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Examining The Use Of Dairy Herd Improvement Association Data To Estimate Monthly Milk Production

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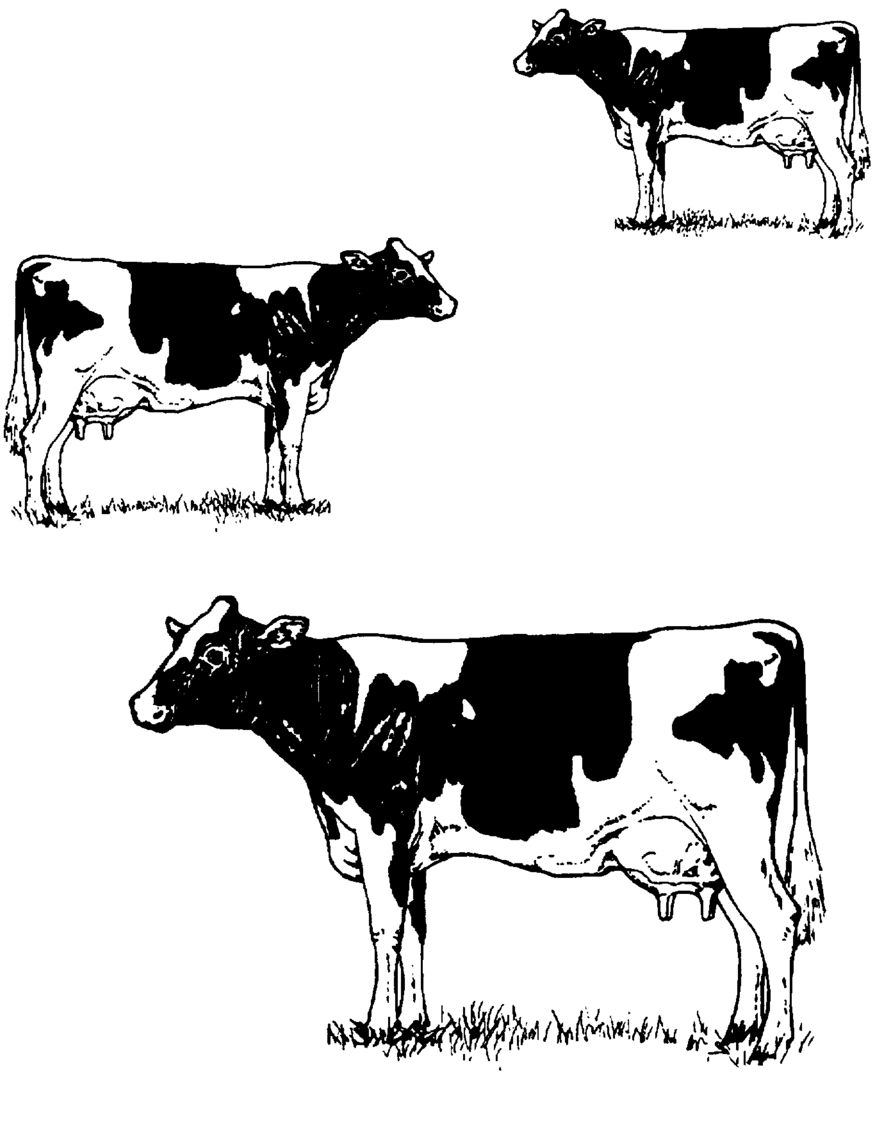

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ABSTRACT

Dairy Herd Improvement Association (DHIA) data are used in regression models to produce estimates for monthly milk production, number of cows and milk per cow. These regression estimates are compared to Agricultural Statistics Board estimates as a measure of performance. Results in Michigan and Ohio indicate that the use of this administrative data in regression models does provide effective estimates of monthly milk production. Results in New York are not as clear because of the difference in variables reported from DHIA. After an adjustment was made to the New York data, acceptable models were developed. This research shows that using DHIA data in regression models to produce monthly milk production estimates would support the elimination of some of the non-probability monthly dairy surveys and would result in substantial cost savings and reduction in respondent burden.

KEY WORDS

Dairy Herd Improvement Association (DHIA); Regression estimates; Moving averages; Monthly non-probability dairy surveys.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

SUMMARY

The National Agricultural Statistics Service (NASS) currently conducts monthly non-probability dairy surveys in 21 States. The sample is stratified by size based on the number of milk cows in each herd. New samples are selected once each year and are implemented for the State's January or July survey. The selected dairy operations are then surveyed for 12 consecutive months. They are contacted either by telephone or mail. Non-response telephone follow-up is usually done at a minimum level, depending on the State's monetary resources or time remaining to complete the survey. This is necessary to supplement mail response.

