THE EFFECT OF LAND QUESTIONS ON THE MULTIPLE FRAME HOG SURVEY

KANSAS 1974 DECEMBER MULTIPLE FRAME HOG SURVEY

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PROBLEM

One serious problem with the SRS multiple frame questionnaire involves the questions on land operated. The reporting unit for the multiple frame survey is *all* livestock, regardless of ownership, on *all* the land which the respondent operates at the time the questionnaire is filled out. For the SRS multiple frame surveys, the assumption is now made that in order to make the respondent report livestock correctly he must consider all land that he operates. The land that the respondent operates is obtained from a series of land questions placed at the beginning of the questionnaire. These questions involve acres owned, acres rented, acres managed, and acres rented out. However, a problem arises because some respondents are sensitive to land questions on livestock surveys. The use of land to construct the reporting unit for livestock may not always be clear to respondents. Accordingly, interviewers often ask the livestock questions first and then ask the land questions, or interviewers sometimes omit the land questions entirely. When this happens the purpose of the land questions is lost.

Whether the land questions achieve their purpose of establishing the reporting unit to the respondent has never been tested. For example, although a respondent correctly reports all the land he operates, does he then report all livestock on those acres *regardless of who owns the livestock?* The Nebraska Study[1/] as well as informal interviews with farmers in other states indicates that *no matter what a respondent reads on a questionnaire, or hears an interviewer say,* he often makes one of two reporting errors:

1. he does not report livestock which is on his land but is owned by someone else.

2. he does report all of his livestock even if they are on someone else's land.

Even if these two reporting errors offset each other, the point is that the land questions may not prevent these two reporting errors and may increase the refusal rate if the respondent does not have a clear understanding of why the reporting of land is important on a hog survey.

OBJECTIVES

The primary purpose of this study is to test whether placing the land questions at the end of the questionnaire:

1. changes the estimates of total number of hogs reported or the total acres of land reported.

2. increases response.

1/ Survey Concept Study - Research Division

Suppose the land questions do not affect the estimates. Then is this suppostion true because the land questions *are* clarifying the reporting unit to the respondent or because the reporting errors offset each other? An original intention of this study was to answer this question. Therefore, two "check" questions are at the end of the test questionnaire to identify the occurrence of either of the two reporting errors defined in the problem section. (See Appendix for a copy of the test questionnaire).

A series of "check" questions is also a possible *alternative* to the land questions. Only a small percentage of the respondents are in a situation where the two reporting errors may occur. "Check" questions would determine who these respondents are, and then explicit questions would prevent any reporting errors. Thus, the test questionnaire should also provide an idea of the efficiency of using "check" questions *instead of* land questions.

Unfortunately, the purposes of these two "check" questions were never realized in this project. On the mail questionnaire, they were often left unanswered, and during interviews respondents often had trouble understanding these two questions. Although the general idea of "check" questions may be sound, the two specific "check" questions used in this case were generally not successful.

PROCEDURES

The objective of this study was to compare a standard questionnaire with land questions at the beginning to a test questionnaire with land questions at the end. Both were used during the same survey--the December 1974 Hog Multiple Frame Survey in Kansas. The nonoverlap domain and the extreme operator strata were not included in the analysis because these groups had their own special questionnaires. Below are the number of names selected for both samples. The number for the test questionnaire was approxomately half the number for the standard questionnaire.

Number of Names Selected for Each Sample

Stratum	Standard Questionnaire	Test Questionnaire
No livestock	222	111
No hogs	373	188
1-99 hogs	347	174
100-199 hogs	181	90
200+ hogs	264	132
TOTAL	1387	695

The following null hypotheses, H_1^0, H_2^0, and H_3^0, were tested against their corresponding alternatives, H_1^A, H_2^A, H_3^A:

H_1^0: There is no significant difference in total number of hogs reported on the two questionn ire versions.

H_1^A: There is a significant difference in total number of hogs reported on the two questionnaire versions.

H_2^0: There is no significant difference in total acres of land.

H_2^A: There is a significant difference in total acres of land reported on the two questionnaire versions.

