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# A Partial Analysis of the Missouri Pig Survey Reports

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## ABSTRACT

ABSTRACT.—This study was designed to test the accuracy of the semi-annual national pig survey reports from a state, local and individual standpoint. Because the procedure involved the comparison of a large number of identical reports an opportunity also was offered to study differences in the reactions to price changes of individual farmers and producing districts. The total number of paired identical reports compared was 3,446.

Possible sources of error in the reports or their interpretation are of two general types: (1) memory bias, and (2) lack of realization of breeding intentions.

Checks on memory bias for number of sows farrowed and pigs saved showed a variable bias, for individual districts, usually positive, and in some cases quite marked. Because these errors are compensating the average for the State as a whole shows a relatively small error due to memory bias.

Intentions to breed are seldom fully realized, and the number of sows bred is practically always larger than the number farrowing, due to both physical and economic factors. For this reason the breeding intentions taken absolutely mean very little. Discrepancies between intentions and realizations for the identical reports were checked, and the intentions as expressed in each survey compared with the actual farrowings recorded in the succeeding survey. It was found that the discrepancies as shown by the comparison of identicals did not vary greatly from one period to another for the State as a whole, but there was a considerable variation between districts. There was 7 to 8 per cent failure to realize intentions for the spring farrow, and 9 to 10 per cent for the fall farrow. The identical report figures for the spring farrow check rather closely with a comparison of intentions and realizations for the State as a whole, and both indicate that realizations are considerably greater in Missouri than for the United States.

While these comparisons furnish some indication of the accuracy of the pig surveys, a better check is obtained by comparing their results with actual marketings, since this takes into account the representativeness of the sample as a whole as well as its components. This has been done for the United States by the Bureau of Agricultural Economics. A similar comparison for Missouri shows that in only one year, 1926, did the survey fail to furnish a fairly reliable indication of future marketings, although there were discrepancies as high as five per cent in 1924 and 1925. If the corrections for memory bias as obtained from the comparison of identicals had been made in the comparison of the survey results with hog marketings, the reliability of the reports as an indicator of marketings would have been improved in only two out of six years, 1924 and 1926.

The comparisons of changes in hog production in the various districts of the state indicate a wide difference according to the density of hog population. The sections of greatest production actually showed an increase in farrowings at the same time other areas showed declines. A consideration of these factors indicates that cyclic changes in hog production possibly are the result of changes in areas where hog production is a major enterprise, although the very limited period covered by the data makes such an induction purely speculative.

Differences in numbers of sows farrowed, these reports show, in many cases may be offset by differences in pigs saved per litter. The number of pigs saved per litter seems to be lowest in districts of greatest hog population. There appears to be no definite tendency for changes in hog production to be associated particularly with either the spring or fall farrows.

Little relationship between the size of the individual sow herd and increases or decreases in number of sows farrowing was observed in the spring surveys for the State as a whole, but there was a marked relation for the fall farrowings. This is true also for the individual districts, with two exceptions. While these results are possibly inconclusive, they indicate that changes in the spring pig crop result from the operations of all classes of producers, while changes in fall production are due more to the large producers, as measured by the sow herd rather than size of farm.

Only 120 identical reports could be found which had been given by the same farmers for the four surveys. Based upon this rather unsatisfactory sample, it may be tentatively concluded that continued reporting, accompanied by the receipt of hog outlook information as a reward, is not likely to offset the representativeness of the pig surveys for some time to come.

# A Partial Analysis of the Missouri Pig Survey Reports

F. L. THOMSEN AND PRESTON RICHARDS\*

## INTRODUCTION

**Objectives.**—The national pig surveys conducted by the United States Department of Agriculture in June and December of each year have been used largely as a basis for forecasting hog supplies in connection with the current hog price outlook. It has been only recently observed that the thousands of periodical reports from farmers concerning their hog production operations constitute a valuable fund of information for research.

The original purpose of this analysis was to test the accuracy of the reports as indicators of production changes, from a state, local and individual standpoint. Experience with the pig surveys over a number of years has given certain fairly definite indications of bias which are used by the Bureau of Agricultural Economics in interpreting the figures given by farmers. It may be reasonably expected, however, that this bias will change as producers become more familiar with the purposes of the survey and outlook work. This essential feature, the extent of bias, necessarily will be the subject of continuous study if the expensive pig surveys are to continue to be of value. The present study is merely one phase of this general question, and seeks to ascertain some of the constituent elements of the general bias.

It was found in addition that the extensive tabulations and pairings of the individual survey reports offered an opportunity for the study of some local and individual differences in the reactions of farmers to price changes, something about which very little is known at present, and which must be the subject of much future research in the field of agricultural prices.

A concrete example of the practical importance of such information may be given. The National Board on Swine Production Policy, a producer's organization, has been formed with the avowed purpose of stabilizing hog prices by influencing farmers with respect to their production and marketing operations. This organization may later be supplanted by other associations having the same objectives. The

\*Acknowledgment is made of the contribution of Mr. G. B. Thorne (resigned), who assisted in initiating and developing the early stages of this project.

Before publication the manuscript was reviewed by Mr. C. L. Harlan and Mr. F. K. Reed of the Bureau of Agricultural Economics. Several changes and additions suggested by them have been made.

The authors are indebted to Mr. E. A. Logan, State Statistician for Missouri, for the loan of the pig survey cards and other material used in this study.

possibilities of reaching this objective hinge, to a considerable extent, upon the character of individual producers' reactions to price changes. If the swings in production are a result of material changes by a relatively few large hog producers the problem would be much different than it would if a large number of slight changes by small producers were involved. Thus far there has been available only meagre information on the constituent elements of changes in hog supplies. The pig surveys offer one means of getting at this problem.

This is only a small part of the general study of farmers' reactions to price changes which must be made in the future. Some preliminary studies of the annual state census records for Missouri indicate the complexity of this subject. It was found extremely difficult to account for individual farmers' changes in crop acreages by changes in price, crop rotations, or any other factor. The statement that farmers follow present or past prices in planning their production programs appears to be true only in a very general way. *Since it is the individual farmer who must be reached in connection with all kinds of outlook work, it is important that we know more regarding the reactions of these individual producers.*

The second purpose, then, of this analysis of the individual pig survey reports for Missouri was to isolate as far as possible the constituent elements of changes in production which go to make up the complete figures for the State as a whole.

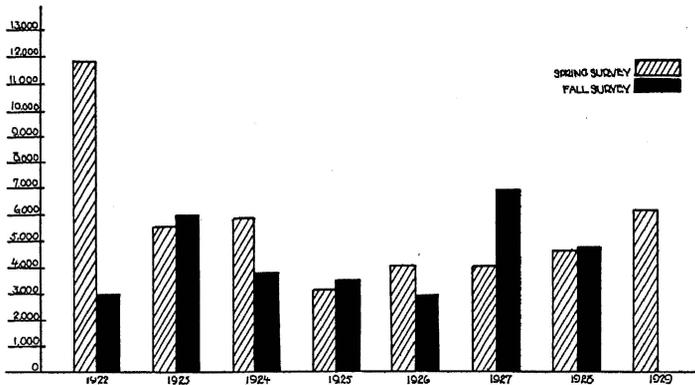


Fig. 1.—Number of farms included in Missouri pig surveys, 1922-1929.

**Sources of Error.**—The pig survey was instituted in June of 1922, when 11,829 reports were secured in Missouri. The number dropped to 2,973 in the December survey of 1922, and since then has averaged 4,711 for the spring and 4,748 for the fall surveys. (See Figure 1 and Table 1.) It is to be noted that the surveys of 1922 are not entirely comparable

TABLE 1.—NUMBER AND SIZE OF FARMS TABULATED IN PIG SURVEYS IN MISSOURI 1922-29<sup>1</sup>

Year	Spring Surveys		Fall Surveys	
	Number of Farms	Average Size of Farm in Acres	Number of Farms	Average Size of Farm in Acres
1922	11,829	143.7	2973	166.3
1923	5,596	162.4	5998	160.9
1924	5,780	160.4	3732	158.5
1925	3,162	164.6	3412	170.6
1926	4,053	164.7	2838	165.0
1927	4,060	165.0	6850	161.0
1928	5,613	183.0	5660	169.0

<sup>1</sup>From a letter to E. A. Logan, State Agric. Statistician for Missouri, from C. L. Harlan, Sr. Agric. Statistician, U. S. D. A.

with later ones, since the type of questionnaire was quite different and editing rules now in use had not been adopted.

Only the cards for June 1927 to and including December 1928 were available for the present study. These included 22,183 separate reports from individual farmers, or an average for each survey of 5,546. This sample is approximately 3.1 per cent of the total number of farms in Missouri that reported swine on their farms in the 1924 census. It represents a somewhat larger proportion of the number of farmers that keep sows and raise pigs, and a still larger proportion of the commercially important hog producers in the State.

With such a sample there are three possibilities of error. First, the reports may not be representative. A sample of this size, *if selected at random*, ordinarily would be sufficient. As a matter of fact, it is not entirely a random selection. If there are 100 farms on a route, and cards are left with 5 to 10 farmers who could be expected to fill them out and return with the least amount of trouble to the carrier, it may be that these are usually the more wide-awake producers, most likely to be giving attention to price changes. With a selective source, increasing the size of sample will not materially improve the returns if there is evidence to indicate that changes in the selective sample are not typical of the whole body of hog producers. With a selective sample that is not typical it is necessary to have other data such as marketings to check the amount and direction of the "unrepresentativeness". This would be particularly true as the years passed, since the more intelligent farmers who furnished the reports would be the ones most likely to be influenced by outlook information, which would in turn influence the latter itself, creating a vicious circle. This is all the more true, because outlook material based on the pig surveys is sent to each individual cooperator as a sort of reward.

The second possible source of error in the surveys is inaccuracies in the individual reports themselves. These may be intentional or un-

intentional. Those who have come into intimate contact with farmers in outlook activities know the many radical viewpoints which are encountered. The authors have met crop and price reporters who were ostracised by many of their neighbors who accused them of aiding the packers and grain speculators. This animosity extends quite commonly to the pig surveys. Most of these antagonists will have nothing to do with the survey, but some try to "strike back", as one farmer put it, by sending in deliberately prepared false reports.

