

Harvest Fluctuations in an Industrializing Economy: Japan, 1887-1912

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THE question of how fluctuations in the harvest of the staple cereal affect a newly industrializing nation has long been discussed within the context of English history without a firm consensus being reached.¹ Explanations differ concerning the influence of abnormal harvests on births, deaths, and marriages, on the level of prices, farmers' incomes, the fortunes of certain industries, and on the level of activity in the economy. Research into these problems might be advanced by extending the geographical field of enquiry to Japan.

During the Meiji period (1868-1912), Japan's economic structure was not unlike that of eighteenth-century England. Population increase was moderate, but there was a marked expansion in urban areas.² Although by 1912 the economy had achieved a degree of complexity, much of the advance came during and after the Russo-Japanese War (1904-05). Yet textiles remained foremost among the modern industries, and important processes continued to be carried on in cottages and

workshops.³ At the opening of the twentieth century, the mercantile marine was small, and few modern ships were constructed. While there were many 'country banks', and a number of city financial institutions, branch banking was little developed. As in eighteenth-century England, agriculture was an important if relatively declining sector, and was commercialized.⁴ It produced a staple grain, rice, which, though other grains and root crops were cultivated and were important in the diet in certain regions, exceeded in volume and value any other farm product. Rice was nationally marketed, and as most settlements were on the coastal plains much was transported by sea, though a railway network evolved from the mid-1880s. Dependence on foreign trade, while still limited, was growing; and, like England earlier, Japan changed from exporting to net importation of the food staple, though normally the great bulk of supply was home grown.⁵

For the student of harvest fluctuations, Meiji Japan has one advantage over eighteenth-century England, where the only available evidence consists of grain prices, contemporary impressions and unsystematically compiled yield figures

¹ Among works touching on these questions are: T S Ashton, *An Economic History of England: The Eighteenth Century*, 1955 and *Economic Fluctuations in England, 1700-1800*, Oxford, 1959; J D Chambers, *Population, Economy and Society in Pre-Industrial England*, 1972; W G Hoskins, 'Harvest Fluctuations and English Economic History, 1620-1759', *Ag Hist Rev*, XVI, 1, 1968, pp 15-31; E L Jones, *Seasons and Prices: The Role of the Weather in English Agricultural History*, 1964; E A Wrigley and R S Schofield, *The Population History of England 1541-1871*, 1981; W Bagehot, *Lombard Street*, 1915; T Tooke, *A History of Prices and of the State of the Circulation from 1793 to 1837*; preceded by a *Brief Sketch of the Corn Trade in the Last Two Centuries*, 1838, Vol I.

² Population growth per annum was: Japan, 1873-1912 — 0.95 per cent; England, 1761-1801 — 0.81 per cent. The urban percentage of the population was: Japan, 1888 — 12.9, 1912 — 27.6; England, 1750 — 15-16, 1801 — 25. See I Taeuber, *The Population of Japan*, Princeton, 1958, Tables 6, 9; P Deane and W A Cole, *British Economic Growth 1688-1959*, Cambridge, 1964, p 7, Table 2.

³ Textiles' percentage contribution to manufacturing output was: Japan 1874 — 26.4, 1912 — 33.8; England 1770 — 36.0, 1800 — 40.0. See K Ohkawa et al, *Estimates of Long Term Economic Statistics of Japan since 1868* (hereinafter *LTES*), Tokyo, 1965, Vol 10, Table 1; Deane and Cole, *op cit*, p 163.

⁴ Agriculture's percentage share of national output was: Japan 1885 — 42, 1912 — 36; England 1761 — 45, 1801 — 32. See *LTES*, Vol I, Table 9, and Deane and Cole, *op cit*, Tables 35, 36.

⁵ Exports as a percentage of national income were: Japan 1874 — 3, 1913 — 15; England 1700 — 5.5, 1800 — 13. See W W Lockwood, *The Economic Development of Modern Japan*, Princeton, 1954, p 315; Deane and Cole, *op cit*, p 309.

TABLE I

Cereal Production in Years of Abnormal Rice Harvests

Year	Rice	Output (000 koku)		Percentage of trend (trend = 100)		
		Rice	Other Cereals	Rice	Other Cereals	Total
1889	33194	18337	51531	84.35	95.46	87.99
1890	43084	19820	62904	110.09	102.67	107.64
1897	33039	20661	53700	82.70	94.17	86.77
1898	47388	23382	70770	116.51	105.62	112.67
1902	36932	20715	57647	85.86	94.81	88.88
1904	51430	21997	73427	114.19	98.84	109.11
1905	38173	20930	59103	83.43	93.78	86.82

Note A: Trend values obtained from a seven-year moving average.

Note B: Other cereals — wheat, barley, naked barley, millets.

Source: K Ohkawa et al, *Estimates of Long-term Economic Statistics of Japan since 1868* (hereafter *LTES*), Vol 9, Table 12.

from a few localities.⁶ Dependent on a Land Tax for the bulk of its revenue, the Meiji government annually collected statistics of the area cultivated and production of the principal crops. Before the mid-1880s, however, the accuracy of the returns was questionable; and so this enquiry will be confined to the period 1887–1912.⁷

Abnormal harvests: definition, measurement, causes

An abnormal harvest has been defined as one where the crop diverges from the norm by at least ten per cent.⁸ Employment of a seven-year moving average to trace the trend reveals deviations in actual output of this order in seven of the twenty-six years between 1887 and 1912. As Table I shows, a bad harvest was immediately preceded or followed by a good one; thus its economic and demographic impact would have been lighter than that of a succession of poor crops. Serious rice production shortfalls were the result of unusually severe insect and disease attacks or an exceptionally cool summer,

typhoons and floods.⁹ Only the last two directly shut down industrial plants, and even they hampered manufacturing less than did frost and drought, causes of bad harvests in England.¹⁰

The output of other cereals: a compensating factor?

In the late Meiji period, rice was the preferred cereal, but wheat, barley, and millets were eaten, particularly by the poor.¹¹ Doubtless, people would have been prepared, when rice was scarce, to increase consumption of other grains. However, as Table I reveals, their harvest history was similar to that of the staple. Consequently, production of all cereals was 11–13 per cent below average in years of low rice yields, and between 7.6 and 12.7 per cent above when rice harvests were good.