H_3^0: There is no significant difference in response rates between the two questionnaire versions.

H_3^A: The test questionnaire yields a higher response rate than the standard questionnaire.

The tests of the first two hypotheses, H_1^0 and H_2^0, are two-sided tests while the test of H_0^3 is a one-sided test.

Also included in the results is a table showing joint land the respondents included in the land they operated and of hogs on the joint land the respondents included with the hogs on the land they operated. Finally, there are tables of the percentage changes due to editing.

Interviewers were instructed to follow the questionnaires exactly. Therefore, omissions of land questions or other similar changes in procedure that interviews may have been using in the past hopefully would not affect the comparison of the questionnaire designs for this survey.

ANALYSIS

In Table 1 are the direct expansions and variances for the data from the standard questionnaire and the test questionnaire while in Table 2 are the differences between the two sets of data and the corresponding t-values. As noted before, all testing in this report was done excluding the nonoverlap and extreme operator strata. Only the five strata shown in the tables were used for the tests. Clearly, the samples for the standard questionnaire and the test questionnaire were independent. The t-values were computed assuming equal variances for corresponding strata. Because the variances were not equal from stratum to stratum, Welch's approximation was used for the degrees of freedom of the test. As one sees from Table 2, the largest difference in estimates occurred in the second largest stratum. Despite this stratum, the overall t-test was not significant at a 10 percent level. The last column in Table 2 gives α_{Data} where α_{Data} is the level at which the test statistic computed from the data is significant. Practically, this meant that the test statistic of 1.27 is significant at the 20 percent level.

Table 1.--Total number of hogs reported on the December 1974 Kansas Multiple Frame Hog Survev*

Stratum	Standard questionnaire			Test questionnaire		
	Direct expansion of total number of hogs (000)	Standard error of total number of hogs (000)	Coefficient of variation of total number of hogs (%)	Direct expansion of total number of hogs (000)	Standard error of total number of hogs (000)	Coefficient of variation of total number of hogs (%)
No livestock.....	97.0	75.4	77.7	8.2	7.8	95.1
No hogs.....	103.7	42.6	41.1	64.9	33.2	51.2
1 - 99 hogs.....	243.3	23.4	9.6	236.0	30.5	12.9
100 - 199 hogs.....	247.2	20.6	8.3	179.6	23.6	13.1
200+ hogs.....	536.2	40.3	7.5	541.2	48.4	8.9
Total list.....	1,227.4	100.5	8.2	1,029.9	70.7	6.9

*Does not include values from the nonoverlap domain or the extreme operator strata.

Table 2.--Tests on total number of hogs reported on the December 1974 Kansas Multiple Frame Hog Survey*

Stratum	Direct expansion of standard questionnaire-direct expansion of test questionnaire (000)	Standard error of the difference in direct expansions (000)	T-value	α_{Data}**
No livestock.....	88.8	104.4	0.848	.40
No hogs.....	38.7	63.0	0.615	.55
1 - 99 hogs.....	7.3	39.5	0.185	.86
100 - 199 hogs.....	67.6	34.0	1.99***	.05***
200+ hogs.....	-5.0	67.1	0.074	.96
Total list.....	197.4	155.6	1.27	.20

$$|t_{.05}| = 1.96$$

$$|t_{.10}| = 1.645$$

*Does not include values from the nonoverlap domain or the extreme operator strata.
**Significance level attained by the data.
***Significant at the 5 percent level.

Standard Error of Difference $= \sqrt{\frac{s^2}{n_1} + \frac{s^2}{n_2}}$ where s^2 is the pooled variance, and n_1 and n_2 are the respective sample sizes of the standard and test questionnaires.

