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THE EFFECTS OF OTHER POLICY CHANGES AND TECHNOLOGICAL DEVELOPMENTS

Thus far it may be concluded that on the basis of prospective input supply alone, China's population, which is growing older and more numerous, can be provided with a quantity of foodgrains equivalent to the amount consumed in 1978. Additional requirements for food processing, industrial use, brewing, and the like may also be accommodated, as can grain stockpiling plans, direct assistance to poor localities, and feed demands sufficient to underwrite the Party's livestock-increase targets. If the growth rate between 1980 and 1985 indeed falls within the range of 3.0-3.5 percent per year, then another 10-20 million tons of grain will also be available to be consumed directly (by those whose consumption is average or below) and to meet the meat supply target. Should the growth rate of supply exceed 3.5 percent per year, it is clear that unsatisfied direct and indirect demand will easily absorb the remainder, at least up to 400 million metric tons of production.

The justification for predicting growth in the 3.0-3.5 percent range rather than the long-term historical average of 2.5-2.6 percent is simply this: the current trends and future prospects for input supply in the target period are more reminiscent of those of China's rapid-growth periods in the mid-1960s (when output grew about 5 percent per year) and in the 1970s (when output grew 3.7 percent per year between 1971 and 1975) than of the slow-growth periods that followed the Great Leap Forward, the first phase of the Cultural Revolution, and the mid-1970s political disturbances. In each of these latter periods, politically ambitious policy shifts were undertaken while the input stream ebbed. After a year or so, output stagnated or declined.

In some ways input supply prospects are now even better than supply increases were in the two rapid-growth periods. The absolute levels of input supply are substantially higher. The growth rates are comparable. If the level of absorption of fertilizer nutrients has indeed been a major constraint, as suggested above, then the growth rate of absorption may very well exceed that required to generate a 3.5 percent-per-year average growth in output. But power and fuel supply is an immediate constraint throughout the economy, and growth continues to depend on major infrastructural efforts. If sheer comparative trends are any indication, the projected supply of irrigation and drainage machinery is suggestive of constraint although this may be temporarily alleviated by increased utilization of existing supply. Soil quality, which in certain areas has unquestionably deteriorated, must also be considered an input. Moreover, the two rapid-growth periods mentioned above did not continue without interruption over the eight-year period. Unfortunately, future periods of stagnation cannot be ruled out. For the immediate future, however, the prospects look very good.

In the remainder of the paper, it will be argued that the prospects for growth from other policy changes and technological developments also look good for the next few years, but that the risk of stagnation has not been eliminated. For convenience it may be assumed that output expansion resulting from these other considerations can be added independently to that resulting from growth in input supply.[269] This is a distortion, particularly in the case of changing technological circumstances, but perhaps one that is not too serious for present purposes.

Under conditions of dynamic technical change associated with "green revolution" developments, foodgrain output expansion is the result of an outward shift of agriculture's production function, as well as movement along that function. Hence potential for growth from technological change in the current period must be compared with growth from this source in past periods.

Recent changes in official policy emphasis are also apt to bring about output increases. The effects of such changes may be subdivided into those operating upon the efficiency of resource allocation within and among collective units and upon the structures for incentive and income

distribution. Although the influences of policy changes on foodgrain production are not limited to effects falling within these categories, the latter are certainly important considerations for China in the current period. Moreover, they are not mutually independent, and their orthogonal elements cannot be easily separated. Nevertheless, this section includes a separate attempt to describe the impact of each of these variables upon the prospective supply of foodgrains.

Before proceeding to these discussions, it should be noted that 1978 was still a bad weather year, although to a lesser extent than 1977. Therefore, it is quite probable that weather in 1985 will be more favorable than it was in 1978. The expected value of this consideration for prosepctive foodgrain output may be estimated without much trouble. In the process of estimation, it is sensible to weight 1970s fluctuations in weather and output much more heavily than previous variations since Chinese ability to mitigate adverse effect on output has improved significantly since the 1950s and 1960s. If this is done, and weather fluctuations are merely trichotomized as in Table 1, an expected increase in supply resulting from the expected difference in 1985 and 1978 weather conditions may still be as much as 10 million metric tons.[270]

The Effect of the 1978-79 Rural Policy Reform Upon Farm Labor and Local Savings Incentives

Three categories of recent policy changes by the central government should raise farm labor and local investment incentives and contribute to a higher effective labor input and savings in rural areas. Some changes increase the government's concentration on the agricultural sector in terms of its administrative priorities and budget allocations. These allocations help develop the agricultural infrastructure and industries with strong demand linkages to agriculture. Such priorities and allocations will expand the long-term rewards available to peasants for applying extra effort to agricultural development.

Other changes will raise the immediate rewards for extra productive effort in the rural sector. They include such measures as the 20 percent increase in the government purchase price of within-quota grain; the additional 50 percent price increase for delivery of surplus grain; the decision not to raise the quotas of grain that must be delivered at the lower, within-quota price, and the abolition of ceilings on collective grain distribution to commune members; the 10-15 percent decrease in the sales price of industrial inputs to agriculture,[271] and increased preferential input allocations to localities that increase output; and encouragement of rural fairs for interrural exchange and sale of produce from private plots and sideline production.[272]

Other changes are embodied in the government and party repudiation of "commandism"—a dictatorial tendency which often leads to the application of production team labor and savings, without team approval, to projects that benefit larger organizational units, or are otherwise unpopular. The frequent increase, contrary to national policy, of compulsory purchase quotas by ambitious local officials is also encompassed by this term. Commandism, of course, not only alienates peasants from expropriating and dictatorial authorities, but results in declines in labor productivity and in locally generated savings and investment. Repudiation of commandism should tend to reverse these declines as should the other incentive measures, although this policy shift may not be without drawbacks and limitations.

The essence of the grain procurement structure as an incentive mechanism is in the tax structure, relationships between the size of compulsory purchase quotas and output per capita, the changes in those quotas, the relationship between the compulsory quota price and the "surplus" delivery price, and the manner of determination and size of the planned "surplus" to be sold to the state.

In 1954, the year after a grain crisis that resulted in the establishment of the state purchasing monopoly, compulsory grain deliveries were introduced because state procurement organs had again been unable to secure enough grain for urban areas, grain-deficit areas, the army, and planned exports. Another crisis in 1955 led to the assignment of a standard production quota to each unit of land. A fixed portion of these quotas was to go to the state at a given low price. After meeting the grain needs of provinces for food, feed, and seed and

delivering the agricultural tax and compulsory quotas, 80-90 percent of all the "surplus" grain was to be sold to the state.[273] Production and fixed purchase quotas were to be set for the three-year period 1955-57 in "normal" years to avoid the powerful disincentive effect of increased output immediately resulting in higher quotas. After a fall in state procurement, an "abnormal" year was invoked, allowing compulsory sales to be increased beyond a legal restriction of 40 percent of extra output (over and above compulsory deliveries, tax, and "planned surplus") and subsequently, the elimination of the 40 percent limit. Pressure to produce more and deliver more grain to the state led to the abandonment of fixed quotas, but the system returned, even before 1962, during the agricultural disasters. Quotas were fixed for 5 years and in some areas, 10 years,[274] although there is evidence that the limitations on quota reassignment were sometimes transgressed.

The longer the declared period of a single fixed quota, the greater the incentive to exceed the quota, and the greater the reward to those who succeed. Compulsory quotas, the absolute quantity of agricultural tax, and the "planned surplus" percentage to be delivered to the state (varying from about 40-85 percent of total output after food and seed needs determined by provincial authorities have been met),[275] were set on the basis of land quality. The structure was progressive.[276] By fixing the tax as an absolute amount, however, an incentive was provided to increase production. This brought rewards to those who could do so and promoted income concentration. The greater the surplus price over the quota price, of course, the greater the incentive and the greater the financial ability of successful localities to purchase inputs, which made future success in exceeding the quotas easier.

