AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

GIANNINI FOUNDATION OF
AGRICULTURAL ECONOMICS
LIBRARY
JUL 13 1970

UNIVERSITY OF
MANCHESTER

FACULTY OF ECONOMIC
AND SOCIAL STUDIES

DEPARTMENT OF AGRICULTURAL ECONOMICS

REGIONAL DIFFERENCES IN THE STRUCTURE OF THE UNITED KINGDOM PIG INDUSTRY

W. T. FRIGGENS
AND
D. R. COLMAN

BULLETIN No. 126

Price: FIVE SHILLINGS

REGIONAL DIFFERENCES IN THE STRUCTURE OF THE UNITED KINGDOM PIG INDUSTRY

BY

W. T. Friggens
and
D. R. Colman

Bulletin No. 126 March 1969

This is a report on a piece of work designed to investigate the existence of regional differences in the structure of pig production in the United Kingdom. The work was not conceived as an end in itself but as a piece of preliminary groundwork for a larger and more complex study of regional supply responses in the pig industry.

The types of structural features which appear likely to influence supply responses are 1) the proportion of pig output to total agricultural output in the region. 2) the average size of pig herds - this may indicate the relative amounts of fixed capital invested in pig production in the different regions, 3) the degree of specialisation in breeding and fattening pig production and 4) the degree of concentration of production within regions.

A THE DATA

The basic data employed was June census data for England and Wales, on a regional basis for 1) total pigs, cross-classified by farm size and herd size, and 2) sows and gilts for breeding, cross-classified on the same basis. This data was made available by the Ministry of Agriculture, Fisheries and Food for the two years 1963 and 1966, which made it possible to compare concentration measures on a two year basis, to obtain a very rough measure of trends in concentration.

Attempts were made to obtain comparable data for the regions of Scotland and Northern Ireland. These were not entirely successful in that for these areas data were not as complete as for England and Wales. In addition, the years for which these data were available differed. Scottish data were obtained for

1964 and 1967, and Northern Ireland data for 1966 and 1967. In consequence, it did not prove possible to obtain comparable measures of regional structure for all the pig producing regions of the U.K.

B. MEASURES OF REGIONAL STRUCTURE

Using only the data mentioned above, a number of measures of regional differences in the structure of pig output were generated.

(i) One structural aspect of production which would seem to have an important bearing upon supply is the proportion of a region's agricultural output which is accounted for by the product under consideration. Thus, ideally, one wants to compare the ratios of the gross or net values of pig output to total agricultural output for the various regions. Unfortunately, the available data did not permit this. One measure which can be obtained for purposes of regional comparison is the number of pigs per hundred acres of agricultural land. This is clearly an imperfect measure of the emphasis on pig production since it is possible that the output of all agricultural products varies in exactly the same proportion as pig output per hundred acres. This is unlikely, although it must be conceded that in regions with large areas of extensive grazing, e.g. Wales and some regions of Scotland, output of many products on a per hundred acre basis will be comparatively low (with the possible exception of sheep). However, the number of pigs per hundred acres of agricultural land may serve as some indicator of the regional importance of pigs in agricultural production, and hence of regional specialisation.

(ii) A second measure of regional differences in the structure of the pig industry is the percentage of all agricultural holdings which produce pigs. The higher this percentage the more extensive the role of pig production in the region, although this does not necessarily denote that pigs are more important in terms of their relative value of output (measure (i)) .

(iii) In fact whether a larger percentage of all holdings with pigs denotes a higher relative importance of pigs in terms of value of agricultural output will depend upon a number of factors, amongst which will be the average size of pigs herds within the region.