⁶ The first agricultural census was in 1866.

⁷ See J Nakamura, *Agricultural Production and the Economic Development of Japan, 1873–1922*, Princeton, 1966; S Yamada and Y Hayami, 'Agriculture' in Ohkawa and Hayami (eds), *Economic Growth: The Japanese Experience since the Meiji Era*, Tokyo, 1973, Vol I.

⁸ Tooke, *op cit*, pp 12–13.

⁹ T Matsuo, *Rice Culture in Japan*, Tokyo, 1961, pp 72–3; G T Trewartha, *Japan: A Geography*, Madison, 1965, pp 213, 217; T Ogura (ed), *Agricultural Development in Modern Japan*, Tokyo, 1970, p 457.

¹⁰ T S Ashton, *Economic Fluctuations in England, 1700–1800*, p 34.

¹¹ Ogura, *op cit*, pp 181–2, 186–7, cites contemporary sources showing that rice in the main producing areas formed 80 per cent of cereal intake; elsewhere the 'lower class' ate a mixture of two parts of barley or millet and one of rice in 1885. By the 1900s, millet had disappeared from the diet. But Basil Chamberlain found that in the extreme south sweet potatoes still formed 'the chief food of the common people', *Things Japanese; being Notes on Various Subjects connected with Japan*, 1905, pp 21–2.

TABLE 2

Production and Supply of Rice and Total Food Grain Supply

Year	Quantity (000 koku)			Percentage of Trend ^a (trend = 100)		
	Rice Output	Rice Supply	All Cereals ^b Supply	Rice Output	Rice Supply	All Cereals Supply
1889	33194	34909	53246	84.35	89.39	91.39
1890	43084	42781	62601	110.09	109.69	107.36
1897	33039	38138	58799	82.70	93.06	93.45
1898	47388	46705	70087	116.51	111.66	109.57
1902	36932	42172	62887	85.86	91.42	92.51
1904	51430	56811	78808	114.19	116.51	110.97
1905	38173	41444	62374	83.43	86.64	86.59

Note a: seven-year moving average.

Note b: wheat, barley, naked barley, millets, rice.

Sources: LTES, Volume 6, Table 11; Volume 9, Table 12.

The influence of food grain imports on domestic supply

Of the grains, only rice was traded in notable quantities. In eight of the thirteen years between 1887 and 1899, Japan was a net exporter; thereafter it became a net importer. Through foreign commerce, supply fluctuations were normally modified: in 1889, 1897, and 1902, deficiencies in the total quantity of cereals amounted to no more than 6.5 to 8.6 per cent; hence in these years there was no widespread famine even if dearth afflicted some households and localities.

Abnormal rice harvests: regional differences

Seasonal swings in rice production wider than for Japan as a whole were experienced by the two regions and five prefectures selected for study (see Table 3). But whereas after 1901 yield oscillations in the south became more muted, in the northern region of Tohoku and the prefectures of Nagano and Aomori they strengthened. Although all the areas had lean and bumper crops when Japanese production was around its trend value, their output tended to move in the same direction as that of the country during years of abnormal national harvests; the districts suffering most in the denoted poor seasons doing rather better than others in times of national abundance.

The effects on local food supply, income, and demography of losses of one-third to one-half of the normal crop, experienced by Tohoku in 1902 and 1905, Aomori in 1902 and 1906, Saga in 1893, and Kagawa in 1894, certainly warrant an investigation beyond the scope of the present study.

Harvests and demography

While national data on births and deaths is available from 1872, and on marriages from 1883, compilation methods, as well as culture traits, limit its usefulness for an enquiry into possible links between harvests and demographic fluctuations.¹² Local returns were annual, not monthly. The births and deaths of many short-lived infants are thought to have gone unrecorded since infanticide continued to be widely practised, and published crude birth and death rates were well below those of more economically advanced nations. Some vital events were not registered in the year of their occurrence. For example, 1906 was unpropitious for female births; consequently, many were assigned a different date, and despite later official adjustments errors may remain. Analysis of nuptiality is frustrated by the custom of registering marriages months after the

¹² Tacuber, *op cit*, pp 42, 50-2, discusses the problem.

wedding ceremony, and only those which had proved 'suitable'.

What do the published statistics of vital rates reveal after removal of the trend by use of an eleven-year moving average? Between 1887 and 1913 there are no discernible extreme fluctuations in births and deaths. When death rates are high, as in 1893 or earlier in the Meiji era, they are associated with epidemic outbreaks, not bad harvests.¹³ Only two of the four worst crop seasons (1902 and 1905) are accompanied by mortality rates above trend (both deviations are small) whereas all were immediately followed by death rates below trend. A regression analysis demonstrated, not surprisingly, the absence of any statistically significant relationship between rice harvests and registered mortality in late Meiji Japan. But defects in the data may not be the cause. Accounts of the aftermaths of Tohoku's terrible crop seasons of 1902 and 1905 show why starvation-related deaths were probably rare.¹⁴ Farmers consumed wild plants and seed rice, slaughtered draught horses, and mortgaged property. Meanwhile, the authorities disbursed accumulated funds earmarked for famine relief to provide daily rice rations to the destitute. Suspension of land tax and reduction of rents lessened the number of applicants as the region's farm sector habitually planted rice well in excess of its own or local urban needs to meet these obligations. Water and rail transport were well developed, and eye-witnesses indicate that ample food supplies were available commercially, except in remote districts. There, famine indeed struck hard but the hundreds of deaths reported were

insufficient to noticeably affect national mortality figures.

Marriage registration rates were subject to several extreme swings — in 1896, 1898–1900, and 1905–06. The last was perhaps due to wartime conscription but the others may be partly the result of official efforts to improve recording of conjugal relationships. Understandably, as registration did not entail additional short-term social costs and referred to marriages previously entered into, no significant correlation between it and harvests emerges in the period 1887–1913.