The most probable source of error of this type arises from carelessness or poor memory or misunderstanding of the questions on the cards. Farmers, whether for or against, take such matters more seriously than many people suppose, and it is not likely that many cards are carelessly filled out. Their memories, however, are subject to the ordinary human failings, which accounts, probably, for a large part of the general bias found to prevail in connection with the reports. It is also evident that quite a proportion of farmers do not understand the questions. Most of this is due to lack of familiarity with the terms "sows farrowed" and "pigs saved".

Another possible source of error in the interpretation of the pig survey is found in connection with breeding intentions. In the June survey are reported intentions to breed for fall farrowing, and in December for spring farrowing. These intentions may not be realized for a number of reasons other than those heretofore discussed. Sows may fail to become pregnant, prices or corn supplies may change so as to cause farmers to feed out and sell the pregnant sows or gilts, and in some years cholera or other diseases may be an important influence.

Allowances for lack of realization of intentions are, of course, made so far as possible in interpreting the results of the pig surveys. The way in which realizations vary for different individuals has been one subject of study in connection with this project.

Both intentional and unintentional bias of individual reporters can be checked up by comparing cards for successive surveys filled out by identical farmers. The intentional prevaricator can hardly be expected to keep a record of his false reports, and in fact frequently shows his hand in a number of different ways familiar to state statisticians. In the study of identical cards his status will be similar to that of the unintentional false reporter, and no differentiation can be made between the two.

**Method.**—For this analysis sorts were made of the individual cards, which were then paired for different periods, as for June and December, 1927, June of 1927 and 1928, etc. The number of identicals for each combination, by districts, is shown in Table 2. The distribution of all pig survey reports, and of identicals used in the study, are shown

TABLE 2.—NUMBER PAIRED IDENTICALS FOR DIFFERENT PERIODS BY DISTRICTS

District No.	Surveys of June 1927 and Dec. 1927	Surveys of June 1927 and June 1928	Surveys of Dec. 1927 and June 1928	Surveys of Dec. 1927 and Dec. 1928	Surveys of June 1928 and Dec. 1928	Average Percent of Total
1	226	101	184	164	121	23.6
2	135	49	138	41	21	11.3
3	94	41	86	71	51	9.6
4	101	30	76	70	69	9.5
5	194	87	125	154	96	19.8
6	105	37	81	77	59	10.2
7	46	11	29	33	31	4.2
8	73	38	47	41	24	6.7
9	61	24	39	34	31	5.1
Totals	1035	418	805	685	503	100.0

in Figure 2. The answers to questions on the cards for identical farms were then compared to ascertain the degree of bias existing. Table 3 shows the number and percentage of farms reporting in each survey from December 1927 to December 1928, which were reported in previous surveys (or were identicals).

The number of these identical reports varies somewhat both relatively and absolutely for the different periods or pig surveys shown in Table 3. The number of identicals shown is somewhat smaller than the actual number paired, since it was necessary to eliminate a large number because they were apparently incorrectly filled out, or because in

TABLE 3.—NUMBER AND PER CENT OF FARMS REPORTING IN EACH SURVEY WHICH HAD REPORTED IN PREVIOUS SURVEYS

	Total Farms Reporting First Period	Identical Farms report- ing 2nd Per'd.	Percentage of Identicals
Number and per cent of farms reporting in December 1927 which also reported in June 1927	6850	1035	15.1
Number and per cent of farms reporting in June 1928 which also reported in June 1927	5613	418	7.44
Number and per cent of farms reporting in June 1928 which also reported in December 1927	5613	805	14.35
Number and per cent of farms reporting in December 1928 which also reported in June 1928	5660	503	8.88
Number and per cent of farms reporting in December 1928 which also reported in December 1927	5660	685	12.1

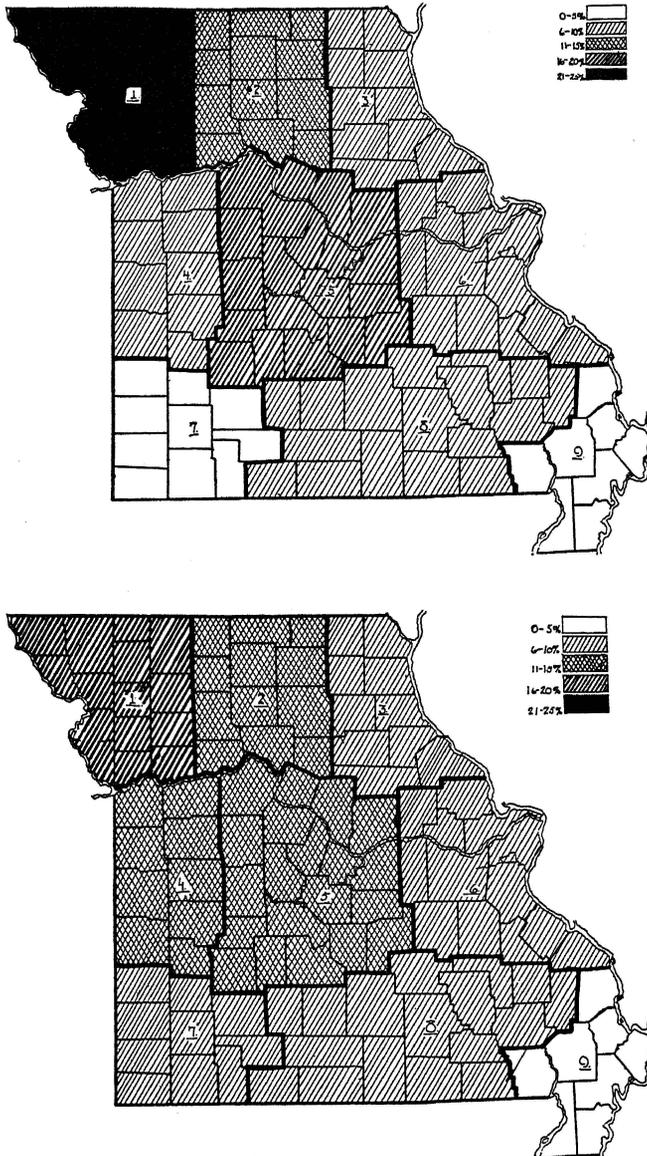


Fig. 2.—(Upper) Percentage distribution of identical reports used for four Missouri pig surveys, June and December, 1927 and 1928.  
 (Lower) Average percentage distribution of all Missouri pig survey reports by districts for four surveys, June and December 1927 and 1928

one survey the answer on some of the cards as to number of sows farrowing or to number of pigs saved currently was zero. Obviously it was

impossible to compute the percentage that one answer was of another if either of these answers were zero.

The districts shown in Table 2, are the same as those used in localization of the data throughout. They are based upon nine types of farming districts used by the State Agricultural Statistician in all tabulations. The percentage distribution of hog population in these districts is shown in Figure 3.

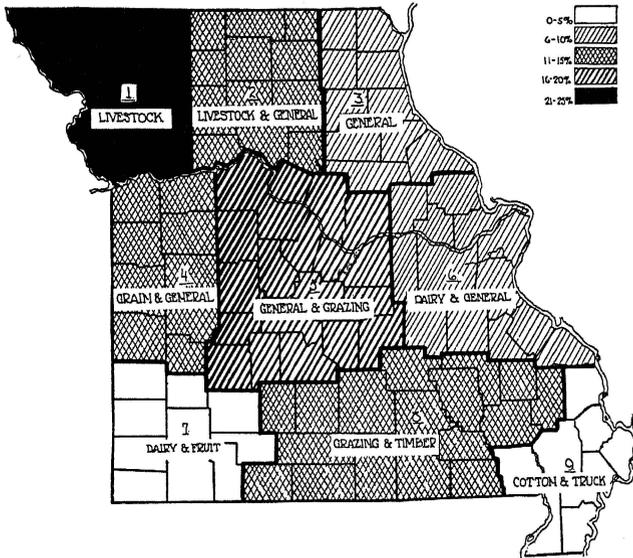


Fig. 3.—Percentage distribution of hog population in Missouri by districts, January 1, 1928.

## KIND AND EXTENT OF INACCURACIES IN THE REPORTS

**Memory Bias.**—One source of error in the reports, as previously suggested, is the erring memory of the individual farmers making out pig survey reports. In order that comparisons may be made between the present pig crop and previous ones, questions are asked in every pig survey concerning occurrences of six months and one year previous. For example, one of the questions asked in the survey of June 1928 was: "How many sows farrowed on your farm last spring, December 1, 1926 to June 1, 1927?" Other questions of a similar nature are also asked.

This same question was, of course, asked in the June 1927 survey. Using the accepted terminology, the former gives the *historic* answer, while the latter gives the *current* answer. The assumption that the current answer is the correct one seems justifiable in that it is made much

closer to the time of occurrence than is the historic answer. Consequently the measurement of the variation of the historic answer from the current answer was used as a determination of the memory bias.

The memory bias comparisons were made for each of the four surveys mentioned and for three different questions of each survey. Using the identical reports previously described the historic answer and the current answer have been compared for the number of sows farrowing six months previously, for the number of sows farrowing one year previously, and for the number of pigs saved one year previously. The percentage relation that the historic answer bears to the current answer was calculated for each of the questions on each of the identical reports. Summaries were then made for each period for the nine reporting districts and for the State as a whole. The deviations from the district average of the individual reports were also computed.

