

Harvest Fluctuations and English Economic History, 1620-1759

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IN THE AGRICULTURAL HISTORY REVIEW, vol. XII, pt 1 (1964), I elaborated a method for assessing the quality of wheat harvests over a period of 140 years (1480-1619) and attempted to relate the fluctuations in harvest yields to some of the general facts of English economic history. In this article I propose to apply the same technique to the succeeding 140 years (1620-1759). My method of classifying harvests was outlined in Appendix I of my earlier paper, to which the reader is referred. Nor do I propose to repeat my main conclusions for the earlier period except by way of comparison or contrast wherever it appears relevant to do so.

Of the 140 harvests between 1620 and 1759 inclusive, 37 were deficient, and of these 22 could be classed as bad; and 53 were good to a varying degree. This leaves 50 harvests out of the 140 as of average quality. These results can best be appreciated perhaps by tabulating them comparatively, as follows. I have added a classification for the period 1760-1800 as a matter of interest though I shall not discuss this period in detail in this article.

TABLE I
CLASSIFICATION OF WHEAT HARVESTS, 1480-1800

<i>Harvests</i>	1480-1619		1620-1759		1760-1800	
	<i>Number</i>	<i>% of total</i>	<i>Number</i>	<i>% of total</i>	<i>Number</i>	<i>% of total</i>
Deficient*	35	25	37	26	12	29
Average*	47	34	50	36	13	32
Good*	58	41	53	38	16	39
<i>Totals</i>	140	100	140	100	41	100

* To save reference to my earlier article on this crucial definition of 'deficient' and 'good', I should say here that where the average price for the harvest year was 10 per cent or more above the norm (a 31-year moving average) I classified the harvest as 'deficient'; and that where the average for the harvest year was 10 per cent or more below the norm I called the harvest 'good'. An 'average' harvest is defined as one where the average price for the year is within ± 10 per cent of the norm.

There is a remarkable consistency about these results over the whole period between 1480 and 1800, except when one looks more particularly at

SHILLINGS
PER QR.

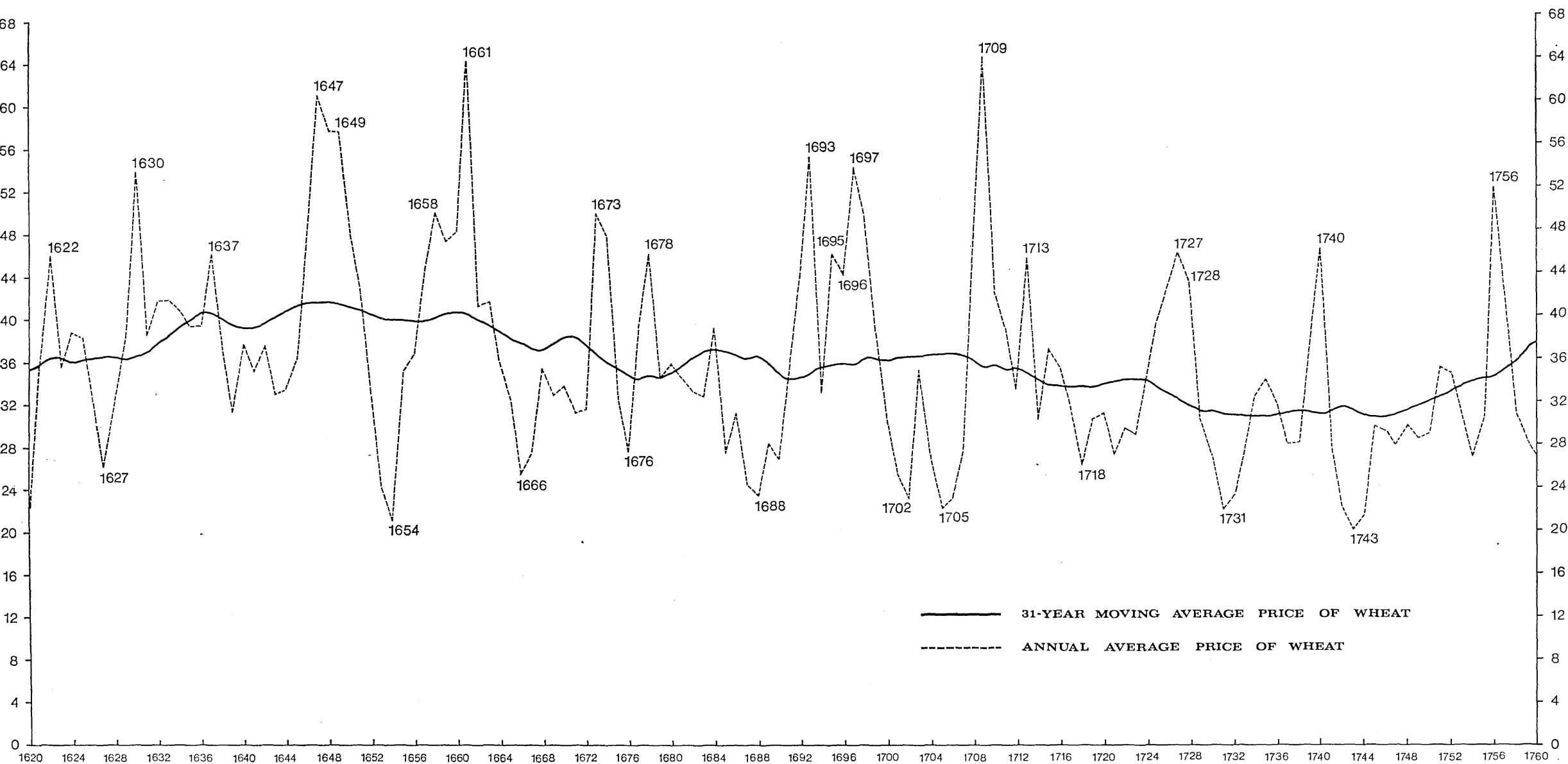


FIG. I

ENGLISH HARVEST FLUCTUATIONS, 1620-1760

the 'bad' harvests, here defined as those where the average price for the year was 25 per cent or more above the norm. Even here, the periods 1480-1619 and 1620-1759 compare closely: 24 bad harvests in the earlier period, and 22 in the later. But of the 41 harvests between 1760 and 1800 only 3 could be

