workers?	1149 ___.___	1150

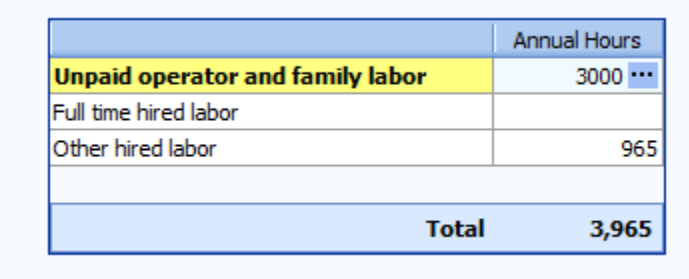
Screenshots from FINPACK FINAN financial analysis labor data entry (the numbers are from a 2004 data entry tutorial):

Value of labor and management/year:



	Amount
Family living/Owner draw	47787 ···
Corporate dividends	
Income & social sec taxes	8,557
Gifts and inheritances	
Capital contributions	
Cash gifts given	
Capital distributions	
Value of labor & mgmt	25,000

Hours of labor/year:



	Annual Hours
Unpaid operator and family labor	3000 ···
Full time hired labor	
Other hired labor	965
Total	**3,965**

Allocation of labor hours between crops and livestock:

	Total amount to be allocated	Percent allocated to Crops	Percent allocated to Livestock	Percent allocated to Other	Percent Remaining
Irrigation energy		100.00			
Fuel & oil	4,434	55.00	45.00		
Repairs	14,619	45.00	55.00		
Hired labor	3,857	55.00	45.00		
Machinery leases		100.00			
Building leases		100.00			
Real estate taxes	3,756	55.00	45.00		
Personal property taxes		100.00			
Farm insurance	3,739	25.00	75.00		
Utilities	6,725	5.00	95.00		
Dues & professional fees	654	40.00	60.00		
Operating interest	3,986	60.00	40.00		
Interest on interm. debt	10,077	30.00	70.00		
Interest on lng term debt	6,788	50.00	50.00		
Machinery depreciation	11,214	60.00	40.00		
Building depreciation					
Miscellaneous	516	40.00	60.00		
Value of labor & mgmt	25,000	40.00	60.00		
Labor hours	3,965	40.00	60.00		

Allocation of livestock labor and other items among individual livestock enterprises:

Allocated Livestock Expenses -- Percentages

	Total to be Allocated	1 Dairy	2 Dairy Replac	3 Farrow-Fin	4 Fin Yearling Str
Default allocation		60	15	20	5
Fuel & oil	1,995				
Repairs	8,040	55	5	35	5
Hired labor	1,736				
Machinery leases					
Building leases					
Real estate taxes	1,690				
Personal property taxes					
Farm insurance	2,804				
Utilities	6,389				
Dues & professional fees	392				
Operating interest	1,594	10		10	80
Interest on interm. debt	7,054				
Interest on lng term debt	3,394				
Machinery depreciation	4,486				
Building depreciation					
Miscellaneous	310				
Value of labor & mgmt	15,000				
Labor hours	2,379				

Allocation of crop labor and other items among individual crops:

Allocated Crop Expenses -- Allocation factors

	Total to be Allocated	1 Corn Normal 72 Acres	2 Corn Normal 70 Acres	3 Corn Silage Normal 17 Acres	4 Oats Normal 15 Acres	5 Alfalfa Hay Normal 46 Acres
Default allocation		10	10	7	5	7
Irrigation energy						
Fuel & oil	2,439					
Repairs	6,579					
Hired labor	2,121					
Machinery leases						
Building leases						
Real estate taxes	2,066	1	1	1	1	1
Personal property taxes						
Farm insurance	935					
Utilities	336					
Dues & professional fees	262	1	1	1	1	1
Operating interest	2,391					
Interest on interm. debt	3,023					
Interest on lng term debt	3,394	1	1	1	1	1
Machinery depreciation	6,728					
Building depreciation						
Miscellaneous	206					
Value of labor & mgmt	10,000					
Labor hours	1,586					

The FINBIN approach of asking hours per day for dairy operations may provide a more accurate accounting of labor hours because routine tasks are performed on a daily basis year-round and possibly operators have a good idea of how much time per day they spend on dairy. However, this approach might lead to an underreporting of overhead costs, although the work routine on a modern dairy farm is constant enough that this seems unlikely to explain much of the observed difference. One unpublished Minnesota survey of automated calf feeder use found that repairs and other tasks beyond regular daily care added only 3% to overall labor hours. For livestock operations the CAR labor quantity questions are integrated with the whole-farm data which asks for hours per week during each of four three month periods, the amount of which farmers specify for the dairy enterprise. Because of this integration it would be difficult to change to an approach of asking for hours per day.