Between 1953 and 1956 compulsory deliveries (the quota plus the "planned surplus") varied between 23 and 34 percent of annual output.[277] They appear to have dropped to an average of a little above 20 percent during the 1960s and early 1970s[278] and rose in the 1970s to an average of around 20-25 percent.[279] In calendar year 1978 total state grain procurement was 19.7 percent of output. In 1979 the figure rose to 20.6 percent despite a cutback in required deliveries.[280]

It is not yet possible to conclude that investment and labor applied to foodgrain production will increase above what they were before 1979. It is only being suggested here that there is an increased investment incentive to accumulate savings (complemented by a higher interest rate available on rural savings accounts) and that there is greater incentive to apply labor effectively to productive efforts. In making even this point, it is necessary to overcome any suspicion that coercive, or patriotically and socially inspired work levels might be superior to those more dependent on motivation through individual and small group self-interest.

Although it is quite possible that the former motivational elements, especially appeals to public-mindedness, at particular times and for particular purposes have yielded positive results, further dependence on such elements has encountered severe constraints. The relatively poor performance of rural policy overly dependent upon these elements in the recent past is one of the primary reasons for the 1978-79 policy changes. Leading Chinese economists and administrators have aggressively pointed out the relationship between substandard agricultural output and overprocurement and low profit rates for, especially, grain and cotton. This relationship has been singled out as a major obstacle to production increases in the mid-1970s.[281] It should also be kept in mind that duration of work, which is relatively easy to control, is only one element in effective labor application. Other elements, such as the quality and intensity of work, are much more difficult to preserve once the incentive structure is undermined and motivation begins to degenerate.[282]

Another idea that must be rejected is that necessity in recent lean years caused work levels to increase to those that can be expected in the current period. This is a complex matter that requires empirical investigation and more substantial treatment than it will receive here. It seems that millions of Chinese have been undernourished in recent years, perhaps chronically (see above). Nutritional studies indicate, however, that undernourishment inhibits effective labor application and that output rises as nourishment does.[283]

It must be admitted that many rural Chinese have incomes greater than the bottom quintile, and that the typical labor application curve has a backward-bending supply section at higher levels of compensation. It does not appear likely, however,

that most rural Chinese are operating on such a backward-bending section. If the 1979 response is any indication, the rural attitude is characterized more by a suspicion that current policy changes may be short-lived and by an eagerness to take advantage of favorable terms of trade through greater production and sales than by a desire for more leisure and less work.[284]

Given that the policy changes will probably generate, if anything, more rather than less effective labor, the above consideration may be cause for optimism that, in the short term, some proportion of incremental savings and effective labor will be applied to raising farm output. The Chinese authorities seem concerned that a dominant share of the large financial transfer embodied in the 1979 price changes will be devoted to upgrading rural housing and general living standards rather than to animal husbandry and agricultural investment. The likelihood of this seems to be borne out by recent experiences in Southeast Asian countries.[285] If the allocation of labor and savings has indeed become more discretionary, this kind of movement can be expected. This does not mean, however, that labor and savings devoted to increasing farm output is likely to fall absolutely as a result of the price changes.

The farm labor supply should be carefully monitored because of China's labor-intensive production methods. As it is more traditionally measured, a gross increase in the rural labor supply owing to population growth can be predicted (see Appendix 2). But net migration to the cities will probably increase between 1980 and 1985, as will the rural nonfarm work force. The size of these two effects is more difficult to predict. Forecasts depending on past trends, not exactly known to begin with, are probably poor measures of those factors, in view of liberal turns in policy and expanded rural opportunities both in and out of farming in the late 1970s. Unfortunately, it is still too early to estimate any short-term trend since then.

Effects of Changes in the Allocation of Resources

Thus far, the thrust of the supply-related arguments has been aimed at demonstrating that a greater rate of increase in the flows of productive resources to the farm sector is apt to occur in the 1980-85 period than before 1978, especially when compared with the slow-growth periods such as 1959-62, the late 1960s, and the years immediately before 1978. They may even compare favorably with the periods of rapid growth in the mid-1960s and the first half of the 1970s. But how much of these resources will be devoted to foodgrain production? And will the pattern of allocation increase or reduce efficiency in grain cultivation? If the repudiation of commandism is complete, might it not be reasonable to expect a large-scale reallocation of resources to more lucrative nongrain and peasant sideline production?

While commandism has been reduced, the limits of current initiatives to increase peasant autonomy should be recognized. On the whole, the 1978-79 rural policy changes were not taken to reduce planning in foodgrain production, but to make planning more effective while conserving expense.

In addition to the measures listed above, several shifts in policy emphasis may have significant effects on the pattern and efficiency of resource allocation. These include: an emphasis on reallocating agricultural land, devoting more to pastures, forests, and nonfoodgrain acreage; greater peasant autonomy over collective decisions and private plots, accompanied by the active encouragement of peasant sideline production; a focus of attention on "major grain bases" and, in particular, "key front runners" within that group which will receive preferential allocations of industrial inputs, investment, and credit in exchange for pledges to deliver large increases in marketed grain; and a focus of attention on the problems of backward localities and low-yield counties. Each of these shifts has affected grain production by influencing the quantity and location of acreage sown to particular crops. Acreage has been reallocated from foodgrain to, especially, sugar beets and cane, oil crops, bast fibers, and pulses. Some of this land has been of high quality. More marginal agricultural lands have been retired on a large scale, particularly for conversion to forest and pasture.

A sample of reported acreage conversions conducted in the spring of 1979 has been tabulated in another work[286] with the most recent foodgrain yield figures available for each area (usually on a provincial basis). The results suggest that foodgrain acreage

reductions as of 1979 were not a significant portion of total grain sown area even quantitatively and did not outweigh reclamation plans. When the quality of the retired lands is considered, the extremely low yields typical of these areas suggests even smaller gross reductions in grain output.

The policy of allowing greater peasant autonomy may indeed be in earnest, but it does not appear that it will result in major declines in foodgrain acreage on collectives except in some poor localities. Some provinces even announced that although they may reorganize foodgrain acreage on a county basis, the total area under grain cultivation will not be permitted to fall.

The private plots are a small proportion of acreage, and only a minor proportion was devoted to foodgrain production. The principal exceptions are in the areas where total foodgrain production per capita is very low—and even many of these areas may be unlikely to radically reduce foodgrain acreage for security motives, despite policy changes. All in all, the total reduction in foodgrain-cultivated area is not likely to be large, particularly when one considers policies to increase large state grain purchase prices and to open the lucrative rural markets to produce from private plots.[287]

The policy of allowing greater peasant autonomy will also reduce the pressure on local units to increase cropping intensity. This development coincides with growing administrational ambivalence over the ultimate value of maintaining even the 1978 level of multiple cropping in many regions. The combination seems likely to result in a decline in foodgrain-sown area in some provinces over and above any net reductions in foodgrain-cultivated land. The implications of this trend for aggregate grain production, however, are again apt to be much less serious than they first appear. In some provinces, most notably Sichuan, combined yields have actually increased when triple-cropped areas have reverted to double cropping or when unpopularly double-cropped land has again been single cropped.[288] In areas such as the lower Yangtse region,[289] triple cropping has coincided with gross increases in foodgrain production since the mid-1960s. But when greater seed requirements, lower milling rates of required varieties, and gains not attributable to increased cropping intensity are netted out, the improvement appears to be small. A shift back to double cropping may indeed occur since any increases in the profitability of net output are swamped by greater input requirements. But even a small reduction in output may be ameliorated by a judicious application of some portion of the difference between the current and mid-1960s input streams.

In the major grain bases, on the other hand, grain-cultivated area is likely to expand if it changes at all. Twelve such bases have been designated by the state, including the entire province of Heilongjiang, sections of Inner Mongolia and Ningxia that are irrigated by the Yellow River, the Gansu Corridor, the Tonting and Boyang Lake areas, the Yangtse Delta, the Songhua-Jiang and Liaohe basins of Jilin province, and the central plains of Liaoning.[290] Most are areas where production per capita is high, either because population density is low and land of modest yield is extensively machine cultivated, or because yields themselves are particularly high.[291] To the extent that grain acreage expansion occurs where yields are particularly high, the marginal impact on aggregate output will be large. Yields from the other land can benefit from the greater concentration of fertilizer, farm chemicals and machinery, capital construction investment, and preferential loans and subsidies that have been flowing to these bases since the spring of 1979.[292]

When all of the above are considered, it does not presently appear that foodgrain production is likely to seriously suffer from any net reductions in foodgrain-sown area. The aggregate effect may even be slightly positive. A number of other allocative considerations have net effects that are less ambiguous.