Dairy Herd Improvement Association (DHIA) data were obtained for Michigan, New York and Ohio to investigate if effective estimation through regression modeling could be obtained for monthly milk production, number of cows and milk per cow. These data are available for the 21 monthly estimating States and are relatively inexpensive to obtain. If some or all of the non-quarterly dairy surveys could be eliminated, then substantial savings from postage and significant reduction to respondent burden would be realized.

Regression models were developed based on the DHIA data from 1990 through 1991 for Michigan and Ohio. Estimates for monthly milk production for 1992 were created for these two States. These estimates were compared to official Agricultural Statistics Board (ASB) estimates to evaluate model performance. The regression estimates for these 2 States were within 2% of the ASB estimates for Michigan and within 4% for Ohio.

The DHIA data for New York were different from the data received for Michigan and Ohio. Values received for monthly milk production were actually annualized values representing milk produced during one year's time. Consequently, regression models developed for monthly milk production were very poor performing models. An adjustment was made on these annualized values by multiplying the monthly values by a percent of total factor. The factors were based on a ten year average from ASB estimates for milk production for each month. The factors were applied to the monthly "annualized" milk production values for 1990 through 1991. These adjusted monthly data were used to develop regression models to estimate monthly milk production. These estimates were within 5% of the ASB estimates, a significant improvement over previous attempts.

The results from this study showed that effective regression models and estimates can be developed to estimate monthly milk production. If non-conforming DHIA data is obtained for a State, such as New York, this data can be adjusted by either historical means (ASB estimates) or by using available administrative check data (for example, milk marketings). Then, the adjusted data can be used to develop appropriate regression models for those States.

INTRODUCTION

Each month surveys are conducted by the National Agricultural Statistics Service (NASS) to provide estimates for monthly milk production, including estimates for number of cows and milk per cow, in 21 States. The population for these surveys consists of all operators possessing milk cow control data on the List Sampling Frame (LSF) master file of active records. The selected sample is stratified by size based on the number of dairy cows in the herd. New samples for these surveys are implemented each year, and once selected, the herd operator (or his representative) will be contacted for the next 12 months. These surveys are generally non-probability in nature, where dairy herd operators are mailed questionnaires or are contacted by telephone. Non-response follow-up varies widely by State and depends on acceptable response rates and available funds.

If part or all of these non-quarterly surveys could be eliminated while still producing reliable milk production estimates, then NASS would realize substantial monetary savings from postage and enumeration costs while showing significant reduction in respondent burden. Therefore, the use of administrative data, from sources like the Dairy Herd Improvement Association (DHIA), was examined as a means of developing regression estimates for monthly milk production as a replacement for part of the current monthly dairy surveys.

This report discusses the procedures and analyses associated with the building and reviewing of the models constructed based on 1990 and 1991 DHIA data for the three States. Comparisons between the Agricultural Statistics Board (ASB) estimates and the regression estimates will be presented as well as evaluations of the models used to make these estimates. This discussion will first focus on DHIA data and results from Michigan and Ohio. Then the paper will present findings for New York. Since the DHIA data received from New York was different in nature from that received for Michigan and Ohio, New York was reviewed separately from the other two States.

DHIA DATA

The available data from DHIA for Michigan and Ohio included the number of herds, the number of cows tested, and the average milk per cow per day. In Michigan, both official and unofficial DHIA data were obtained for these three variables, while only official data were obtained for Ohio. Official DHIA data are defined as data which are collected on site by a representative of DHIA. Unofficial DHIA data are collected by the herd operator and mailed to the State DHIA office. The number of cows tested in Michigan represented approximately 47% of the State's estimate for milk cows, while in Ohio the DHIA coverage was approximately 40%.

DHIA data for the years 1982 through 1992 were obtained in Michigan, while data for years 1984 through 1992 were obtained for Ohio. Initially, the analysis utilized all available years to develop regression models for the study. Due to limited data for all twenty-one States, only two years of DHIA data were used in this study. Therefore, only models based on two years of

DHIA data were developed to determine the feasibility of using this data in regression models to estimate monthly milk production.

The search for appropriate models did not limit itself to just the three variables obtained from DHIA from each State. The DHIA data itself was manipulated to create other possible predictor variables. For example, the average milk per day was multiplied times the number of days in that particular month and the number of cows tested that month to obtain an indication of DHIA monthly milk production. Several moving averages were also calculated for use, including number of cows averaged over one or two previous months and average production averaged over the same period. Other variables were created and used in the model search routines. For example, a variable for TIME was created and was equal to 1 through 24, where the values corresponded to the number of consecutive months in the data set.