Table 6.--Non-response rates for the December 1974 Kansas Multiple Frame Hog Survey*

Stratum	Standard questionnaire					Test questionnaire				
	Refusals			Inaccessible**	Total**	Refusals			Inaccessible**	Total**
	Mail**	Telephone**	Interview**			Mail**	Telephone**	Interview**		
No livestock.....		8		17	25	1	1	1	6	9
		3.6		7.7	11.3	0.9	0.9	0.9	5.4	8.1
No hogs.....		20	3	14	37		6		2	8
		5.4	0.8	3.8	10.0		3.2		1.1	4.3
1 - 99 hogs.....	1	23	8	5	37		14	2	4	20
	0.3	6.6	2.3	1.4	10.6		8.0	1.1	2.3	11.5
100 - 199 hogs.....		16	3	3	22		6	5	2	13
		8.8	1.7	1.7	12.2		6.7	5.6	2.2	14.4
200+ hogs.....		39	9	7	55	1	2.1	5	3	30
		14.8	3.4	2.7	20.9	0.8	15.9	3.8	2.3	22.7
Total.....	1	106	23	46	176	2	48	13	17	80
	0.0	7.6	1.7	3.3	12.7	0.3	6.9	1.9	2.4	11.5
Total percentages weighted by each stratum***.....	0.0	5.5	0.9	4.5	10.8	0.5	3.7	0.7	2.3	7.2

*Does not include values from the nonoverlap domain or the extreme operator strata.

**Top numbers = number of observations. Bottom numbers = percent of total selected sample size.

***This weighted total percentage is: $\sum_{n=1}^{5} W_n P_n$ where W_n is the proportion of the population in stratum n and P_n is the non-response rate for stratum n.

Our t-statistic is t = -2.37 which has a 1 percent significance. *Thus, without significantly changing the land and hog estimates at a 10 percent level, the test questionnaire significantly increases the response rate.* Although this increase was good, one should note that the improvement in the response rate for the test questionnaire was in the "no livestock" and "no hogs" strata and so their twc weights were much larger in the above formula than the weights of the other three strata. Therefore, for the *list* population, the response rate for the test questionnaire is higher.

The response rates on the mail questionnaires are also compared because no interviewer effects complicate this comparison. For the mail questionnaires, the percentages were:

Standard questionnaire:	$P_s = 27.95$
Test questionnaires:	$P_t = \underline{33.10}$
Difference	-5.15

Out t-statictic in this case is t = -1.88 which has a 3 percent significance. Thus, one has the same result in both response rate tests. One rejects the hypothesis that the two questionnaire versions yield equal response rates and accepts the alternative hypothesis that *the test questionnaire yields a higher response rate than the standard questionnaire.*

Tables 7 and 8 contain the acreage of joint land included by the respondent with his total land and the number of hogs on these joint acres included in the total hogs figure. Most of these hogs on joint acreage were a relatively few large items. All of the hogs on joint land were included in the "total hogs on land operated by the respondent" question. The total hogs owned by the respondent was edited to eliminate the hogs on joint land. These edits are some of the edits considered in Table 9.

One measure of the efficiency of a questionnaire design is the amount of editing of the data. Thus, the percentage changes due to editing are compared for the data from the standard questionnaire and the data from the test questionnaire. Tables 9, 10, and 11 contain the percentage changes due to editing for the estimates of the total number of hogs reported, the estimates of the expected number of farrowings and the estimates of the previous number of farrowings. Relative to other surveys made by SRS, the hog multiple frame surveys usually require little editing. In fact, most of the percentage changes for the December 1974 Kansas Multiple Frame Hog Survey are below 6 percent. When percentages are this low, it is difficult to use them as evidence of the superiority of one questionnaire design over another. For example, the data from the standard questionnaire had a 1.5 percent change in the total number of hogs estimated and the data from the test questionnaire has a 5.1 percent change. However, the difference was not large enough to believe that it was caused by the questionnaire design. The difference may be an effect of random sampling. Furthermore, one questionnaire version does not consistently have a smaller percentage of editing than the other. Therefore, there was no difference detected between the two questionnaire versions in regard to the amount of editing.

