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FOOD POLICY IN CHINA

That China has solved its food problem is the universal story brought back by medical, agricultural, and other scientific observers who have recently toured China. It is a claim made by the Chinese themselves. How could the world's oldest, largest, and in many respects most impoverished nation accomplish such a feat when the food prospects for many of the rest of the world's poor nations seem increasingly bleak?

The National Academy of Sciences delegation that toured China in the summer of 1975 attempted to answer this question while observing small-scale rural industry and its interaction with agricultural growth. From the beginning it was clear that small-scale rural industry was not a goal in itself but was intended as a vehicle for imparting vitality into the countryside.

The solution to China's food problem involves two fundamental and connected components—increasing food supplies through agricultural growth and ensuring access to those food supplies by means of socialist distribution mechanisms. Small-scale rural industry as one major component of China's food policy was observed directly. Observations, questions, and briefings provided information on the other.

A substantial technical and scholarly literature exists on the details known to the outside world of China's agricultural development program.[1] This article is not a review of that literature but rather is a broad sketch of the strategies used by the Chinese in their development effort and of the mechanisms used to ensure that the entire population has access to the fruits of that effort. While it is convenient to treat these two topics separately, the Chinese emphasize that the social mechanisms of access and distribution are an integral component of the production system itself. An attempt is made to convey this lesson in the following discussion.

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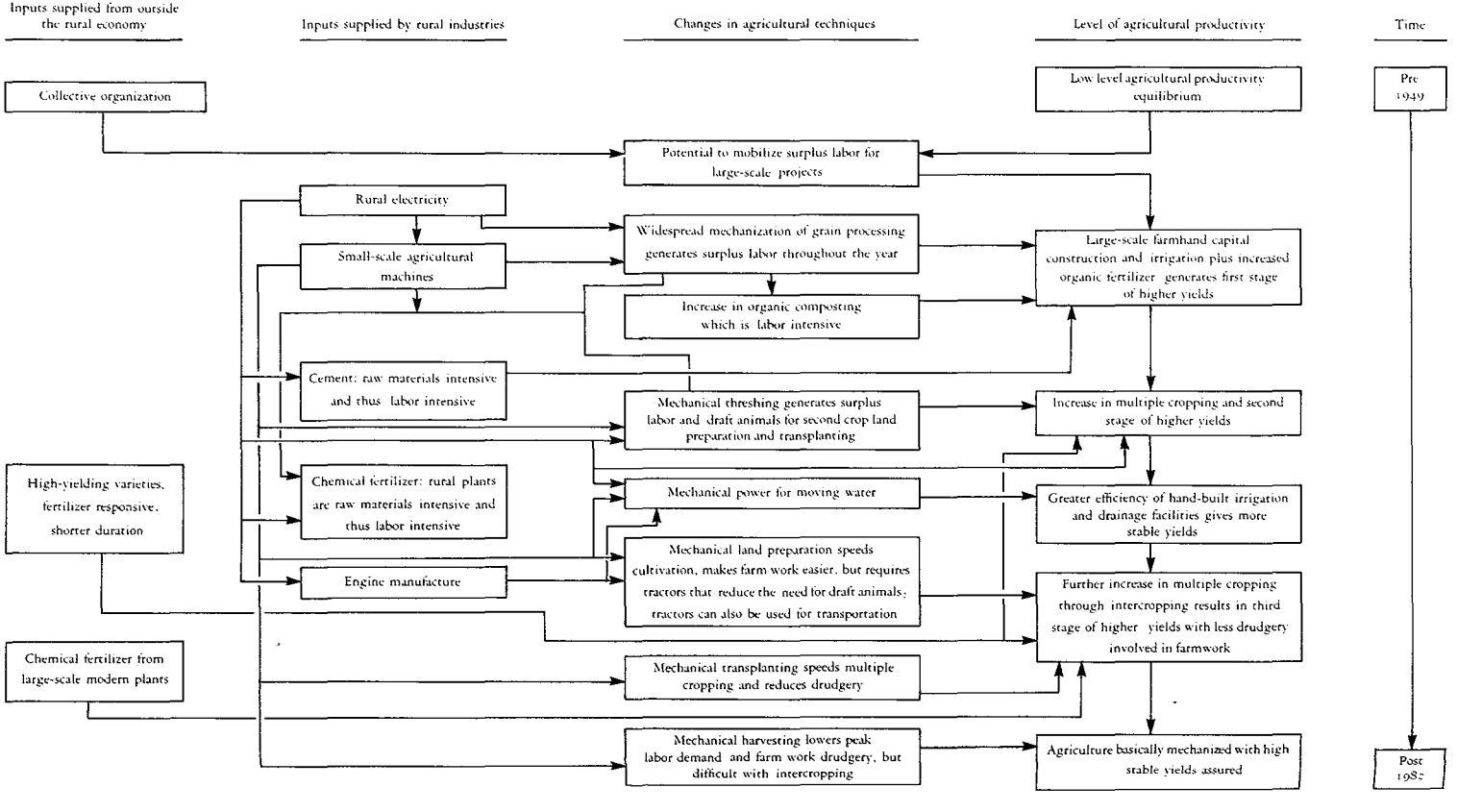
[1] Four references provide a suitable introduction in themselves and also contain excellent references: Stavis (5), Perkins (4), Wortman (8), and Keesing (2).