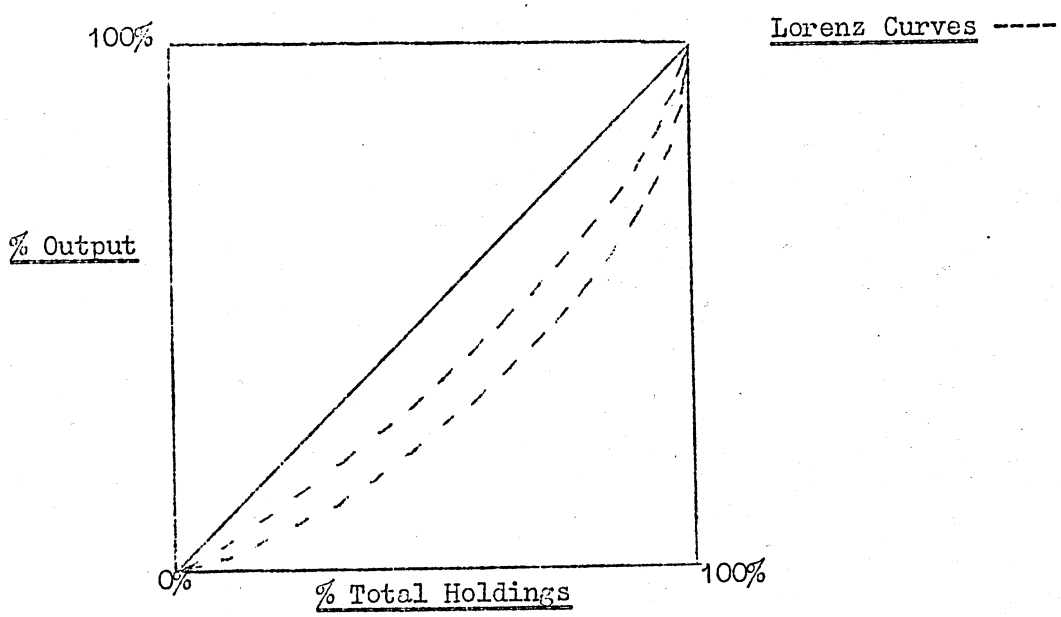
(iv) For any given average regional pig herd size and given proportion of total holdings with pigs supply response may vary with differences in the degree of producer specialisation within regions. That is to say that two regions may well have the same proportion of pig holdings to total holdings and an identical average herd size, with all other features identical, but the distribution of the pigs between holdings may differ in such a way as to cause the supply response pattern of the regions to differ. The measure employed for differences in production concentration within regions is the Gini coefficient. An explanation of this measure, which is derived from the Lorenz curve, is presented below.

It was intimated in the introduction that an attempt would be made to consider regional differences in breeding and fattening pig numbers (thus far discussion) has been confined to pigs as a whole). Data availability prevented the producer concentration analysis being performed for fattening pig production, and hence this is presented for breeding pig numbers only.

C. The Gini Coefficient

The Gini Coefficient, derived from the Lorenz curve is a single statistical measure showing the overall distribution of total output between holdings. Usually used in connection with studies concerning the degree of inequality in the distribution of income, the Lorenz curve is a geometric device in which the cumulated distribution of one variable is plotted against the cumulated distribution of a second variable. Theoretically, it is a smooth curve, but if GROUPED DATA are used (as in this study) then a series of points will arise and thus the curve derived is the set of straight lines joining these points.

In this study, the cumulative percentage of holdings in each herd size group has been measured along one axis, and the cumulative percentage of pig output from each of these groups has been measured along the other axis. If output is equally distributed, a given percentage of the holdings will produce the same percentage of output, and the resulting Lorenz curve will be a 45° line.



It is usually the case, however, that output is not equally distributed. In the diagram above the percentage of total holdings has been cumulated from smallest to largest. As the degree of inequality increases with the small number of large holdings contributing a greater percentage of total output, then the Lorenz curve moves away from the diagonal into the bottom right hand triangle. However, if the percentage of total holdings had been cumulated from largest to smallest, the Lorenz curve would have moved outwards into the top left hand triangle as the degree of inequality increased.

There are a number of disadvantages in using Lorenz curves. When two curves intersect, for example, it may be difficult to decide which curve represents the greater degree of inequality. In addition comparison of regional concentration is difficult when based on several curves drawn in the space - it becomes extremely difficult to visually disentangle them. The GINI COEFFICIENT provides a way of overcoming these difficulties. It is measured by :- "The ratio of the area between the Lorenz curve and the line of perfect equality to the area of maximum inequality which is given by the right-angle triangle underneath the diagonal. This measure is the mean difference between the outputs divided by twice the arithmetic mean of the terms - in other words one half the relative mean difference"[1]. Expressed differently, the Gini coefficient measures the ratio of the area between the plotted curve and the 45° line to the area of the triangle under the 45° line.