Table 7.--Joint land and hogs on joint land for the standard questionnaire on the December 1974 Kansas Multiple Fram Hog Survey*

Stratum	Acres of joint land (000)	Acres of joint land included (000)	Number of pigs on joint land (000)	Number of pigs on joint land included in total number of hogs (000)
No livestock	295.8	226.6	0	0
No hogs	2,021.4	1,254.1	0	0
1 - 99 hogs	242.9	150.7	8.7	8.7
100 - 199 hogs	99.6	68.9	7.9	7.9
200+ hogs	80.7	80.7	11.5	11.5
Total list	2,740.4	1,781.0	28.1	28.1

*Does not include values from the nonoverlap domain or the extreme operator strata.

Table 8.--Joint land and hogs on joint land for the test questionnaire on the December 1974 Kansas Multiple Frame Hog Survey*

Stratum	Acres of joint land (000)	Acres of joint land included (000)	Number of pigs on joint land (000)	Number of pigs on joint land included in total number of hogs (000)
No livestock.....	337.8	123.7	0	0
No hogs.....	3,450.7	690.5	79.6	79.6
1 - 99 hogs.....	239.0	217.2	17.8	17.8
100 - 199 hogs.....	85.8	85.8	0	0
200+ hogs.....	221.1	199.7	24.1	24.1
Total list.....	4,334.5	1,317.2	121.5	121.5

*Does not include values from the nonoverlap domain or the extreme operator strata.

Table 9.--Percentage changes due to editing the total number of hogs reported for the 1974 Kansas Multiple Frame Ho Survey*

Edit code	Standard questionnaire (%)	Test questionnaire (%)
20	-0.30	+0.48
21	-0.08	0.00
23	-0.01	0.00
24	0.00	-0.09
25	0.00	-0.02
45	-0.06	0.00
200	+2.07	+5.09
300	0.00	-0.37
Total	+1.62	+5.09

20--Total hogs and pigs not equal to sum of classes. (This reason does not apply if other editing caused the prices not to add).
21--Pigs on hand from previous farrowings greater than market hogs < 120 pounds. Market hogs increased.
22--Market hogs < 120 pounds decreased because > pigs on hand from previous farrowings.
23--15 sows reported on Item 331 and 6 on Item 301 - decided there were 21 sows in all.
24--Edit action due to 20 and 21.
25--Sows and gilts used for breeding less than expected farrowings.
200--Prorated for operation description.
300--Added animals because of Question 19 or 20.

*Does not include changes from the nonoverlap domain or extreme operator strata.

Table 10.--Percentage changes due to editing the expected farrowings reported for the 1974 Kansas Multiple Frame Hog Survey*

Item	Edit code	Standard questionnaire (%)	Test questionnaire (%)
Expected farrowings in December, January, and February	30	+0.46	+0.50
	32	-0.16	0.00
	200	+2.70	+0.27
	Total	+3.00	+0.77
Expected farrowings in March, April, and May	30	+1.32	+0.81
	32	-0.18	-0.54
	200	+4.79	+2.22
	Total	+5.94	+2.49

30--Expected farrowings exceed sows and gilts for breeding.
32--Farmer didn't know when his hogs would farrow but knew they all would.
200--Prorated for operation description.

*Does not include changes from the nonoverlap domain or extreme operator strata.

Table 11.--Percentage changes due to editing the previous farrowings reported for the 1974 Kansas Multiple Frame Hog Survey*

Item	Edit code	Standard questionnaire (%)	Test questionnaire (%)
Farrowings in September, October, and November	43	+0.29	0.00
	44	+1.70	-0.36
	200	+2.21	+1.54
	Total	+4.20	+1.19
Pigs from farrowings in September, October, and November now on hand	40	+0.61	+0.80
	41	-0.05	0.00
	46	-0.50	-3.52
	200	+1.04	+1.90
	Total	+1.10	-0.82
Pigs from farrowings in September, October, and November now on hand	42	+3.00	-14.00
	46	-1.93	0.00
	200	+1.93	0.00
	Total	+3.00	-14.00

40--Changed pigs on hand to reflect litter rates.
41--Pigs on hand previous farrowings > < market hogs < 120 pounds.
42--Changed pigs sold to reflect litter rate.
43--Farmer summed total hogs in 326.
44--Changed number of sows farrowed to reflect litter rates.
46--Man wrote in "all" and number of market hogs < 120 was edited in as pigs from farrowings or as pigs sold.
200--Prorated for operation description.