MODEL BUILDING PROCEDURES

The strategy was to build models for monthly milk production, number of cows and monthly milk per cow. A SAS procedure named R-SQUARE was used to search for the best possible models for each commodity. Appropriate pools of eligible independent variables were included in these search routines. Due to the correlation among the predictor variables, only one and two variable models were reviewed for each commodity. The "best" model was selected for each commodity based on the adjusted R^2 and Mean Square Error (MSE) values. All possible one- and two-variable models were reviewed for each commodity. The adjusted R^2 and MSE values were the measures used to evaluate the overall model performance relative to all other models reviewed.

The resulting model for monthly milk production for Michigan was based on two independent variables: the official DHIA monthly milk production and time. The corresponding model for Ohio contained only one independent variable: DHIA monthly milk production. The model for estimating the number of milk cows for Michigan was based on the variable for unofficial number of herds. The Ohio model for number of cows was based on a moving average of the current month number of cows with the previous two months number of cows and a time variable. The model for monthly milk per cow for Michigan was based on an average of official and unofficial DHIA monthly milk per cow. The corresponding model for Ohio was based on one independent variable: the DHIA monthly milk per cow.

Table 1 summarizes the independent variables that were selected in each of the three models. In the two-variable models, each independent variable was statistically significant (p-values < 0.0001). In the remaining one-variable models, each model was statistically significant (p-value < 0.0001). Notice that newly created variables were significant predictor variables for the milk cow model in Ohio and for the monthly milk per cow model in Michigan.

Table 2 shows the resulting adjusted R^2 values for each of the three models selected from the model search procedure. All models had adjusted R^2 values above 0.800.

Appendix A shows the analysis of variance tables for each model for each State.

Table 1: Variables used for the three models based on DHIA data for 1990 - 1991 for Michigan and Ohio.

STATE	TOTAL PRODUCTION	MILK COWS	MONTHLY MILK PER COW
MICHIGAN	Off. Total Milk Time (1,2,...,24)	Unoff. Herds	Avg. of Off. & Unoff. Monthly Milk per Cow
OHIO	Total Milk	Time (1,2,...,24) Avg. of Curr. Month & Prev. 2 Months Cows	Monthly Milk per Cow

Table 2: Adjusted R^2 values for the three models using DHIA data for 1990 - 1991 for Michigan and Ohio.

STATE	TOTAL PRODUCTION	MILK COWS	MONTHLY MILK PER COW
MICHIGAN	0.903	0.878	0.881
OHIO	0.818	0.852	0.818

Since only DHIA data for 1990 through 1991 were used in the model search routines, a concern raised was the loss, if any, from using only two years of data to build the regression models. Table 3 shows the resulting adjusted R^2 values obtained by allowing all available DHIA data for Michigan (1982 through 1991) and Ohio (1984 through 1991) to be used in the model search. Overall, there is only a modest loss from limiting the search to only two years worth of DHIA data.

Table 3: Adjusted R^2 values for the three models using DHIA data for all available years for Michigan (1982-1991) and Ohio (1984-1991).

STATE	TOTAL PRODUCTION	MILK COWS	MONTHLY MILK PER COW
MICHIGAN	0.898	0.965	0.955
OHIO	0.808	0.915	0.737

It should be noted that the three models based on all available DHIA data have different or slightly different predictor variables than the models developed based on two years worth of DHIA data. Variables associated with trends, such as TIME, become statistically significant when more years of input data are available.

METHODS OF ESTIMATION

As discussed previously, the primary goal of this study is to determine if regression estimates developed from DHIA data can effectively estimate monthly milk production. In order to determine the effectiveness of those estimates, a comparison was made between 1992 ASB estimates for monthly milk production and the monthly regression estimates in Michigan and Ohio.

Two approaches were employed to generate milk production estimates. The first approach was based on developing a regression model for monthly milk production. This approach, called Method 1, used the milk production model previously discussed.

The second approach, Method 2, was based on a multiplication of the component estimates. Method 2 used the regression estimates produced from the regression models for number of cows and for monthly milk per cow. These two estimates were then multiplied together to create another indication of monthly milk production.

MICHIGAN AND OHIO RESULTS

Monthly milk production estimates for Method 1 and Method 2 were computed for each month in 1992 for each State. Recall that the models used were based only on 1990 and 1991 DHIA data. These estimates were compared to the ASB estimates of milk production for each month. The estimates for Method 1 and Method 2, computed for Michigan and Ohio, are shown in the time series charts in Figure 1 and Figure 2.

Survey expansions from the monthly non-probability survey for each State are also presented. These indications for monthly milk production are derived by multiplying the ratio-to-base and identical expansions times the survey indicated monthly milk per cow. They will be denoted by Base Exp. and Identical Exp. in Figure 1 and Figure 2. These expansions are discussed in the Estimation Manual, Volume 4, Chapter 10.