---

1. The formula for the Gini coefficient is: $c = \sum_{k=0}^{n-1} \frac{(X_k \cdot Y_{k+1} - X_{k+1} \cdot Y_k)}{10,000}$

where the X_k are the elements of the cumulative frequency distribution on the independent (X) axis and the Y_k are the elements of the cumulative frequency distribution of the dependent (Y) axis, $k = 0, 1, \ldots, n$

The Gini Coefficient has been claculated for each region. The values of the coefficient could theoretically range from zero (perfect equality) to unity (perfect inequality). As the degree of inequality increases, so the Lorenz curve moves outward from the diagonal, and the area between the curve and the 45° line increases. Thus, the greater the degree of inequality in the distribution of output, the higher the value of the Gini Coefficient.

The coefficient is a summary measure and as such, is useful in this study. But it must be realised that a single measure may conceal other changes within the distribution which cancel each other out. Thus two regions may produce the same value of the Gini Coefficient, but have different Lorenz distributions. These might be detected by providing supplementary information on the percentage of output from largest five and smallest five per cent of farms. This is not possible given the data used, and an alternative less satisfactory measure is suggested later.

(1) Pig Output Per 100 Acres in England and Wales

Using the indicator of pig output per 100 acres reveals (in Table 1) that the Lancashire/Yorkshire and Eastern regions are relatively the most important from the point of view of intensity of pig production. These are followed by the South East, South West and West Midlands; the remaining three English regions fall some way behind, with Wales at the bottom of the table (not surprisingly in view of the large area of upland sheep grazing in Wales). It is interesting that this pattern does not imply any simply graded national pattern of specialisation, i.e. concentration is not highest at one locus and diminishing with the distance from that locus. There is some evidence that production is concentrated in areas of the largest urban concentration; the only

TABLE 1 SOME MEASURES OF THE REGIONAL STRUCTURE OF THE PIG INDUSTRY

ENGLAND AND WALES 1966*

Region	Ratio of Pig Holdings to Total Holdings (%)	Pigs per 100 Acres of Farmed Land	Average Size of Pig Herd
South West	32.2 (1)	22.8 (4)	56 (6)
Lancs/Yorks	31.2 (2)	35.05(1)	74 (3)
Eastern	27.3 (3)	34.8 (2)	114 (2)
West Midland	25.3 (4)	21.3 (5)	61 (5)
North	24.3 (5)	12.3 (7)	52 (7)
East Midland	24.0 (6)	15.0 (6)	65 (4)
Wales	21.7 (7)	9.4 (8)	26 (8)
South East	17.3 (8)	26.7 (3)	134 (1)
England/Wales	25.8	20.9	70

* Figures in parentheses are rankings

SCOTLAND AND NORTHERN IRELAND 1967

South East (S)	a	a	101 (1)
East Central (S)	a	a	92 (2)
South West (S)	a	a	72 (3)
North East (S)	a	a	70 (4)
Highlands (S)	a	a	53 (5)
Scotland	a	a	76
Northern Ireland	a	a	42

(S) = Scotland

a = Data not available

region which is much out of line being the West Midlands where production intensity seems rather low given the large markets nearby.

(ii) Ratio of Pig Holdings to Total Holdings in England and Wales

In general there is a very close correspondence between the rankings of regions on the basis of pigs per 100 acres and the ratio of all holdings which have pigs. With the exceptions of the South East and South West regions the ranks of regions according to both criteria (i) and (ii) lie within two of each other. It is the former of these two regions which deviates most in these two ranking schemes, lying eighth in the percentage of holdings ranking and third on the basis of intensity of output per 100 acres.

This correlation between the two ranking schemes, suggests that regional specialisation in pig production is a direct function of the percentage of pig holdings in the region - not a very surprising discovery.

(iii) Average Size of Pig Herd

From Table 1 it also turns out that the regional ranking for England and Wales on the basis of average herd size is very closely correlated with the rank on the basis of pigs per 100 acres. In this comparison none of the ranking value diverge by more than two and for four of the eight regions the ranked values are identical.