The zoning changes in several instances will make the spatial pattern of production more efficient if the risks of monoculture can be neutralized. For example, cotton yields in the southern and western sections of Liaoning are comparable, but grain yields are 3.7-4.0 tons per hectare in the south while only 0.75 tons per hectare in the west. It was therefore proposed that most cotton production be shifted to the west and grain to the south without significantly changing grain-sown area.[293] Heilongjiang province will concentrate production of wheat in the north, wheat and soybeans on the rich Songhuajiang and Nenjiang plains, maize and soybeans in the south, and maize and rice in the productive river valleys. It will relegate beets and oil crops to the compara-

tively saline and alkaline soils of the west.[294]

In addition to increasing allocative efficiency, such shifts in regional cropping patterns can bring ecological benefits, especially in the Yellow River watershed and in areas threatened by desertification. Ultimately, there may be some advantage to foodgrain production of the "green belt" now under construction in the northwest. This is seen as the answer to the problem of reducing silt content in the Yellow River, now used for irrigation with limited success.[295] Benefits to aggregate yields in the current period, however, will be negligible.

The sizeable boosts in the foodgrain purchase price mentioned above were made, of course, to provide rural localities with the means and incentive to make further input purchases required to raise production (or to maintain application levels within areas in which greater peasant autonomy would be apt to bring about cuts in those levels owing to perceived unprofitability at pre-1979 prices). The price increases could also improve the efficiency of resource allocation within collective units.

In general, acreage sown to foodgrains has been officially determined and impossible to disguise. Yet the purchase price of private and sideline products has been high relative to foodgrains, creating incentive not only for the individual to concentrate variable inputs like labor and fertilizer on his private plot, but also for the fairly successful collective unit to devote more resources to nonfoodgrain activity. The recent price change may be sufficient to turn the allocational decisions of collectives toward greater emphasis on foodgrain production. Since the old price structure would have resulted in a relatively land-abundant, and capital- or input-scarce foodgrain production mix, shifting units of capital and inputs could have a high marginal impact.

To be sure, there have also been large boosts in the purchase prices of nongrain farm products.[296] but for the most successful localities—those able to greatly exceed quota assignments—the surplus grain price must now compare much more favorably with prices of other agricultural products. The poorest localities, whose quota assignments have been reduced or cancelled, may also be motivated to produce more grain.

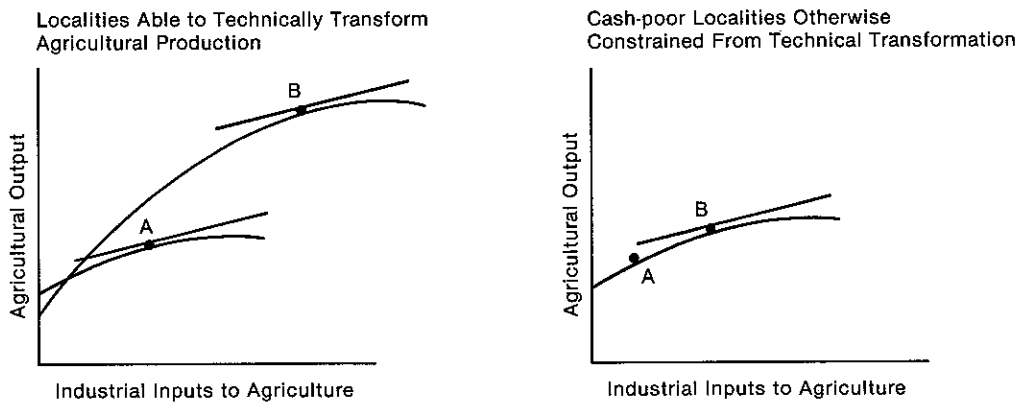
Foodgrain production in poor areas, however, may benefit more directly from the elimination of taxes and purchase quotas and from selective subsidy programs being implemented by the provinces. These measures may almost be prerequisites to obtaining more than nominal profit from the pricing changes in some poorer localities. They may be far more important than any increase in allocative efficiency within a collective.

For Chinese agriculture of the late 1950s, characterized by relatively high yields for a predominantly preindustrial production process and with little surplus land that could be easily converted to agricultural use, the most auspicious way to increase foodgrain output was the road of technical transformation.[297] A region able to put together a complete package of requisite inputs and field management patterns would be able to shift upward the production function of the agricultural sector, transforming its technical base. The region could increase output by large margins and to varying degrees, depending on the state-dictated terms of trade between agriculture and other sectors, justify the very sizable additional expense for the inputs purchased.

In general, those localities not able to put together such a package would suffer sharply diminishing returns when applying only part of the package. Thus, large-scale increases in, for example, chemical fertilizer application could easily be uneconomic for such localities even with favorable terms of trade. This observation conforms with results of research on Indian agriculture.[298] But even when the road of technical transformation is not open and the region is constrained to the existing production function, the path of making the most of available techniques may lead to some increased output, if the application of such inputs as farm chemicals and fertilizers has been at very low levels. The difference in potential between this type of region and one able to fully transform agricultural production is schematized in Figure 2.

While long-term aggregate growth rates in Chinese agriculture have been, on average, relatively modest and slightly above the rate of population growth, it can be documented that in many regions of the country, foodgrain output growth has, on the contrary, been very high.[299] This indicates that there are areas with essentially no growth or even negative growth in output per capita. It is in these localities that the better-off rural inhabitants have more incentive to separate themselves from poorer peasants and reject

Figure 2—Agricultural growth in two categories of localities



Notes: Point A on each function is the initial position; point B is the final position. The slope of the straight tangential lines may be considered to be the ratio of the price of agricultural output to the price of the industrial inputs used in the agricultural sector. Or it may indicate the marginal product of the last unit of the available inputs when such inputs are allocated to maximize production.

collective behavior patterns. It is these areas that have probably been the centers of "reviving landlordism" and pressure for dissolution of the communes.[300] And these are also localities that may be chronic beneficiaries of the redistributive revenue policies of the state.[301] But although these policies include revenue sharing by the provinces, aid to many of the very poorest localities does not seem to have been oriented toward directly facilitating productive investment, but has generally taken the form of emergency grain aid, lowered agricultural taxes and procurement requirements, and, from time to time minor terms-of-trade advantages. Donnithorne has pointed out that counties and provinces that are designated "deficit areas" have had low priority in the competition for scarce inputs and allocations.[302]

The implicit policy described by Donnithorne may be reasonable for increasing allocative efficiency when distributing large quantities of industrial inputs to agriculture by region, but the rationality may break down somewhat at the local level. Many poor localities have had a long unbroken history of constrained growth. The fundamental constraint may be either deficiency in rural infrastructure and organizational support or the unavailability of an improved seed technology suitably adapted to local conditions. While these localities probably cannot, for example, efficiently use large additional applications of fertilizer, relatively modest increases may have a greater impact on production in some of these poorer locations than in those that are somewhat wealthier but are encountering new growth constraints. Judicious allocations in these poorer areas would also serve to ameliorate rapidly increasing income differentials between localities.

Available material suggests that areas with low rates of chemical fertilizer use also tend to have low rates of organic manure application.[303] Moreover, these areas are probably receiving little organizational support and have higher population growth rates. They are strongly subsistence oriented and higher state purchase prices have not appreciably increased cash income because quotas are of necessity set at very low levels. Grain, for the most part, has been eaten or paid as tax, not sold to the state. The larger constraint limiting rapid expansion in output is not merely a lack of fertilizer, but a more general discrimination by central authorities against poor areas, not only in distributing scarce physical inputs, but in allocating investment in infrastructural categories,[304] such as transportation, water control, and hydroelectric power. Owing to this more general constraint, and because these peasants are too cash poor and too risk averse to purchase or produce fertilizer, the most needy areas may not be disposed to finance even modest fertilizer applications, though

they might thereby bring about respectable additions to output.

In spring 1979 authorities in some provinces began a systematic attempt to supplement consumption assistance to poor counties and brigades with direct production assistance. In each case this was done selectively and the scope of such programs was limited. Surveys were conducted, and participating units were selected either according to their potential for expanding production or simply owing to their particularly low per capita income level. What few results are available on these programs seem to show some success and their expansion has been indicated.