Estimates for both methods usually followed the ASB estimates well, while the survey expansions were somewhat variable, especially in Ohio. Appendix B shows the ASB estimates, the regression and survey indications used to produce these time series charts.

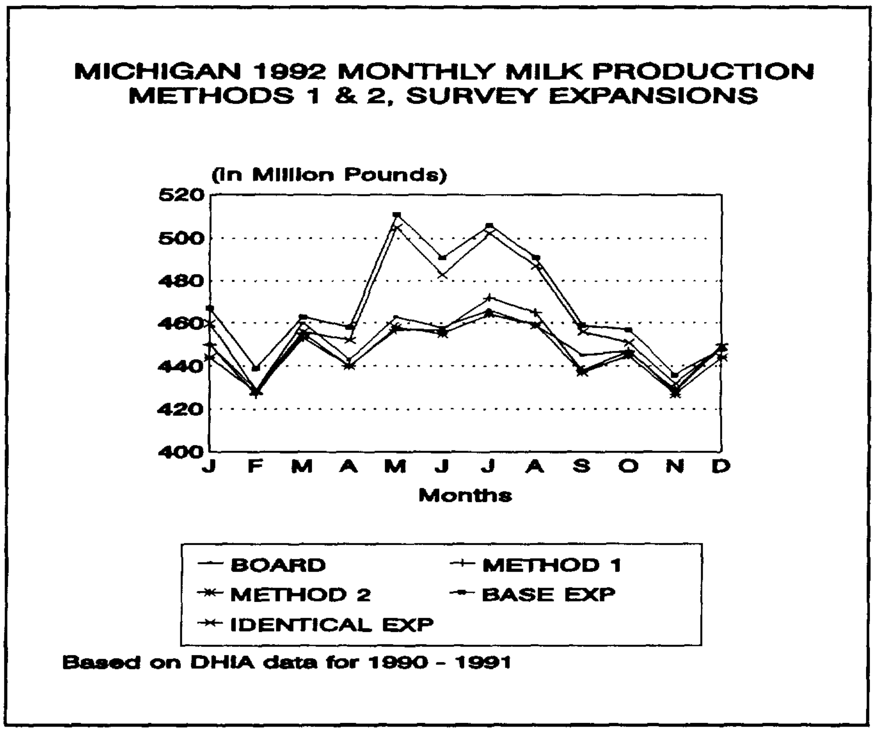

Figure 1

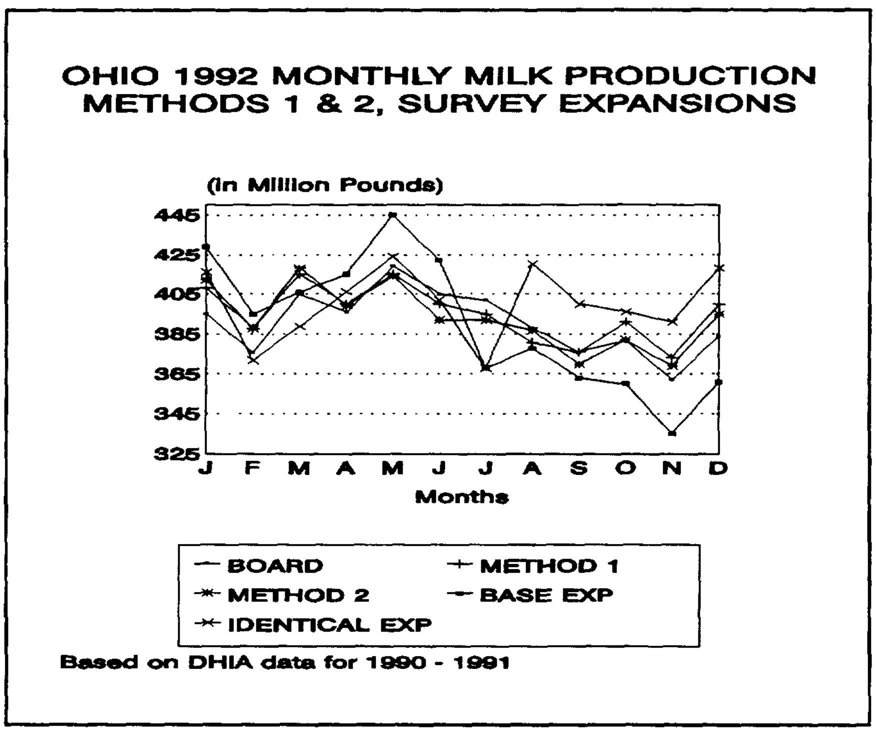

Figure 2

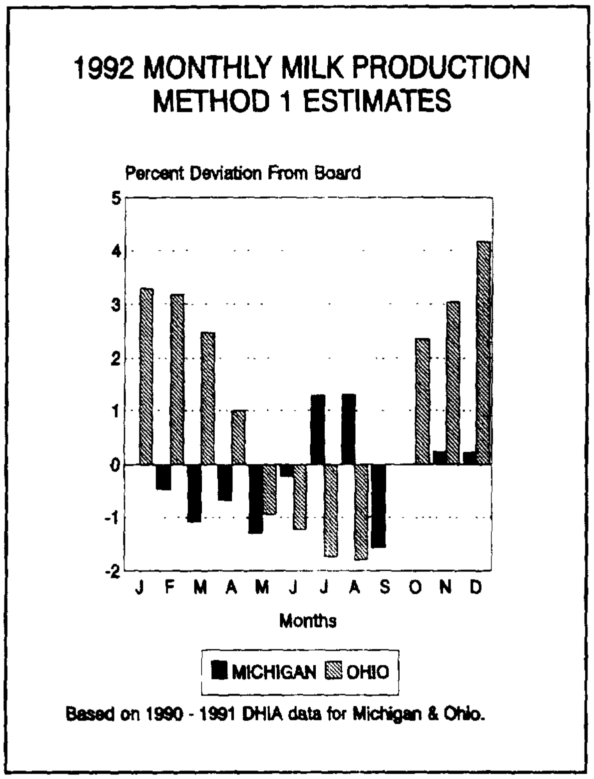

Figure 3

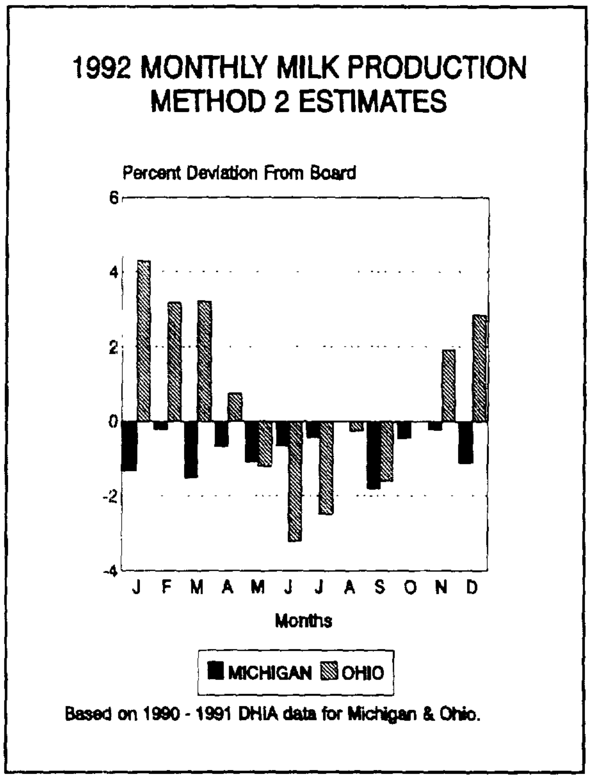

Figure 4

Figure 3 and Figure 4 show the percent deviations of both methods from the ASB estimates for each State. Michigan's estimates deviated from the ASB estimates much less than the estimates for Ohio. For Michigan, 9 of the 12 estimates were within 1% of the ASB estimates for Method 1 and 7 of 12 for Method 2. The remaining estimates for both methods fell within 2% of the ASB estimates. The estimates for Ohio, although not as good as Michigan, had 8 of 12 and 7 of 12 within 2% of the ASB estimates for Method 1 and Method 2 respectively. Each method had one estimate greater than 4% but all others were less than 4% of the ASB estimates.

NEW YORK DHIA DATA, MODELS, AND ESTIMATION RESULTS

The DHIA data available for New York was slightly different from what was received for Michigan and Ohio. As in the other two States, DHIA data was the same for the number of herds. However, data was reported in terms of "cow years" instead of number of cows. Also, values for total milk pounds per month were received instead of an average daily milk per cow. Upon further review, it was discovered that these monthly values of milk pounds were actually an annual value of milk produced. This annual value was updated by DHIA personnel each month to reflect annual milk pounds produced. This action was done at the herd level, and these values were then aggregated to the State level. As in Michigan, official and unofficial DHIA data were received for the number of herds, cow years, and milk per month (annual basis) for

1983 through 1992. As with Michigan and Ohio, only DHIA data for 1990 and 1991 were used to develop regression models.

Again, where possible, these data were manipulated to create other variables for use in the model building activities. Variables for TIME and moving averages were also generated as in the other two States.