Only fertility appears in any way sensitive to crop fluctuations. A regression of birth registrations lagged one year on below average rice yields indicates, with a 95 per cent level of confidence, that over one-third of their variance can be attributed to harvest size. Nevertheless, it should be noted that two of the three lowest birth rates were not associated with poor crops, and after one of the worst harvests the fertility rate was above trend, while not only the previous season's rice production but the Russo-Japanese War has to be considered in an explanation of the 1906 result, when the deviation below trend of registrations was at its maximum for the period.

Rice: crop fluctuations and prices

Exploration of the relationship between rice prices and harvests in late Meiji Japan might help assess the validity of the method adopted in England of using price as a proxy for production statistics. According to one proponent of this technique, a thirty-one year moving average eliminates the effects of monetary and population changes.¹⁵ Thus, an actual price signalled, if it was over 50 per cent above the trend value, a dearth; if 25 to 50 per cent, a bad harvest; 10 to 25 per cent, a deficient crop; whereas a price of 30 per

¹³ Cholera, which had afflicted three million Japanese between 1858 and 1860, killed 250,000 in Tokyo in 1860, raised the death rate to 17.5 and 21.1 per cent above trend in 1885–6, ceased to be a scourge after 1895. Mass vaccinations conquered smallpox. In 1893, the increase in all epidemic disease deaths raised the mortality rate by no more than 3.6 per cent above trend. See Tauber, *op cit*, p 51 and *Résumé Statistique de l'Empire du Japon*, Tokyo, Imperial Cabinet, various issues. Only at the time of the 1858–60 pandemic were rice prices rising rapidly.

¹⁴ See *Japan Weekly Mail*, Yokohama, XXXIX, 7, 14, 21 February, 7 March, 2 May 1903, 6, 20 January, 3 February 1906.

¹⁵ W. G. Hoskins, 'Harvest Fluctuations and English Economic History, 1480–1619', *Ag Hist Rev*, XII, I, 1964, pp 28–46.

cent or more below trend proclaimed an abundant crop; and one between 10 to 30 per cent below, a good harvest. A much earlier writer suggested that when price rose by 30 per cent, the crop was 10 per cent below average; while a price increase of 80 per cent indicated a deficiency of 20 per cent.¹⁶

The proposition that price movements are a mirror image of output changes has been tested against Japanese price and crop data. As rice is not harvested until September–November (and as crop year figures are unavailable before 1896), the price taken to be affected is that of the following calendar year. The thirty-one year moving average method detects the abnormal harvests of 1890, 1897, 1898, and 1904, but it fails to show up those of 1889, 1902, and 1905 (see Table 4). It also finds 'good' and 'abundant' crops when actual yields were not far from average, in 1891–4 and 1907–08. Substitution of a seven-year moving average or the use of the least squares technique produce no better results; while a twenty-five year moving average is even further off the mark.

The discrepancies noted may be due to weaknesses in the Japanese raw data but more probably result from the employment of a theory only applicable to a closed economy, where staple output equals marketed supply and no factor other than output of the staple changes. In late Meiji Japan, however, rice prices were affected by imports and exports, inventory changes, and the proportion of the crop retained by farmers for their own consumption, as well as by changes in income, the prices of other goods, and tastes. The thirty-one year moving average price technique, therefore, is an unreliable gauge of the annual oscillations in production during the period.

Harvest fluctuations and the farming community

Did Japanese farmers benefit or suffer financially as a result of abnormal harvests?¹⁷ Were fluctuations in rice earnings offset by changes in monetary returns from sales of other farm products? To answer these questions calls for some reference to the pattern of agricultural production at national and regional levels; the size distribution of farms; and the influence of changes in prices, wages, rents, taxes, and the value of money.

From production data and Shinohara's estimates of farmers' own consumption and seed requirements, the volume of rice sales can be calculated.¹⁸ The results show that in the poor years of 1889, 1897, and 1902 cultivators were able, because of favourable shifts in the rural/urban terms of trade, to moderate the cuts in their own consumption, and to reduce the proportion of the crop marketed. Conversely, it would seem, when nature was bountiful in 1890 and 1898, farmers could afford to let their share diminish and yet consume a larger quantity. As imports built up in 1904 and 1905, growers appear to have eaten more in the first year; while in the second they responded to a stronger market demand by lowering their own rice intake so that the quantity and share of the crop offered to the market did not decline as much as in previous bad harvests.

Aided by Shinohara's estimates, certain conclusions can be reached concerning money income obtained from rice deliveries. Measured in current prices, there were increases in both abnormally good and bad seasons before 1900, due to more acute inflationary pressures. But a deceleration in the upward movement of producer prices early in the present century led to falls in nominal earnings in 1902 and 1905, when

¹⁶ Gregory King, cited in Tooke, *op cit*, p. 12.

¹⁷ For conflicting views on how abnormal wheat harvests affected English farmers see: Ashton, *op cit*, pp. 42–4; Chambers, *op cit*, p. 30; Jones, *op cit*, p. 130; Tooke, *op cit*, pp. 12, 15.

¹⁸ LTES, Vol 6, Tables 9, 12. Descriptions of data deficiencies and their treatment are given in this and other volumes.

farm sales were exceptionally light. In the three years of abundant harvests not only nominal but real earnings rose, whereas the years of sparse yields (other than 1889) saw, despite the generally improving rural/urban terms of trade, decreases in real terms. More generally, a delivery heavier than that of the preceding season produced a gain in purchasing power; a lighter one, in most instances, resulted in a loss. Thus, at the national level, the conclusion is that a good crop and an increase in sales were usually more beneficial to farmers than an enhancement of prices in poor seasons.

The general relationship between yield and income also applied in Kinki and Tohoku.¹⁹ However, in each of the nationally poor harvest years, except the third, Kinki producers' income from rice sales rose, as its crop losses were smaller than the average for Japan as a whole. In contrast, Tohoku's different yield pattern meant that region suffered revenue losses in two of the three nationally good seasons.