TABLE 4.—MEMORY BIAS OF ANSWERS TO QUESTIONS CONCERNING SOWS FARROWING SIX MONTHS PREVIOUSLY

Districts	(Sows farrowed Dec. 1, 1926 to June 1, 1927) June and Dec. 1927 Surveys				(Sows farrowed June 1 to Dec. 1, 1927) Dec. 1927 and June 1928 Surveys			
	Spring 1927 Current	Spring 1927 Historic as Reported in Dec.1927	Percent 1927 Historic is of 1927 Current	Standard <sup>1</sup> Deviation	Fall 1927 Current	Fall 1927 Historic as Reported in June1928	Percent Fall 1927 Historic is of 1927 current fall	Standard <sup>2</sup> Deviation
1	1647	1617	98.1	17.21	968	1001	103.4	23.51
2	501	494	98.6	41.81	508	530	104.3	28.12
3	438	443	101.1	23.12	325	327	100.6	22.01
4	536	533	99.4	19.93	389	391	100.5	14.37
5	788	770	97.7	27.72	493	509	103.2	22.25
6	345	348	100.8	21.00	218	224	102.7	25.12
7	142	160	112.6	32.17	113	173	103.0	45.87
8	220	190	86.3	26.11	116	119	102.5	43.97
9	231	206	89.2	46.76	125	135	108.0	38.45
Totals	4738	4761	100.5		3255	3409	104.7	

<sup>1</sup>The standard deviations as here given are a measure of dispersion about the unweighted district average of the individual per cents that the historic answer is of the current answer in each district.

Tables 4, 5, and 6 show the results of the memory bias comparisons for two different periods for the three questions. The answer totals are given in every case for each district and for the State as a whole. As might have been expected, there is considerable variation in the several districts for all three questions. The maximum positive memory bias or error as applied to both sows farrowed and pigs saved for any one district was 23.8 per cent, and the minimum positive bias was .2 per cent. Corresponding figures for the negative bias were 13.7 and .2; making a range in memory bias from -13.7 to +23.8 per cent, a total of 37.5 per cent. Individual districts varied greatly within this range, but for

TABLE 5.—MEMORY BIAS OF ANSWERS TO QUESTION CONCERNING SOWS FARROWING ONE YEAR PREVIOUSLY

Dis- tricts	June 1927 and June 1928 Surveys (Sows farrowed Dec. 1, 1926 to June 1, 1927)				Dec. 1927 and Dec. 1928 Surveys (Sows farrowed June 1, 1927 to Dec. 1, 1927)			
	Spring 1927 Current	Spring 1927 Historic as Reported in June 1928	Per cent 1927 Historic is of 1927 Current	Standard <sup>1</sup> Deviation	Fall 1927 Current	Fall 1927 Historic as Reported in Dec. 1928	Percent fall 1927 Historic is of Fall of 1927 Current	Standard <sup>1</sup> Deviation
1	755	757	100.2	17.33	987	938	95.0	24.71
2	197	237	120.3	37.22	155	152	98.0	35.25
3	211	214	101.4	26.55	179	208	116.2	40.77
4	192	190	98.9	33.00	323	323	100.0	20.11
5	346	353	102.0	37.98	545	570	104.5	34.00
6	104	109	104.8	28.25	216	225	104.1	33.25
7	40	45	112.5	42.31	98	93	94.8	39.27
8	110	114	103.6	20.23	133	122	91.7	51.07
9	81	72	88.8	58.87	100	120	120.0	52.28
Totals	2036	2091	102.7		2736	2751	100.5	

<sup>1</sup>See footnote to Table IV

TABLE 6.—MEMORY BIAS OF ANSWERS TO QUESTION CONCERNING NUMBER OF PIGS SAVED ONE YEAR PREVIOUSLY

Dis- tricts	June 1927 and June 1928 Surveys (Pigs saved Dec. 1, 1926 to June 1, 1927)				Dec. 1927 and Dec. 1928 Surveys (Pigs saved June 1, 1927 to Dec. 1, 1927)			
	Spring 1927 Current	Spring 1927 Historic as Reported in June 1928	1927 Historic 1927 Current	Standard <sup>1</sup> Deviation	Fall 1927 Current	Fall 1927 Historic as Reported in Dec. 1928	1927 Historic 1927 Current	Standard <sup>1</sup> Deviation
1	4108	4018	97.8	21.88	5468	5360	98.0	24.00
2	1260	1329	105.5	46.88	600	601	100.1	18.60
3	1113	1104	99.1	20.03	852	939	110.2	46.43
4	1235	1248	101.0	30.62	1684	1608	95.4	28.75
5	1749	1936	110.6	40.62	3100	3239	104.4	32.87
6	463	526	113.6	36.75	1270	1293	101.8	25.87
7	218	270	123.8	78.11	596	693	116.2	46.81
8	505	583	113.4	50.35	550	522	94.9	38.05
9	320	321	100.3	27.90	606	605	99.8	69.37
Totals	10,971	11,335	103.3		14,726	14,860	100.9	

<sup>1</sup>See footnote to Table IV.

a majority of them the bias was positive. In other words, farmers in their historic answers were inclined to over-estimate the number of sows reported currently in the survey of six months previous, and the number of sows and pigs reported currently in the survey one year preceding. The extent of the memory bias by districts is shown graphically in Figure 4. The variation by districts might be due to the varia-

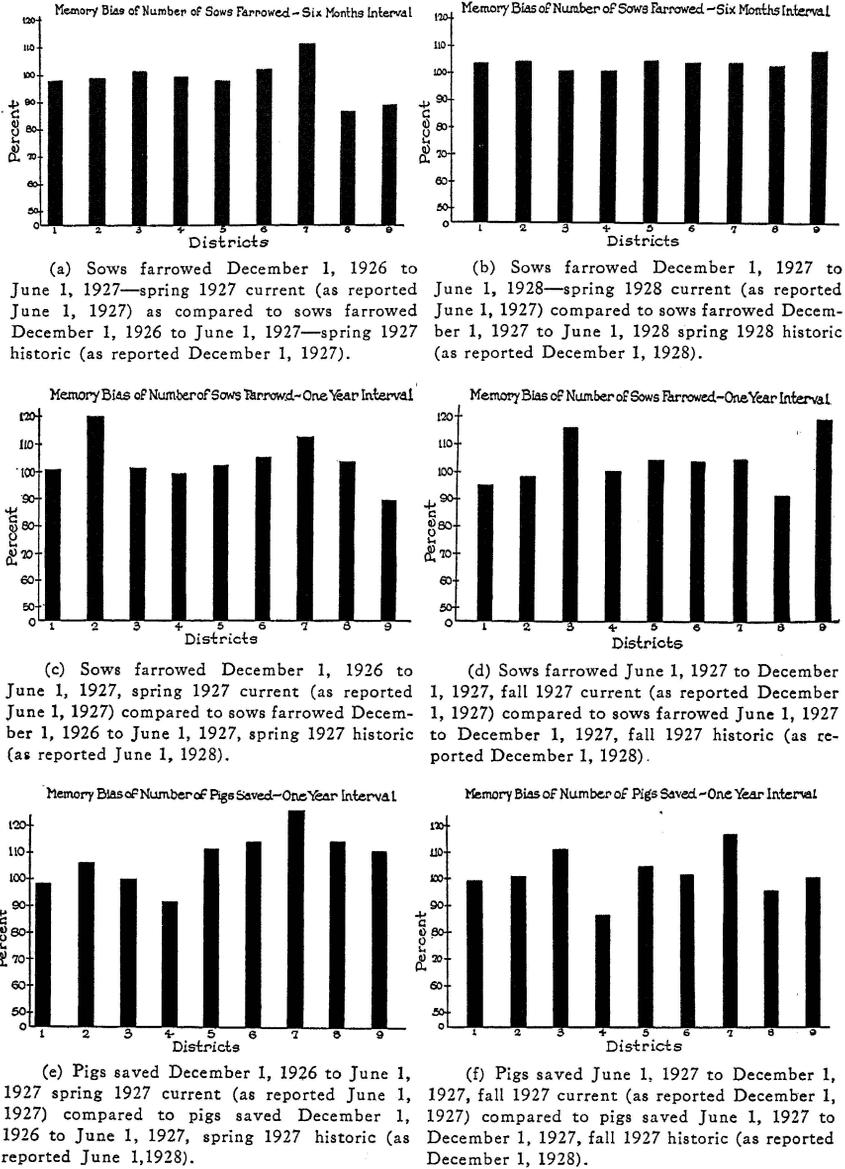


Fig. 4.—MEMORY BIAS

tion in the size of the sample, or to actual differences in the memories of the farmers reporting for each district. In most cases the differences are compensating so that the State average shows only a relatively small error due to memory bias, as shown in the tables.

Contrary to expectations there seems to be no more bias in the reports sent in after one year than those after a lapse of six months. At least the difference is not significant. There is practically no difference in the memory bias for sows farrowed and pigs saved for the State as a whole, as shown by comparing Tables 4 and 5 with Table 6, although individual districts vary considerably. The percentage memory bias as checked from reports one year preceding for the entire State was  $+1.6$  for sows farrowed and  $+2.1$  for pigs saved.

The limitations of the data should be kept in mind in considering this problem. It was only because of special efforts to obtain additional reports following the regular survey that the number of identical reports is as large as it is.

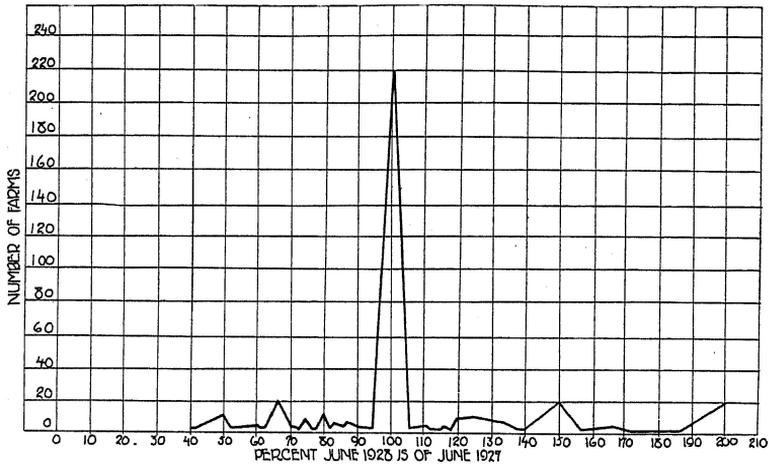


Fig. 5.—Frequency distribution of memory bias of individual identical reports for Missouri. Sows farrowed December 1, 1926 to June 1, 1927 reported currently June 1, 1927, and historically June 1, 1928.