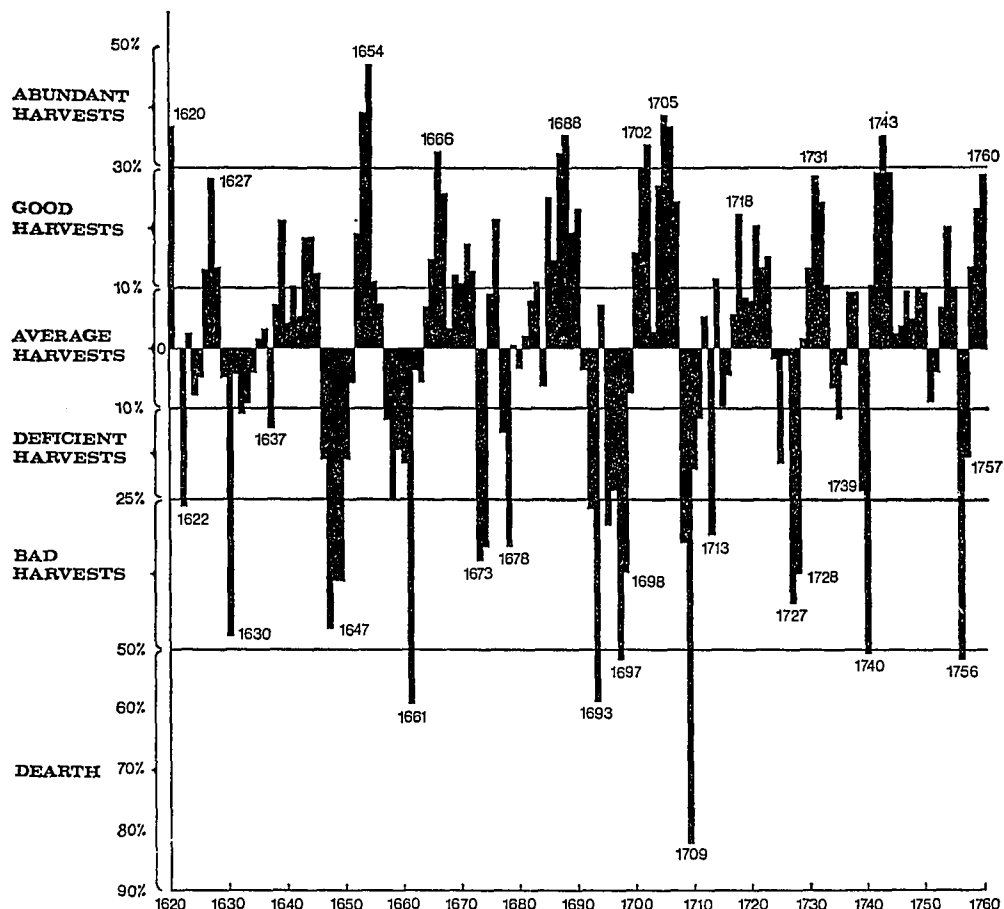


FIG. II

THE QUALITY OF ENGLISH HARVESTS, 1620-1760

The percentage figures in the left-hand margin represent the deviation of the annual average price from the thirty-one-year moving average for that year.

called 'bad' by this price-definition, despite the fact that the percentage of 'deficient' harvests was rather more than in earlier periods. I strongly suspect that the fewness of really bad harvests (by this kind of definition) was due to the effect of increased imports of corn in keeping down prices in the period 1760-1800. In other words, the classification of harvests by the criterion of price, though it works well in earlier periods when corn imports were diffi-

cult or marginal in effect, breaks down in a period when imports were both more easily organized and more massive in quantity.¹

* * *

The earlier period (1480-1619) revealed a feature of the English economy which had never before been realized, and that was that harvests—which I called “the heartbeat of the whole economy”—often showed a sequence of three or four good years in a row, or, much more dramatic in their effects, three or four failures in a row. I also suggested that these good or bad runs were not basically due to weather-cycles but to the underlying factor of yield-ratios. One bad harvest tended to generate another because of a scarcity of seed-corn and so cumulatively until a fundamental change in the weather-pattern in a given year broke the downward sequence and restored the ‘normal’ balance between bread-corn and seed-corn. The English economy in the sixteenth and seventeenth centuries was an agrarian economy that worked on a very fine margin between sufficiency and shortage.

What was the harvest-pattern during the 140 years between 1620 and 1759? Table II serves to bring out the essential facts:

TABLE II
HARVEST-PATTERN BY DECADES, 1620-1759

<i>Decade</i>	<i>Deficient harvests</i>	<i>Good harvests</i>
1620-9	1	4
1630-9	3	1
1640-9	4	4
1650-9	4	4
1660-9	2	4
1670-9	4	4
1680-9	nil	6
1690-9	6	1
1700-9	2	7
1710-19	3	2
1720-9	3	3
1730-9	2	4
1740-9	1	5
1750-9	2	4
	37	53

¹ A reading of the chronology of harvests given in E. L. Jones, *Seasons and Prices*, 1964, suggests there were far more ‘bad’ harvests in the years 1760-1800 if one has regard only to home production.

At first sight this seems to represent a random pattern, yet on closer inspection it reveals some curious—and at this stage rather inexplicable—phases. Thus the pattern of good harvests is fairly consistent down to 1680: five of the six decades between the 1620's and the 1670's each produced four good harvests. Then follows a very variable pattern from 1680 to 1730; and after that a relatively consistent pattern again from 1730 to 1760. This deep-seated pattern, if it is one, hardly seems explicable in terms of yield-ratios. Perhaps at this point we have to turn to the historians of climate and ask whether in the fifty or so years from 1680 onwards there ensued a period of greater variability than is normal even in the English climate.

Good and bad harvests do not, however, fit neatly into decades. Just as the sixteenth century showed some remarkable sequences of good and bad, so did the seventeenth and eighteenth centuries. The worst of the 'bad runs' came in the years 1646–50 and 1657–61: each showed five bad harvests in a row. Or to put it in another way, those who lived through the time of the Civil War and the Commonwealth endured no fewer than ten harvest failures in the space of fifteen or sixteen years. Charles II returned to England in a deficient year, and the next year was even worse—it was a dearth, with its worst impact on the mass of people in the spring of 1662 before the new harvest was got in.¹ Other 'bad runs' were 1695–8 (four failures in a row) and 1708–11 (again four in a row). The worst decades of the period were the 1630's and the 1690's with only one good harvest in each decade.