When the Japanese staple cereal harvest was bad did the agricultural community succeed in offsetting the fall in real earnings by obtaining higher returns from other farm products? The task was not easy for during the period rice provided 45 to 55 per cent of gross agricultural income; the only other important money earners were sericultural products (16–23 per cent) and industrial crops (13–20 per cent). As can be seen in Table 7, both rice and non-rice income, in real terms, rose in 1889 but fell in the period 1895–7, while in 1902 the gain from other produce sales did not cover the loss in staple grain deliveries. Even the 1905 result is unsatisfactory when compared not with the previous year but with 1903, a more normal rice season. Deflated by the farm household price index, total earnings from agricultural activities rose by 1.5 per cent in the first and last, fell by 9.6

per cent in the second, and by 13.3 per cent in the third nationally bad rice harvest period.

Regional experience would have varied in nationally abnormal seasons. Apart from differences in the degree of yield fluctuations, already noted, rice had a larger share in the cropping pattern in some areas. In 1907, it occupied 59.9 per cent of the cultivated land in northern Honshu, where the wildest swings occurred, but only 34.4 per cent in Kyushu, in which the Saga prefecture is located.²⁰

How did good or bad harvests affect large and small farmers? If we assume each household planted the same proportion of its land to rice and obtained the national average yield, then the contribution to total output of each scale of growers can be calculated. In 1900, some 37.2 per cent of households (those with farms of under 0.5 hectare) produced only 10.7 per cent of the crop.²¹ Hence, if they had the national average number of members and consumed the national per capita quantity of rice, even in an ordinary year they would have grown less than 43 per cent of their requirements.²² The remaining 62.8 per cent of households would all have produced some surplus, though 38 per cent of the total harvest was reaped by only 10.6 per cent of the farmers.

Use of national data on yields, farm prices, agricultural wages, labour requirements, and per capita consumption, permits charting of the effects of abnormal rice harvests on large and small producers.²³ The more normal crop years, 1895, 1901,

²⁰ Computed from data in *Résumé Statistique*, 23^e année, 1909.

²¹ For the 1888 statistics, see K Shibusawa (ed), *Japanese Society in the Meiji Era*, Tokyo, 1958, Vol 6, Table 10; for 1908, see *One Hundred Years of Agricultural Statistics in Japan*, Tokyo, 1969, Tables 3, 6.

²² S Tobata, 'The Japanese Rice Control', in W L Holland (ed), *Commodity Control in the Pacific Area*, 1935, pp 162–3, states that in 1930–1, 32 per cent of farm households had to buy some rice, and 22 per cent purchased more than three months' supply. In 1933, 49 per cent bought some rice. See T Yano and K Shirasaki, *Nippon — A Chartered Survey*, Tokyo, 1936, p 192.

²³ Data sources: *One Hundred Years of Agricultural Statistics in Japan*; *LTES*, Vol 6, Tables 8, 12; Vol 8, Table 25; H Seko, *Lowland Rice and Upland Farming in Japan*, Japan, Central Agricultural Station, 1923.

¹⁹ For yields, see Table 3. From 1892, prices are given in *Résumé Statistique*, annually.

and 1903, are taken as the bases for the comparison. The sizes of rice farms considered were: of 5 hectares, dependent on hired labour (a rarity); 1 hectare; 0.4 hectare, and 0.25 hectare; the latter three relying entirely on family labour. Results in the case of the largest farm are ambiguous. In money terms, income, minus labour costs, increased by 25 per cent in the bad harvest of 1897, and by 35 per cent in the good year of 1904, but fell by 35 per cent in the good harvest of 1898, and by 21 and 20 per cent, respectively, in the bad years, 1902 and 1905. However, deflated by the farm household price index, the gains in 1897 almost disappear, while the previously mentioned losses increase, in real terms. Evidence from land tax returns suggests that the larger farmers may have been disadvantaged by the abnormal harvests of 1889 and 1890 for fiscal land valuations were revised downwards, and in 1891 the number of rural landowners paying sufficient tax to be on the electoral roll fell by 16.6 per cent, the largest annual change between 1881 and 1894.²⁴ On 1 hectare and 0.4 hectare holdings gross money income from rice increased in abundant and declined in poor harvests. The 0.25 hectare plot owner, who had to work off the holding in order to purchase the balance of his family's food needs, would have had to increase time spent in outside employment by 75 to 200 per cent following the bad seasons of 1897, 1902, and 1905, whereas after the good harvests of 1898 and 1904 he could have reduced it to a quarter of the normal. In real terms, the income of cultivators of 1 hectare and 0.4 hectare plots would have been cut in all three bad harvests. Tenants, who usually had to hand over about half of their rice as rent, would, in many cases, be excused from paying part in a poor season.

Nonetheless, all probably preferred a heavy than a light crop.

In prefectures where yields were much lower than the norm in 1889, 1897, 1902, and 1905, farmers would have experienced losses irrespective of the scale of their operations. Likewise, where the yield did not rise above its norm to the national extent, income earned could be less than from the previous poor harvest, as happened in Aomori and Nagano in 1898. Thus, circumstances were sufficiently varied that the experience of some farmers and some localities would have run counter to the national perspective in any given year.

Many farm households derived income from non-agricultural activities.²⁵ Their prospects of increasing these earnings to offset crop losses were slight. Although continuous estimates of receipts do not exist prior to 1921, when the Farm Household Economic Surveys commenced, it should be clear from the next section of this study that rural industries suffered and the prospects of temporary urban employment were diminished following an unfavourable season.

Harvest fluctuations and the economy

It has been claimed that a good crop boosted and a bad harvest reduced activity in a newly industrializing economy not entirely unlike that of late Meiji Japan.²⁶ The scenario might well have run as follows. A bad harvest, by raising the price of demand-inelastic staple foods and because farmers hoarded windfall gains, brought about a shift in the pattern of personal consumption expenditure towards food and away from alcoholic beverages, clothing, and household goods. Subsequent rises in stocks of these latter commodities, obtained on bank credit by

²⁴ EH Norman, *Japan's Emergence as a Modern State*, New York, 1940. Those who organized rural industries suffered, too, from the subsequent trade recession.

²⁵ Rural textile production, petty trading, and temporary work in towns.