Figure 5 shows the frequency distribution of all the individual reports for one period, June 1927 to June 1928 for memory bias in number of sows farrowed. The number reporting correctly is, of course, large, but the fairly large number at either end of the distribution indicates, not necessarily poor memory, but rather lack of understanding on the part of the reporting farmers as to just what the question means. The distribution for the period shown is quite typical for the other periods which were included in the study.

Table 7 shows the combined result of the memory bias both as to number of sows farrowed and as to number of pigs saved, in terms of the number of pigs saved per litter. For the State as a whole the number of pigs saved per litter in the spring of 1927 as reported cur-

TABLE 7.—NUMBER OF PIGS SAVED PER LITTER IN MISSOURI BY DISTRICTS, SPRING AND FALL 1927, HISTORIC AND CURRENT ANSWERS ON IDENTICAL REPORTS COMPARED

Districts	Number of Pigs Saved Per Litter Spring 1927 Current June 1927 Survey	Number of Pigs Saved Per Litter Spring 1927 Historic June 1928 Survey	Number of Pigs Saved Per Litter Fall 1927 Current Dec. 1927 Survey	Number of Pigs Saved Per Litter Fall 1927 Historic Dec. 1928 Survey
1	5.44	5.31	5.54	5.71
2	6.39	5.60	3.87	3.95
3	5.27	5.16	4.76	4.51
4	6.43	6.57	5.21	4.98
5	5.05	5.48	5.67	5.68
6	4.45	4.82	5.88	5.75
7	5.45	6.00	6.08	7.45
8	4.59	5.11	4.13	4.28
9	3.95	4.46	6.06	5.04
State	5.39	5.42	5.38	5.40

rently and historically were 5.39 and 5.42, respectively. In the fall of 1927 they were 5.38 and 5.40, a very close check for both surveys. While there is some variation between districts, in most cases the historic answer checks very well with the current one. These results are, of course, subject to compensating errors not only between the several districts, but also between the two questions. An error or a large memory bias with the number of pigs saved might be cancelled by an opposite error in the number of sows farrowed.

These figures covering the memory bias of individual reporters are also significant with respect to the belief held by some individuals that the pig surveys are vitiated by intentional misrepresentation on the part of farmers reporting. Such prevarication would probably appear in the checking of identical reports, and show up included with unintentional bias. These checks may indicate that the value of the reports is not nullified by the hypothecation of figures on the part of any material number of farmers.

**Breeding Intentions.**—One of the questions on every pig survey card concerns the number of sows that have been bred or will be bred for the next farrowing period. The number of sows bred for farrowing is practically always larger than the number farrowing. Intentions are seldom realized, due either to natural causes originating in the animal itself or to improper production methods. Other probable reasons for this lack of realization may be shipment of pregnant sows to market, and an increase or decrease in number of sows or gilts bred from the number which was reported as intended. These latter changes are due largely to the producer who is influenced by various factors such as hog prices, corn prices and supplies, and prices of other livestock.

The identical reports were used to determine discrepancies between the actual farrowings and the breeding intentions of six months previous, and how much variation existed from district to district and from period to period.

Other checks on this breeding intentions estimate have been made by comparing the intentions of one survey with the actual farrowings in the next survey. During the years since 1923, the breeding intentions have fallen short in the United States as a whole about 18 per cent. The intentions for fall breeding have been less indicative of actual farrowings than the intentions for the spring farrow, the number of sows farrowing as compared with intentions being 12.5 per cent less for the spring and 21.6 per cent less for the fall, in the United States. The realizations are shown as percentages of the intentions for all surveys in Table 8 and Figure 6, in which the United States, the corn belt, and Missouri are shown separately. It will be seen from Table 8 that on

TABLE 8.—PERCENTAGE REALIZATION OF BREEDING OF INTENTIONS FOR ALL SURVEYS FOR MISSOURI, CORN BELT, AND U. S. 1923-1929<sup>1</sup>

	Missouri	U. S.	Corn Belt
June 1929	89.4	85.67	89.35
Dec. 1928	85.99	83.52	87.99
June 1928	95.17	87.24	89.83
Dec. 1927	89.35	84.83	88.78
June 1927	94.32	90.98	93.48
Dec. 1926	74.70	73.66	76.83
June 1926	95.18	90.88	93.15
Dec. 1925	84.57	80.95	84.63
June 1925	94.19	86.10	89.39
Dec. 1924	72.46	76.30	78.32
June 1924	81.66	79.75	84.24
Dec. 1923	72.88	71.16	74.82
June 1923	91.84	91.86	93.44
June Average	91.68	87.50	90.41
Dec. Average	79.99	78.40	81.89

<sup>1</sup>Figures taken from U. S. D. A. Yearbooks 1923-1928. They represent the relationship between breeding intentions (sows bred or to be bred) as reported in June or December and sows actually farrowed as reported six months later (December or June). Ratios shown are obtained by dividing the published percentage of sows bred to sows farrowed (intentions) by the published percentage of sows farrowed to sows farrowed (realizations).

the average Missouri comes closer to realizing the full intentions than either the United States or the corn belt. This is particularly true of the intentions for the spring farrow, the average for Missouri being 8.32 per cent short as compared with 9.6 per cent for the corn belt and 12.5 per cent for the United States. Realizations for the fall farrow in Missouri (20.01 per cent short) are slightly under corn belt figure (18.1 per cent) but slightly above the United States average (21.6 per cent).

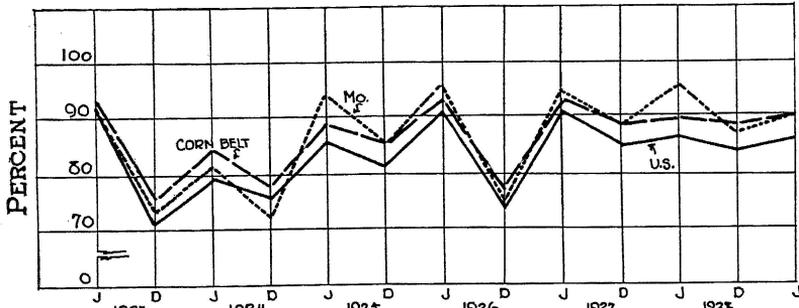


Fig. 6.—Realization of breeding intentions by sections 1923-1928 as shown by the Pig Survey summaries for Missouri, the corn belt, and the United States.

Table 9 shows the realization of breeding intentions as shown by the comparison of the identical reports. Two realizations for the fall farrow and one realization for the spring farrow are shown. The variations in realizations by districts and periods are also shown in Figure 7. The State average shows the fall realizations only slightly lower than the spring realizations. In most of the individual districts, however, there is a pronounced tendency for fall realizations to be less than those in the spring.

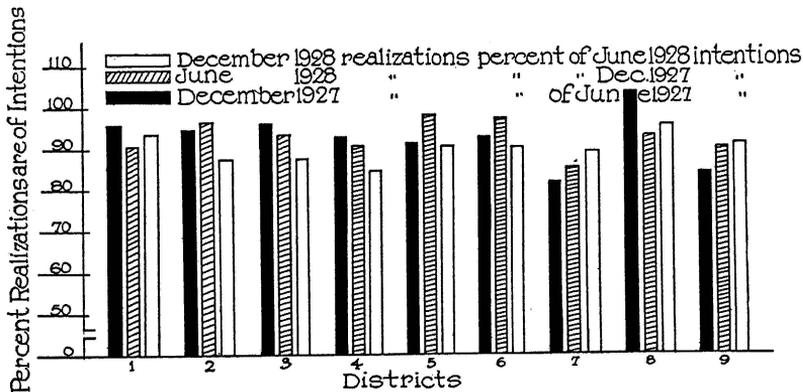


Fig. 7.—Variations in realizations of breeding intentions by districts in Missouri for three survey periods

The identical reports show about a 7 to 8 per cent failure to realize breeding intentions for the spring farrow for the State as a whole. The fall farrow according to the same reports is from 9 to 10 per cent short of the intentions. While the results obtained by comparing identicals for the fall farrow do not check with the final Missouri results shown in Table 8, which is based on all reports received in the State, the percentage realizations in the spring are in fairly close accord. Table 8, of

TABLE 9.—BREEDING INTENTIONS AND REALIZATIONS AS SHOWN BY IDENTICAL REPORTS

Districts	June 1927. Survey Indications of Number of Sows Bred or Intended to be Bred For Fall Farrow 1927	Dec. 1927 Survey Indications of Number of Sows Farrow- ing Fall 1927	Per Cent of Realization	Standard <sup>1</sup> Deviation	Dec. 1927 Survey Indications of Number of Sows Bred or Intended to be Bred For Spring Farrow 1928	June 1928 Survey Indications of Number of Sows Farrow- ing Spring 1928	Per Cent of Realization	Standard <sup>1</sup> Deviation	June 1928 Survey Indications of Number of Sows Bred or Intended to be Bred For Fall Farrow 1928	Dec. 1928 Survey Indications of Number of Sows Farrow- ing Fall 1928	Per Cent of Realization	Standard <sup>1</sup> Deviation
1	1085	1033	95.2	29.00	1699	1536	90.4	23.66	818	762	93.1	25.77
2	408	384	94.1	33.68	734	707	96.3	28.76	92	80	86.9	38.40
3	326	312	95.7	28.63	422	392	92.8	25.31	204	179	87.7	16.21
4	353	325	92.0	33.00	492	443	90.0	23.87	426	356	83.6	21.12
5	761	689	90.5	25.25	676	663	98.0	21.68	347	312	89.9	25.15
6	295	272	92.2	45.12	297	290	97.6	19.50	179	161	89.9	17.62
7	136	112	82.3	30.30	197	167	84.7	26.73	98	87	88.7	24.48
8	197	203	103.0	43.95	177	164	92.6	29.13	90	84	93.3	24.07
9	229	191	83.4	29.25	182	164	90.1	38.00	93	84	90.3	28.50
Totals	3790	3521	92.9		4876	4526	92.8		2347	2105	89.6	

<sup>1</sup>The standard deviations given in this table are measures of dispersion about the unweighted district average of the individual percents that realizations are of intentions in each district.

course, includes figures for many more periods, so that the two results are hardly comparable. There is also a wide range in the figures in Table 8, so that the average is hardly typical of any one year. The Bureau of Agricultural Economics is to be commended for the recent inclusion of some of these factors in their pig survey report. The breeding intentions taken absolutely mean very little, but when compared with intentions and realizations of other years, a much more reliable basis of judgment is available.