The farm total hours from this form are allocated to livestock and crops using percentages entered elsewhere. Then each of those portions is allocated to individual enterprises based on per-acre or per-head relative factors. One solution to the apparent under-estimate of unpaid labor in the CAR crop estimates would be to add labor-related questions to ARMS that are similar to those lines from the FINPACK screens. However, adding crop enterprise labor questions to the ARMS, as is done for livestock in the ARMS, would cover the calendar year and not the crop year being studied, thus omitting labor used after the previous crop is harvested

up until the beginning of the calendar year. This would be particularly problematic for fall planted crops such as winter wheat.

5) Capital is a difficult input to cost. Replacement costs for capital are used in the capital recovery approach to estimate capital costs. Is this the best strategy for expressing what this cost item represents?

Capital recovery costing based on replacement costs – The replacement cost-based capital recovery approach of the CAR implies a perspective regarding opportunity costs and decision-making that is different from the financial-reporting perspective of farm business summary programs such as FINBIN. Given that, it might be useful to discuss this difference in ERS publications such as "Characteristics and Production Costs of (commodity) farms". because the replacement costs used in the CAR can lead to quite different numbers from those derived from the cost-basis balance sheets that the business summary programs tend to use. Using replacement costs, the CAR method probably comes closer to estimating the amounts required to be set aside and accumulate over time to totals that would actually replace capital assets at the end of their life than do the accounting-based methods.

Custom rate survey data as an alternative to the engineering formulas

There was some concern that estimating machinery costs based on the prices of new machinery, the hours used per year, the field efficiency, etc. and then estimating a cost based on the old agricultural engineering formulas may be unreliable. There is so much variation that can occur and the formulas do not get updated very frequently. Time and motion studies done for a recent industry-sponsored project suggested that the costs are not as accurate as they could be. Also, the assumptions regarding annual hours of use, useful life, salvage values, etc. can have a major impact on the results, and do not appear to be well-documented at present.

The committee recommends that ERS staff explore the possibility of working with NASS on a national custom rate survey. State NASS offices already do custom rate surveys in some states such as Wisconsin and North Dakota via NASS's reimbursable survey program with funding from Extension. Professor Damona Doye at Oklahoma State University is in discussions with NASS staff about trying to standardize procedures for those surveys to reduce costs and then to involve more states in those surveys. Given the importance of machinery costs in the ERS CAR estimates, perhaps ERS could share some of that cost with Extension in order to have more custom rate data available for the CAR estimates.

If costs such as repair and maintenance, fuel use, and depreciation were still needed, these questions could be asked as part of the survey. It is suggested that such a custom rate survey could concentrate on operators who regularly do custom operations for others. Not only would these numbers be useful for the cost of production studies but the custom rates would be useful for many Extension Services. Custom rates are one of the most common Extension questions.

Kansas State currently uses survey custom rates to value machinery operations in their crop enterprise budgets. This avoids the need to obtain data on machinery prices, machine sizes, field efficiencies, depreciation, interest costs, engineering formulas, etc. Practically all the costs (except for irrigation costs) become variable costs. They feel that the custom rates give them a better handle on the machinery costs.

McBride provided the committee with additional detail not in the published documentation on the assumptions and data for the capital recovery calculations that is not currently shown on the ERS website:

- The ownership periods for the specific items are in an Excel spreadsheet.
- Years owned are assumed to be one-half years of useful life.
- Years of useful life are from various sources. One source for buildings and equipment other than field equipment is the Marshall and Swift valuation system that is also used for building replacement values.
- Field machinery years of useful life are calculated by dividing the estimated life hours in the ASABE Standards, by typical hours of annual use (American Society of Agricultural and Biological Engineers 2006).
- The source for hours of annual machinery use is the old Oklahoma State Budget Generator that was used to do the COP calculations until the early 1990s when ERS converted to the SAS program currently used. For example, the ERS years owned for a 140-159 hp 2 wheel drive tractor is 9 years. That implies a useful life of 18 years. The ASABE estimated life for 2 wheel drive tractors is 12,000 hours, which would imply annual use of 667 hours/year. Another example is that the ERS years owned for a chisel plow is 10 years, implying a useful life of 20 years. The ASABE estimated life for a chisel plow is 2,000 hours, which would be reached with annual use of 100 hours. Annual use of 667 hours for a tractor and 100 hours for a chisel plow seem to be on the high side, but within reason. Note: It is suggested that annual use be compared with the crop acreages, machinery sizes, and passes/year data that are collected in the phase 2 and 3 questionnaires. That might be easier if multiple crop enterprises on the same farm were to be included in one survey rather than in separate surveys, as suggested above under B1.
- The field machinery is assumed to have salvage values at the end of the years owned. The field equipment salvage values are based on the formulas in the 1994 John Deere publication “Machinery Replacement Strategies” by Wendell Bowers (Bowers 1994). That is a respected source, but is obviously 21 years old now. The committee suggests that more recent salvage value research be considered for adoption. At least two more