A much larger number of provinces have announced assistance programs to poor brigades for 1980. Sometimes these programs are nothing more than agricultural tax exemptions or grain aid. Often they provide special organizational assistance and give encouragement and material aid to develop sideline production or cash crop cultivation. Occasionally, they include allocation of agricultural inputs or financial, technical, and organizational assistance to establish enterprises to produce inputs.[305]

How far such programs will eventually proceed is open to question. Grain production growth in these localities will be limited. But the programs represent a source of untapped potential and may mitigate the effect on aggregate grain production of acreage shifts out of foodgrains in poor localities.

Consideration of all the various adjustments of rural policy that may affect incentives and resource allocation suggests that the net incidence through these mechanisms on foodgrain production will be positive when compared with even 1978, although the magnitude of such influence is not possible to estimate at the present time. The most powerful reason for such a conclusion lies in the alleviation through terms-of-trade adjustment of the disincentive caused by the low, declining, and sometimes negative profit rates for foodgrain production. These rates were characteristic of important agricultural areas between 1966 and 1977, and more than occasionally brought about a fall in real income levels.[306] The most serious cause for pessimism is that this same experience, coupled with increased local peasant autonomy over farm decisionmaking, may result in widespread hesitancy to invest further in grain production expansion.

Rural Policy Changes, Income Distribution, and Political Unrest

A full discussion of the interaction among China's rural policies, the pattern of income distribution, and foodgrain production will not be attempted here. It would be remiss, however, not to offer a few basic observations of probable relevance to the future course of farm output in China: the 1979 shifts in rural policy will almost certainly have a profound effect upon the pattern of income distribution in China; distributional issues have been important historically in generating mass response to and participation in political upheavals; and periods of political unrest in the People's Republic have been associated with declines of agricultural output.

There should be little doubt that to the extent that policy measures of the kind embodied in the 1979 rural policy reform provide incentive to expand production, they will also widen the gap between fast-growing and slow-growing counties and brigades. An abolition of the ceiling for collective distribution to commune members and a freeze on quotas at their 1971-75 levels to be delivered at the lower compulsory purchase price will enable localities that are able to sell large and increasing shares of grain at the surplus price to generate large gains in incomes.

The inequality will be ameliorated by fewer bureaucratic restraints and active encouragement for all areas, (especially those relatively unsuccessful in generating income through grain production), to diversify into cash crops, animal husbandry, and farm subsidiary pursuits. But to a large extent, those best able to take greatest advantage of higher prices for these goods will be comparatively affluent localities. Poorer counties and brigades will be assisted by measures discussed above. But for the peasants in those localities to increase their income by as much as farmers in advanced and fast-growing areas, not to mention state industrial workers, the only alternatives may be migration, greater reliance on non-agricultural sources of income, or removal of some constraint barring technical transformation.

The latter two possibilities could require major capital transfers that the budgeting authorities may still not find justified. Even if such transfers were forthcoming in the current period, rapid growth in income

would at best be a long way off for many such localities.

Perkins and Myers argue that modest projects requiring a family or a few families have been pursued intensively by the Chinese for centuries.[307] More recently, several teams have gotten together to undertake more ambitious tasks. But there still remain projects that require more technology, working capital, or organization than a production team can manage. Such projects, coupled with indivisibilities in other capital investments too expensive for a team to handle, have created periodic pressures to shift the accounting unit from the team to the production brigade.

Yet, the brigade is generally too unwieldy for the link between effort and individual or family benefit to be clearly perceived. Ishikawa has shown that the social structure of Chinese rural society seems well designed for productive organization centered around the production team and incorporated into the looser framework of people's communes.[308] Within a production team of approximately 30 families, information flows freely and a certain community feeling prevails, contrasting sharply with mistrust of people outside the team and a sense of isolation from larger or neighboring organizational units. Ishikawa cites cases of production teams that have refused to surrender their collective savings to the brigade for the purchase of agricultural machinery.[309]

The National Agricultural Congress decided in 1975 that the investment funds for mechanization should be accumulated mainly from the surplus earned from production enterprises, which in turn should receive greater emphasis within brigades and communes. But this is not always an auspicious possibility and the result was often commandism, causing peasant resentment, low quality labor application, and occasionally output decline. Criticism of commandism similar to Liu Shaoqi's complaints about the Great Leap Forward,[310] may indicate an abandonment of active support for these collective projects and a disinclination to expropriate surpluses for machinery purchase and other development needs. As counterproductive as such actions can be, they may still be the only way to loosen key infrastructural constraints beyond the capacity of individual production teams in backward areas in the absence of larger capital and skilled manpower allocations from the central authorities.

Distributional themes in periods of political unrest and the use of distributional issues to mobilize the masses have been and, no doubt, will be the focus of much research. Howe discussed a variety of distributional issues in his investigation of groups most actively participating in the Cultural Revolution.[311] Donnithorne noted that five of the first six provinces to establish revolutionary committees at the start of that period were grain-deficit provinces.[312] Field, McGlynn, and Abnett developed a methodology for quantifying political stability and investigated its correlation with industrial output growth during the political conflicts of the mid-1970s.[313] They found that provinces of moderate or strong growth were stable and that, with one exception, politically unstable provinces experienced slow growth or even declines of output during the period. These effects were linked to a centrally administered program of phased discriminatory investment in industrial capital construction. Work cited by Dernberger indicates that "advanced-type counties" where significant yield increases were registered usually received preferential state assistance and tended to be high-yielding counties in traditional China.[314]

The exact nature of the distributional issues involved in each case and their exact relationship to the phases of the social upheavals that have been detrimental to production cannot be discussed here. It is enough to note that distributional issues have historically been of particular political significance in China. Popular consciousness of and sensitivity to changes in distribution have been heightened by the experience in recent decades under the CCP's leadership.

The association of political unrest with declines of output can be appreciated with a glance at Table 1. The Great Leap Forward (beginning 1958), the first phase of the Cultural Revolution (beginning 1966), and the mid-1970 s political conflict (beginning 1974) all brought on periods of dislocation and unrest; all were followed, within a year or two of their advent, by stagnation or decline in agricultural production. It would be a serious distortion to overemphasize the similarity of the three periods. The causes of falling farm output have been varied and complex, but the declines were always at least exacerbated by stalls or drops in the rate of industrial input supply to agriculture and, to varying degrees, by direct rural participation in the upheavals. Problems

with the implicated industries have included instances of rural unwillingness or inability to finance demand, and political unrest within the industrial sector itself.

What do these considerations mean for the prospect of foodgrain output stalls caused by political unrest? First, since income and consumption increases are being widely distributed now after a recent period of upheaval and a decade or more of income stagnation for many localities, the hypothesized chain of causation seems unlikely to cause growth to stall in the next few years.

Secondly, it is unwise to assume that the current policy emphasis is in any sense final. Future administrations (or even the current one) are not at all incapable of attempting to shift China's development along lines more closely approximated by the social revolution as articulated by leading figures during the Great Leap and the Cultural Revolution.[315] Finally, even if there is no change in emphasis for the time being, popular participation in periods of political unrest, speaking simplistically, seems to have occurred when income distribution has been perceived as insufficiently egalitarian, as well as when it has been too egalitarian. If the current policies do provide incentives and materially reward the successful, they run the ultimate risk of being politically controversial once perceptions of growing inequalities supplant the euphoria from the initial broad-based income improvements.

The Suitability of Chinese Policy to Present Technological Developments

It is quite possible, then, that current trends, recent policy, and allocational changes may favorably affect output by increasing the growth rate of input and resource applications; improving the quality of inputs, especially labor inputs; and improving the efficiency of resource allocation. At the same time it does not appear likely that the gross allocational shifts away from foodgrain production and gross reversions toward less intensive cropping patterns that will inevitably accompany the developments described above will result in a large and negative influence on grain production once the amount and quality of lands involved and gross increases in grain acreage are considered. On the other hand, although the danger for the next several years does not seem great, these same policies will bring about profound and increasing changes in the pattern of income distribution in China. Put conservatively, such changes seem to have had an association with political disturbances that stall growth, although the causes of the latter are complex and not limited to distributional issues.