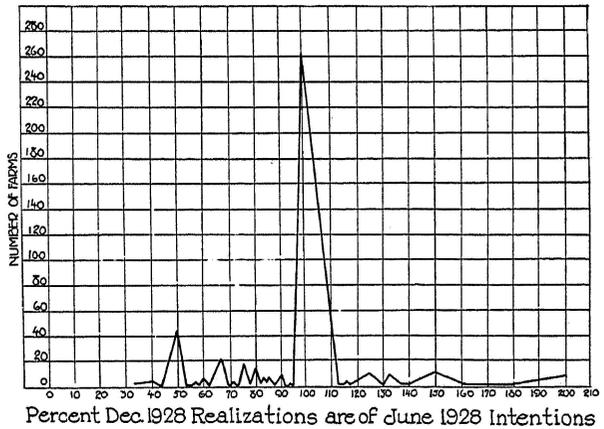
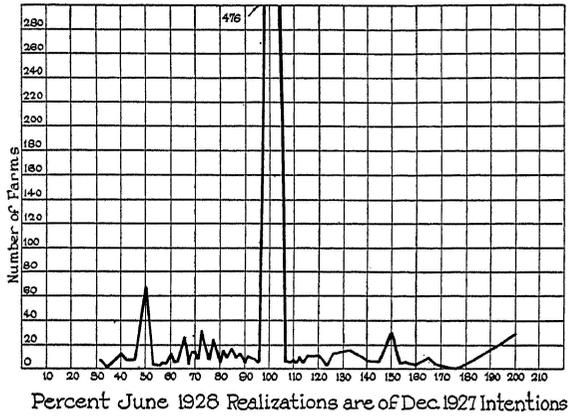
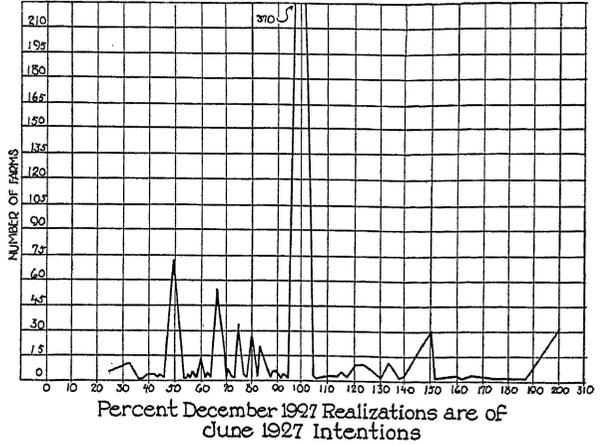
Figure 8 shows the frequency distribution, for identical reports, of the percentages that realizations were of intentions for the December surveys of 1927 and of 1928 and for the June survey of 1928. There are, of course, in all three cases a large number of correct reports, but there are also a surprisingly large number of reports whose realizations were under 50 per cent. There is little difference in the frequency distributions of realizations of the spring and fall surveys, and there was very little difference in the State average realizations (See Table 9). The dispersion in the per cent which realizations are of intentions does not necessarily distort the weighted state average, because the variations are compensating. It helps to explain why realizations do not check any closer with the intentions of five or six months before.

These figures show that hog production is quite flexible within limits from one farrow to another or from one year to another. This flexibility of production on the part of some producers shows the possibilities of farmers reacting rather quickly to economic outlook information. However, the range in the frequency distribution of these reports may be due to errors in reporting or interpretation, and probably are not reactions in response to outlook reports.

It should also be noted that the data used in connection with breeding intentions on identical reports were always current answers, so that the figures used are not subject to errors of memory. However, there are probably some few errors in reporting, which could not very well be eliminated.

**A Comparison of Survey Indications and Actual Marketings for Missouri.**—It should be remembered that in practically every case one pig survey has been checked against another. That is, the intentions in one survey have been checked with realizations in the succeeding survey, and in connection with the memory bias the historic answer was checked against the current. There is no question that these measures give some indication of the accuracy of the reports but they are not an absolute test of the accuracy of the survey as a whole. These measures may be supplemented by checking the pig survey indications with actual hog slaughter. In the final analysis we are interested in just how good a criterion the pig survey is in indicating changes in hog production.

Fig. 8.—Frequency distribution of realizations of breeding intentions in percentages of identical reports for (upper) June and December 1927 Missouri pig surveys, for (middle) the December 1927 and June 1928 Missouri pig surveys, for (lower) and for June and December 1928 Missouri pig surveys.



The discovery of errors in memory bias and in breeding intentions is simply a step toward improvement in methodology, in order to make the pig survey a more accurate measure of such production changes.

The checking of pig surveys against hog marketings for the entire country has been done by the Bureau of Agricultural Economics<sup>1</sup>. Table 10 shows the check for Missouri for 1923-1928. The pig survey indications for Missouri of the number of pigs saved were compared with hog marketings of the State for the following year. The year November to October was used in getting these total hog marketings. In order to arrive at a percentage increase or decrease for the entire year, the spring and fall survey indications were weighted by 60 and 40 respectively. This is the relationship which was computed in another part of this study, and is shown in Table 14. It should be noted that the accuracy of the comparison might be lessened to some extent because of the variation in numbers of stock hogs shipped out of and into the State.

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<sup>1</sup>See "Charts Relating to 1929 Agricultural Outlook Part II, Livestock and Livestock Products," issued in mimeographed form by the Bureau of Agricultural Economics.

TABLE 10.—A COMPARISON OF MISSOURI PIG SURVEY INDICATIONS WITH SUBSEQUENT MARKETINGS OF HOGS FROM MISSOURI, 1923-1928

Pig Survey Indications (Increase or decrease in pigs saved)		Marketing Succeeding Months (Nov.-Oct. fiscal year)			Marketings Succeeding Month (Oct.-Sept. fiscal year)	
Time of Survey	Percent Increase or Decrease	Marketing Period	Number of Hogs	Increase or Decrease	Marketing Period	Percent Increase or Decrease
Spring 1923	9. %	Nov. 1923-May 1924	3,449,114	7.9 %	Oct. 1923-Apr. 1924	19.9 %
Fall 1923	— 8.3 %	June-Oct. 1924	2,086,085	— 13.5 %	May-Sept. 1924	— 9.5 %
Weighted Increase or Decrease for Yr.	2.08 %	Nov. 1923-Oct. 1924	5,535,199	— 1.3 %	Oct. 1923-Sept. 1924	7.9 %
Spring 1924	—24.2 %	Nov. 1924-May 1925	2,699,138	— 21.7 %	Oct. 1924-Apr. 1925	—22.4 %
Fall 1924	—29.7 %	June-Oct. 1925	1,670,758	— 19.9 %	May-Sept. 1925	—17.9 %
Weighted Increase or Decrease for Yr.	—26.4 %	Nov. 1924-Oct. 1925	4,369,896	— 21.0 %	Oct. 1924-Sept. 1925	—20.9 %
Spring 1925	— 6.1 %	Nov. 1925-May 1926	2,040,210	— 24.4 %	Oct. 1925-Apr. 1926	—27.6 %
Fall 1925	—13.2 %	June-Oct. 1926	1,637,665	— 2. %	May-Sept. 1926	— .7 %
Weighted Increase or Decrease for Yr.	— 8.94 %	Nov. 1925-Oct. 1926	3,677,875	— 15.8 %	Oct. 1925-Sept. 1926	—18.0 %
Spring 1926	— .3 %	Nov. 1926-May 1927	2,364,223	15.9 %	Oct. 1926-Apr. 1927	7. %
Fall 1926	.6 %	June-Oct. 1927	1,848,945	12.9 %	May-Sept. 1927	21.2 %
Weighted Increase or Decrease for Yr.	.06 %	Nov. 1926-Oct. 1927	4,213,168	14.6 %	Oct. 1926-Sept. 1927	13.1 %
Spring 1927	5.6 %	Nov. 1927-May 1928	2,780,603	17.6 %	Oct. 1927-Apr. 1928	21.0 %
Fall 1927	12.6 %	June-Oct. 1928	1,710,141	— 7.5 %	May-Sept. 1928	—11.2 %
Weighted Increase or Decrease for Yr.	8.4 %	Nov. 1927-Oct. 1928	4,490,744	6.6 %	Oct. 1927-Sept. 1928	6.1 %
Spring 1928	7.4 %	Nov. 1928-May 1929	2,689,063	— 3.3 %	Oct. 1928-Apr. 1929	— 1.0 %
Fall 1928	— 3.6 %	June-Oct. 1929	1,937,299	13.3 %	May-Sept. 1929	9.4 %
Weighted Increase or Decrease for Yr.	3.0 %	Nov. 1928-Oct. 1929	4,626,362	3.0 %	Oct. 1928-Sept. 1929	3.0 %

<sup>1</sup>The marketings of hogs by months up to 1927 were obtained from the "Missouri Farm Census, 1927" by E. A. Logan. Data for the remaining years were obtained directly from Mr. Logan. The weighted average increase or decrease in pigs saved for the year was obtained by weighting the spring and fall survey figures by 60 and 40 respectively.