Of the 'good runs', the best—each of four good harvests in a row—were 1652–5, 1704–7, 1730–3, and 1741–4; but these were all surpassed by the years 1685–90, when there were six good harvests in a row, of which two—1687 and 1688—were abundant.

* * *

It is now time to consider the whole period chronologically and to relate the harvest-picture, so far as is possible, to the general course of English economic history. For the sake of a logical roundness I begin by summarizing briefly the two decades that ushered in the seventeenth century though they were dealt with in my previous article. At the very opening of the century there were six good harvests in a row (1601–6). The year 1607 was average to poor, and the harvest of 1608 was bad. It was followed, clearly by no mere coincidence, by the severe plague-year of 1609. Plague had become a disease of poverty and malnutrition, and 1609 was a year long remembered as "the sickness time."

¹ Fig. III, *London Bread Prices 1620–1760*, shows that the average price of bread reached a peak in 1661 not equalled throughout the entire period.

The decade 1610-19 was about average as a whole but it ended with two good harvests (1618, 1619). The sequence continued: the year 1620 saw the most abundant harvest within living memory. One had to look back as far as 1558 to find a comparable abundance of corn.

The years 1621 to 1623 were unusually wet, culminating in the disastrous harvest of 1622 and the subsequent famine-months of the spring of '23. A Lincolnshire squire on the Wolds complained that many of his tenants had given up their farms and sheep-walks, that thousands of the poor had sold all they possessed and were reduced to eating dog's flesh and old horse-meat.¹ The textile workers of Wiltshire appealed to the county justices to fix

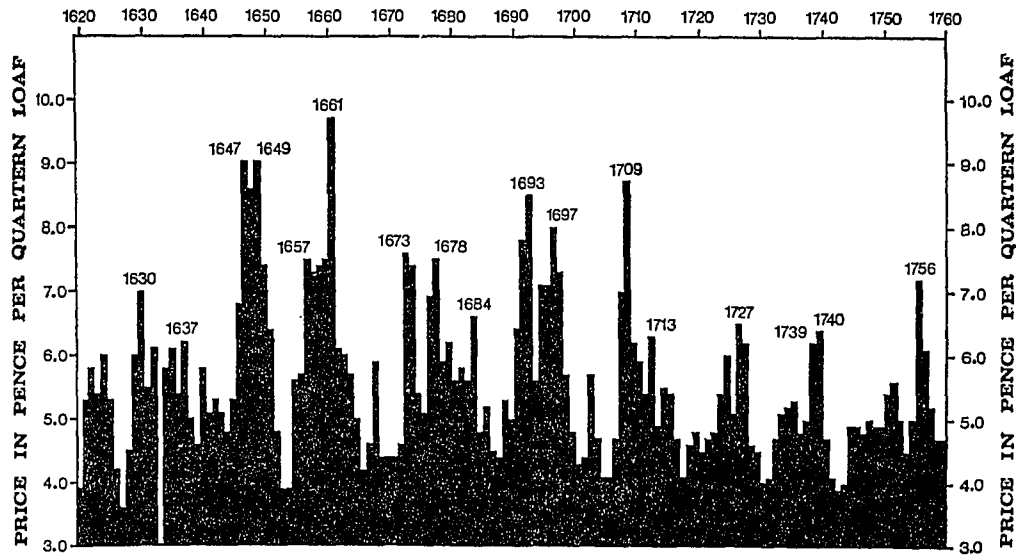


FIG. III

AVERAGE PRICE OF BREAD IN LONDON, 1620-1760

wages "in this great dearth of corn." Even so, widespread unemployment in the textile areas generally kept the price of corn below the famine-level it might have reached. From the northern counties it was reported in the same year that "scarcity and famine be great . . . yet the prices of corn are . . . such . . . as have been in time of indifferent plenty, and this happeneth because of want of monies and want of employment and labour for the poor."²

The rest of the decade was on the whole good from the harvest standpoint (1626-8 brought three plentiful harvests in a row) and the cost of living fell

¹ Quoted in Joan Thirsk, *English Peasant Farming*, p. 193.

² For Wiltshire, see *English Economic History: Select Documents*, ed. by Bland, Brown, and Tawney, pp. 356-7; for the northern counties, B. E. Supple, *Commercial Crisis and Change in England, 1600-1642*, p. 15.

appreciably. But the 1630's, with only one good harvest in ten years instead of the usual four, were a time of high food-prices and of urgent government action in all spheres of social policy. The harvest of 1630 was bad, the spring of 1631 therefore critical. The Somerset justices, noting the high prices not only of corn but of "butter, cheese, and all other commodities," in 1630 tightened their control of badgers and maltsters, and proceedings were taken against engrossers and other offenders in a time of scarcity. The Derbyshire justices, stirred up by the Privy Council like all others, were also active in 1631 about corn supplies and enclosures.¹

Evelyn says of this year (1631): "there happened an extraordinary dearth in England, corn bearing an excessive price," and plague again raged among the poor. No harvest rose above average until the very end of the decade (1639). That of 1637 was very deficient and probably explains the renewed onslaught of the Privy Council against enclosers who were generally regarded as guilty of wholesale conversion to pasture, so reducing the supplies of corn. 'Depopulators' were heavily fined and also required to give an undertaking to restore farmhouses with their arable land attached to them.²

No fewer than three commissions were appointed in the 1630's to inquire into depopulation and enclosures (in 1632, 1635, 1636) and the 1640's opened with widespread agrarian disorders.³ But on the whole, despite the local ravages of the war-years, it was a plentiful time down to the middle of the decade. The harvest of 1646 was, however, deficient, and the next three were very bad, verging upon a dearth. The year 1648 was exceedingly wet: a bad harvest was accompanied by a widespread murrain among cattle. Food-prices rocketed year after year, reaching a peak in 1650. The Phelps-Brown index of food-prices (base-period 1451-75=100) rose as follows:

1646 : 569	1649 : 821
1647 : 667	1650 : 839
1648 : 770	

In other words, food-prices rocketed by nearly 50 per cent in five years. The early 1650's saw a steady fall, so much so that by 1656 the price-index of consumables was rather below that of ten years before. For the vast majority of the population, these short-term fluctuations in the cost of living (of food above all) were infinitely more important than the long-term movements to which economic historians have always paid such assiduous attention. In no

¹ Bland, Brown, and Tawney, *op. cit.*, pp. 385-91, for these counties and Rutland also.