CHART 1.—SCHEMATIC FLOW DIAGRAM DEPICTING THE DEVELOPMENT OF CHINESE AGRICULTURE



INCREASING FOOD SUPPLIES

Before the People's Republic consolidated its victory in 1949, China was among the most wretched of countries. The overwhelming misery and human suffering that existed are still vivid memories for the survivors who tell and retell their stories to the younger generation which has not lived under the "triple yokes of feudalism, imperialism, and bureaucratic capitalism." The contrast between the peasant's life then and now is constantly invoked as motivation for and justification of the enormous physical effort and ostensible loss of personal freedom involved in the transformation of Chinese agriculture.

The process of that transformation is schematized in Chart 1, which models a series of necessary but not sufficient organizational and technical inputs to Chinese agriculture that interact with each other in a cumulative fashion. Chart 1 does not depict the historical evolution of any single commune or region, but rather it models a purposeful abstraction of the development of Chinese agriculture. It is, in some sense, Chinese agricultural development as the Chinese would like the visitor to understand it. The ultimate purpose of the schema then is to help us understand Chinese agricultural policy—to understand what the Chinese leadership *wants* to happen. Since the Chinese have adequately demonstrated a real capacity for implementing policies, this understanding is an important ingredient in evaluating China's success. How fast the basic model is diffusing across the Chinese countryside is a question answered only by time and the Chinese themselves.

Pre-Liberation Chinese agriculture was trapped in a low level equilibrium with farm productivity balanced by the resources available and the incentives and organizational structures for change. Given the devastation of the economy during the Second World War and subsequent civil strife, some increase in food production would have been forthcoming under a private economy. But major progress was unlikely without substantial restructuring of land ownership and of the organizational mode of farming. These changes came sequentially with the land reform of the early 1950s, the primitive co-ops of the mid-1950s, and the final culmination of the Rural People's Communes in 1958. The organizational structures then existed that were capable of mobilizing vast quantities of surplus labor for large-scale projects primarily involved in restructuring farmland and in carrying out major water control works (transportation facilities also absorbed much labor).

Some of the labor needed for such vast undertakings had been available in the slack seasons for many years. But much more was needed to attack and transform nature on the grand scale widely advertized by the Chinese and now attested to by a variety of uniformly impressed foreign visitors. This seemingly paradoxical need to generate more surplus labor provides the rationale for the first stage of agricultural mechanization—processing basic food grains by machines instead of by hand. Such mechanization became possible only when rural electricity began to be available, and the labor savings were truly enormous. According to a local Chinese spokesman, in 200 days of operation a commune-run rice mill of three tons per hour capacity saves about 2 million man-hours of labor. This saved labor is mostly female, but the argument is not weakened. Women work side by side

with men in the water conservancy and farmland capital construction projects. A very substantial proportion of the total labor input in such projects involves moving soil and stone with baskets on shoulder poles. Women and men both engage in this task.

Two other important roles existed for the newly generated surplus labor. Cement is a critical ingredient in a wide variety of rural industrial and agricultural projects, and its production in small-scale rural plants is a unique feature of the Chinese model. These plants transform locally quarried limestone and coal into low- and medium-quality cement which is suitable for lining aquaducts and for mortaring bridges and terrace-retaining walls. The process from coal mine and quarry to production and use is enormously labor intensive and could not be conducted at its present magnitude without the workers freed by the first stages of agricultural mechanization.