recent sources are available: The ASAE Standard D497.7 dated March 2011, and Wu and Perry's May 2004 AJAE article (Wu and Perry 2004). The data and estimation procedure behind the ASAE Standard formulas is unclear. The Wu and Perry formulas were estimated using Hot Line auction price data. We have not evaluated the differences between these three sets of formulas for typical machines and ownership years.

- The buildings and other equipment are not assumed to have salvage values.

It is suggested that the repair cost engineering formulas be periodically cross-checked against what the farmers reported as a breakout of the farm cost in phase 3. McBride reports that the old ASAE engineering formulas are used to calculate the repair costs for the field equipment. A long time ago, he cross checked the formulas against what the farmers reported as a breakout of the farm cost in phase 3, but not recently. He remembers that the means were fairly close, but the distribution of repair cost was much wider with the direct cost estimates, not unexpectedly with individual farm data.

In summary, capital recovery is a large cost, so if the current general methodology is continued, then it might be worthwhile to review the ownership years, salvage value formulas, and repair costs more closely. It appears that it would be easy to shift to one of the more recent sources for the salvage value formulas. It would be more work but probably worthwhile to compare the repair cost formulas against the phase 3 reported costs again for a crop or two.

Spot-checking the ERS cost recovery calculations for two commodities against the FINBIN numbers, the 2014 ERS estimate for corn in the Heartland region matches the FINBIN estimate almost exactly when an estimate of interest on equity is added to the FINBIN number - $95.64 for ERS and $95.00 for FINBIN. The numbers for milk in Minnesota were not as close - $6.00/cwt for ERS and $1.91 for FINBIN.

6) Manure produced on livestock operations is treated as a return to the livestock enterprise, and manure used on crops farms is treated as a cost to the crop enterprise. Manure storage is regarded as a livestock expense, while application is a crop expense. Is this the most appropriate way of handling manure? Is computing the manure N, P, and K value the best approach for expressing this livestock return and crop cost?

The committee did not recommend any changes to the regular ARMS questionnaires especially as information collected in ARMS livestock questionnaires become more limited because of space considerations. They did encourage doing special studies from time to time to obtain better information on how to account for manure in the livestock and crop enterprise reports, and the role of manure valuation in producer decision-making. One suggestion is to ask respondents whether and how they credit manure nutrients in their fertilizer decisions.

ERS currently computes manure values as a return for livestock based on an estimated N, P, K content determined using coefficients that reflect the nutrient content of manure from each species with adjustments for how the manure is stored and applied. Thus manure handled in a slurry system would have a much greater value to livestock producers, and incur a greater cost for crop producers, than manure handled with the lagoon and spray system. For livestock they record a nutrient value of the manure regardless of how it was used (e.g. whether applied to corn or a 'sprayfield' of Bermuda grass). For crops they charge a cost for the amount of manure applied.

It is recognized that manure only has value if fertilizer practices are adjusted to account for the N, P, and K from the manure. The allocation of storage cost to livestock and application cost to crop is an acceptable arbitrary assumption as long as it is made clear to users and especially if the storage and application cost estimates are published. The NPK concentrations are useful quality identifiers but are probably weakly correlated with actual value as manure markets are extremely local. Actual transaction/sale prices conditioned on who bears the cost of transport and application are probably the best estimate of local value. Some surveys of those prices have been done. Economically, the value of manure is usually estimated as the value of synthetic fertilizer purchase avoided minus the cost of applying manure plus the cost avoided of applying synthetic fertilizer plus the value of net yield increase arising from manure application plus or minus the value of any intangibles associated with manure application. This latter equation would be difficult to survey and may not be representative of actual transaction value.

The complexity and diversity of manure handling systems may be worth a special study from time to time. ARMS APHIS and/or CAR may have conducted some surveys of manure management methods in some species. A future special study could produce CAR estimates for selected types of manure handling systems for each species that would be useful in constructing livestock enterprise CAR estimates. Perhaps NRCS and EPA and NSF and DoE may support such a study and survey.