*Does not include changes from the nonoverlap domain or extreme operator strata.

This study compares a test questionnaire with land questions at the end to the standard questionnaire with land questions at the beginning. At a strict 10 percent level one would accept the following hypotheses:

H_1^0: There is no significant difference in the total number of hogs reported on the two questionnaire versions.

H_2^0: There is no significant difference in the total acres of land reported on the two questionnaire versions.

H_3^A: The test questionnaire yields a higher response rate than the standard questionnaire.

In effect, the test questionnaire does not affect the estimate but does increse the response rate. However, as discussed in the ANALYSIS section, one does not totally accept a conclusion by whether a test statistic is significant or is not significant. The t-value calculated from the data for the test of H_1^0 was high--t = 1.27. *This t-value was not high enough to use as evidence of a significant difference in the estimates, but high enough to be alarming.* The test of H_2^0 yields a similar result.

The test of equal response rates was significant for both the overall response rates and also the mail response rates. The test questionnaire has the higher response rates in both cases. However, these increases in response rates for the test questionnaire were in the "no livestock" and "no hogs" strata. These are two strata where the respondent is likely to have no or few hogs. Although any increase in a response rate is good, one prefers the improvement be in the other three strata because a larger part of the estimates comes from them.

The percentage changes in estimates due to editing indicate the efficiency of the questionnaire. In this study, the percentage changes were too small to signify a difference in the efficiency of the two questionnaire versions.

The comparison of the test and standard questionnaires in this study was for *one state at one point in time.* There is no need to state the possible effects this limitation may have on any conclusions. Obviously, more comparisons should be made for other states at other points in time. The results shown here were not persuasive enough by themselves to make any conclusions about which questionnaire was better for all the multiple frame states. For Kansas in December 1974, we conclude:

1. The response rates were significantly increased on the test questionnaire.

2. There was no proven difference in the estimates of total hogs reported.

APPENDIX: A copy of the test questionnaire for the December 1974 Kansas Multiple Frame Hog Survey (Interview Questionnaire).

C.E. 11-0088k
U. S. DEPARTMENT OF AGRICULTURE
Statistical Reporting Service

(40) O. M. B. Number 40-R3774
Approval Expires 3-31-75

I(a) Kan.

HOG AND PIG INQUIRY – December 1, 1974

Mr. _____, I am _____
from _____. We publish reports on Hogs and Pigs four times a year. We are now making the December 1, Survey and your name was selected in a sample of farmers in this State. Your report is confidential and used only in combination with reports from other producers to arrive at State estimates.

Is your operation known by any name other than _____? *(Read above name to respondent.)*

☐ NO ☐ YES Enter name _____

RESP. CODE (CIRCLE ONE)	
20	Telephone
30	Interview
70	Telephone Refusal
80	Interview Refusal
90	Inaccessible (explain)

OFFICE USE

111	ISUBSTRATUM	RESP.	
00	___	___	1

(Please turn to page 2.)

HOG AND PIG INVENTORY

1. Do you or anyone else have any **HOGS** or **PIGS** on the land you now operate?

☐ Yes No ☐

2. Since September 1, 1974 did you or anyone else have any **HOGS** or **PIGS** on the land you now operate?

YES ☐ *Skip to question 9.*

NO ☐ *Skip to question 12.*

Now I want to ask you about the Hogs and Pigs on the land you operate, regardless of ownership. First I would like to ask about **HOGS** and **PIGS KEPT FOR BREEDING.**

3. How many are:...

a. **SOWS, GILTS** and **YOUNG GILTS** for breeding? *(Include those bred and to be bred.)*..... 301

b. **BOARS** and **YOUNG MALES** to be used for breeding?..... 302

c. **SOWS** and **BOARS** no longer used for breeding?..... 303

Now let's talk about the **HOGS** and **PIGS** for **MARKET** and **HOME USE** on the land you operate. *(Exclude breeding hogs already reported.)*

4. How many are:...

a. Under 60 pounds? *(Include pigs not yet weaned.)*..... 311

b. 60 – 119 pounds?..... 312

c. 120 – 179 pounds?..... 313

d. 180 – 219 pounds?..... 314

e. 220 pounds and over? *(Exclude hogs no longer used for breeding.)*..... 315

5. *Add questions 3a through 4e:* Then the **total hogs and pigs** now on the land you operate is..... 300

Is that correct?