² See among a wealth of contemporary documents, Bland, Brown, and Tawney, *op. cit.*, pp. 275-6, for action by the Lincolnshire justices, c. 1637. In Leicestershire there were even more ferocious fines, the squire of Foston, for example, being fined £2,000 in 1638.

³ E. Lipson, *Economic History of England*, II, pp. 406-7.

other field of human life is Keynes's pungent dismissal of 'the long run' more appropriate;¹ and it is high time that economic historians devoted themselves to this sort of microscopic scrutiny, above all in an economy that was so wildly unequal in its distribution of wealth and resources.

The 1650's saw fairly stable prices generally, with a slight rise towards the end. The Age of Cromwell was blessed on the whole with abundance, the consecutive years from 1652 to 1655 being particularly fruitful. But 1657 was deficient, and Cromwell died of a tertian ague on 3 September 1658, amid a great tempest of wind, while England gathered in the first really bad harvest since the ominous year 1649. A run of bad years culminated in the dearth of 1661-2. Thorold Rogers calls 1662 "a famine," but this must refer to the pre-harvest months, as the harvest itself was an average one. There was a steady fall in the cost of living throughout the 1660's, with only insignificant short-term fluctuations. Indeed, from 1665 to 1672 inclusive, there were no fewer than seven good harvests out of eight, a bounty perhaps unprecedented in English history.

The Corn Laws, which in general were designed to regulate closely the export of corn from a country always liable to a sudden shortage, varied in the price-level at which they prohibited export. They have a somewhat complicated history, but the statutory price limit, above which grain exports were forbidden, had risen greatly during the hundred years or so since 1555 when the limit for wheat had been fixed at 6s. 8d. a quarter. The raising of this limit always followed rapidly upon a serious harvest failure² until in 1663, consequent upon the dearth of 1661-2, it had reached 48s. a quarter. But the Good Years from 1665 to 1672 altered all this.

In 1670 a new Act permitted the export of corn whatever the price in the home market. Though designed, as Lipson says, to promote the interests of landowners and corn-growers, it was made possible only by the dramatic change in the harvest-picture that now appeared to have taken a permanent shape. The freedom to export was still not quite absolute: an embargo could be placed on the transportation of corn in bad seasons. Yet this embargo had to be applied once only in the next thirty years, in the year 1698, after a sequence of bad harvests. It was applied also in 1709; and not until 1741 was it again found necessary. The closing years of the 1750's also saw an embargo (1757-9); but from 1765—outside the present scope of this article—it had to be almost continuously applied. The picture was beginning to change again within roughly a hundred years.

¹ For those who have still never heard it, Keynes said in answer to some objection on 'long-term' grounds: "In the long run we are all dead."

² See, for example, the brief table in Lipson, *op. cit.*, p. 450.

There had clearly been a revolution in corn-production from about the middle of the century, which continued, except for occasional bad spells, so strongly that Defoe could assert in the 1720's that Britain "may truly be called a corn country," able to supply southern and western Europe with corn whenever their own crops failed. The reasons for this revolution lie outside the scope of this present article.¹

The long series of good harvests between 1665 and 1672 ended, as so often, in a bad patch. The harvests of 1673 and 1674 were both bad, and so too was that of 1678. But the 1680's were generally good. Again there was a marvellous bounty. Of the eight harvests between 1683 and 1690, seven were good; and the relative cheapness of food continued into the early 'nineties.

Once again the pattern appeared to revert to the bad old days: 1692 was bad, 1693 a dearth, and then there were bad or deficient harvests in 1695-8 inclusive, with 1699 only average in yield. The level of food-prices (Phelps-Brown index) rose again painfully for almost the whole decade:

1690 : 513	1696 : 697
1691 : 493	1697 : 693
1692 : 542	1698 : 767
1693 : 652	1699 : 773
1694 : 693	1700 : 671
1695 : 645	

The problems of unemployment and destitution, added to those of high corn-prices, led to the great spate of provincial workhouses between 1696 and 1700, beginning at Bristol in 1696, in seven other towns in 1698 alone, and two more in 1700. Altogether ten workhouses were established in these Bad Years. The Acts setting up these institutions expressly stated that the numbers of the poor had greatly increased lately, because of the long war with France, with the consequent decay of trade and increase in unemployment, combined with the years of dearth.

The first decade of the eighteenth century reversed the pattern of the 1690's. Instead of six deficient harvests, the 1700's produced no fewer than seven good ones; but the decade ended disastrously with two very bad harvests (1708, 1709), and those of 1710 and 1711 were still deficient. Thorold Rogers calls both 1709 and 1710 "famine" years, and 1709-10 saw massive killer-epidemics arising from malnutrition. Once again these are scarcely, if ever, referred to by modern economic and social historians: one usually looks in vain in their indexes for entries under 'Harvests' or 'Epidemics', two matters of the highest concern to the great mass of the population.

¹ They are discussed to some extent in an important essay by A. H. John, 'The Course of Agricultural Change, 1660-1760', in *Studies in the Industrial Revolution*, pp. 125-55.

The bad patch—I speak from the consumers' standpoint—did not end until 1714, and apart from 1718 the rest of the decade was only average. The 1720's were also a very mixed decade with three good harvests in a row (1721-3) and two distinctly bad (1727-8). From 1713 to 1730 food-prices were therefore variable without any bad period except for a minor peak in 1729. Tooke refers to "a general sickness" from 1725 to 1729, coinciding with some degree of dearth.

Tooke speaks also of the 1730's as a decade without one season of any general or marked deficiency. In point of fact the Beveridge statistics show a moderate deficiency in 1735 and a greater one in 1739. Other records bear this out: Ellis says that 1735 was "one of the wettest seasons I ever knew," accompanied by "the most general rot in the memory of man." And 1739 was a very wet and stormy season also, followed by the great dearth of 1740. The winter of 1739-40 was one of the most hellish in the memory of man; and in 1741 came the first embargo on the export of grain since the disaster-year of 1709.

As so often happened, the bad run of harvests gave way to a splendid sequence. There were five good harvests in the 1740's (1741-4 inclusive) and another in 1749; and exports of grain from England reached a new peak.