Manure handling varies by livestock species. Below are additional comments by species:

Comments specific to swine:

Most US swine production enterprises that involve confinement and a concrete pad or slatted floor, use one of two manure handling systems. The slurry handling system is common in the Midwest and particularly the Midwest north of Interstate 40 (approximate). The slurry system includes lower water content (90 to 95% water vs 99 to 99.5 % water in lagoon/anaerobic digestion systems) and requires more expensive land application (tractor pulled slurry wagon or drag-hose versus irrigation for lagoon effluent). Slurry by virtue of its higher nutrient density is more suited to sale and to transport while lagoon effluent is typically not transported far and is rarely sold. CAR can identify the manure management system, use regional average sale prices for appropriate products (probably slurry) qualified by nutrient density, bearer of transport and application costs, etc. CAR may try to establish value of lagoon effluent applied to row crops via

the quantity of synthetic nutrient purchases avoided and try to establish irrigation costs. Typically, this may appear as a net cost to the swine enterprise. The cost estimation is further complicated when the crop receiving lagoon effluent is a low value crop selected for its capacity to use plant available nitrogen at a high rate. There may actually be opportunity cost associated with the 'sprayfield' crop defined as land rent plus net receipts above operating costs for a commercial crop (e.g. corn, soybeans, wheat rotation) minus net operating receipts for a 'sprayfield' crop (e.g. hybrid Bermuda grass and ryegrass or wheat for hay as a winter cover crop). Further complications include the RYE (reasonable yield expectations) yields for the crops produced in each location and the valuation of P that may be used by crops over more than one season or more than one year. Higher RYE yields for crops allow more dense application of slurry resulting in reduced transport and application costs per gallon or ton of slurry applied. Multi-season P budgeting may not be a direct concern to CAR if the market prices collected reflect such use of P.

Comments specific to poultry:

Most turkey and broiler enterprises handle manure in the form of litter. Litter may be composed mostly of wood shavings or similar substrate and so tends to be handled as a moist solid. Market prices are established locally for litter with high fractions of the total being sold in some regions. More information is required here about the formula for valuing litter as a function of composition (considering factors such as water content, density of the nutrients N, P, and K , who bears transport and application costs, application rate, incorporation tillage operations, etc.). Layer operations may handle a slurry with distinct uses and value.

Trucking costs can be substantial. Poultry operations often do not view manure as a valuable output because they are stuck paying the trucking, which can exceed the nutrient value.

Comments specific to dairy and beef cow-calf:

Several common systems can be observed on dairy operations, each resulting in different effluent streams, fractions sold, and markets. Similarly beef cattle feedlots handle manure solids and some capture and handle liquid effluents; with local markets and nearby use as crop fertilizers/soil amendments.

C. Communication with Stakeholders

1) A frequent comment from data product users is that the data cannot be realistic because returns above total costs are chronically negative. Oftentimes users do not realize that we publish economic costs and not just accounting costs. Is there a way we can help the user community better understand this distinction and what it means for the published estimates?

The committee suggests including something in the documentation that discusses the concept of zero economic profit. ERS would then have a place to send users for information that would help them better understand why chronically-negative returns are not unrealistic.

With regard to the realism of chronically-negative returns (C1), it was noted that crop insurance indemnities and returns to crop storage for marketing after harvest might be important considerations that provide positive returns to producers and are ignored in the CAR. Including crop insurance and returns to marketing are NOT recommended for the baseline spreadsheet products, but should be discussed in the publications.

Understanding economic costs is difficult for most people. The fact that economic profit of zero means all factors of production are paid at their fair rate and zero profits is perfectly acceptable is difficult to comprehend. Users bear some responsibility to put effort into understanding the costs. The milk cost of production costs are clearly labeled as "operating" and "allocated." One suggestion is to consider reporting costs without unpaid labor, management and capital which is closer to what most people think of as cost of production, but this muddies the water.

2) Are the published estimates presented in a way that is useful to our stakeholders? For example, should the account format that was recommended by the AAEA task force be changed? Are the regional definitions appropriate, or should another way of presenting regional estimates be considered?

The regional definition issue will be addressed if the estimates are incorporated into the crop production practices tool (see A1 and C6). The current regions work well for most commodities, but are difficult to interpret or defend in cases where the Fruitful Rim is presented. This is true concerning the CAR for milk production where the Fruitful rim aggregates farms in disparate states including CA, FL, and TX. Because of this issue, estimates of milk production costs for sub-regions are offered upon request, including estimates for the Northern Crescent-East (ME, VT, NY, PA and OH) and Northern Crescent-West (MI, MN, and WI); the Southern Seaboard-East (GA and VA) and Southern Seaboard-West (TX), and; the Fruitful Rim-East (FL, GA, and TX) and Fruitful Rim-West (AZ, CA, ID, OR, and WA). Perhaps ERS could mention in the web page text that you will make them available upon request. The crop production practices tool may make it possible for users to group the data into alternative regions.