The upper part of Figure 9 shows the percentage increase or decrease in hog production as shown by the pig survey compared with percentage increases or decreases in hog marketings the following year (November to October). In only one year, 1926, did the pig surveys fail to be fairly indicative of changes in hog marketings. There were, however, discrepancies amounting to five per cent or more in two other years, 1924 and 1925. The lower portion of Figure 9 shows the comparison of

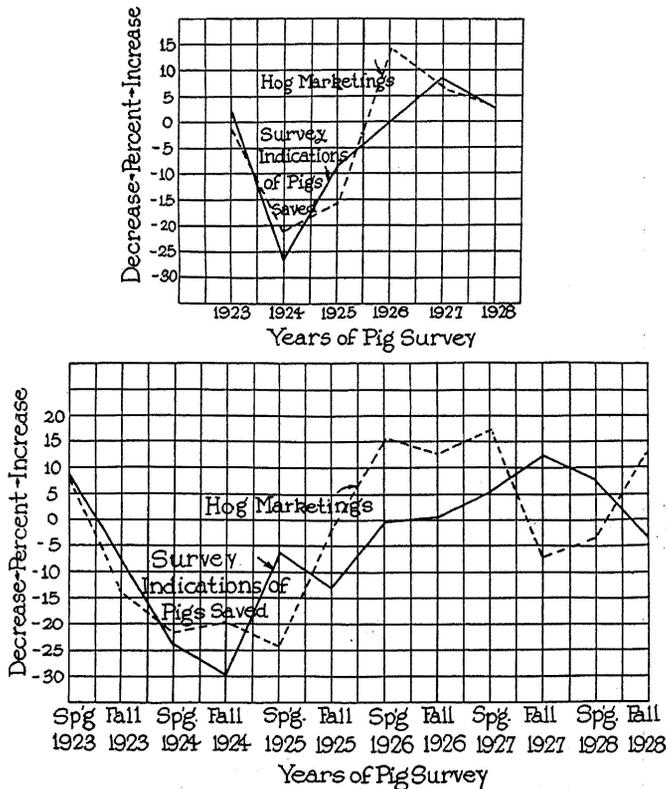


Fig. 9.—(upper) A comparison of the Pig Survey indications for Missouri and marketings of hogs from Missouri the succeeding year, November to October.

(lower) A comparison of Pig Survey indications for Missouri and marketings of hogs from Missouri in succeeding months, November to May for the spring farrow and June to October for the fall farrow.

individual survey results in Missouri with marketings of hogs from the State. It was assumed that the spring crop was marketed from November to May, and the fall crop from June to October. As would be expected, due to compensating errors, the yearly figures checked more closely than those for the individual survey periods, but the latter check fairly well.

If the memory bias correction factor of +.9 per cent to +3.3 per cent, as determined from the study of identical reports, were applied to the Missouri pig survey results for the years shown in Figure 9, there would have been two years, 1924 and 1926, when the check of survey results with hog marketings would have been improved, but in the other years a greater error would have been introduced.

The selection of November to October as the fiscal year of hog marketings is, of course, an approximation. No doubt there is considerable overlapping in the marketing of the spring and fall farrows, with wide variations from year to year. There are also a large number of pigs farrowed in the summer months in Missouri. This situation really means a third farrowing period and complicates the problem somewhat. Another complicating factor is the fact that there are approximately 300,000 stock hogs fattened in Missouri each year whose average age at the time of marketing is several months greater than hogs fattened and sold in the usual way.<sup>2</sup> Inasmuch as Missouri is one of the southern states of the corn belt, it was thought that probably the year October to September should be used for measuring hog marketings. The increases and decreases in hog marketings using these months were calculated for 1923-1928. It will be seen in Table 10 that the number of hogs marketed during this period did not correspond quite as well with the pig survey figures as those for the November to October period. This does not mean that the November to October year more nearly fits the annual hog marketings of hogs farrowed during the previous year. It does, however, show difficulties involved in making an accurate check on the results of the pig survey.

### Factors Affecting Production Changes

**Source of Material.**—Most of the data for this portion of the study were taken from the listing sheets and summaries of the pig surveys of Missouri for June and December, 1927 and 1928. In most cases the material has been changed to a percentage basis, and the data from which the percentages were computed do not appear.

**Regional Changes.**—The distribution of hog population in Missouri by districts has been shown in Figure 3. The northwestern and central portions of the State are clearly the large hog producing sections. District No. 5, by reason of its large area, has a large total but less dense hog population. This is particularly true of the southern part of the district. Figure 10, showing the number of hogs per 1000 acres of land by districts, is more indicative if the difference in size of the various districts is considered.

\*A detailed study of the Missouri stock hog movement has been made by the authors and will shortly be released in another publication.

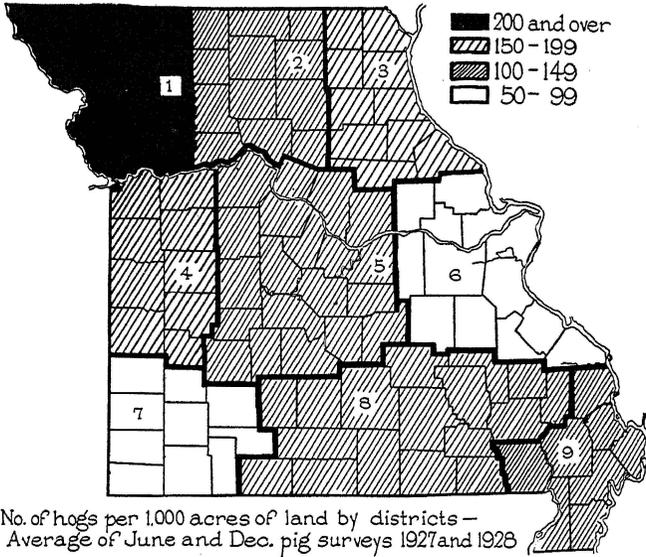


Fig. 10.—Number of hogs per 1000 acres of land by districts in Missouri as shown by the January 1, 1928 Farm Census.

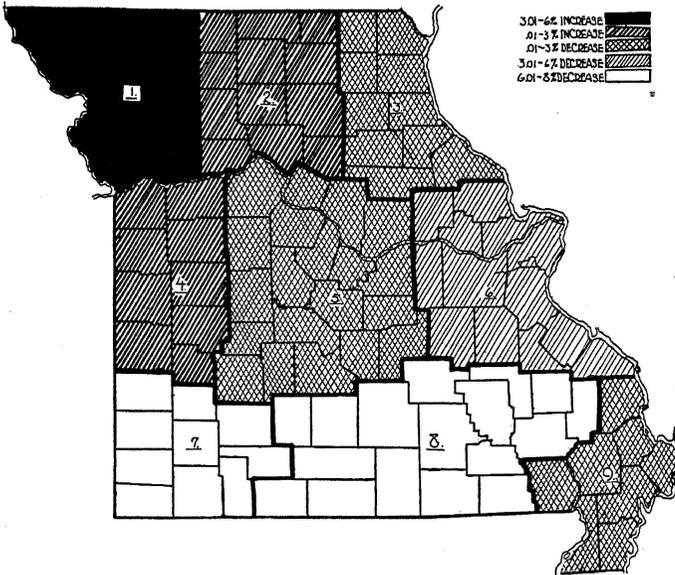


Fig. 11.—Percentage change in number of sows farrowed in Missouri by districts, average of four pig surveys, June and December 1927 and 1928.

Differences in the percentage change in number of sows farrowed for the several districts are shown in Figure 11. It will be noted that the greatest percentage of increase in sows farrowed (6.95) comes in District No. 1, the district of greatest hog population, both actually and per 1000 acres of farm land. The greatest decrease in number of sows farrowed (7.18) is in District No. 8, which is one of the regions of very sparse hog population. Figures for all districts as to increase or decrease in number of sows farrowed are shown in Table 11. These data were taken from the original pig survey tabulations for the periods indicated. The density of the hog population by districts is also shown.

TABLE 11.—MISSOURI HOG POPULATION WITH AVERAGE PERCENTAGE INCREASE BY DISTRICTS, 1927-1928

District	Number of Hogs Per 1000 Acres of Farm Land Jan. 1, 1928 <sup>1</sup>	Number of Swine Over 6 Months <sup>2</sup> Per 1000 Acres of Farm Land Dec. 1928	Percent of Total State Hog Production in each district <sup>1</sup>	Average Per cent Decrease or Increase in Sows Farrowed as Shown by June and December Surveys of 1927 and 1928
1	263.04	187.83	24.8	6.95
2	134.64	95.6	11.7	.20
3	154.08	99.64	10.5	-1.45
4	152.74	119.20	11.1	2.27
5	113.77	80.41	15.5	-1.70
6	88.50	61.88	6.9	-4.33
7	70.09	54.58	4.6	-6.63
8	116.08	53.42	10.8	-7.18
9	101.52	82.46	4.0	-1.60
State	136.12	98.28	100.	-.66

<sup>1</sup>Hog population taken from "Missouri Farm Census, 1927", Bulletin of Mo. State Board of Agriculture. Acres of land in farms from 1925 U. S. Census of Agriculture.

<sup>2</sup>Swine population and acres of land in farms taken from December 1928 Pig Survey.

The figures indicate that regions having different hog populations do not move up or down in hog production together. The sections of greatest production actually showed an increase in sows farrowed (the best indication of farmers intentions) during the same period that other areas recorded declining numbers. Since during this time the general tendency was to increase numbers of hogs on farms, it would appear, only insofar as the data for one state and the small number of years included are representative, that cyclic changes in hog production may be the result of changes in areas where hog production is a major enterprise. Similar studies in other states would be necessary before any definite conclusions on this point could be reached.