The reason why a relatively low number of South Eastern farmers produce a relatively high pig output per 100 acres is explained by the very large average size of pig herds in the region. The converse situation for the South West region appears to be due to the comparatively low average herd size.

If average herd size is accepted as a measure of producer specialisation it then appears that producer specialisation dominates the relative numbers of producers as the determinant of regional specialisation in pig production (this being measured as pigs/100 acres). Their effects will of course be cumulative, but this does not prevent the dominance of one characteristic.

It is interesting to note that regional differences in herd size in Scotland are almost as great as those for the regions of England and Wales.

(iv) Regional Concentration of Producers for Total and Breeding Pigs

For the purposes of this part of the analysis the following definitions were used.

(a) For total pigs, small holdings were defined to be those with less than 50 pigs.

(b) For total pigs, large holdings are defined to be those with more than 500 pigs in England and Wales and more than 250 pigs in Scotland.

(c) For breeding pigs, small holdings are defined to be those with less than 15 sows in England, Wales and Scotland and less than 10 sows in Northern Ireland.

(d) For breeding pigs, large holdings are defined as those with 50 sows or more.

Concentrating first or the Gini coefficients produced for the regions of England and Wales for the year 1966: If one compares the ranking of these coefficients (Table 2A) to the regional ranking according to average herd size it appears that a fairly close correlation exists. This is precisely what one might expect. The Gini coefficient measures the degree of producer concentration, a large value of the coefficient denoting that a high proportion of total output

TABLE 2A TOTAL PIG CONCENTRATION

Region	Gini Coefficient		% Output in Small holdings		% Output from Large Holdings	
	1963	1966	1963	1966	1963	1966
East	0.30567	0.34294 (2)	13.1	7.8 (2)	22.0	35.0 (1)
South East	0.32487	0.34526 (1)	12.3	7.2 (1)	24.0	31.0 (2)
East Midlands	0.28255	0.31586 (3)	24.8	16.2 (4)	12.0	25.0 (4)
West Midlands	0.27222	0.28929 (6)	25.3	18.4 (5)	13.0	17.0 (6)
South West	0.25630	0.28923 (7)	26.0	19.3 (6)	15.0	22.0 (5)
North	0.27887	0.29777 (5)	27.0	21.0 (7)	13.0	16.0 (7)
Lancs/Yorks	0.27490	0.31380 (4)	22.0	14.0 (3)	17.0	31.0 (3)
Wales	0.21447	0.22739 (8)	51.6	44.2 (8)	11.0	14.0 (8)
England/Wales	0.29148	0.32380	22.0	15.0	18.0	27.0
	1964	1967	1964	1967	1964	1967
Highlands	0.34958	0.37752 (2)	19.2	16.0 (4)	45.7	50.6 (5)
North East	0.31020	0.35310 (5)	23.4	16.3 (5)	45.3	55.1 (4)
East Central	0.35047	0.37206 (3)	14.8	10.0 (2)	50.6	55.6 (2)
South East	0.40167	0.40846 (1)	9.5	7.8 (1)	61.9	62.9 (1)
South West	0.31144	0.36654 (4)	20.9	14.1 (3)	42.2	55.5 (3)
Scotland	0.33470	0.36986	18.7	13.4	48.6	56.4
	1966	1967	1966	1967	1966	1967
North Ireland	0.20470	0.21258	32.3	31.9	11.7	12.3

is in the hands of a small proportion of producers. If this is so the average herd size would be expected to be large. Thus both of these measures of producer (as opposed to regional) specialisation provide the same result.

In Scotland, were it not for the anomalous performance of the Highlands region, the correlation of the two producer specialisation rankings would be perfect. The Highlands with the lowest average herd-size of all the Scottish regions turns out to have the second most concentrated producer structure. This displaces the second, third and fourth regions in the average herd size rankings by one position. It is interesting to note that the coefficients for the Scottish regions are in general higher than those for England and Wales. This denotes a greater degree of relative producer specialisation in pig production in Scotland.