The SAS procedure R-SQUARE was used to search for the best model for each commodity. Appropriate pools of eligible variables were included in the search routines. All possible one- and two-variable models were reviewed for each commodity. The "best" model was selected for each commodity based on the adjusted R^2 and MSE value listed for each model built.

The milk per month variable was an extremely poor predictor variable in the milk production model, since that milk per month variable was actually an annual reported value. Adjusted R^2 values for the milk production models were under 0.30 and deemed not acceptable.

Consequently, an adjustment was made to this variable in the following manner. Ten years of Agricultural Statistics Board estimates for New York monthly milk production were used to calculate an average percent of total milk produced for each month. These percents of total were applied to the reported DHIA monthly milk pounds for 1990 and 1991. These "transformed" monthly values were then used as an additional variable in the model building process of the SAS procedure R-SQUARE. The resulting models for milk production were vast improvements over previous model building attempts.

The resulting model for monthly milk production was based on two independent variables: the official adjusted DHIA monthly milk production and the unofficial number of herds. The model for estimating the number of milk cows was based on a moving average of the current month adjusted milk per cow with the previous two months adjusted milk per cow and the unofficial number of herds. The model for monthly milk per cow was based on the unofficial adjusted monthly milk per cow.

Table 4 summarizes the independent variables that were selected in each of the models based on this SAS procedure. All models selected were significant (p-values < 0.0001) as were all of the partial tests on the individual predictor variables (p-values < 0.0016).

Table 4: Variables used for the three models based on DHIA data for 1990 - 1991 for New York.

STATE	TOTAL PRODUCTION	MILK COWS	MONTHLY MILK PER COW
NEW YORK	Off. Adj. Total Milk Unoff. Herds	Unoff. Herds Avg. of Curr. Month & Prev. 2 Months Adj. Milk per Cow	Unoff. Adj. Monthly Milk per Cow

Table 5 shows the resulting adjusted R^2 values for each of the three models selected from the model search procedure.

Table 5: Adjusted R^2 values for the three models using DHIA data for 1990 - 1991

STATE	TOTAL PRODUCTION	MILK COWS	MONTHLY MILK PER COW
NEW YORK	0.796	0.675	0.924

Appendix A shows the analysis of variance tables for each model for New York.

Monthly milk production estimates for Method 1 and Method 2 were computed for each month in 1992 for New York. These estimates were compared to the ASB estimates of milk production and are shown in the time series chart in Figure 5. Direct expansions and base expansions from the monthly non-probability survey are also plotted with the estimates for Method 1 and Method 2. Both the estimates for Method 1 and Method 2 and the survey expansions track the ASB estimates well.

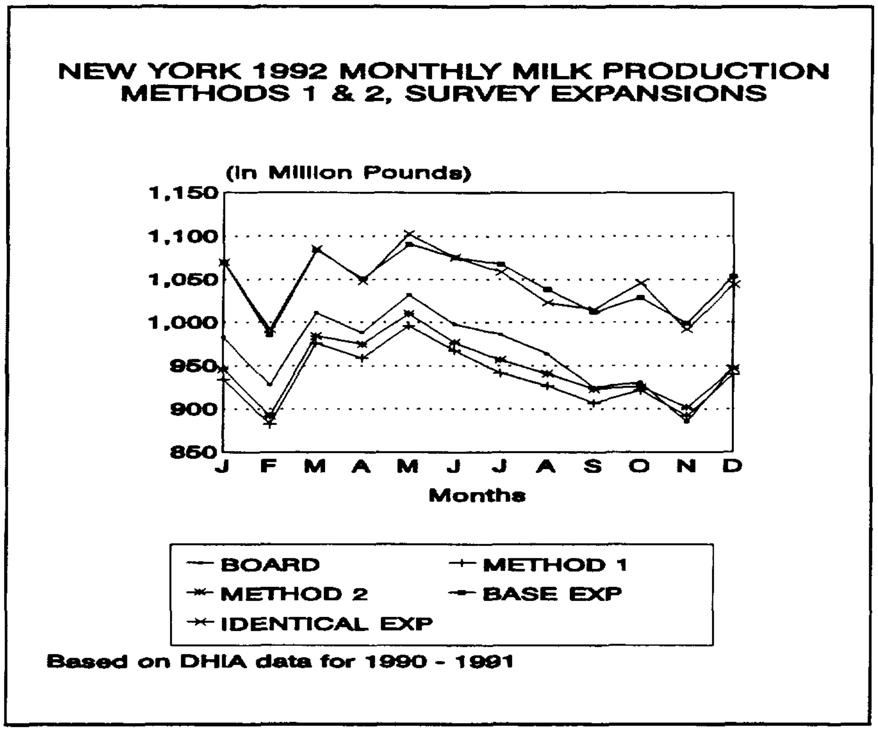

Figure 5

DISCUSSION AND RECOMMENDATIONS

This paper examined the feasibility of using DHIA data to develop regression models for estimating monthly milk production, including estimates for the number of cows and the monthly milk per cow. DHIA data for 1990 and 1991 were used for three States to develop regression models. Estimates for monthly milk production for 1992 were obtained for these three States, and those estimates were compared to the ASB estimates to evaluate model performance.

