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EFFECTS OF A NEW AREA SAMPLING FRAME ON LEVELS OF ESTIMATES

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ABSTRACT

Effect of a new area frame on levels of area expansions are investigated. No significant evidence of changes in the levels of the expansions were detected.

Keywords: stratified sampling, post-stratification, sampling errors

This paper was prepared for limited distribution

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SUMMARY

Analysis relative to the new (1989) area sampling frames for Iowa and West Virginia is performed to determine if there is evidence of potential changes in the levels of estimates due to replacing old frames. No evidence of significant new frame induced changes in levels of estimates were detected for any item in any state.

INTRODUCTION

Each year the Area Frame Section of the National Agricultural Statistics Service (NASS) constructs new area sampling frames for two to four States. The frames are used to conduct surveys for crop acreages, cost of production, farm expenditures, livestock inventories and other items. When a new frame is first used, there is concern about potential change in the level of estimates due solely to using the new frame. The purpose of this analysis is to determine if there is any evidence of such change.

BACKGROUND

Two states were included in this study: Iowa and West Virginia. Descriptions of the old and new Iowa and West Virginia area frame designs are given in the tables below for documentation and contrast.

Table 1. The OLD Iowa Area Frame Design

Stratum	Sample Size	Number of Substrata	Stratum Definition
11	36	9	ASD 10 and any % cultivated
12	32	8	ASD 20 and any % cultivated
13	32	8	ASD 30 and any % cultivated
14	40	10	ASD 40 and any % cultivated
15	36	9	ASD 50 and any % cultivated
16	32	8	ASD 60 and any % cultivated
17	28	7	ASD 70 and any % cultivated
18	24	6	ASD 80 and any % cultivated
19	28	7	ASD 90 and any % cultivated
3	8	4	Agri-urban
4	2	1	Residential-commercial
Total	298		

Table 2. 1989 Iowa Area Frame Design Information

Stratum	Sample Size	Number of Substrata	Stratum Definition
13	238	14	75-100% cultivated
20	48	6	25-74% cultivated
31	8	1	Agricultural-urban
32	4	1	Residential-commercial
40	8	1	Woodland-range
50	2	1	Non-agricultural
Total	308		

Table 3. The OLD West Virginia Area Frame Design

Stratum	Sample Size	Number of Substrata	Stratum Definition
13	83	.	33-100% cultivated
22	132	.	0-32% cultivated
31	5	.	Agri-urban
32	4	.	Residential-commercial
42	26	.	Woodland-range
Total	250		

Table 4. 1989 West Virginia Area Frame Design Information

Stratum	Sample Size	Number of Substrata	Stratum Definition
13	25	5	50% or more cultivated
20	35	7	15-49% cultivated
31	10	2	Agricultural-urban
32	5	1	Residential-commercial
40	85	17	Woodland-range
50	5	1	Non-agricultural
Total	165		

New area sampling frames for Iowa and West Virginia were constructed for first use in the 1989 June Agricultural Survey (JAS). The primary stratification is based on land-use classification described by Cotter and Nealon [1]. Geographic substratification within primary strata is also used. A replicated sample design is used within each state. Sample sizes are based primarily on a multivariate optimum allocation program. Use of the allocation program is described by Mergerson [2]. One of the required sets of input is estimated stratum-level standard deviations. Sample units (segments) from the old area sampling frame are post-stratified into new frame strata. Estimated stratum-level standard deviations for the new frame along with means and other statistics are computed from these segments. The stratum-level means and standard deviations are used to compute estimates and coefficients of variation (CVs) relative to the new frames.

ANALYSIS

Analysis items in Iowa were planted acreages of corn, soybeans and oats, harvested acreages of alfalfa and tract hogs. Analysis items in West Virginia were planted acreages of corn, oats and winter wheat. Both 1987 and 1988 JAS data were used for Iowa. Only 1987 data were used for West Virginia since the allocation analysis for West Virginia was performed prior to the 1988 JAS. Old frame estimates are compared to the new frame (post-stratified) estimates. To compute post-stratified estimates, old frame segments are located relative to new frame strata. Using old frame data and new frame stratum-expansions, comparable new frame estimates are obtained. Each pair of estimates are based on the same set of sample units. Corresponding estimates and CV's for each analysis item in each State are presented in tables 5, 6 and 7.