The third role for surplus labor is to increase the amount of organic manure prepared and distributed to the fields. The new awareness of the finite supply of fossil fuels has prompted a number of recommendations in the West that energy-intensive agricultures should reduce chemical fertilizer applications in favor of organic manures. There seems to be little understanding, however, of the extent to which organic manure is merely congealed human labor. Organic manure has always been the mainstay of Chinese agriculture, but it was never applied in the past in the prodigious quantities now being used in the model areas because vast quantities of communally organized labor are required. Thus the generation of surplus labor within the commune permitted a substantial increase in the production and application of this vital yield-sustaining-and-raising input into Chinese food production.[2]

As the productivity potential of farmland was raised through leveling and terracing and the risks from drought and floods were attenuated by irrigation and drainage works, opportunities emerged for extension of double cropping. Double-cropped rice land in the South has been common for centuries, but extension of the system northward and to other crops meant rapidly performing the harvest of the early crop and all the preparations for the second. These tasks are highly labor intensive with traditional techniques, and existing labor was already fully employed. The bottleneck was broken by the introduction of mechanical threshers, technically the easiest area of mechanization. Indeed, pedal operated, semi-mechanized threshers had been a fairly standard feature in double-cropped rice fields since the 1950s. But wheat threshing is technically more difficult because more power is required. Widespread mechanical wheat threshing awaited widespread rural electrification so that motor driven threshers on central threshing floors could be used.

Rural electrification has had an enormous impact on agricultural mechanization and hence on generation of the labor surplus needed to "drive" the model depicted in Chart 1, for two distinct reasons. First, the availability of electricity

[2] As an example of the enormous quantities of organic manure being used in some areas, the delegation visited communes applying over 200,000 kilograms of organic compost per hectare. Even conservative estimates of nutrient content indicate a nitrogen application of over 500 kilograms per hectare, which is high by any standard. For further details see National Academy of Sciences (3).

at the commune and brigade level has fostered an extensive network of agricultural machinery repair and manufacturing shops. All of the shops visited had lathes, grinders, and milling machines. Many, especially at the commune level, are engaged in relatively large-scale manufacture of threshers, pumps, tractors, and similar items which would be impossible without electricity. Rural electrification then has permitted the diffusion of manufacturing and repair capability well into the countryside, with obvious advantages in terms of local access to agricultural machinery and repair and suitability of the machinery to local conditions.

Second, electric motors are the prime movers for a surprisingly large range of agricultural machinery. Most western agricultural machinery is designed to take the mechanical process to the field and to return with what is directly consumable. The Chinese view agriculture in a broader, more ecologically sound, perspective. They bring more of the land's output to a central place, but ultimately more is returned to the land (after composting and fermentation into organic manure). If the central place has electricity, a great many functions can be electrically powered that in other circumstances would tend to be done by hand in the field before mechanization and with gasoline or diesel engines afterward. Threshing tends to be one of the first field tasks mechanized, usually by an electrically powered thresher on a central threshing floor, often in conjunction with an electric fan to assist in winnowing. The low standards of construction and maintenance required for electric motors relative to petrol engines thus make many mechanization tasks cheaper and technically simpler, and hence more readily adopted in the countryside.

With increased potential for multiple cropping two other inputs become critical to further production gains: short-season, high yielding, fertilizer-responsive grain varieties and the chemical fertilizer to put on them. The evidence is now clear that the Chinese developed and widely distributed short-stature, high yielding rice and wheat varieties somewhat before similar advances were made by the international research institutes, especially the International Rice Research Institute (IRRI) and the International Center for the Improvement of Maize and Wheat (CIMMYT). The Chinese rice varieties did not have quite the yield potential of the early IRRI varieties but did have a significantly shorter growing season, which was essential to double cropping.

Although double cropping is not doubly exhausting to the soil relative to single cropping because yields usually do not double, substantially more nutrients are required on a long-term basis. These added nutrients are very difficult to provide strictly from organic manures, and so chemical fertilizers suddenly had a very high productivity if they could be gotten to the fields. In this context the small-scale rural fertilizer factories for which China is famous make excellent economic sense despite their apparent high costs in raw materials per nutrient ton. The factories use coal as the primary raw material to produce reduced hydrogen and then ammonia via the standard Haber process. The unusual aspect of the Chinese process is the end product derived from the gaseous ammonia. Instead of using technically sophisticated (and very expensive) compressors to convert the ammonia gas directly to anhydrous ammonia and possibly then to urea, as in modern plants, the Chinese rural factories compress the gas only

enough to react it with other inexpensive agents to form ammonium nitrate (35 percent nitrogen) or ammonium bicarbonate (17.5 percent nitrogen). The first compound is a well known fertilizer and also an explosive when pure. The ammonium nitrate from Chinese factories is used for both purposes. The second compound is much lower in nutrient content and is little known outside China.