²⁶ See works cited in note 1.

distributors, would provoke a financial crisis leading to production cutbacks and falls in employment and earnings. These would result, as purchasing power declined, in further changes in consumption expenditure, and so would be set off another round of cuts in manufacturing output, employment, and earnings. Large quantities of grain might have to be imported, creating balance of payments difficulties and bringing about a specie outflow which would lead to further tightening of credit. The downward spiral would eventually be reversed, if not by stock replenishment, or an exogenous factor, such as war, then by a good harvest. A bountiful crop, by holding down foodstuff prices and hence manufacturing wages, would have allowed industrial products to be sold at lower prices, stimulating demand for them and thereby reviving activity in the economy.

Application of the above analysis to the Meiji economy would not be inappropriate. Of the goods produced (including buildings) in the period 1889 to 1903, more than two-thirds emanated from the agricultural sector, rice making up half of this figure. Over one-third of the manufacturing sector's 20 per cent share of total output consisted of textiles; processed foods provided another one-third.²⁷ Capital goods industries were still in their infancy. The urban proportion of the population — dependent on non-agricultural earnings — was small, 13 per cent in 1888 and 27 per cent in 1912. Very few townspeople were factory workers, many more were employed in workshops or at home, relying on merchants for credit, raw materials, and orders.²⁸ Much industrial production, in particular, of raw silk and cotton cloth, was undertaken as a rural by-employment. The rural sector, by its sheer size, was an

important market for the more common manufactured goods, such as clothing, processed foods, and household utensils. Calculations suggest that abnormal harvests would have directly increased or reduced the supply of goods by 4 to 8 per cent in Meiji Japan, though if services are included the immediate real GDP effect would have been only 2 to 3 per cent.

Factors other than abnormal harvests were also responsible for the long swings and short cycles found in the Meiji period.²⁹ Structural transformation, too, was occurring. Hence the influence of annual variations in the rice crop could be expected to alter as Japan became more industrialized and linked to the world economy, and as disturbing elements, such as wars, made their presence felt. The stage reached in the trade cycle when the abnormal harvest occurred also would have had some bearing on its effects.

In 1889, the poor rice crop was reaped when manufacturing was booming. The boom centred on the cotton industry: some 24 spinning mills started up between 1887 and 1889. Their advance, though partly at the expense of imports and hand spinners, was mainly stimulated by increased local demand, for there were then no exports. Capacity expansion at this rate would have eventually brought about over-production, but before this could happen disaster struck the rice fields.

In 1890, the retail price of rice rose by 54 per cent, and estimated expenditure on this staple by 50 per cent. Meanwhile, clothing and household goods prices dropped. Were rice excluded, the Consumer Price Index would have fallen 8 percentage points, instead it climbed by almost 7 per cent.³⁰ Food items, on average, increased by 19

²⁷ Computed from *LTES*, Vol I, Table 9; Vol 10, Table 1.

²⁸ According to S Tsuru, *Essays on Japanese Economy*, Tokyo, 1958, there were 113,000 factory workers in 1886; G C Allen, *A Short Economic History of Modern Japan*, 4th ed, 1981, Table V, shows 948,000 in 1914; many were in small establishments.

²⁹ See K Ohkawa and H Rosovsky, 'Economic Fluctuations in Japan. A Preliminary Analysis of Cycles and Long Swings', *Hitotsubashi Journal of Economics*, 3, 1, October 1962, pp 10-33; S Fujino, 'Business Cycles in Japan, 1868-1962', *Hitotsubashi Journal of Economics*, 7, 1, June 1966, pp 56-79.

³⁰ Unless otherwise shown, price information in this section comes from *LTES*, Vol 8.

per cent, and sake (rice wine) by 16 per cent. Efforts to maintain food consumption forced up the prices of other grains, and the poorer members of the community may have spent one-third of their income on cereals, compared with a norm of one-quarter. Foodstuffs' share in personal consumption expenditure nationally is calculated to have expanded from 60.9 to 66.3 per cent, while that of clothing contracted from 9.7 to 7.2 per cent.³¹ Purchases of clothing, sake, charcoal and fuelwood, furnishings and utensils, tea and shōchū, appear to have slumped.

Of the 34 manufactured commodities featuring in the *LTES* Volume 10 production time series, about one-quarter show a decline in output in a normal year. In 1890, half had production cutbacks, including sugar, flour, various alcoholic beverages, processed foods, wood products, oils and fats, paper, indigo, and cotton fabrics. Shionoya indicates that the output of stone, clay, and glass products also fell. He estimates that manufacturing production overall was reduced by more than 6 per cent.³² The official Statistical Yearbook records that the number of factory workers declined from 346,079, at the peak of the boom in 1889, to 321,624 in 1890, and, a sign that recovery was slow, to a low of 294,425 in 1892. Though statistics are unavailable, Tsuru considers unemployment in small workshops must have been more acute.³³

Fujino's dating, July 1890, of the start in the downturn in economic activity accords well with an explanation of harvest causation, as it allows an adequate time-lag for consumption expenditure pattern shifts and stock accumulation of certain goods.³⁴ Since February, there had been a severe

financial crisis which must be linked to the contraction of rice output. The bad harvest temporarily halted staple grain exports, which in the previous year had earned 11 million yen, and required expenditure on imported rice of 12.3 million yen, a total foreign exchange cost of 23.3 million yen. The trade balance, favourable since 1882, recorded a 25.1 million yen deficit, leading to a specie outflow of 12.6 million yen.³⁵ These changes in money income, specie reserves, and rice importers' credit demands descended on a banking system, which, due to generous assistance to share speculators in the boom, was already over-committed. Too late, the Osaka banks, in March, lifted their lending rate to 18.25 per cent. Initially unable to accept company stock as collateral, the Bank of Japan could not accommodate the commercial banks, thus many new firms collapsed.³⁶ A fall in raw silk export earnings of 12.8 million yen, due to currency appreciation following American legislation raising the price of silver, exacerbated the crisis.³⁷ But the silk trade's problems came in the second half of 1890. Undoubtedly, it was the bad rice harvest which set off the economic downturn. In Tsuru's words, 'It had the immediate effect of depressing the business outlook.'³⁸ The small gains the rural community made from rice sales were soon lost as earnings from raw silk, sake brewing, and cotton spinning and weaving declined.