One difficulty in the application of Gini coefficients is to decide what size difference in the coefficients constitutes a significant difference. There are no statistical tables for this. Differences found in previous studies, such as that of income distribution by P. Devine,[1] found differences very much lower than those exhibited between regions in this study. Thus, on the basis of some previous work the concentration differences noted here appear to be of 'significant' size. Had results been produced for the percentage of pigs on the smallest five and largest five per cent of farms the ranking would have been

---

1. Devine P. J. Unpublished M.A.(Econ.) Thesis. University of Manchester 1967. "Inter Regional Variations in the Degree of Income Distribution. The United Kingdom 1949-1965"

TABLE 2B BREEDING PIGS CONCENTRATION

Region	Gini Coefficient		% Output in Small holdings		% Output from Large Holdings	
	1963	1966	1963	1966	1963	1966
East	0.24726	0.29003 (2)	28.3	19.9 (2)	33.0	39.8 (2)
South East	0.25701	0.30034 (1)	26.5	18.0 (1)	31.6	42.5 (1)
East Midland	0.19536	0.24340 (3)	46.0	33.2 (3)	20.6	28.2 (3)
West Midlands	0.19026	0.21983 (5)	49.0	40.1 (5)	16.8	21.2 (5)
South West	0.16700	0.20194 (7)	52.6	43.6 (7)	15.2	20.5 (6)
North	0.17292	0.21491 (6)	54.1	41.5 (6)	11.9	20.0 (7)
Lancs/Yorks	0.18290	0.22111 (4)	48.2	38.3 (4)	13.6	23.8 (4)
Wales	0.10908	0.12785 (8)	78.6	71.8 (8)	5.1	4.8 (8)
England/Wales	0.20372	0.24469	43.5	33.6	21.2	28.6
	1964	1967	1964	1967	1964	1967
Highlands	0.20449	0.27128 (3)	44.4	26.9 (3)	27.2	30.1 (3)
North East	0.19146	0.23699 (5)	53.0	35.1 (5)	18.9	26.7 (5)
East Central	0.26314	0.28355 (2)	25.8	21.7 (2)	37.6	44.3 (2)
South East	0.31274	0.32380 (1)	18.3	14.5 (1)	49.3	52.3 (1)
South West	0.20091	0.24275 (4)	42.5	34.0 (4)	26.9	29.0 (4)
Scotland	0.23401	0.26237	35.2	29.0	33.7	39.0
	1966	1967	1966	1967	1966	1967
North Ireland	0.18956	0.19614	63.5	58.4	4.6	5.4

identical with the Gini coefficient ranking. Presentation of such figures would have helped illustrate the empirical meaning of the Gini coefficient. In the absence of the data required for these figures, the next best alternative has been presented. These are the proportion of output from small holdings and large holdings (as defined above). It will be seen that although the ranking of those proportions are not perfectly correlated with the Gini coefficient ranking, they are very similar - given that an inverse ranking has been assigned to the output of small holdings:

What these figures on the proportion of output from the two classes of farms indicate is that the higher the Gini coefficient the higher the proportion of output from the larger farms and the lower the proportion of output from small farms. Thus they merely serve as an illustration of the implications of different values of the Gini coefficient.

Turning to breeding pigs in 1966 or 1967 the immediately noteworthy feature is the much lower values of the Gini coefficients. The implication of this is that there is much less concentration in the breeding side of the industry, than in the industry as a whole. Because the difference between total pig and breeding pig numbers is the number of fattening pigs, the implication of the difference between these two sets of values is that concentration in fattening sector must be higher than that indicated for pigs as a whole.

It is also of interest that the rankings of regions of England, Wales and Scotland according to their coefficients of concentration in pig breeding are almost identical to the rankings obtained for total pig numbers.

The rate of change in producer concentration between 1963 and 1966 in England and Wales appears to have been very rapid. All the results in Tables 2A and 2B indicate marked increases in the size of the Gini coefficients, with a correspondingly large fall in the proportion of total and breeding pigs on small holdings and a substantial increase in the proportion on large holdings It also appears that this change in concentration in production is proceeding at roughly the same rate in all regions; for a ranking of regions according to the different concentration measures in 1966 or 1967 appears to be similar for the ranking on the 1963 or 1964 basis.