The capital costs of the rural fertilizer factories are substantial even when much of the material and labor for construction is local and of low opportunity cost. The ammonium nitrate factory in Da Zhai, for example, required 33 tons of stainless steel, which is available only by allocation from the State. The banks of reciprocal compressors needed in either type of plant are made only in State factories. Thus the widespread appearance of these small-scale rural fertilizer factories was a clear signal of the understanding at the national policy level of the necessity to invest heavily in the food production sector if output was to be increased.

But the marginal, or operating costs, of the small fertilizer factories are borne locally. These costs are mostly labor and raw materials, primarily coal, which is actually labor just one stage removed if a local coal deposit exists. So once again, the necessity to *create* surplus labor is clear. Mechanization of threshing and processing seems to have been the most economical source of this surplus.

With these transformations the basic ingredients of high-yielding agriculture—water control, fertilizer, responsive seeds, and adequate labor for careful cultivation—were in place. The addition of high capacity pump sets to the hand-dug water control network permitted the high potential yields to become high and stable yields, which was the first priority of food production policy. The efficacy of the policy and the implementation was demonstrated from 1972 through 1974 when droughts struck much of northern China. It was a major achievement that Chinese food production did not drop significantly during this period.

MECHANIZATION

Achieving high and stable yields has been the central thrust of Chinese food policy over the past decade. But Chairman Mao pointed out that "mechanization is the only way out for agriculture." Present plans call for the basic mechanization of Chinese agriculture by the early 1980s.

In retrospect the mechanization of food processing, threshing, and some land preparation served as the catalyst to speed the labor-driven model of increasing and guaranteeing food supplies. For the future, widespread mechanization of land preparation, transplanting, and harvesting will continue to free large volumes of labor, but except for some marginal increases in multiple cropping, the yield gains will be small. In addition, mechanizing these tasks faces major technical difficulties.

Two important factors explain why land preparation is only beginning to show substantial progress in mechanization. The first is the level of technology required on a broad front to mechanize land preparation. The essential input is the tractor, either two-wheeled or four-wheeled. The tractor requires sophisticated engine making and repairing capacity as well as petroleum products available in the countryside. The second factor is that mechanizing land preparation leaves

only a marginal role for draft animals in direct agricultural production. Since these animals play a substantial role in the generation of organic fertilizer, removing them from the farm scene in China is rather more complicated than it was in the United States where only their horsepower was replaced.

Mechanization of land preparation is further complicated by the pressing need for transportation vehicles in rural China. Large quantities of materials are still moved by shoulder poles, human-drawn carts, and animal-drawn vehicles of all descriptions. The temptation is enormous to substitute tractors for human labor. Since plowing with animals is easier work than transporting materials long distances by hand, most tractors in the countryside seem to be on the road and not in the field. Many animals were seen by the delegation preparing the land for second crops. A much higher proportion of the winter and spring deep plowing may be done by machine.

Nevertheless, it is not surprising that a production unit might decide to use its animals for plowing at low opportunity cost and use its tractors primarily on the road. This suggests that full mechanization of land preparation will only be solved simultaneously with the rural capacity to build small, locally adapted trucks. Only at this stage will it be possible to get rid of draft animals, thereby raising the opportunity cost of animal plowing.

Mechanical transplanting is still in its infancy even in the model areas. Research and development in this area are being pushed vigorously as a further means of flattening seasonal labor demand peaks and speeding the turnaround time between growing crops in the field. Success in this effort will also make a major contribution to one other goal high on the list of priorities of Chinese leaders—to reduce the drudgery of agricultural labor. The Chinese do not shun hard physical work. Nearly everyone, including government bureaucrats and university professors, is expected to engage in some manual labor each year, preferably on farms. But the goal of policy is to reduce the gap between the physical effort involved in field work versus that in the factory. By narrowing this gap as well as the income differential between rural and urban areas, the Chinese feel they can dampen the presently strong preferences of rural workers to try to obtain factory jobs in cities. By reducing rural pressures to migrate to the cities, pressures thwarted at the moment by effective bureaucratic controls over access to urban food supplies (as well as other measures), the subsequent social overhead capital investment required to house and service adequately a large flow of rural migrants will be similarly reduced. The intent is to keep peasants on the farm by making rural work as attractive as possible.