For the 1750's there are some discrepancies between the harvest-picture as deduced from the Beveridge price-data and that tabulated by E. L. Jones in *Seasons and Prices* (1964). My own conclusions show only two deficient harvests and four good ones. Dr Jones records 1750 as "an abundant harvest" but my own conclusion is that it was only an average one generally. Again, in 1751 he suggests "a late and poor harvest" but in general it was average in quantity. In the south-west (Exeter prices) it was, however, deficient, and his Wiltshire reference bears out this regional difference. In 1752 he records "poor harvest" but I find it of average size, though again deficient in the west. His "plentiful harvest" in 1753 I find merely average, though here again some important regional differences may be concealed. For the remaining years—1754 to 1760—we are in agreement.

There were widespread food-riots in the years 1756 and 1757. The summer of 1756 was "the wettest summer in the memory of man" (a familiar phrase) and according to Tooke the harvest was "greatly deficient through the greater part of Europe." The riots of 1757 resulted from the bad preceding harvest, though the harvest of 1757 was itself still deficient and once again an embargo was placed on the export of corn.

After roughly a hundred years of rising corn production and rising grain exports, in which the age-old spectre of harvest-failure, famine, and social disorders was practically eradicated from English thinking, the 1750's were

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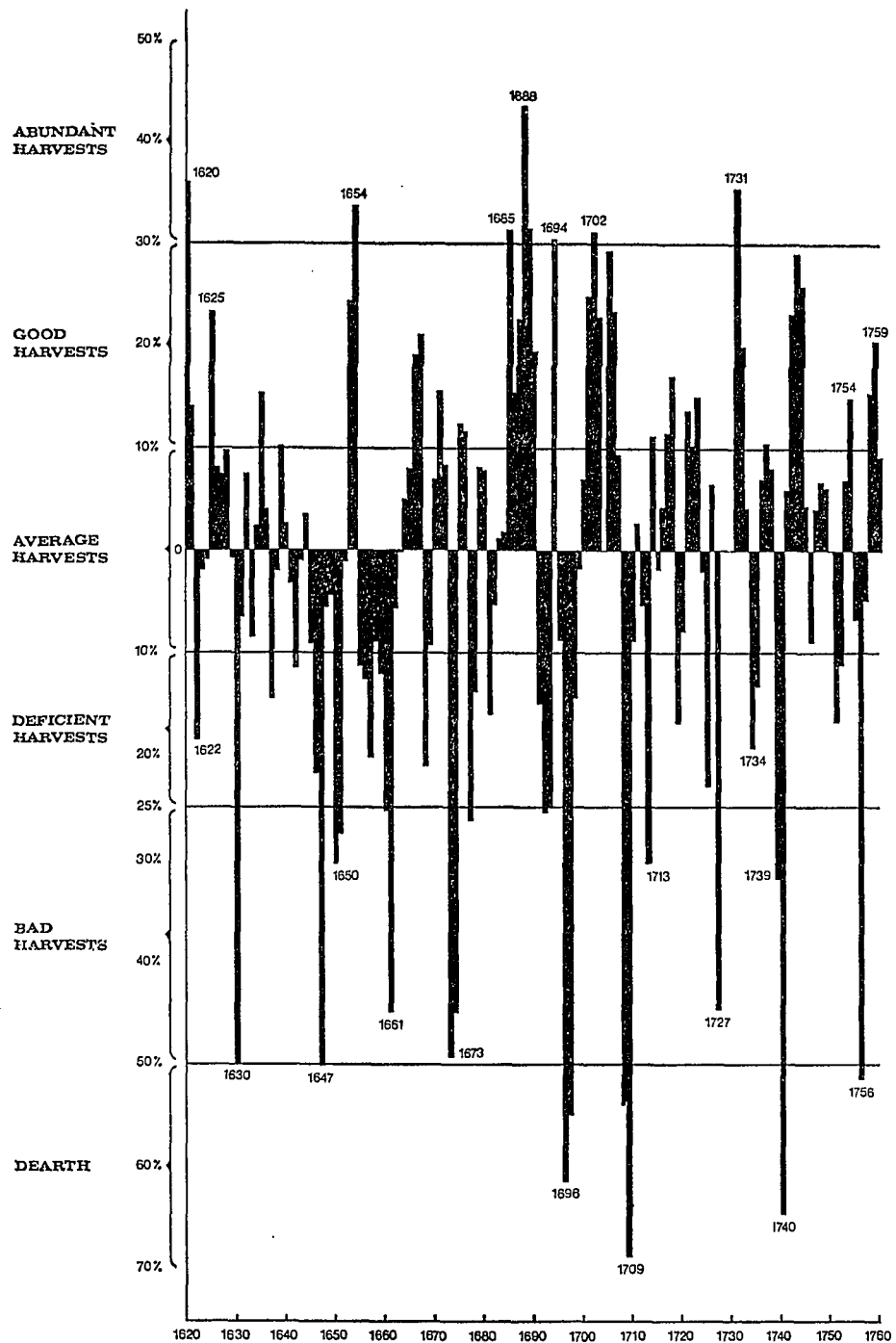


FIG. IV

QUALITY OF SOUTH-WEST ENGLAND HARVESTS, 1620-1760
(based on Exeter wheat prices)

closing with yet another reversal of fortune, just as the millions of non-producers, those in factories and growing towns, required more and more sustenance from the land. There was no sudden or dramatic change in the picture, and the new pattern was perhaps not clearly apparent until the 1790's; but it was beginning to emerge in the late 'fifties. And now I turn, finally, to discuss the most fundamental pattern of all: that of the relationship between yield-ratios and population during the two periods I have discussed in this and my preceding article.