The committee agrees with using the AAEA CAR methods and account format, but raises the question about whether special reports that show economic versus accounting costs could be prepared or whether cash accounting totals (e.g. costs excluding donated inputs and farm specific financing arrangements, margins above such subtotals) could be shown within the account or described in a footnote. The feasibility of this would need to be examined.

3) Are the data being delivered in a format (Excel spreadsheets) that is useful to our stakeholders? Should we change formats or consider giving data users more options for obtaining the data?

Currently the ARMS is available in an interactive format divided into farm financial and crop production practice components. One option to consider is if the crop costs and return could be incorporated into the crop production practice component. Cross tabs of costs with various production practices would enable users to obtain data on the average cost of producers using various production practices (see A1 and C6).

Results of the ERS internal data product review requires that the data product be accessible in an open data format such as CSV or API's. Plans are to offer the data product in an open data format in addition to the current Excel spreadsheets.

4) Is the project documentation on the web site appropriate and/or sufficient for a broad audience of potential data users? Should the documentation include more information about the procedures used during non-survey years? Are there other ways that the documentation can be improved for our user community?

Additional documentation with greater detail about the estimation procedures used during the off-survey years will be added, including the specific indexes used to update the survey data for off-survey years. The committee suggests adding a link to the ARMS questionnaires from the CAR documentation web page. ERS currently has links to the ARMS questionnaires from the ARMS data page.

5) We periodically produce a report titled Characteristics and Production Costs of (commodity) farms as a way of making the public more aware of information from the survey and the technology set that underlies the cost and return estimates. Is this a useful report? Should it be changed, and if so how? Would some other type of publication be more useful to our stakeholders?

The committee indicates that reports about commodity costs and returns, and the structure of production have been useful and recommends that they be continued. They also suggest that solicitation from commodity groups and other users may help to determine the kind of reports to produce and the issues on which to focus. ERS has contacted data users and commodity experts in the past regarding the design and content of questions for the ARMS, so that they can reflect the set of changing issues in commodity production. These contacts provide

information for developing the questionnaire, as well as ideas for developing reports from the data.

The committee notes that it may be useful to use the survey to describe some of the 'new' forms of livestock enterprises, noting the growth of highly specialized contract hog producers. ERS has added accounts for 'farrow-to-wean' and 'weanling-to-feeder pig' operations from data collected in the previous two hog surveys ('wean-to-finish operations are included with feeder pig-to-finish operations). With the new survey data from 2015 they could consider examining the growth, structure, and costs of these types of swine farms in more detail.

ERS is also considering more issue oriented reports that could be produced from the ARMS cost and return data, and using data from periodic surveys in more of a time-series type of analysis. This has been done extensively for hog production, examining changes in industry structure and productivity, and manure management, using data from 1992, 1998, 2004, and 2009. They plan to use ARMS data for cotton collected 2015, 2007, and possibly earlier years to explore the issue of declining cotton acreage and the state of the cotton industry.

6) Would it be useful to publish a measure of precision for the survey year CAR estimates, such as the coefficient of variation (CV)? If so, what suggestions do you have for presenting this information?

The addition of a measure of precision such as coefficient of variation for survey year CAR estimates was discussed and thought to be a useful addition to help users of the data understand the degree to which the costs vary, at least for the major items such as milk price, feed cost, and operating and allocated overhead cost subtotals.

A column with Relative Standard Error (RSE) of each estimate could be added if the survey year costs-of-production data is added to the ARMS Farm Financial and Crop Production Practices data tool as mentioned above in A1 (see:

http://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices/tailored-reports-farm-structure-and-finance.aspx)

(See also the discussion of smoothing above under question A6.)

ERS currently indicates the survey year breakdown using tabs in Excel workbooks and including the survey year in the table footnote. They plan to evaluate a spreadsheet format that uses a system of coloring each period of survey estimates and then use some kind of heading or footnote that indicates the survey year of each colored section. This would move away from using the workbook tabs in Excel and presenting the data in one long series (or using the tabs for other data presentations such as sub-regions). Combining a smoothing technique (A6) with the colored survey period could improve the usability of these data in a time-series context.

Another thought would be to generate CAR estimates for a high third group and a low third group by some profitability measure in addition to the overall averages generated now.

There was also some interest expressed for a cash flow report in addition to the economic report format used now. It is recognized that the pre-1996 format did include a cash costs and returns section in addition to an economic costs and returns section, but the cash section was discontinued after the AAEA CAR task force called it confusing.

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