YES ☐ *Continue.* NO ☐ *Correct answers in 3, 4 and 5.*

EXPECTED FARROWINGS

6. How many of the _____ **SOWS** and **GILTS** are **EXPECTED TO FARROW:**
(question 3a)

a. From now through December 1974 and January and February 1975?..... 331

b. During March, April and May 1975?..... 332

PREVIOUS FARROWINGS

9. How many **SOWS** and **GILTS FARROWED** on the land you operate during September, October and November 1974 until now? *(If zero, skip to question 11)*..... 326

10. How many **PIGS** from these (question 9) litters are:...

a. Now on hand?..... 327

b. Already sold?..... 328

HOG AND PIG DEATHS

11. Did any **HOGS** and **PIGS** of **weaning age** and **older DIE** since September 1, 1974 on the land you operate? *(Check One)* ☐ YES ☐ NO – *Go to question 12.*

    a. How many **HOGS** and **PIGS** of **weaning age** and **older DIED** since September 1, 1974 on the land you operate? 335

HOGS AND PIGS BUTCHERED

12. How many **HOGS** and **PIGS** have been or will be **BUTCHERED** in 1974: .....

    a. On **THIS PLACE?** 336

    b. For you at a **CUSTOM BUTCHER** locker or slaughter plant? 337

LAND OPERATED NOW

Include cropland, pastureland, idleland, woodland, wasteland and non-agricultural land you now:

13. **OWN?** ..... 002 Acres

14. **RENT FROM others?** ..... 003 Acres

15. **MANAGE FOR others?** ..... 004 Acres

16. Add lines 13, 14 and 15 ..... 005 Acres

17. **RENT TO or MANAGED BY others?** ..... 006 Acres

18. *Subtract lines 17 from line 16.* Then the land you now operate is ..... 900 Acres

19. Are **all** of the **HOGS** and **PIGS** you reported in question 5 **on the land you now operate?** ☐ YES – 1 ☐ NO – 2 011

20. Are there any **HOGS** and **PIGS** on the land you now operate **not included** in question 5? ☐ YES – 1 ☐ NO – 2 012

(Please turn to page 4)

OPERATION DESCRIPTION OF LAND

21. Do you operate any agricultural land in a joint arrangement with another person? **Exclude landlord-tenant arrangements.** *(Check One)* ☐ YES – *continue.* ☐ NO – *Go to question 25.*

22. Who are the persons in the joint land arrangement with you?

a. Name _____ *(Last)* *(First)* *(Middle)*

b. Address _____ *(Street or Route)* *(City)* *(State)* *(Zip)*

c. Is he a: ☐ Partner ☐ Corporate member ☐ Manager ☐ Other _____

d. Partnership or Corporation Name _____

a. Name _____ *(Last)* *(First)* *(Middle)*

b. Address _____ *(Street or Route)* *(City)* *(State)* *(Zip)*

c. Is he a: ☐ Partner ☐ Corporate member ☐ Manager ☐ Other _____

d. Partnership or Corporation Name _____

23. How many acres are in this joint land arrangement?..... Acres 007

24. How many:...

a. Acres of joint land were included in land you now operate?..... Acres 008

b. Hogs and pigs are now on the joint land?..... Number 009

c. Hogs and pigs now on the joint land were included in question 5, page 2?..... Number 010

25. The results of this survey will be published in late December. Would you like to receive a copy? ☐ YES ☐ NO 011

That completes the survey. Another **HOG** survey will be conducted in about three months and we may need to contact you again. **Thank you for your help.**

Reported by _____ Enumerator _____

Telephone Number _____ _____ Date _____
(Area Code) *(Number)*

ENUMERATOR COMMENTS