* * *

The ratio of crop yields to seed sown is a fundamental factor of human life, above all in pre-industrial societies. I touched upon this subject only briefly in my previous article mainly because the available information for the sixteenth century is scarce. "Before the sixteenth century eight to ten bushels of wheat were thought a reasonable return for the sowing of two bushels; and thereafter it was still a common return from the strip in the open field."¹ In other words the normal yield-ratio before the sixteenth century was reckoned to be 4 or 5. At Hurdwick in west Devon (a Tavistock Abbey estate) a short series of wheat harvests between 1504 and 1537 shows an average ratio of 6.6, the lowest figure being 4.6 in 1537 and the highest 9.3 in 1508.² In a good year, therefore, the yield-ratio could be just about double that of a bad year. According to Trow-Smith, the sixteenth century saw a very marked rise in yield in those areas where enclosure had given land a long rest under pasture, especially where the practice of convertible husbandry had been widely adopted.³

Single years are almost valueless as a guide, but for what it is worth the estimated yield-ratio for wheat at Walton (Somerset) c. 1583 was 8.0; and for Cuxham (Oxfordshire) in the 1570's Thorold Rogers calculated a ratio of 8.0. Harrison in 1577 (quoted by Trow-Smith) considered that the yield of wheat in average years was commonly 16 to 21 bushels, which again gives a ratio to seed of between 8 and 10.

For rye, we have only Finberg's figures for Hurdwick which show an average ratio of 8.8 for the fifteenth century and 8.1 for the early sixteenth century. For oats, we are again dependent on the pioneer work of Finberg on the Tavistock Abbey estates. At Hurdwick the average ratio for large oats in

¹ R. Trow-Smith, *English Husbandry*, 1951, p. 105.

² See B. H. Slicher van Bath, *Yield-Ratios, 810-1820*, from which my figures in this section are taken, unless otherwise stated.

³ For the extent of convertible husbandry in a Midland parish in the late sixteenth century, see, for example, W. G. Hoskins, *The Midland Peasant*, pp. 162-4, 233.

1504-37 was 4.5, small oats 4.4. Peas and beans were an important crop from medieval times onwards but our statistical information about these yields is even more meagre. The figures calculated by Raftis for the fifteenth century (Huntingdonshire, 1401-13) show a yield-ratio of 1.7; at Grantchester in 1456 and 1457, the ratio was 2.2 and 2.3 respectively. For peas alone Thorold Rogers calculated a ratio of 6.0 at Cuxham (Oxfordshire) in the years 1571 to 1580.

Seventeenth-century yield-ratios are more informative. At Harwell (Berkshire) between 1612 and 1620, the average ratio for wheat was 11.6, although the range of yield was very wide—from as little as 5.5 in 1613 (a deficient harvest generally) to 20.2 in 1616. But at Nibley (Gloucestershire) at roughly the same time (1604-17) the average ratio for wheat was only 4.7, and at Kempsford (Gloucestershire) it was only 4.0 for a few years between 1618 and 1631. These low figures may be due to poor soils, as some of Arthur Young's statistics for the late eighteenth century (Suffolk, 1797) show a range from 6.0 on poor sandy soils to 20.0 on the finest soils. According to Thorold Rogers the ratio for wheat *c.* 1655 was 6 to 8 but some statistics for Devon and Cornwall in 1668 show much higher ratios.¹ In Devon the yield of wheat ranged from 10 to 20-25 bushels per acre according to the quality of soil, with an average yield of 15 bushels per acre. Yields are given for bad, average, and good soils. On good soil the yield of wheat was generally twice that of a poor soil. For barley the range was between 10 bushels and 25-30, so a good soil yielded 2½ to 3 times a poor one. The mean yield of barley was 14 bushels per acre. Rye ranged from 8 to 14 bushels, with an average of 12; oats, 10 to 20 with a mean of 13. Peas, 10 to 14, with an average of 12; and beans, 10 to 13 with an average of 12. In the 'Marl country' of Devon, generally "very hilly and steep," all yields were lower, only oats and barley showing a higher yield-ratio than the county generally.

TABLE III
YIELD-RATIOS ON AVERAGE SOILS IN DEVON AND CORNWALL

	<i>Wheat</i>	<i>Rye</i>	<i>Barley</i>	<i>Oats</i>	<i>Peas</i>	<i>Beans</i>
Devon	10.0	9.6	5.6	4.3	9.6	9.6
'Marl country'	9.0	9.0	6.0	7.5	4.7	5.3
Cornwall	12.0	10.0	5.0	5.0	6.0	10.0

¹ During the reign of Charles II the Royal Society collected much agricultural information from various parts of the country but only the report on Devon and Cornwall gives seed-rates and yields. See R. V. Lennard, 'English Agriculture under Charles II', *Economic History Review*, IV, no. 1, 1932.

Whatever the merits or demerits of these figures, they are the best we have so far, and they are in line with those for Harwell earlier in the century. They also appear to represent a substantial advance on those for the early sixteenth century, but much more work needs to be done on sixteenth-century yields before we can assert how great was the advance in yield-ratios between the reign of Henry VIII and that of Charles II.

Trow-Smith cites one or two literary references which bear out the fact that seventeenth-century yields were substantially above those for the early sixteenth century. In 1601 Edward Maxey in his book *New Instruction of Plowing and Setting of Corne* reckoned that the yield of wheat in the open fields was not above 16 bushels (that is, a yield-ratio of about 8) but that in well-cultivated enclosed land "well dunged and sown with choicest picked seed" the yield could be as high as 48 to 64 bushels to the acre. Norden in 1607 asserted that on the fertile mid-Somerset levels it was possible to get as much as 10 quarters to the acre.

In view of the wide range of the seventeenth-century figures an 'average' yield-ratio may be almost without meaning for particular regions; but what has been said above would suggest that the ratio rarely fell below 8 to 10 in this period. In other words, the yield-ratio roughly doubled between late medieval times (c. 1500) and the middle of the seventeenth century. Revolutionary as this increase was, it only just kept pace with the rise of population in the same period. I estimate the population of England and Wales to have been about 2,600,000 in the 1520's and 3,800,000 in 1603.¹ Gregory King estimated the population of the country to be 5½ million in 1688. On this basis we may conclude that the population approximately doubled between the reigns of Henry VIII and Charles II. Thus the remarkable advance in yields in this period brought no real improvement in basic food supplies for the mass of the population.

It seems likely, too, that there was no discernible rise in yield-ratios from the mid-seventeenth century to the end of the eighteenth. Slicher van Bath collects together 129 yield-ratios for wheat given by Arthur Young between 1768 and 1771.² Of these, 72 places showed ratios of less than 10, and 57 were 10 and over. The median ratio was about 9, though a few places were half of this, and some were nearly double (e.g. Holderness 16, Ormskirk 18, and others). Other values given by William Marshall and contemporaries

¹ The first figure is based on what appear to be full musters of able-bodied men in various counties in the 1520's (*Letters and Papers of Henry VIII*, various references). The estimate for 1603 is based on the return of communicants in that year, allowing for children under 15 constituting 40 per cent of the total population.