Subsequent economic recovery owed much to the 1890 record rice crop, though a silver price downturn also helped. Exports of rice resumed, those of raw silk recovered, and the trade surplus in 1891 reached the 1889 figure. Yet despite some fall, the retail price of the staple cereal remained 26 per cent above its pre-1889 harvest level, delaying full restoration of

³¹ Consumption expenditure data, except where noted, is from *LTES*, Vol 6.

³² Y Shionoya, 'Patterns of Industrial Development', in L Klein and K Ohkawa (eds), *Economic Growth: the Japanese Experience since the Meiji Era*, Homewood, Ill., 1968.

³³ Tsuru, *op cit*, p 137.

³⁴ Fujino, *op cit*.

³⁵ For foreign trade statistics, see *LTES*, Vol 6 and *One Hundred Year Statistics of the Japanese Economy*, Tokyo, 1966, Table 114.

³⁶ T F M Adams, *A Financial History of Japan*, Tokyo, 1964, Part I.

³⁷ Japan was on the silver standard until 1897.

³⁸ Tsuru, *op cit*, p 135.

the consumer spending pattern until 1892. The continued drop in bank loans and rise in deposits, seen in Tsuru's statistical series,³⁹ suggests that business confidence was slow to recover, even if industrial production in 1891 surpassed that of 1889.⁴⁰

The economic situation in 1898 was complex. Two years of poor crops pushed up the rice price by 51 per cent, and led to a shift in the consumer expenditure pattern: the share of foodstuffs went up from 61 to 64.7 per cent, whereas that of clothing dropped from 11 to 9.3 per cent. Signs of pressure on the lower and middle income groups can be seen in the statistics of the Post Office savings bank. Between 1896 and 1898, farmers, small manufacturers, merchants, factory operatives, and public servants withdrew deposits. The decline in funds held ranged from 20 per cent for cultivators to 40 per cent for officials. All sections, except farmers, closed a significant proportion of their accounts.⁴¹ However, forces countering the harvests' effects were operating. Unlike in 1890, rises in wages partly compensated for price hikes.⁴² Temporarily, Chinese reparations had eased constrictions on capital goods imports. Cotton spinners' successes in foreign markets enabled a 50 per cent expansion of yarn production.⁴³ Yet even if the volume of manufacturing output increased in 1898, there were more than the average number of goods, including shōchū, processed foods, tea, indigo, lacquer, oils and fats, camphor and waxes, paper, pig iron, and cotton fabrics, whose production contracted.⁴⁴ Overall economic activity was dampened between November 1897 and November 1898, and bad harvests must be held responsible for it. As

Haruki Yamawaki commented: 'Trade in general became greatly depressed on account of the poor crops of rice happening in successive years'.⁴⁵

Awareness of a bumper grain crop may have induced the speedy revival of business confidence in 1899. From a peak in August 1898, the rice price returned to the 1896 level. But government, too, seems to have assisted recovery by facilitating a considerable expansion of the money supply, which in turn induced a general fall in interest rates.⁴⁶ There was, as well, a big increase in exports, and a further sign of better times was an increase in the number of accounts held by each category of depositor in the Post Office savings bank.

Even in the early 1900s rice crop fluctuations could still disturb the economy. A British observer reported, 'The spending power of the people was exceptionally reduced by the extremely bad harvest of 1902 and this . . . may well have contributed to the present depression in trade.'⁴⁷ Retail prices of household goods fell by over 9 per cent as that of the staple grain climbed by 14 per cent. Output of yarn was down by 15 per cent, and of cotton cloth by more than 8 per cent. Annual reports of 45 spinning companies reveal that 22 made losses. Poor results stemmed in part from a Chinese devaluation affecting exports but were mainly due to a decline in domestic demand commencing in the last quarter of 1902 and attributed to the sorry situation in the paddy fields.⁴⁸ Funds accumulated in banks and lending rates had to be reduced.⁴⁹ Business activity tapered off after April 1903, but aggregate manufacturing output, which, according to Shionoya, declined between 1900 and 1902, did not shrink further in 1903, and by

³⁹ Tsuru, *op cit*, statistical appendix.

⁴⁰ Shionoya, *op cit*.

⁴¹ *Financial and Economic Annual of Japan*, IV, Tokyo, 1904, Table 54.

⁴² *LTES*, Vol 8, Table 25.

⁴³ S J Koh, *Stages of Industrial Development in Asia*, Philadelphia, 1966, statistical tables to chapter one.

⁴⁴ *LTES*, Vol 10, and Shionoya, *op cit*.

⁴⁵ *Japan in the Beginning of the 20th Century*, Tokyo, 1903, pp 581-2.

⁴⁶ See Shibusawa Eiichi, 'The Revolution of Banking in Japan', in Count Okuma, *Fifty Years of New Japan*, 1909, and *Financial and Economic Annual of Japan*, IV, Table 49.

⁴⁷ *Board of Trade Journal*, XLIV, January-March 1904, p 17.

⁴⁸ *Anglo-Japanese Gazette*, September 1903, p 57.

⁴⁹ *Japan Weekly Mail*, 12 September, 31 October 1903. Japan Brewery Company sales were also down.

December the recession was over.⁵⁰ An above average rice crop and an off-loading abroad of yarn stocks helped to cut it short.

The Russo-Japanese War had a much greater impact on the economy in 1905 than the abundant harvest of the previous year, though slightly falling rice prices reduced inflationary pressures. Taxes on textiles were introduced, saving was officially encouraged, production was affected by the absence on military service of several hundred thousand men, but war increased machinery imports and kept the manufacturing sector fully occupied.⁵¹ Despite the poor harvest of 1905, the cessation of hostilities was accompanied by unusual commercial activity, and 'cotton mills had their most successful year' with large dividends being earned and order books filled for several months ahead.⁵² One reason why the natural calamity had little effect was because stocks of imported rice, accumulated during the War, were released.