Thus far policy initiatives resulting in shifts in the patterns of resource allocation have been discussed as changes that may bring about a single absolute increase in output by increasing allocative efficiency under recent technological arrangements and gross input supply levels. Ultimately, however, the suitability of that pattern for fully exploiting the growth potential of the currently emerging technology and supply levels may be of dominant importance. In the past, instances have been reported in which input application in areas of newly constrained growth has proceeded not only beyond the point of profitability under the concurrent relative prices, but far beyond the zone in which quantities applied may be considered rational from the standpoint of sheer physical allocative efficiency.[316]

What then is the technological context that will be relevant for the remainder of the current plan? How will it gel with the current shifts in policy emphasis and resource allocation? One of the bright spots is a recent domestic breakthrough in rice production.[317] China's own male-sterile F1 rice hybrid was grown successfully in 1977 and 1978 on 5 percent (more than 2 million hectares) and 13 percent (4.3 million hectares) of China's rice acreage.[318] In 1977 it yielded about 20-30 percent more than conventional dwarf rice hybrids.[319] In 1978 nationwide increments over yields sown to conventional improved varieties averaged 700 kilograms per hectare.[320] The basic strain reportedly has a longer growing period than the varieties it replaces.[321] It is therefore suitable as a late or middle crop but discourages multiple cropping in some areas. Despite some indications that the new hybrid strains have not been an immediate success in certain areas, 1979 planting increased to over 5 million hectares, and yield increases reportedly averaged 750 to 1,125 kilograms per hectare.[322]

China is now actively participating in seed institute exchanges and hence will be exposed to a wider range of genetic variation,

with good potential for increasing disease and pest resistance.[323] It should be noted that many countries have been unable to realize that potential. But China's genetic stock has been particularly cloistered, and disease and pests have been an outstanding problem. This suggests that the short-range potential from the interchange for China is greater than for many other countries with a longer history of contact.

Finally, China has evolved a streamlined system permitting simultaneous stabilization, selection for local adaptability, evaluation, and seed multiplication, within about three or four years rather than the more customary eight to ten.[324] Hence as yet undeveloped varieties could further raise yields even during the current economic plan.

The F1 hybrid is already beginning to noticeably augment aggregate yields and is especially suited to localities with histories of successful well-integrated development. Hence policy concentration on these areas may be advantageous to output growth.

Shaanxi's experience seems typical in this regard. In 1978 the F1 hybrid yielded an average of 8.3 tons per hectare on 2,730 hectares (or about 2 percent of the province's rice acreage), whereas conventional hybrids were already yielding 6.1 tons per hectare. In 1979 Yangfengzao was planted on 38,630 hectares (or about 27 percent of provincial rice acreage).[325] As of 1979 the hybrid has been reported as being sown extensively in Hunan, Hubei, Jiangsu, Jiangxi, Shanghai, Zhejiang[326]—all with substantial proportions of high-yielding rice acreage prior to introduction of the hybrid.

F1 may therefore make a major contribution to rice production growth, especially in the rice regions among China's grain bases such as the Yangtze Delta. But what about the evolving technological situation across the board? It should be recalled, for example, that the largest part of the major grain bases are most suitable for wheat, soybeans, corn and other coarse grains.

Recent work by Lardy[327] based upon incomplete provincial statistics indicates that yields during the 1960s and 1970s varied increasingly among provinces in the same major cropping region. Lardy's provisional conclusion is that the conditions underlying this variation suggest considerable growth potential.

The crux of the argument may be summarized as follows: in the 1950s variation between provinces in the pattern of growth (with few exceptions) seemed modest, suggesting the exhaustion of growth based on traditional technology. Growth in the 1967-75 period (more than 3 percent per annum) has been divergent—because of the limited pattern of diffusion of technological change in agriculture and because of inappropriate agricultural development policy. Broader geographic diffusion and the current reversal of poorly conceived agricultural policies of the past should help the rate of growth of foodgrain output accelerate.

It would be dangerous to accept such a thesis in gross statement or generalize from it. Nevertheless, it would be doing Lardy a disservice to presume that he is unaware of the cost efficiencies involved in increasing output through selective concentration and that he is ignorant of divergent growth patterns in countries at various stages in the process of "green revolution." The thesis must be taken, if it is taken at all, in a relative sense and with a particular reference to current circumstances in China.

Part of Lardy's optimism stems from his discovery that rice production growth may have accelerated in the 1970s, long after the introduction of conventional dwarf hybrids. This is contrary to popular supposition and suggests that a longer time lag than expected has been required to develop the full potential of these varieties. Although some of the well-publicized advanced areas seem to have exhausted this potential in the 1960s,[328] the process may still be continuing in several regions. An important implication for production in the current period is that the contributions of the newest seed technologies with their requisite input stream, and the contributions of the older type of improved seed technology which has now become common (when combined with better water control, more fertilizer, etc.) are to a certain extent additive at the present time in China, rather than the former being categorically a substitute for the latter.

Evidence that state plans will exploit this dual potential may be seen in China's capital construction efforts. As was discussed above, a small subset of high and stable yield lands are being converted to lands with yield of a ton per mu, and the major grain bases, almost half of which have high and stable yields, receive preferential financial assistance and input deliveries. Meanwhile, additional high and stable yield areas are now again being constructed. It may be useful to roughly sort out the possible

sources of growth among various crops and strains. (1957-77 growth disaggregated by crop is shown in Table 11.) Though it is somewhat illegitimate to do so, seed technical growth is discussed in isolation from the particular nature of the input stream that is normally required to increase yields from improved varieties, and in isolation from the input stream as a source of growth independent of seed technology changes.[329]

Conventional dwarf rice hybrids have accounted for slow but steady growth since 1964 when they were first distributed for full production. Yield growth between 1957 and 1976 was about 1.4 percent a year. Total production growth between 1957 and 1977 may have been about 2 percent a year. Provincial research indicates that rice production growth was accelerating rather than declining in the 1970s. The full potential of these varieties has probably not been realized, even though they were sown on 80 percent of all rice acreage in 1977.

It is claimed that yields from Fl male sterile rice hybrids are 20-30 percent greater than yields from conventional hybrids in areas where the full potential of the latter may have already been realized. Large-scale distribution did not begin until 1977, when they were sown on 5 percent of all rice acreage. These hybrids accounted for 13 percent of rice acreage in 1978 and over 15 percent in 1979.

Although wheat production has grown more than 3 percent a year since 1957, much of the increase is attributable to displacement of coarse grains and improved water control. Semi-dwarf varieties from more disease-resistant Chinese-Mexican crosses were introduced in 1973 and were widely disseminated by 1977. But peak growth rates from these varieties have yet to be realized.

In Shanxi, a number of hybrid wheat strains have been developed from a recently identified male-sterile strain which appeared through natural mutation and produces offspring, half of which are fertile. Thus one of the major stumbling blocks to male-sterile wheat development seems to have been overcome, although the usefulness of the hybrid to the current plan is still unproven.

Maize production growth has proceeded at 4.5 percent a year since 1957, benefiting from the displacement of coarse grains and improved water control. Double-cross maize occupied a large proportion of total maize acreage by the mid-1960s, but was susceptible

Table 11–Foodgrain production disaggregated by crop, 1957 and 1977

Grain	1957	1977
	(million metric tons)	
All foodgrains	195.05	286
Rice (unmilled)	86.80	129
Wheat	23.65	41
Coarse grains[a]	52.65	86
Corn	21.44	48
Tubers[b]	21.90	19
Soybeans[c]	10.05	10

Sources: All figures for 1957 are from People's Republic of China, State Statistical Bureau, *Ten Great Years* (Peking: Foreign Languages Press, 1960), p. 119. The figure for all foodgrains, however, is not the figure appearing on that page, but the sum of the figures for the categories included in the table.

For 1977 the figure for all foodgrains is from *Beijing Review*, January 12, 1979, p. 7. It is assumed that this figure includes soybean production and not merely soybeans directly consumed. The figures for rice, wheat, and corn are from Thomas B. Wiens, "Agriculture Among the Four Modernizations," a paper prepared for the Workshop on Agriculture and Rural Development in the People's Republic of China, Cornell University, Ithaca, N.Y., May 17-19, 1979, p. 20. Wiens based his figures on statements given by a Chinese official to a delegation in 1978. The figure for soybeans is from the U.S. Department of Agriculture, and was cited in George Gunset, "China's Grain Push Could Alter Markets," *Chicago Tribune*, February 7, 1979. The coarse grain figure was calculated as a residual.