² S. van Bath, *op. cit.*, pp. 53-5.

aries suggest that a ratio of 9-10 was about the expected level in the last years of the eighteenth century, by which date the population of England and Wales had risen to just over 9,156,000 (1801 census). This represented a rise of over fifty per cent since the beginning of the eighteenth century, with no general rise in yield-ratios. Professor J. Percival, writing some thirty years ago, said that "it is clear that during the last three hundred years there has been little or no change in the yields of wheat which can be obtained from well-cultivated land." Since these words were written, however, the technological revolution of the last two decades has changed the whole picture dramatically. We are now living through another Agricultural Revolution comparable to that of the eighteenth century; or perhaps one might even say, the seventeenth century, about which we still know so very little.¹

¹ J. Percival, *Wheat in Modern Britain*, 1934, quoted by Trow-Smith, *op. cit.*, p. 106. In 1929-38 the yield-ratio for wheat was still only about 10 (15 cwt. per acre). For 1952-62 the average ratio was about 17 (25.6 cwt. per acre). The technological revolution has recently pushed the yield to 34.8 cwt. (1962) which may represent a maximum, giving a yield-ratio of rather more than 20. For barley the ratio averaged about 23.5 in 1952-62, reaching 29 in the latter year. I get these statistics from *The Times* for 26 January 1967, supplemented by information about seed-rates from Mr Tristram Beresford of Chilmark, Wiltshire, to whom I am grateful for expert guidance. He is not, however, responsible for any conclusions I have drawn in these concluding pages.

APPENDIX I

TABLE OF ANNUAL HARVESTS FROM 1620 TO 1759 CLASSIFIED BY QUALITY
(Prices are given in shillings per quarter)

Year	1 <i>General average for year</i>	2 <i>Exeter average for year</i>	3 <i>31-year moving average (norm)</i>	4 <i>Deviation of general average from norm (percentage)</i>	5 <i>General quality of harvest</i>	6 <i>Comments</i>
1620	22.21	22.57	35.28	-37.1	Abundant	Good in West Deficient in West
1621	35.98	30.73	35.77	+ 0.6	Average	
1622	45.89	43.10	36.36	+26.1	Bad	
1623	35.52	37.13	36.44	- 2.6	Average	
1624	38.82	36.30	36.01	+ 7.8	Average	Good in West Average in West Average in West Less good in West
1625	38.25	27.74	36.23	+ 5.6	Average	
1626	31.64	33.44	36.41	-13.1	Good	
1627	26.10	33.69	36.54	-28.6	Good	
1628	31.48	32.88	36.48	-13.7	Good	
1629	38.06	36.53	36.27	+ 4.9	Average	
1630	53.80	54.68	36.44	+47.6	Bad	Dearth in West
1631	38.48	39.33	36.92	+ 4.2	Average	Average in West
1632	41.80	35.02	37.80	+10.6	Deficient	
1633	41.88	41.53	38.44	+ 9.0	Average	
1634	40.91	38.00	39.33	+ 4.0	Average	

HARVEST FLUCTUATIONS, 1620-1759

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Year	1 <i>General average for year</i>	2 <i>Exeter average for year</i>	3 <i>31-year moving average (norm)</i>	4 <i>Deviation of general average from norm (percentage)</i>	5 <i>General quality of harvest</i>	6 <i>Comments</i>
1635	39.43	33.84	40.05	- 1.6	Average	Good in West
1636	39.41	39.08	40.71	- 3.2	Average	
1637	45.99	46.52	40.62	+13.2	Deficient	
1638	36.96	40.66	39.91	- 7.4	Average	
1639	31.11	35.40	39.44	-21.1	Good	
1640	37.64	38.32	39.33	- 4.3	Average	Average in West Deficient in West Average in West Average in West Average in West Dearth in West Average in West Average in West
1641	35.18	40.54	39.28	-10.4	Good	
1642	37.54	44.38	39.70	- 5.4	Average	
1643	32.95	40.92	40.48	-18.6	Good	
1644	33.40	39.53	40.99	-18.5	Good	
1645	36.11	45.05	41.30	-12.6	Good	
1646	49.22	50.65	41.63	+18.3	Deficient	
1647	61.04	62.72	41.72	+46.3	Bad	
1648	57.78	44.01	41.71	+38.5	Bad	
1649	57.66	43.36	41.53	+38.8	Bad	
1650	48.87	53.88	41.26	+18.4	Deficient	Bad in West
1651	43.10	52.13	40.80	+ 5.6	Average	Bad in West
1652	32.69	40.89	40.42	-19.1	Good	Average in West
1653	24.33	30.34	40.08	-39.3	Abundant	Good in West
1654	21.04	26.47	39.93	-47.3	Abundant	Deficient in West Deficient in West Average in West
1655	35.13	44.56	40.01	-12.2	Good	
1656	36.77	44.84	39.80	- 7.6	Average	
1657	44.43	47.78	39.72	+11.8	Deficient	
1658	50.13	43.66	40.11	+25.0	Bad	
1659	47.42	45.50	40.60	+16.8	Deficient	
1660	48.30	50.78	40.54	+19.1	Deficient	Bad in West
1661	64.04	58.37	40.25	+59.1	Dearth	Bad in West
1662	41.30	42.16	39.92	+ 3.5	Average	Average in West Good in West Good in West Deficient in West Average in West
1663	41.61	39.50	39.44	+ 5.5	Average	
1664	35.93	36.76	38.68	- 7.1	Average	
1665	32.25	34.94	37.97	-15.1	Good	
1666	25.13	30.16	37.51	-33.0	Abundant	
1667	27.53	29.32	37.17	-25.9	Abundant	
1668	35.43	45.07	37.18	- 4.7	Average	
1669	32.83	41.16	37.66	-12.8	Good	
1670	33.72	35.17	37.86	-11.0	Good	Average in West
1671	31.08	31.91	37.73	-17.6	Good	Average in West Worse in West
1672	32.48	34.19	37.34	-13.0	Good	
1673	49.57	54.79	36.66	+35.2	Bad	Good in West
1674	47.79	52.11	35.95	+32.9	Bad	
1675	32.02	30.89	35.29	- 9.2	Average	Bad in West Deficient in West
1676	27.26	30.77	34.87	-21.8	Good	
1677	38.94	43.20	34.20	+13.9	Deficient	Deficient in West
1678	46.04	39.44	34.67	+32.9	Bad	
1679	34.21	31.55	34.37	- 0.5	Average	
1680	35.82	32.00	34.70	+ 3.2	Average	Deficient in West
1681	34.33	40.69	35.08	- 2.2	Average	