Increases in numbers of sows farrowed may not always mean an increase in numbers of pigs saved. The differences in pigs saved per litter might offset the increase in number of sows farrowed. This seems

TABLE 12.—NUMBER OF PIGS SAVED PER LITTER BY DISTRICTS IN MISSOURI 1927-1928<sup>1</sup>

District	Spring 1927	Fall 1927	Spring 1928	Fall 1928	Average	
					Spring	Fall
1	5.6	5.7	6.2	5.7	5.9	5.7
2	5.9	5.7	6.4	6.1	6.15	5.9
3	6.0	5.9	6.7	6.1	6.35	6.0
4	5.8	6.0	6.3	6.1	6.05	6.05
5	5.8	6.2	6.5	6.2	6.15	6.20
6	6.3	6.2	6.5	6.3	6.40	6.25
7	6.4	6.2	6.5	6.4	6.45	6.3
8	6.0	5.6	6.1	6.6	6.05	6.10
9	5.5	5.5	6.1	5.6	5.8	5.55
State Avg.	5.8	5.9	6.4	6.07	6.1	5.98

<sup>1</sup>Figures taken from the original Pig Survey tabulations for Missouri of the U. S. Department of Agriculture.

to be true in Missouri during the period studied. The number of pigs saved per litter by districts for four pig surveys is shown in Table 12. While there is not a wide difference, the regions of greater density of hog population in the State (District 1) seem to have the lowest number of pigs saved per litter, having an average for both farrows of 5.8 pigs per litter, while District 7, of lowest density, has an average of 6.4 per litter. This difference is also illustrated in a less striking manner in the number of pigs saved per litter in the various sections of the United States. The corn belt, while not lowest in this respect, is one of the lower sections in number of pigs saved per litter

TABLE 13.—NUMBER OF PIGS SAVED PER LITTER BY SECTIONS IN U. S.; AVERAGE AS SHOWN BY PIG SURVEYS<sup>1</sup> 1923-1928

	Spring	Fall
North Atlantic	6.24	6.51
Corn Belt	5.50	5.66
South Atlantic	5.68	5.72
South Central	5.37	5.45
Far Western	5.78	5.87

<sup>1</sup>Data compiled from U. S. Dept. of Agri. Yearbooks 1923-1928.

In fact, Table 13 shows that only the South Atlantic states have a smaller number of pigs saved per litter on the basis of a six year average. These conditions may be explained by the fact that there is a larger number of sows on each farm in these heavy producing regions, and farmers in these regions are more interested in production per farm or per hog herd than in production per individual sow. It is also true that the percentage of gilts farrowing every year is somewhat higher in the corn belt than in other sections, and this would certainly be another reason for a smaller number of pigs saved per litter.

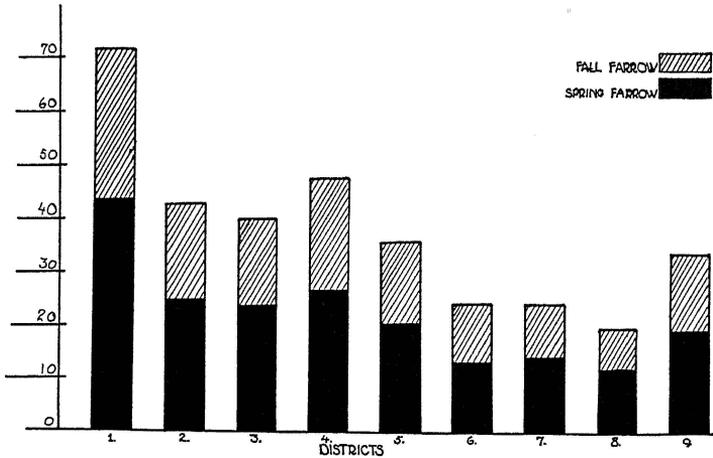


Fig. 12.—Number of farrowings per year per 1000 acres of farm land in Missouri by districts showing the distribution of spring and fall farrowings. Averages of December 1927 and 1928 pig surveys, and of the June 1927 and 1928 pig surveys.

In considering production changes in the different sections of the State the differences in the proportion of sows farrowing in the spring and fall are of some significance. This is shown for the nine districts in Figure 12, based on the number of sows farrowing per 1000 acres of farm land. The total number for both spring and fall corresponds quite closely with the density of hog population. The relative proportion of spring and fall farrowings is about the same for all districts, as will be seen in Table 14. There is no marked difference in this proportion from the standpoint of differences in hog population. Hog producers seem to have about the same percentage of sows for farrow

TABLE 14.—SOWS FARROWING PER 1000 ACRES OF FARM LAND IN MISSOURI BY DISTRICTS<sup>1</sup> 1927-1928

District Number	Spring 1927	Fall 1927	Spring 1928	Fall 1928	Spring Ave. No.	Entire Yr. Ave. No.	Percent in Spring
1	43.7	27.2	42.5	30.4	43.1	71.9	59.94
2	25.9	15.8	24.1	18.	25.	41.9	59.66
3	25.4	15.8	22.0	16.8	23.7	40.0	59.25
4	26.3	18.8	27.7	22.6	27.0	47.7	56.6
5	21.6	14.2	19.9	15.4	20.7	35.5	58.3
6	14.0	11.4	14.2	11.2	13.6	24.9	54.61
7	15.5	9.5	13.0	11.6	14.2	24.7	57.48
8	13.1	8.8	10.2	7.7	11.6	19.8	58.58
9	21.6	14.3	17.4	13.2	19.5	33.2	58.73
State Average	24.96	15.81	23.45	17.72	24.0	40.92	58.65

<sup>1</sup>Averages compiled from Pig Survey tabulations for Missouri for the June and December Surveys of 1927 and 1928, U. S. Dept. of Agr.

in the fall in southwest Missouri as they have in northwest Missouri. The relationship between spring and fall farrowings seems to be on

about a 60-40 basis for the entire State. While the tables do not show it conclusively, there seems to be no definite tendency for hog production to increase or decrease proportionately more in the spring than in the fall, or vice versa.

**Individual Changes.**—Relatively little is known about the constituent elements of changes in hog production in any given region; that is, how individual producers of different types make changes in their volume of hog production. Since no information regarding the individual reporters' business other than size of farm and herd was available, comparisons could be made only on these bases.

In studying the relation between hog production on individual farms and the size of farm, and the number of sows farrowing on the farm during the year, or size of herd, the criterion chosen to measure the increase or decrease in hog production was the percentage which the number of sows farrowing was of the number for the previous year, for each individual farm. As far as measuring the actual increase or decrease in hog production is concerned, the number of pigs saved would have been a better measure, but the farmers' *intentions* to increase or decrease hog production are better indicated by the percentage increase or decrease in sows farrowed.

The size of farm refers to the number of acres of land in each individual farm as reported on the pig survey cards. The size of sow herd is measured by the total sows farrowing in spring and fall rather than the average for spring and fall. This, of course, over-estimates the actual size of the herd on the farm in most cases, but the relationship is probably more exact.

In determining the relation between size of herd and increase or decrease in number of sows farrowed, all of the farms for each survey were divided into classes according to the size of herd. The results are shown in Table 15, for the entire State for the four surveys, June and December 1927 and 1928.

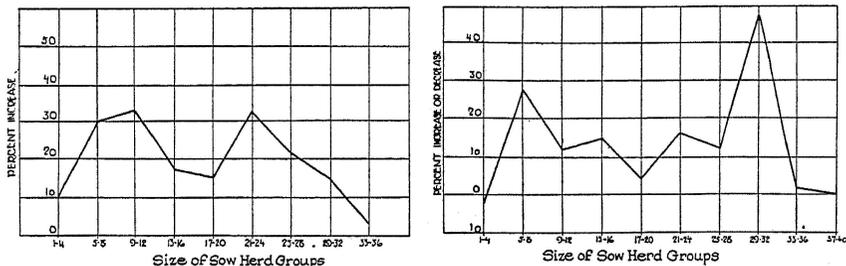


Fig. 13.—(left) The relation between the size of sow herd and the per cent increase or decrease in number of sows farrowed in the spring of 1927 over or under the number farrowed in the spring of 1926—Missouri.

(right) The relation between the size of sow herd and the percent increase or decrease in number of sows farrowed in the spring of 1928 over or under the number farrowed in the spring of 1927.

TABLE 15.—SUMMARY OF THE RELATIONSHIP OF SIZE OF SOW HERD AND INCREASE OR DECREASE IN NUMBER OF SOWS FARROWED IN MISSOURI AS SHOWN BY THE JUNE AND DECEMBER PIG SURVEYS OF 1927 AND 1928<sup>1</sup>

Size of Herd	December 1928 Survey		June 1928 Survey	
	Sows Farrowed in Fall of 1928 Expressed in Per Cent of Sows Farrowed Fall 1927	Number of Farms	Sows Farrowed in Spring of 1928 Expressed in Per Cent of Sows Farrowed Spring 1927	Number of Farms
1-4	102.3	1364	98.3	1897
5-8	111.7	916	126.9	1311
9-12	110.2	493	111.8	730
13-16	118.0	263	115.0	442
17-20	107.1	157	104.5	317
21-24	134.2	95	116.1	122
25-28	118.2	46	111.8	79
29-32	139.4	33	146.3	32

Size of Herd	December 1927 Survey		June 1927 Survey	
	Sows Farrowed in Fall of 1927 Expressed in Per Cent of Sows Farrowed Fall 1926	Number of Farms	Sows Farrowed in Spring of 1927 Expressed in Per Cent of Sows Farrowed Spring 1926	Number of Farms
1-4	105.0	1360	109.7	1603
5-8	117.9	1008	130.4	927
9-12	116.8	607	133.7	518
13-16	123.7	260	117.3	228
17-20	144.2	165	115.5	152
21-24	158.0	94	133.1	67
25-28	128.8	44	121.9	40
29-32	150.7	108	115.5	28

<sup>1</sup>The data on which this summary is based were compiled from the original pig survey Tabulations for Missouri of the U. S. Department of Agr.

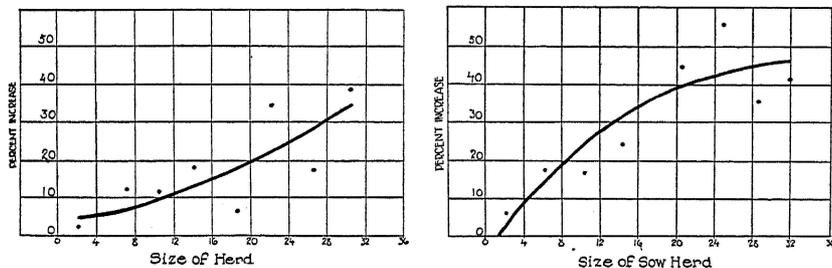


Fig. 14.— (left) The relation between the size of sow herd and per cent increase in number of sows farrowed in the fall of 1927 over the number farrowed in the fall of 1926. This curve is of the form  $Y = ax^2 + bx + c$ .