According to Chinese sources in U.S. Foreign Broadcast Information Service (FBIS), *People's Republic of China: Daily Report*, September 10, 1979, p. T4, potato acreage rose from 20 million mu in 1949 to 80 million (5.3 million hectares) in 1979; yields increased from 700 to 1,300 jin per mu at that time. Irish potato acreage may have been about 20 million mu in 1949 as the figures for 1952-57 ranged from 25 to 32 million mu (Nai-Ruenn Chen, *Chinese Economic Statistics: A Handbook for Mainland China* [Chicago: Aldine, 1967], pp. 286-7). Chen cites official figures giving total tuber acreage in 1952-57 as 130-165 million mu and in 1949 as 105.159 million mu. It is therefore assumed that the sources found by FBIS refer only to Irish potatoes and that the tuber figures found in a news bulletin issued by Xinhua [New China News Agency], September 19, 1979, p. 5 (FBIS, *PRC*, September 26, 1979, p. 118) refer to sweet potatoes. Xinhua's figures are 4.6 million hectares sown with tubers, yielding 9 metric tons per hectare.

Table 11—(Continued)

Adding Irish and sweet potato production gives the total tuber production figure for 1979, 93.348 million metric tons. This has been used as a proxy for the 1977 figure. Since the total foodgrain production figure and its components are used to derive an estimate of coarse grain output, the total tuber production figure has been divided by five as the Chinese have done since 1963 when aggregating foodgrain statistics. See Bruce Stone, *A Review of Chinese Agricultural Statistics, 1949-79* (Washington, D.C.: International Food Policy Research Institute, forthcoming), Table 2.

[a] These include millet, corn, sorghum, barley, buckwheat, oats, proso-millet, small beans, small green beans, broad beans, and peas, and others.

[b] These include Irish, sweet, and other potatoes. Following official definitional conventions at the time, tubers in 1957 are valued at one-fourth of their natural weight; tubers in 1977 are valued at one-fifth of their natural weight.

[c] These include yellow soybeans, green soybeans, and black soybeans (or black beans). All soybean production is included although current official foodgrain definitions may only include the production of soybeans consumed directly as foodgrains, and exclude some 3–4 million metric tons of output devoted to edible oil and bean cake production.

to disease over broad areas in 1961 and 1966. Single-cross maize was distributed by the late 1960s. It occupied 40 percent of total maize acreage in 1973 and about 60 percent in 1978. Growth potential is still available from some displacement of other grains, continued displacement by the single-cross hybrids of other maize, and yield increases in current hybrid-maize areas.

Soybean production fell in the 1960s due to displacement by higher-yielding varieties of other foodcrops; recovery began in the late 1960s and early 1970s and may now be close to the 1957 level. Hybrid soybeans have recently become available, but their yield increment in ordinary farm situations has yet to be clearly documented. On the other hand, government incentive measures have been introduced to encourage increased acreage on collective lands and private-plot production. These seem to have had some effect, and further measures have been introduced by the provinces in 1979 and 1980. The growth rate of production of coarse grains other than maize since 1957 has been as low as 1 percent a year or less. Acreage displacement by higher-yielding and more valuable wheat and corn varieties and a general lack of concerted attention to coarse grains has worked against improvements in the input stream. Displacement is likely to continue, but a higher-yielding wheat-elytigia hybrid and drought-resistant hybrid sorghum and triticale varieties have been developed and are being disseminated.

The yields of potatoes since 1957 have probably increased less than 1 percent a year, and 1978 production may be little above the 1957 level. But potatoes have probably been valued at one-fifth rather than one-fourth their natural weight since 1963, which may have confused the yield computation. Potato yields seem to have stagnated owing to viral infections, but sharply divergent yields in contiguous areas confirm official reports that lack of coordinated emphasis on the dissemination of optimal field management practices is also at fault. The first virus-free potato farm was not established until 1975. By 1979 seven such farms and several potato institutes had developed 40 varieties. In 1978 seed potatoes were produced which are claimed to increase yields 150 percent on test farms. Dissemination should begin in the early 1980s but extensive adoption is still hampered by the small volume of seed currently produced. More suitable field management practices are also being promoted, notably in Fujian, Heilongjiang, and Inner Mongolia.

Producing 380-400 million metric tons of foodgrains by 1985 appears quite feasible from a seed-technology standpoint. On the basis of the kind of information given above, a sample distribution of an 80-million-metric-ton increment over 1978 production is offered.[330]

Thirty-five million metric tons could be rice, of which 13 million metric tons would come from acreage and especially yield increases of conventional dwarf hybrid and 22 million metric tons would come from adoption of the new Fl male-sterile dwarf in place of conventional hybrids. Thirteen million metric tons could be wheat. The increase would come primarily from yield improvements on existing semi-dwarf acreage, secondarily from acreage expansion of semi-dwarfs. No gain can yet be expected from male-sterile wheat hybrids. Seventeen million metric tons could be maize. This increase would come primarily from expansion of the acreage of single-cross hybrids and from yield improvements on existing hybrid acreage. Five million metric tons could come from coarse grains. Growth from an improved input stream would be almost

counterbalanced by acreage displacement; some increase could come from hybrid sorghum and triticale. Five million metric tons or more could come from potatoes. The increase would come from virus-free seed technology to be introduced in the 1980s and from improved field management. Less than 5 million metric tons would come from soybeans as a result of acreage increases and greater input application. No gain can presently be counted on from hybrid soybeans.

The point to be made here is not that the Chinese will produce 385 million metric tons by 1985. Whether they do will depend primarily on their success in fulfilling their plans for fabrication and delivery of requisite inputs to the localities that can most efficiently use them and their success in designing and administrating rural and urban policies to harness initiatives in both sectors and to avoid growth stalls due to political unrest and disaffections. With better than average marks in these areas, even the 400-million metric-ton target is not out of the question.

The rough crop distribution synopsis of possible production increases given above is designed to suggest that available seed technology provides potential for an average annual rate of growth of over 3.5 percent a year—an ambitious mark but not an unprecedented achievement—and to show that a large proportion of the potential increase over the current 10-year plan (perhaps 50 to 60 of the 80 million-metric-ton increment hypothesized) is dependent on the performance of China's relatively advanced agricultural regions. Hence, at least for the purpose of increasing aggregate output, a concentration on these regions may be well advised.

In the past China's ability to deliver requisite inputs to favored localities has been good, especially compared to other planned and developing economies. Its continued ability to do so should assure some acceleration of growth in the current period and foodgrain production levels well in excess of the 360 million metric tons the historic long-term rate implies. Whether they come close to the 1985 target of 400 million metric tons may depend on the Chinese being eclectic enough to supplement their efforts with a course of action that will tap the potential of less advanced and slow-growing localities without squandering resources—an approach that could also mitigate the threat of growth stalls from political disputes over maldistribution which may be risked by many of the new agricultural policies.

FOOTNOTES

[269]The supply relationship hypothesized and developed descriptively in this section may be formalized in a loose theoretical sense as follows.

Abstracting from the reflexive influence of demand upon foodgrain supply,

$$Q = f(I, P, T, W),$$

where P is policy, T is seed technology and the appropriate field management practices, and W is weather. I is the nonlabor input stream not embodied in T. Abstracting from the interrelationship among "independent" variables, it is assumed that the expected value of the change in foodgrain supply between 1978 and 1985, E(dQ), is of the form:

$$E(dQ) = E(dQ/dI) + E(dQ/dP) + E(dQ/dT) + E(dQ/dW)$$

It is also assumed that E(dQ/dI) can be written:

$$E(dQ/dI) = [1+E(g_{Q/I})]^6\ Q_{1978} - Q_{1978}$$

where $g_{Q/I}$ is the average annual foodgrain production growth rate from 1978 to 1985 that results from input supply increases alone. It has already been suggested that $g_{Q/I}$ is expected to be within the 3.0 to 3.5 percent range so that E(dQ/dI) is about 70 to 85 million metric tons, since Q_{1978} is 305 million metric tons.

As 1978 was a bad weather year, $E(dQ/dW) \geq 0$. It is briefly discussed in the text and the succeeding footnote.