Year	1 <i>General average for year</i>	2 <i>Exeter average for year</i>	3 <i>31-year moving average (norm)</i>	4 <i>Deviation of general average from norm (percentage)</i>	5 <i>General quality of harvest</i>	6 <i>Comments</i>
1682	33.09	37.90	36.03	- 8.1	Average	Average in West
1683	32.62	36.21	36.72	-11.2	Good	
1684	39.01	36.00	36.83	+ 6.0	Average	Abundant in West
1685	27.43	25.12	36.76	-25.4	Good	
1686	31.09	30.83	36.47	-14.8	Good	Good in West
1687	24.38	28.00	36.25	-32.7	Abundant	
1688	23.37	20.50	36.33	-35.7	Abundant	Abundant in West
1689	28.74	24.36	35.57	-19.2	Good	
1690	26.63	28.01	34.76	-23.4	Good	Deficient in West
1691	35.67	39.65	34.46	+ 3.5	Average	
1692	43.60	43.29	34.47	+26.5	Bad	Bad in West
1693	55.09	43.46	34.75	+58.5	Dearth	
1694	32.71	24.56	35.33	- 7.4	Average	Abundant in West
1695	45.97	38.69	35.60	+29.1	Bad	
1696	44.02	57.68	35.71	+23.3	Deficient	Dearth in West
1697	54.15	55.29	35.66	+51.9	Dearth	
1698	49.42	41.25	36.09	+37.0	Bad	Deficient in West
1699	38.68	36.67	36.00	+ 7.4	Average	
1700	30.13	33.40	35.93	-16.1	Good	Average in West
1701	25.25	27.20	36.18	-30.2	Abundant	
1702	23.80	24.90	36.21	-34.3	Abundant	Good in West
1703	35.18	27.97	36.24	- 2.9	Average	
1704	26.55	—	36.49	-27.2	Good	Good in West
1705	22.30	25.79	36.56	-39.0	Abundant	
1706	23.02	28.01	36.57	-37.0	Abundant	Good in West
1707	27.44	32.93	36.37	-24.6	Good	
1708	47.42	55.27	35.90	+32.1	Bad	Average in West
1709	64.28	59.47	35.24	+82.3	Dearth	
1710	42.46	38.63	35.45	+19.8	Deficient	Less deficient in West
1711	39.12	34.12	35.06	+11.6	Deficient	
1712	33.21	37.02	35.12	- 5.4	Average	Better in West
1713	45.55	45.40	34.79	+31.0	Bad	
1714	30.24	30.29	34.16	-11.5	Good	Deficient in West
1715	36.94	34.35	33.78	+ 9.4	Average	
1716	35.32	32.08	33.52	+ 5.4	Average	Better in West
1717	31.47	29.60	33.44	- 5.9	Average	
1718	25.98	27.80	33.55	-22.6	Good	Deficient in West
1719	30.56	39.12	33.48	- 8.7	Average	
1720	31.03	36.39	33.71	- 8.0	Average	
1721	27.02	29.36	34.02	-20.6	Good	
1722	29.57	30.69	34.18	-13.5	Good	
1723	29.04	29.05	34.21	-15.1	Good	
1724	34.52	34.57	33.89	+ 1.8	Average	
1725	39.62	41.04	33.33	+18.9	Deficient	
1726	33.20	30.72	32.86	+ 1.0	Average	
1727	46.01	46.78	32.30	+42.4	Bad	
1728	43.71	—	31.88	+37.2	Bad	
1729	30.55	—	31.11	- 1.8	Average	

HARVEST FLUCTUATIONS, 1620-1759

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Year	1 <i>General average for year</i>	2 <i>Exeter average for year</i>	3 <i>31-year moving average (norm)</i>	4 <i>Deviation of general average from norm (percentage)</i>	5 <i>General quality of harvest</i>	6 <i>Comments</i>
1730	26.88	—	31.08	-13.5	Good	Abundant in West
1731	21.91	20.00	30.83	-28.9	Good	
1732	23.06	24.46	30.59	-24.6	Good	
1733	27.25	29.22	30.53	-10.7	Good	Average in West
1734	32.55	36.53	30.60	+ 6.4	Average	Deficient in West
1735	34.08	34.67	30.56	+11.5	Deficient	Better in West
1736	31.54	28.50	30.70	+ 2.7	Average	
1737	28.01	27.68	30.94	- 9.5	Average	
1738	28.06	28.50	30.99	- 9.4	Average	Worse in West
1739	38.23	40.84	30.93	+23.6	Deficient	
1740	46.33	50.74	30.78	+50.5	Dearth	Average in West
1741	27.84	29.34	31.18	-10.7	Good	
1742	22.17	24.11	31.44	-29.5	Good	
1743	19.99	22.00	30.96	-35.4	Abundant	Less abundant in West
1744	21.47	22.50	30.47	-29.5	Good	
1745	29.61	28.97	30.33	- 2.4	Average	
1746	29.23	33.16	30.43	- 3.9	Average	Less good in West
1747	27.80	29.45	30.76	- 9.6	Average	
1748	29.61	29.08	31.17	- 5.0	Average	
1749	28.42	29.80	31.70	-10.3	Good	Deficient in West
1750	28.87	31.92	31.94	- 9.6	Average	
1751	35.33	37.84	32.44	+ 8.9	Average	
1752	34.69	36.75	33.03	+ 4.9	Average	Average in West
1753	31.17	31.15	33.48	- 6.9	Average	
1754	26.88	28.69	33.82	-20.5	Good	
1755	30.22	36.39	34.10	-11.4	Good	Average in West
1756	51.91	51.91	34.21	+51.8	Dearth	
1757	41.32	36.77	35.00	+18.1	Deficient	
1758	30.95	30.39	35.93	-13.8	Good	Average in West
1759	28.42	29.40	36.99	-23.2	Good	