Clearly, by the mid-1900s a bad rice crop had become a much less economically significant event in Japan. Thereafter, rice was never again to constitute such a high proportion (15-17 per cent) of total imports as it had in 1889, 1898, and 1902. Furthermore, as the country became more industrialized and urbanized, the farming community's contribution to GDP and market demand steadily diminished. After 1912 there would be further fluctuations in Japanese economic activity, but exceptional harvests would cease to play any major role in them.

Conclusions

Several conclusions can be reached concerning the effects of abnormal staple grain harvests on the population and economy of newly industrializing Japan during the period 1887-1912. First, the

output of other cereals and rice imports only moderated, they did not eliminate, supply deficiencies after a bad rice crop. Secondly, shortages were not such as to cause a national famine, though the local impact of the far greater prefectural and regional yield variations deserves investigation. Thirdly, analysis of somewhat deficient data suggests below normal harvests influenced birth rates but reveals no association between oscillations in rice production and national mortality and nuptiality. Fourthly, statistical techniques using price as a proxy for output give unreliable results in the Japanese case. Fifthly, farmers appear to have varied rice deliveries in accord with crop and price conditions, and thereby generally increased their income. Sixthly, wide yield swings and differences in cropping patterns meant that some areas gained less or suffered more than the national figures indicate. Seventhly, in bad harvests, real earnings from other agricultural commodities did not increase sufficiently, except in 1905, to offset rice income reductions. As to whether farms employing labour would have profited from a poor national rice crop, the evidence is inconclusive owing to the unstable rice price/agricultural wage ratio. A light harvest undoubtedly injured small farmers, whereas a bountiful crop benefited them.

Abnormal harvests happened at different stages in the trade cycle and sometimes in the presence of stronger factors. The effects seem to have been most potent at the beginning of the period, when, with the forces behind the 1887-9 boom already largely spent, they played a significant role both in the serious recession and the subsequent recovery. In the mid period their impact on the economy was less. Industrial expansion continued through the first poor harvest season, in 1896, although that of 1897 appears to have brought on — along with government monetary restrictions — the temporary difficulties

⁵⁰ Fujino, *op cit.*

⁵¹ *Board of Trade Journal*, LI, October-December 1905, p 10.

⁵² *Board of Trade Journal*, LVII, April-June 1907, p 575; LVIII, July-September 1907, p 234.

experienced shortly afterwards. The brief period of prosperity in 1899 must be attributed to expansionist policies and new export opportunities, and not just to the good rice crop of 1898. Yet the deficient harvest in 1902 seems to have been the trigger for a brief recession in the early 1900s. On the other hand, the bountiful 1904 crop, because it coincided with a wartime boom, was a minor influence on economic activity, even if welcome to a government that had restricted expenditure on other consumption goods. This generous harvest, along with stockpiles of imported grains, partly explains why the

following poor season had no discernible effects. However, between 1889 and the early 1900s (even if the pattern of long swings was determined by other factors)⁵³ sharp fluctuations in rice yields initiated, accentuated or reversed several short-term cyclical movements, and in the newly industrializing Japan of that period the lives of bankers and businessmen, factory workers and farmers were all affected, to a greater or lesser degree, by the state of the harvest.

⁵³ See Ohkawa and Rosovsky, *op cit.*

TABLE 3
Rice Yields: Percentage of the Trend (trend = 100)

Year	Japan	Kinki	Tohoku	Nara	Nagano	Saga	Kagawa	Aomori
1887	109.4	115.6	109.3	101.7	115.3	117.4	116.6	103.9
1888	102.9	103.9	95.3	93.2	93.5	116.2	114.0	103.9
1889	84.4	75.8	89.5	75.5	87.4	70.0	70.6	88.8
1890	110.1	113.8	104.1	127.1	106.7	133.8	106.8	118.4
1891	97.5	99.7	97.6	111.2	102.9	90.0	89.6	86.4
1892	105.6	102.1	106.0	102.2	99.3	117.8	126.1	113.6
1893	93.8	96.3	95.1	80.9	99.6	46.3	108.9	74.5
1894	109.3	115.6	113.2	121.0	110.7	110.6	63.1	117.3
1895	100.9	101.0	107.8	100.3	102.6	94.2	110.3	110.9
1896	92.1	80.1	96.7	89.3	91.1	121.3	100.1	99.5
1897	82.7	83.9	78.8	83.8	87.6	96.0	70.5	88.0
1898	116.5	124.8	103.2	114.8	107.1	128.9	132.7	100.1
1899	98.7	91.6	101.1	96.3	96.5	90.2	79.3	112.2
1900	99.4	98.1	110.5	92.7	109.9	76.0	103.4	102.8
1901	105.8	106.8	114.4	111.8	105.3	88.1	105.4	111.6
1902	85.9	93.5	66.2	93.8	88.2	109.7	94.6	49.2
1903	105.7	98.8	116.4	97.4	106.7	115.6	96.7	113.5
1904	114.2	107.9	129.5	106.2	118.9	99.4	110.3	145.3
1905	83.4	96.0	55.3	97.8	75.5	80.2	97.6	80.0
1906	96.5	101.3	84.7	96.6	88.1	107.7	97.5	60.5
1907	102.2	96.6	112.1	99.0	107.3	108.9	100.1	112.8
1908	108.1	106.8	110.6	108.4	100.4	116.7	109.1	105.1
1909	105.4	101.4	112.9	101.6	117.5	92.7	107.1	107.6
1910	92.7	96.7	95.7	96.6	97.5	89.4	91.5	117.1
1911	100.5	99.7	104.6	103.3	102.9	101.6	100.9	115.6

Sources: computed from data in *LTES*, Volume 9, Table 12: T Ogura ed, *Agricultural Development in Modern Japan*, figs 24.2, 24.4.