E An Attempt to investigate specialisation in the Fattening of Pigs

The basic data used gave the number of holdings with any type of pigs and the number of holdings which only had breeding pigs. The difference between these two must clearly be comprised of those holdings which had fattening pigs. For the subsequent piece of analysis these holdings are referred to as specialist fattening pig holdings. It is acknowledged that this definition is imprecise, since there is no indication that holdings classified on this basis are those belonging to the largest pig fatteners - the data provides no way of checking this.

Table 3 presents details of the distribution of holdings defined as specialist fattening holdings. One feature which does emerge is that there is a fairly close correlation between the rankings of the number of holdings with breeding pigs and the number of specialist fattening holdings. For Scottish regions these two rankings can be seen to be identical, while for England and Wales this relationship is somewhat less than perfect. Using our rather weak measure of the number of fattening pig specialists it appears

TABLE 3 THE REGIONAL DISTRIBUTION OF SPECIALIST FATTENING PIG HOLDINGS

Region	Total Pig Holdings	Holdings with Breeding Pigs	Holdings Specialising in fattening pigs	% Fattening Spec. Holdings to total Holdings	% Breeding Holdings to Total Holdings
1966					
East	12,104	9392 (2)	2712 (3)	22.4	77.6
South East	6,275	4599 (8)	1676 (7)	26.7	73.3
East Midlands	7,139	4913 (6)	2226 (5)	31.2	68.8
West Midlands	10,839	7959 (5)	2880 (2)	26.6	73.4
South West	18,201	14,149 (1)	4052 (1)	22.3	77.7
North	6,104	4673 (7)	1431 (8)	23.4	76.4
Lancs/Yorks	11,032	8343 (3)	2689 (4)	24.4	75.4
Wales	10,433	8336 (4)	2097 (6)	20.0	80.0
England/Wales	82,127	62,364	19763	24.1	75.9
1967					
Highlands	239	127 (5)	112 (5)	46.9	53.1
North East	3,109	2287 (1)	822 (1)	26.4	73.6
East Central	953	579 (3)	374 (3)	39.2	60.8
South East	713	390 (4)	323 (4)	45.0	55.0
South West	1,424	918 (2)	506 (2)	35.5	64.5
Scotland	6,438	4301	2137	33.2	66.8
1967 North Ireland	22,780	19236	3544	15.5	84.5

that the proportions of breeding herds and purely fattening herds are closely clustered around a mean value for the regions of England and Wales. This is illustrated in the last two columns of Table 3. The mean proportion of specialist fattening holdings to total holdings is 24.1 per cent and that for holdings with breeding pigs is 75.9 per cent. The variations of the regional proportions around these means are small.

In Scotland there appear to be relatively large differences between regions in their proportions of specialist fattening and breeding herds to total holdings with pigs. It is also of interest that the mean proportion of specialist fattening holdings is larger than in England and Wales, while the mean proportion of holdings with breeding herds is smaller. This demonstrates a higher degree of producer specialisation in Scotland and is consistent with the finding of the concentration analysis, that producer concentration (specialisation) was higher in Scotland than in England and Wales.

CONCLUSIONS

It has been demonstrated that there are marked differences in the degree of specialisation in pig production between the various regions of the U.K. Extrapolating the results of the England and Wales regional analysis suggests that these regional differences in specialisation result from the extent to which producers within the region are specialist producers. In principle, a region might be an important pig producing region, despite having a small average size, simply because all agricultural holdings produced pigs. In fact variations in the number of pig holdings between regions do not appear to have as much bearing upon regional specialisation as does the number of large producers in the region. These regional differences in the structure of the pig industry

may well influence the pig supply response patterns of the regions.

As far as time series supply response analysis goes the existence of rapid shifts in producer specialisation may well cause changes in supply response behaviour over time. Thus supply elasticities may be changing rapidly, a feature which would be masked in using multiple regression on time series data.

With respect to these changes in concentration over time it is important to note that they do not appear to disturb the ranking of regions according to their degree of specialisation. However between 1963(1964) and 1966(1967) there was a change in the ranking of regions according to the proportions of pigs carried on small and large holdings. Hence if regional supply response behaviour depends upon producer concentration, it seems likely that relative regional differences in the parameters governing these responses may well change over time, which has considerable implications for time series analysis.