In general, it can be suggested that E(dQ/dP) and E(dQ/dT) are not negative and that E(dQ/dP) is significantly different from zero. The components of the latter to be considered implicitly assume that E(dQ/dP) can be written:

$$E(dQ/dP) = E(dQ/dR_1) + E(dQ/dR_2) + E(dQ/dS_1) + E(dQ/dS_2),$$

where R_1 is the effects of 1979 policy changes on resource allocations among communes and R_2 is those effects within communes; and where S_1 and S_2 are the effects on the labor and local savings incentive structure and upon the income distribution structure. A principal difficulty with the above equation and any attempt to discuss the included variables is that the latter are far from mutually independent and their orthogonal elements cannot be easily separated.

[270]Although weather fluctuations have resulted in drastic harvest variations within particular localities in China (see footnote 20), weather-related oscillations in national aggregate production of grain have for the most part been considerably damped. Moreover, China's improved ability to handle adverse weather has been one of, if not the most, important contributions to rural welfare. While sizable variations still occur in many localities, the 1976-78 period was one of the most severe stretches of extended bad weather in Chinese twentieth-century history. In the worst year, 1977, aggregate foodgrain output only fell by a few million tons (see Table 1). Similar periods of stagnation cannot be ruled out, unfortunately, as meteorological research suggests that the 1970s may mark the beginning of a period in which weather fluctuations are more drastic than they were in the last 30 years.

[271]"Decisions of the Central Committee," FBIS, *PRC*, August 31, 1979, p. L27, and March 5, 1979, pp. K2, K3.

[272]See, for example, the source listed in footnote 146.

[273]Audrey Donnithorne, *China's Grain: Output, Procurement, Transfers and Trade* (Hong Kong: Chinese University, Economic Research Centre, 1970).

[274]John C. Pelzel,"Economic Management of a Production Brigade," in *Economic Organization in Chinese Society*, ed. W. E. Willmott (Stanford: Stanford University Press, 1972), pp. 392-3; cited in Stavis, "Making Green Revolution."

[275]Stavis, "Making Green Revolution," p. 147.

[276]See ibid., and Lardy, *Economic Growth*.

[277]Donnithorne, *China's Grain*, and Audrey Donnithorne, "Economic Indicators for China," *U.S.–China Business Review*, 1 (March-April 1974): 33; cited in Audrey Donnithorne, "Per Capita Grain Output in China and India," *Food Policy* 2 (February 1977): 60-6.

[278]Stavis, "Making Green Revolution."

[279]This is the result of a calculation by Thomas B. Wiens which he based on recent official material. None of the percentages quoted in the paragraph are highly reliable, but the trends observed are consistent with central policy toward the rural sector. Over the present 10-year plan, a fall might be expected from the 1978 figure, which is probably much lower than the 31 percent estimated by Ng for 1976-77. Ng finds an average of 31 percent among 22 counties in 15 provinces during 1976-77 (Ng Gek-boo, "The Incentive Policy in Chinese Agriculture: An Overview," International Labor Office, World Employment Program, Rural Employment Policies Branch Research Programme, 1978, p. 20). However, in a more recent publication, based on Food and Agriculture Organization of the United Nations, "Information Gathered on a Private Visit to China," W/K 6874, FAO, Rome, 1976, p. 28, he gives 20-30 percent for the 1970s (Ng Gek-boo, "Incentive Policy in Chinese Collective Agriculture," *Food Policy* 4 [May 1979]: 75-86).

[280]Based on 1978 output of 304.75 million metric tons and the 1979 preliminary figures of 315 million metric tons.

[281]See for example, Xue Muqiao, "How Can We Effect Planned Management on the National Economy," *Renmin Ribao* [People's Daily], June 15, 1979, and "A Study in the Planned Management of the Socialist Economy," *Beijing Review*, October 26, 1979, pp. 14-20. See also Yao Jinguan, "Preliminary Discussion on Price Scissors."

[282]See Bruce Stone, "Industrial Incentive Structure in the People's Republic of China," Cornell University, Ithaca, N.Y., 1976; and G. William Skinner and Edwin A. Winckler, "Compliance Succession in Rural Communist China: A Cyclical Theory," in *A Sociological Reader on Complex Organizations*, 2nd ed., ed. Amitai Etzioni (New York: Holt, Rinehart and Winston, 1969, based on Etzioni's organization theory. For a discussion of the components in effective labor application, see Jaroslav Vanek, ed., *Self-Management: Economic Liberation of Man* (London: Penguin, 1975) and Jaroslav Vanek, *The General Theory of Labor Managed Market Economies* (Ithaca, N.Y.: Cornell University Press, 1970).

[283]Vanek ed., *Self-Management*, and Mellor, *The Economics of Agricultural Development*, pp. 37-56.

[284]Several items have turned up in the Chinese press on the subject of pork and pig sales, which exceeded the commerce bureau's storage capacity in a number of areas. One such report for Hunan province is found in FBIS, *PRC*, January 29, 1980, pp.P2, P3. In Beijing overprocurement has engendered local administrative pressure to lower the purchase price and reduce the amount of grain awarded for large pigs. Superior levels have prevented the move (FBIS, *PRC*, April 23, 1980, p. P4).

[285]Shigeru Ishikawa, Hitotsubashi University, conversation, Tokyo February 1980.

[286]Stone, "A Review of Statistics," Table 9A.

[287]Ibid.

[288]Chou Chin, "China's Most Populous Province: Back to Order," *Peking Review*, December 1, 1978, pp. 20-2.

[289]Based on preliminary findings of research in progress conducted by Thomas B. Wiens in Jiangsu (Thomas B. Wiens, letter to Randolph Barker, January 31, 1980).

[290]FBIS, *PRC*, July 10, 1979, p. L13; March 14, 1979, p. E14; Xinhua, news bulletin, February 21, 1980.

[291]In sparsely populated Heilongjiang, for example, mechanized sowing was applied in 80 percent of the wheat and soybeans and 50 percent of miscellaneous grain acreage (FBIS, *PRC*, April 14, 1980, p. S1). In Jilin's grain base, 5.6 million people or about one-third of the province's moderate population, produce one half of its grain (Xinhua, news bulletin, February 21, 1980). In 1979, 50 percent of spring acreage in the base was machine sown—up 20 percent from 1978 owing to preferential allocations (FBIS, *PRC*, June 7, 1979, p. S4).

[292]See footnotes 290 and 291; in addition, see FBIS, *PRC*, December 14, 1979, p. S1; September 6, 1979, pp. S5, S6. Since the entire province of Heilongjiang has been designated a commercial grain base, it will receive a large supply

of preferential inputs. But the province will further concentrate these supplies in the hands of 42 rich brigades to maximize growth in provincial agricultural output.

[293]FBIS, *PRC*, April 24, 1979, p. L6.

[294]FBIS, *PRC*, March 5, 1979, p. L1.

[295]For afforestation see FBIS, *PRC*, March 8, 1979, p. M1; March 9, 1979, p. M2; March 19, 1979, p. R1; and March 23, 1979, p. T1. Water for irrigation from the Yellow River currently sets a world's record for greatest silt content among irrigation waters extensively employed (Stone, "A Review of Statistics," Table 12, discussion). For an article discussing some success cases in the war to arrest soil erosion on the loess plateaus through forestry, see Xinhua, news bulletin, April 16, 1980; FBIS, *PRC*, April 17, 1980, pp. L12, L13.

[296]Eighteen major agricultural purchases prices were raised 15 to 50 percent ("Higher Purchases Prices Bring Good Results," *Beijing Review*, November 9, 1979, p. 5).

[297]Mark Elvin, *The Pattern of the Chinese Past: A Social and Economic Interpretation* (Stanford: Stanford University Press, 1973); Dwight Perkins, *Agricultural Production in China* (Chicago: Aldine, 1969); Carl Riskin, "Surplus or Stagnation," in Dwight Perkins, ed., *China's Modern Economy in Historical Perspective* (Stanford: Stanford University Press, 1975).

[298]Dharm Narain, "Growth of Productivity in Indian Agriculture," Occasional Paper No. 93, Cornell University, Department of Agricultural Economics, Technological Change in Agriculture Project, Ithaca, N.Y., June 1976.