(right) The relation between the size of the sow herd and the per cent increase in number of sows farrowed in the fall of 1928 over the number farrowed in the fall of 1927. This curve is of the form  $Y = ax^2 + bx + c$ .

The figures indicate little if any relationship between size of herd and the percentage increase or decrease in number of sows farrowed for the two spring pig surveys, as shown in Figure 13. However, there was a very marked relation for the two fall surveys. The percentage

figure shown in every case is the simple average per cent increase or decrease for each size group. The smoothed parabolic curve relationship for the two fall surveys is shown in Figure 14.

It will be noted that the average of the percentage increases in number of sows farrowed for the different size of herd groups, as shown in Table 15, is greater than the total percentage increase in number of sows farrowed in the State as shown in the pig surveys of the same years. This is due to the fact that the percentage for each size group is a simple average of the percentages for each farm. An average of these averages, even if weighted by the number of farms in each group, obviously will not give the same result as an average based on the total number of sows for the State as a whole. Without this explanation it might be assumed that the group averages were based on selective cases, whereas all of the reports of the survey were used in every case.

The relationship between the percentage increase or decrease in number of sows farrowed and the size of herd has not been shown by districts. In the two spring surveys only District 1 in June 1927 shows any marked degree of relationship. For the 1927 fall survey the relationship is quite marked for all districts except No. 5 and No. 7 in 1927. The 1928 fall survey shows a fairly high degree of relationship for Districts 1, 2, 3, and 6. The other districts do not show much relationship. The possible explanation of these district differences may again be the differences in hog population or in the density of hog population. There is some indication that the relation is higher in the districts of relatively dense hog population.

Why the two spring surveys should show no relation between the size of herd and increase or decrease in sows farrowed and the two fall surveys should show a marked relation is, of course, difficult to determine. A possible explanation might be found in the fact that the spring litter is raised partially on pasture and more sows can be farrowed without any additional buildings and equipment. This is probably not true of the fall farrow. Then, carrying this assumption a step farther, it is probable that the farms having larger herds can provide such additional building space and equipment as is needed with much greater facility.

It should also be noted that the curve of relationship for both fall surveys starts with a small increase and goes gradually upward. The number of sows farrowed in the fall of 1927 in Missouri showed a 10 per cent increase over the fall of 1926, and the number in the fall of 1928 showed a 3 per cent decrease under the same number in the fall of 1927. The relationship between the size of herd and increases or decreases in the fall crop is much more marked in the fall of 1927 than in the fall of 1928, and it would seem that the above differences offer a

partial explanation. In a survey in which there was a greater decrease the relation might not have existed, and if it did exist, the curve would have likely started with a decrease.

Another factor to be considered is the size of farm. There was naturally a fairly high degree of relationship between the size of farm and the size of herd in the 1928 fall survey, which was the only period for which these two factors were compared. This relationship is shown in Figure 15, and in Table 16.

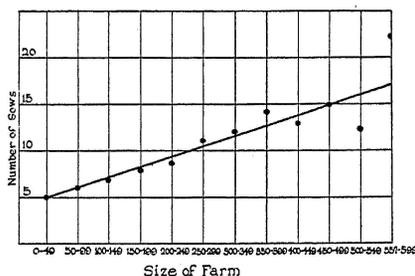


Fig. 15.—The relation between the size of sow herd and the size of farm as shown by the December 1928 Pig Survey for Missouri.

TABLE 16.—THE RELATION BETWEEN THE SIZE OF FARM AND SIZE OF SOW HERD OF THE FARMS INCLUDED IN THE DECEMBER 1928 SURVEY FOR MISSOURI

Size of Farm	Average Size of Herd
0-49	4.03
50-99	5.25
100-149	6.59
150-199	7.75
200-249	8.67
250-299	11.34
300-349	12.41
350-399	15.22
400-449	13.94
450-499	16.20
500-549	12.60
550-599	22.75
Ave. 167.8	6.83

The relation between the percentage increase in number of sows and the size of farm is negligible in practically every district and for the State as a whole. The individual district relationships are not shown.

The summary for the State for all the four periods is shown in Figure 16 and Table 17.

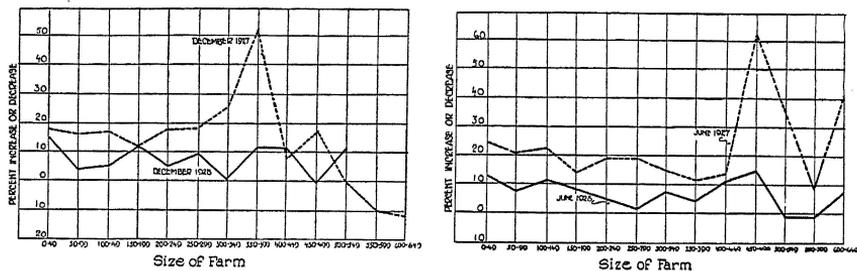


Fig. 16.— (left) The relation between size of farm and the per cent increase or decrease in number of sows farrowed as shown by the June 1927 and the June 1928 Pig Surveys for Missouri.

(right) The relation between size of farm and the per cent increase or decrease in number of sows farrowed as shown by December 1927 and December 1928 Pig Surveys for Missouri.

While the comparison of size of herd and size of farm was only made for one survey, the fall of 1928, it is probable that this relation is similar for the other periods under consideration. Because there was a high relation between the size of herd and increase in sows farrowed, it might be concluded that there would be a similar relation between size of farm and increase in sows farrowed on individual farms. This would probably be true if the latter relation was extremely high. Since this is not the case, it is likely that there are other factors which affect the changes by individual farmers in number of sows farrowed.

The results of this phase of the study are far from conclusive, but they indicate that increases and decreases in spring pig crops are the result of changes in production operations by all classes of producers, while changes in fall production are more directly due to the movement of the larger producers. While seemingly paradoxical, the results also seem to show that the size of the individual farm has little or no influence on the percentage increase or decrease. The size of the sow herd, whether on a large farm or on a small farm, is the more influential factor.

**The Effect of Continued Reporting.**—The question has been raised as to whether or not farmers who return pig survey cards in several successive periods would react in their production changes in a manner similar to that of the entire group of farmers in the State. The assumption has been that farmers who report in successive periods are more interested in economic information than others and would probably react more intelligently to price changes than the entire group of farmers.

TABLE 17.—SUMMARY OF THE RELATIONSHIP OF SIZE OF FARM AND INCREASE OR DECREASE IN NUMBER OF SOWS FARROWED IN MISSOURI AS SHOWN BY THE JUNE AND DECEMBER PIG SURVEYS OF 1927 AND 1928<sup>1</sup>

Size of Farm	December 1927 Survey		June 1927 Survey	
	Sows Farrowed in Fall of 1927 Expressed in Per Cent of Sows Farrowed Fall 1926	Number of Farms	Sows Farrowed in Spring of 1927 Expressed in Per Cent of Sows Farrowed Spring 1926	Number of Farms
0-49	117.	219	124.0	248
50-99	115.5	709	120.6	811
100-149	116.4	888	121.8	867
150-199	111.9	707	114.4	714
200-249	117.0	492	119.5	490
250-299	118.1	169	119.5	193
300-349	125.5	158	114.6	144
350-399	152.1	72	111.4	70
400-449	107.6	71	113.7	65
450-499	117.3	38	163.4	19
500-549	98.6	30	130.0	25
550-599	90.5	23	108.3	13
600-649	88.8	58	143.8	50

Size of Farm	December 1928 Survey		June 1928 Survey	
	Sows Farrowed in Fall of 1928 Expressed in Per Cent of Sows Farrowed Fall 1927	Number of Farms	Sows Farrowed in Spring of 1928 Expressed in Per Cent of Sows Farrowed Spring 1927	Number of Farms
0-49	114.0	186	112.7	171
50-99	103.6	674	107.8	918
100-149	106.2	822	111.0	1117
150-199	112.7	721	108.8	1075
200-249	106.9	480	105.2	710
250-299	109.3	196	101.6	293
300-349	101.4	150	107.5	269
350-399	112.7	72	103.3	117
400-449	111.0	90	110.2	125
450-499	99.6	45	112.7	51
500-549	111.8	31	99.8	52
550-599	123.2	6	99.6	25
600-649	107.8	7	113.9	92

<sup>1</sup>The data on which this summary is based were compiled from the original pig survey tabulations for Missouri of the U. S. Dept. of Agr.

With this in view a comparison was made of the results of 120 identical reports, which were all that could be obtained for the four surveys, June and December of 1927 and 1928. The results of this comparison are shown in Table 18. Because of the relatively small number of identical reports available for all four periods the significance of the results may be questioned. The table shows the number of sows farrowed in the spring and fall of 1928 expressed as a percentage of the number of sows farrowing in the spring and fall of 1927.

The number of pigs saved for the same periods is similarly shown. The percentages given show some variation between identical reports and the entire survey. In June 1928 the identical reports indicated a decrease of 2 per cent in number of sows farrowed, while the entire survey for the State showed an increase of 0.7 per cent. The results of the same comparison for the December 1928 survey were a 5.6 per cent increase and a 3.6 per cent decrease for identical reports and the entire survey, respectively. There seems to be no indication that the production changes of farmers making the identical reports is more in accord with changes in prices than the changes of the entire group of farmers included in the surveys for the same periods.

TABLE 18.—A COMPARISON OF CHANGES IN SWINE PRODUCTION AS SHOWN BY IDENTICAL REPORTS AND BY ALL SURVEY REPORTS FOR THE JUNE AND DECEMBER 1928 SURVEYS FOR MISSOURI<sup>1</sup>

	Identical Reports	Entire Survey
Number of Sows Farrowed Spring 1928 as Compared to Spring 1927	98%	100.7%
Number of Pigs Saved Spring 1928 as Compared to Spring 1927	99.1%	107.4%
Number of Sows Farrowed Fall 1928 as Compared to Fall 1927	105.6%	96.4%
Number of Pigs Saved Fall 1928 as Compared to Fall 1927	96.1%	96.4%

<sup>1</sup>Based on 120 identical reports for the four periods given.

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