Table 5. A Comparison of Old Frame Estimates to New Frame Estimates Using 1988 Iowa JAS Data

Item	Old Frame 1988 JAS Estimates (millions)	CV's (%)	New Frame 1988 Post Stratified Estimates (millions)	CV's (%)	Percent Change In Estimates
Corn	11.3	2.6	11.5	2.3	1.8
Soybeans	7.9	3.7	8.1	3.6	2.5
Oats	2.1	5.0	2.1	5.5	-
Alfalfa	1.3	7.8	1.3	8.8	-
Tract Hogs	14.2	11.7	14.9	12.8	4.9

Table 6. A Comparison of Old Frame Estimates to New Frame Estimates Using 1987 Iowa JAS Data

Item	Old Frame 1987 JAS Estimates	CV's	New Frame 1987 Post Stratified Estimates	CV's	Percent Change In Estimates
	(millions)	(%)	(millions)	(%)	
Corn	10.2	2.9	10.4	2.5	2.0
Soybeans	7.9	3.7	8.1	3.6	2.5
Oats	4.3	4.1	4.3	4.1	-
Alfalfa	1.3	7.7	1.3	9.0	-
Tract Hogs	11.1	12.5	11.5	10.9	3.6

Table 7. A Comparison of Old Frame Estimates to New Frame Estimates Using 1987 West Virginia JAS Data

Item	Old Frame 1987 JAS Estimates	CV's	New Frame 1987 Post Stratified Estimates	CV's	Percent Change In Estimates
	(000)	(%)	(000)	(%)	
Corn	83.6	20.6	81.4	18.6	-2.6
Oats	11.1	36.9	14.6	32.3	31.5
Wheat	9.1	34.1	8.8	34.5	-3.3

All corresponding estimates are within a standard error of each other. This implies there are no significant differences in the levels of any of the corresponding estimates. In Iowa two were identical (rounded) and the other three did not differ by more than 5%. In West Virginia the percentage difference varied from -3.3% for wheat to 31.5% for oats. However, due to the large sampling errors for oats the difference was not statistically significant.

Some new frame CVs are greater than corresponding old frame CVs (Iowa 1988 - oats, alfalfa and tract hogs, Iowa 1987 - alfalfa and West Virginia 1987 - wheat). Some other new frame CVs are only slightly less than corresponding old frame CVs. Relative to improved precision, one might question the justification for constructing a new frame for Iowa. However, other factors were considered in addition to precision.

Projected 1989 new frame CVs and actual 1989 CVs are shown in the table below for documentation and contrast.

Table 8. A Comparison of Projected CVs to 1989 Actual CVs

Item	Coefficients of Variation (CVs %)				
	Iowa			West Virginia	
	1987 Based Projection	1988 Based Projection	1989 Actual	1987 Based Projection	1989 Actual
Alfalfa	9.0	8.8	6.5		
Corn	2.5	2.3	2.1	18.6	14.5
Hogs	10.9	12.8	12.0		
Oats	4.1	5.5	6.2	32.3	30.1
Soybeans	3.6	3.6	2.9		
Wheat				34.5	35.3

CONCLUSIONS

There is no significant evidence of new frame induced changes in levels of estimates for the new Iowa and West Virginia area sampling frames. Each year, after area frames are constructed and sample units are allocated to strata, analysis should be performed to determine if there is any evidence of changes in the level of estimates due to the new area sampling frame. Sample units from the old frame would be post-stratified relative to the new frame to obtain comparable estimates and variances.

REFERENCE

[1] Cotter, J. and Nealon, J., 1987, *Area Frame Design For Agricultural Surveys.* National Agricultural Statistics Service, Washington, D.C.

[2] Mergerson, J.W., 1988, *A Guide To Computing Multivariate Optimal Allocations,* National Agricultural Statistics Service, Washington, D.C.