[299]Average grain yields in Wusih County, Jiangsu (with a population of approximately 1 million and with 61,153 cultivated hectares) grew from 3.6 tons per hectare in 1949 to 5.3 in 1956, 8.1 in 1965, and 12.5 in 1976 (Chin Chi-chu, "New Picture on a Blank Sheet of Paper: Farm Mechanization in Wusih County (1)," *Peking Review*, July 29, 1977, pp. 20-4). Average yields in Pingting County, Shansi (with a population of 300,000 and 31,500 cultivated hectares) rose from 2.74 tons per hectare in 1974 to 5.25 tons in 1977. They hope to achieve yields of 7.5 tons per hectare in 1980 (Chin Chi-chu, "All-out Effort to Develop Agriculture—A Glimpse of Pingting County in Shansi Province," *Peking Review*, June 30, 1978, pp. 12-5). Hsiyang County's celebrated Tachai Brigade increased their average yields from 1.3 tons per hectare in 1949 to 1.9 in 1953, 4.1 in 1958, 5.6 in 1963, 6.0 in 1964-65, 8.0 in 1967, 7.7 in 1973, and 9.8 in 1977 (Kuo Feng-lien, "The Tachai Road," *Peking Review*, October 4, 1974, pp. 18-25; and *Peking Review*, December 9, 1977, p. 30). Such success stories are common in the Chinese press and are borne out by visitor's reports.

[300]Shigeru Ishikawa, "Agrarian Reform and Its Productivity Effect: Implications of the Chinese Pattern," a paper presented at the Conference on Comparative Economic Systems, Tokyo, 1968. Also see Subramanian Swamy's comments on Ishikawa's presentation. The fact that Chinese policy has continued to financially penalize and restrict the opportunities available to former landlords and rich peasants—and their progeny—long after other undesirable elements have been "uncapped" is some indication that central authorities are still aware that the current structure of farm organization may degenerate in some areas. Efforts to redress this situation were made in the 1979 round of legal reforms.

[301]Lardy, *Economic Growth*.

[302]Donnithorne, *China's Grain*.

[303]Thomas B. Wiens, "China's Agricultural Targets: Can They Be Met?" *Contemporary China* 2 (Fall 1978): 115-27; Thomas B. Wiens, "Agricultural Statistics in the People's Republic of China," in *Quantitative Measures of China's Economic Output*, ed. Alexander Eckstein (Ann Arbor: University of Michigan Press, forthcoming).

[304]An exception to this statement appears to be developing in mountainous areas of Sichuan. This province, China's most populous, has suffered slow industrial growth and recent and temporary food deficits. The installation of tubewells and the introduction of rapid-spray irrigation technology may make more water available. A lack of water has effectively barred the transition to more intensive cropping patterns. Chou Chin, "China's Most Populous Province: Back to Order," *Peking Review*, December 1, 1978, pp. 20-2. Also see Wiens, "Agriculture in the Four," "China's Agricultural Targets," "The Evolution of Policy."

[305]A subset of available citations from the recent Chinese press appears in FBIS, *PRC*, for various provinces as follows:

Heilongjiang: April 2, 1980, p. 53; February 28, 1980, p.S1;
Hubei: April 8, 1980, p. P1;
Hunan: March 3, 1980, p. P3;
Gansu: January 22, 1980, p. T3;
Zhejiang: December 20, 1979, p. O12-O13;
Qinghai: February 8, 1980, p. T4;
Guangdong: April 16, 1980, p. P1.

[306]Yao Jinguan, "Preliminary Discussions on the Price Scissors"; Wiens, letter to Barker; Ishikawa, "China's Food and Agriculture"; Ishikawa, "Prospects for the Chinese Economy."

[307]Perkins, "Radical Land Reform," pp. 30-1; Ramon Myers, *The Chinese Agricultural Development in Peasant Economy: Hopei and Shantung, 1890-1949* (Cambridge, Mass: Harvard University Press, 1970); Ramon Myers, "Cooperation in Traditional Agriculture and Its Implications for Team Farming in the People's Republic of China," in Dwight Perkins, *China's Modern Economy in Historical Perspective* (Stanford: Stanford University Press, 1975), pp. 261-78; Ramon Myers, "Trends in Agriculture, 1911-49," Stanford University, Hoover Library, Stanford, Cal., no date. (Mimeographed.)

[308]Shigeru Ishikawa, "Chugoku no Kojin-Shotoku Kakusa to Kettai in (1) Seido Shoshiki no Sentaku to Shijo no Hattatsudo o Chushin Toshite" [China's Personal Income Disparity and Its Determinants (1) Choice of Institution and Degree of Market Development], *Ajia Keizai* [Asian Economy] 17 (June 1976).

[309]Ishikawa, "China's Food and Agriculture," pp. 100-1.

[310]Comparison with Liu Shaoqi's arguments drawn by Thomas B. Wiens, "China's Agricultural Targets."

[311]Christopher Howe, "Labor Organization and Incentives."

[312]Donnithorne, *China's Grain*.

[313]Field, McGlynn, and Abnett, "Political Conflict and Industrial Growth."

[314]Robert F. Dernberger, "The Program for Agricultural Transformation in the People's Republic of China," a paper prepared for the Seventh Sino-American Conference on Mainland China, Taipei, June 5-10, 1978. He cites evidence collected by John Gates, University of Michigan, Ann Arbor, for his honors thesis, and Marsh S. Marshall, "Red and Expert at Tachai: A Source of Growth Analysis," Oxford, U.K. (Mimeographed.) Dernberger's econometric investigation of this hypothesis, however, was inconclusive.

[315]In political science literature, see the works of Carl Walter (graduate program, Stanford University), relating to Liu Shaoqi and the role of criticism by negative example. As early as 1975 Walter's excellent paper predicted and placed in appropriate context Liu Shaoqi's current rehabilitation. For a sociological treatment, see Skinner and Winckler "Compliance Succession." For a more recent and somewhat amusing statement of related issues, see Johann Galtung, "Is there a Chinese Strategy of Development," United Nations University, Goals, Processes and Indicators of Development Project, Tokyo, 1979. (Mimeographed.)

[316]The issue of unprofitable current input investments has already been addressed. See Yao Jinguan, "Preliminary Discussions on the Price Scissors"; Xue Muqiao, "How Can We Effect Planned Management of the National Economy," *Renmin Ribao* [People's Daily], June 15, 1979; Ishikawa, "China's Food and Agriculture"; and Ishikawa, "Prospects for the Chinese Economy." In addition, in a variety of instances the marginal physical product of such investments has even been low. (Yao Jinguan, "Preliminary Discussions on the Price Scissors"; Wiens, "China's Agricultural Targets"; Chou Chin, "China's Most Populous Province."

[317]Stone, "A Review of Statistics," Table 8.

[318]FBIS, *PRC*, June 29, p. L17; State Statistical Bureau, "Communique on Fulfillment."

[319]"More Areas Sown to Hybrid Rice," *Peking Review*, March 3, 1978, p. 30.

[320]State Statistical Bureau, "Communique on Fulfillment."

[321]Thomas B. Wiens, "Agriculture Among the Four Modernizations," a paper prepared for the Workshop on Agriculture and Rural Development in the People's Republic of China, Cornell University, Ithaca, N.Y., May 17-19, 1979, p. 7.

[322]Xinhua, news bulletin, April 18, 1980; FBIS, *PRC*, April 18, 1980, p. L3.

[323]Wiens, "The Evolution of Policy," p. 677.

[324]Ibid.

[325]FBIS, *PRC*, March 1, 1979, p. M2.

[326]FBIS, *PRC*, March 8, 1979, p. G6; April 10, 1979, p. L17; June 24, 1979, p. L17.

[327]Nicholas R. Lardy, "The Prospects for Chinese Agricultural Growth," a paper prepared for the Workshop on Agriculture and Rural Development in the People's Republic of China, Cornell University, Ithaca, N.Y., May 17-19, 1979.

[328]See, for example, Wiens' research on the lower Yangtze region (Wiens' letter to Randolph Barker, January 31, 1980).

[329]The source for this section is Stone, "A Review of Statistics," Table 8 and discussion. This combines research by the author with research by Wiens and Lardy.

[330]Roughly estimated from the above information, Table 11, and Stone, "A Review of Statistics," Tables 8 and 9. Anything more reliable than this sort of rough approximation would require a region-by-region analysis of past trends and present technological potentials and production constraints.