Results from Michigan and Ohio strongly support the notion that reliable regression models can be developed to provide estimates of monthly milk production. Results from New York show that those models developed based only on the unadjusted DHIA data were not adequate for estimating monthly milk production. Model performance in New York was greatly enhanced when this data were adjusted to a monthly basis, and only then did the models perform at an acceptable level.

These experiences illustrate that available DHIA data needs to be reviewed in detail for each State. Adequately performing regression models can be found for States with DHIA data similar to Michigan and Ohio. However, the manner of adjusting certain values of DHIA data variables needs to be addressed for States with DHIA data similar to New York in order to produce reliable models.

The models developed in this study were based on two years of DHIA data and used to estimate monthly milk production for an entire year. All models were statistically significant, and all partial tests on the independent variables were statistically significant for the two-variable models.

If this approach goes operational, the development and application of these models needs further review. For example, regression models for each State in this program could be developed each month, where results from the previous month could be used to update model coefficients. If this regression approach is used in conjunction with a quarterly non-probability dairy survey, then these quarterly survey expansions could also be used as dependent predictor variables.

Initially, models should be developed on an individual State basis. With just two years of DHIA data available, models with different variables for the three States were found to be the "best" performing models as a result of the model search routines. As more data becomes available for model building during the use and implementation of this approach, more State specific variables will appear in the model building routines. Also, variables related to time and seasonality will become more significant, and these will vary by State.

If all twenty-one monthly estimating States were in this type of program, then regional models could be developed to set regional estimates prior to making State estimates. This action is dependent on time and personnel available to develop, implement and maintain this process.

If all monthly estimating State were operating in this program with a quarterly non-probability survey, substantial benefits would be realized by NASS from reduced respondent burden and lower postage costs. If all States were only mailing quarterly surveys, approximately $90,000 to $100,000 of postage could be saved. By mailing to these dairy operators only four times a year, then these operators are spared an extra eight contacts for the year.

The authors recommend that this procedure be implemented on a State by State basis as DHIA data becomes available. This regression estimating approach would be done in conjunction with quarterly non-probability dairy surveys that would assist with making estimates on the overlapping months and provide a "benchmark" for the regression estimates for the follow-on months.

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APPENDIX A: ANALYSIS OF VARIANCE TABLES FOR MICHIGAN, OHIO, AND NEW YORK FOR EACH MODEL

Monthly Milk Production

State = Michigan

Dependent Variable: OF_TOMLK

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	5128.17263	2564.08632	108.388	0.0001
Error	21	496.78570	23.65646		
C Total	23	5624.95833			

Root MSE	4.86379	R-square	0.9117
Dep Mean	437.04167	Adj R-sq	0.9033
C.V.	1.11289		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	101.066481	27.12139252	3.726	0.0012
TIME	1	-0.806875	0.15187731	-5.313	0.0001
TOTALMLK	1	2.254985	0.15324557	14.715	0.0001

State = Ohio

Dependent Variable: OF_TOMLK

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	7252.36923	7252.36923	104.265	0.0001
Error	22	1530.25577	69.55708		
C Total	23	8782.62500			

Root MSE	8.34009	R-square	0.8258
Dep Mean	390.12500	Adj R-sq	0.8178
C.V.	2.13780		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	46.424507	33.70277324	1.377	0.1822
TOTALMLK	1	2.475634	0.24244717	10.211	0.0001

State = New York

Dependent Variable: OF_TOMLK

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	36777.35720	18388.67860	45.780	0.0001
Error	21	8435.14280	401.67347		
C Total	23	45212.50000			

Root MSE	20.04179	R-square	0.8134
Dep Mean	922.75000	Adj R-sq	0.7957
C.V.	2.17196		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	589.856337	106.92101647	5.517	0.0001
UHERDS	1	-0.572431	0.11260713	-5.083	0.0001
OMILKADJ	1	15.146004	1.61620901	9.371	0.0001

Monthly Number Of Milk Cows

State = Michigan

Dependent Variable: OF_COWS

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	86493342.932	86493342.932	165.971	0.0001
Error	22	11464990.401	521135.92732		
C Total	23	97958333.333			

Root MSE	721.89745	R-square	0.8830
Dep Mean	342791.66667	Adj R-sq	0.8776
C.V.	0.21059		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	303641	3042.5478110	99.798	0.0001
UNOFHERD	1	67.487247	5.23848709	12.883	0.0001