TABLE 4
Rice Output and Price: Percentage of Trend (trend = 100)

Year	Output	Price: Percentage of Trend, based on:				Least Squares Trend Value
		31-Year Moving Average	25-Year Moving Average	7-Year Moving Average		
1889	84.4	101.4 A	106.3 A	134.0 B		131.3 B
1890	110.1	77.9 G	81.4 G	94.2 A		96.0 A
1897	82.7	132.0 B	139.7 B	129.8 B		135.1 B
1898	116.5	87.3 G	90.8 A	84.2 G		87.8 G
1902	85.9	108.7 A	112.9 D	109.7 A		107.6 A
1904	114.2	81.2 G	94.9 A	89.7 G		89.1 G
1905	83.4	88.8 G	101.4 A	102.0 A		98.4 A

Note a: Price is of the year following the harvest.

Note b: Hoskins' classification of the harvest:- A — average, D — deficient, B — bad, G — good.

Sources: Prices: E H Norman, *Japan's Emergence as a Modern State*, New York, 1940, pp 41-2; Output: LTES, Vol 9, Table 12.

TABLE 5
Rice Production and Estimated Quantity Marketed (000 koku)

Year (1)	Output (2)	Consumed by Farmers (3)	(3) as a per cent of (2) (4)	Seed Reserve (5)	Farm Sales (2) - ((3) + (5)) (6)	(6) as a per cent of (2) (7)
1887	41308	21690	52.51	2065	17553	42.49
1888	39474	20218	51.22	1973	17283	43.78
1889	33194	18849	56.78	1659	12686	38.22
1890	43084	23388	54.28	2154	17542	40.72
1891	38181	20123	52.70	1909	16149	42.30
1892	41429	21591	52.12	2071	17767	42.89
1893	37267	19682	52.81	1863	15722	42.19
1894	41859	21361	51.03	2092	18406	43.97
1895	39960	19400	48.55	1998	18562	46.45
1896	36240	18213	50.26	1812	16215	44.74
1897	33039	18168	54.99	1651	13220	40.01
1898	47388	23203	48.96	2369	21816	46.04
1899	39698	19565	49.28	1984	18149	45.72
1900	41466	19883	47.95	2073	19510	47.05
1901	46914	23266	49.59	2345	21303	45.41
1902	36932	20631	55.86	1846	14455	39.14
1903	46473	25602	55.09	2323	18548	39.91
1904	51430	28433	55.28	2571	20426	39.72
1905	38173	19220	50.35	1908	17044	44.65
1906	46302	22930	49.52	2315	21057	45.48
1907	49052	23936	48.80	2452	22664	46.20

Source: computed from LTES, Volume 6, Tables 9 and 12.

TABLE 6
Farm Income from Rice Sales

Year	Estimated Farm Sales '000 koku	National Farm Price Yen/Koku	Farmers' Rice Income '000 Yen	Real Income '000 Yen	Farm Household Price Index (1887 = 100)
1887	17553	4.33	76004	76004	100.00
1888	17283	5.40	93328	88833	105.06
1889	12686	8.05	102122	90462	112.89
1890	17542	6.37	111742	104412	107.02
1891	16149	6.59	106421	96738	110.01
1892	17767	6.75	119927	107751	111.30
1893	15722	8.12	127662	111049	114.96
1894	18406	8.21	151113	119817	126.12
1895	18562	8.89	165016	121720	135.57
1896	16215	11.26	182580	117984	154.75
1897	13220	14.06	185873	111022	167.42
1898	21816	10.44	227759	143951	158.22
1899	18149	11.43	207443	117286	176.87
1900	19510	10.79	210512	121172	173.73
1901	21303	12.02	256062	142012	180.31
1902	14455	13.70	198033	104542	189.43
1903	18548	12.56	232962	120028	194.09
1904	20426	12.21	249401	121357	205.51
1905	17044	13.98	238275	115326	206.61
1906	21057	15.66	329752	145099	227.26
1907	22664	15.19	344266	157235	218.95
1908	24663	16.42	404966	192392	210.49
1909	25160	16.24	408598	193035	211.67
1910	22178	21.11	468177	206409	226.82
1911	24878	23.99	596823	249591	239.12
1912	23614	25.80	609241	246996	246.66

Sources: computed from data in *LTES*, Vols 6 and 8.

TABLE 7
Estimated Gross Agricultural Income ('000 yen)

Year	At current prices			Real income		
	Rice	Other	Total	Rice	Other	Total
1888	93328	93634	186962	88833	89124	177957
1889	102122	101790	203912	90462	90167	180629
1890	111742	106970	218712	104412	99953	204365
1895	165016	167933	332949	121720	123872	245592
1896	182580	160522	343102	117984	103730	221714
1897	185873	185701	371574	111022	110919	221941
1898	227759	193812	421571	143951	122495	266446
1901	256062	219599	475661	142012	121790	263802
1902	198003	235376	433409	104542	124254	228796
1903	232962	267098	500060	120028	137615	257643
1904	249401	262728	512129	121357	127842	249199
1905	238275	284668	522943	115326	137780	253106

Sources: computed from *LTES*, Volume 6; Volume 9, Table 12.

TABLE 8
Fluctuations in Vital Rates, 1887-1913

Year	Percentage of the trend (trend = 100)		
	Births	Deaths	Marriages
1887	96.18	95.18	102.52
1888	104.27	92.10	102.26
1889	105.84	96.83	104.48
1890	98.60	96.86	97.52
1891	93.55	100.19	91.81
1892	102.16	105.08	97.38
1893	97.48	109.57	96.76
1894	98.40	96.51	98.30
1895	100.16	96.73	99.20
1896	99.97	102.73	134.28
1897	99.74	97.37	96.06
1898	101.97	98.53	109.87
1899	101.06	102.55	123.03
1900	101.51	98.62	89.86
1901	105.72	99.08	96.09
1902	103.80	101.44	101.72
1903	99.97	96.88	93.52
1904	95.30	97.60	101.47
1905	93.78	101.59	86.50
1906	91.88	95.72	109.78
1907	101.92	101.06	103.94
1908	103.76	101.68	109.87
1909	104.72	106.12	102.39
1910	102.43	102.13	102.06
1911	102.65	98.53	98.21
1912	100.15	95.73	97.59
1913	99.85	91.20	96.36

Note: Derived from an 11-year moving average. Based on registrations.

Sources: computed from: *Résumé Statistique* various years, and Tacuber.