State = Ohio

Dependent Variable: OF_COWS

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	167536298.79	83768149.394	61.408	0.0001
Error	19	25918246.667	1364118.2456		
C Total	21	193454545.45			

Root MSE	1167.95473	R-square	0.8660
Dep Mean	338545.45455	Adj R-sq	0.8519
C.V.	0.34499		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	523765	63423.729319	8.258	0.0001
TIME	1	-726.621657	138.23193122	-5.257	0.0001
AVG2COWS	1	-1.220027	0.53745410	-2.270	0.0350

State = New York

Dependent Variable: OF_COWS

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	1159076913.6	579538456.78	22.773	0.0001
Error	19	483513995.54	25448105.028		
C Total	21	1642590909.1			

Root MSE	5044.61148	R-square	0.7056
Dep Mean	761136.36364	Adj R-sq	0.6747
C.V.	0.66277		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	719148	35120.073242	20.477	0.0001
UHERDS	1	166.982671	28.03822998	5.956	0.0001
OMLK2ADJ	1	-5622.905814	1511.9083940	-3.719	0.0015

Monthly Milk Per Cow

State = Michigan

Dependent Variable: OF_MOMPC

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	40880.83146	40880.83146	170.687	0.0001
Error	22	5269.16854	239.50766		
C Total	23	46150.00000			

Root MSE	15.47604	R-square	0.8858
Dep Mean	1275.00000	Adj R-sq	0.8806
C.V.	1.21381		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	282.982357	75.99670694	3.724	0.0012
AVGMMPC	1	0.675493	0.05170358	13.065	0.0001

State = Ohio

Dependent Variable: OF_MOMPC

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	65399.16526	65399.16526	104.664	0.0001
Error	22	13746.66807	624.84855		
C Total	23	79145.83333			

Root MSE	24.99697	R-square	0.8263
Dep Mean	1150.41667	Adj R-sq	0.8184
C.V.	2.17286		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-90.378154	121.39065428	-0.745	0.4644
MOMLKPCW	1	0.837762	0.08188828	10.231	0.0001

State = New York

Dependent Variable: OF_MOMPC

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	2	70730.95209	35365.47605	141.062	0.0001
Error	21	5264.88124	250.70863		
C Total	23	75995.83333			

Root MSE	15.83378	R-square	0.9307
Dep Mean	1214.58333	Adj R-sq	0.9241
C.V.	1.30364		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	623.632150	88.61792496	7.037	0.0001
UHERDS	1	-0.606455	0.08569996	-7.076	0.0001
UMLKADJ	1	55.218339	3.35503594	16.458	0.0001

APPENDIX B: AGRICULTIRAL STATISTICS BOARD (ASB) ESTIMATES, REGRESSION AND SURVEY INDICATIONS FOR MILK PRODUCTION FOR 1992

Table 1: Michigan Indications and ASB Estimates (in Million Pounds)

MONTH	ASB	METHOD 1 (2 YRS)	METHOD 2 (2 YRS)	BASE EXP	IDENTICAL EXP
January	450	450	444	467	460
February	429	427	428	439	429
March	460	455	453	463	456
April	443	440	440	458	452
May	463	457	458	511	505
June	458	457	455	491	483
July	466	472	464	506	502
August	459	465	459	491	487
September	445	438	437	459	456
October	447	447	445	457	451
November	428	429	427	436	432
December	449	450	444	448	449

Table 2: New York Indications and ASB Estimates (in Million Pounds)

MONTH	ASB	METHOD 1 (2 YRS)	METHOD 2 (2 YRS)	BASE EXP	IDENTICAL EXP
January	983	934	946	1070	1070
February	928	882	892	986	992
March	1011	976	984	1084	1086
April	988	959	975	1051	1048
May	1032	996	1010	1091	1103
June	998	968	977	1076	1076
July	986	942	957	1068	1059
August	964	927	941	1038	1023
September	925	907	923	1012	1015
October	934	922	926	1029	1046
November	885	892	902	999	992
December	948	940	947	1054	1044

Table 3: Ohio Indications and ASB Estimates (in Million Pounds)

MONTH	ASB	METHOD 1 (2 YRS)	METHOD 2 (2 YRS)	BASE EXP	IDENTICAL EXP
January	395	408	412	429	416
February	376	388	388	395	372
March	405	415	418	406	389
April	396	400	399	415	406
May	419	415	414	445	424
June	405	400	392	422	402
July	402	395	392	368	368
August	388	381	387	378	420
September	376	376	370	363	400
October	382	391	382	360	396
November	362	373	369	335	391
December	384	400	395	361	418