The last stage of Chinese agriculture to be mechanized will probably be harvesting. The mechanical revolution in European and American agriculture began with harvesting, and similar large, uniform tracts of grain in the northeast of China are reported to be similarly mechanized. But mechanically harvesting small plots of intercropped grains is a different task. Small reapers mounted on walking tractors have been successfully demonstrated, but their use is not widespread. Small combines for wheat, which may be interplanted with corn (a popular new practice that raises the multiple-cropping index), may be feasible, but their development is in the design stage only. The Chinese custom is to

remove all the straw from the field for fodder and composting; thus combines lose much of their potential advantage over simpler reapers. By either means great volumes of material must be carried out of the field, a task likely to be done by hand in the foreseeable future. Development of suitable machines will no doubt be pushed, however. Like the transplanter, mechanical harvesters are justified for their contribution both to speeding the interchange of crops and to reducing the physical effort required of agricultural workers.

Speeding agricultural work by substituting machines for human labor raises the fairly immediate possibility of the kind of technological unemployment witnessed in a number of Asian rural areas. Eventually, and perhaps within a decade, a substantial proportion of China's rural population will not be needed in the fields. The Chinese are unconcerned about this eventuality. The reasons have to do partly with the distribution mechanisms discussed in the next section. If mechanization does not cause output to fall, then total agricultural income will remain the same and be communally shared. Such technological unemployment might better be termed leisure, which is as valued in China as elsewhere. But more important in Chinese plans is the continued potential to create productive new jobs for the labor saved in agriculture. Significant diversification away from crop raising and toward animal husbandry, fruit raising, beekeeping, food and fiber processing, and small-scale rural industries is already apparent even at the brigade level in some model areas. The share of these sideline occupations is expected to rise sharply as fewer workers are needed directly on the land. This transfer of workers from farm to factory is a feature of the development of all wealthy societies. The Chinese model is unique in that the transfer in this early stage involves shifts in occupation but not changes in location.

INCENTIVES AND ACCESS TO FOOD SUPPLIES

Except for the unique aspect of employing the surplus agricultural labor in rural factories rather than in urban ones, the physical schema the Chinese are using to increase food production is entirely consistent with the classical surplus labor model of economic development outlined over two decades ago by W. Arthur Lewis. Implementation of the model is the critical issue. Any country could (and some did) place similar schemes on the paper of ten- and twenty-year perspective plans. The Chinese are succeeding in transforming the plan into reality. If other poor countries are to learn any lessons for their own food policies from the Chinese experience, they must not stop with the physical model, although it is very important, but must also understand what the Chinese regard as twin complements to the physical model: the organizational and personal incentives needed to push the model from paper to field and the social and bureaucratic mechanisms that distribute the resulting output.

Certain inevitable tensions exist between incentive and distributional policies in a society bent on guaranteeing minimal living standards to all citizens while raising those standards on the average. China has not escaped those tensions, but it has attempted to balance them in a pragmatic fashion evolved from the results and lessons of many experiments.

Many in the West view Chinese society, or at least the commune, as noble

confirmation that individuals can join in an effort directed toward the general good without concern for individual reward beyond the shared public welfare. The belief is that the guiding principle of Chinese distributional policy is the traditional Marxist formulation—"from each according to his ability, to each according to his need." The Chinese emphasize that the reality is considerably more complex. The present formulation of the distributional rule in all but a very few circumstances is "from each according to his ability, to each according to his work." This rather Calvinistic expression demonstrates that at the heart of both Chinese distributional *and* incentive policies are individual material rewards for the human labor that drives the physical production model.

Wages in factories and offices are typically based on an eight grade scale where beginning wages tend to be half or less the level in the upper ranges. Cadre and technicians seem to be paid salaries well above the top level in the regular wage scale. The disparity in incomes generated by these differences is not large by private economy standards for either poor or rich countries, but it is not insignificant either. Recent attempts have been made to narrow the income gap by upgrading lower level wages without raising those in the upper ranges or by promoting workers to higher grades so that a bunching in the upper levels exists. But the attempts do not seem to be widely popular, and strikes and work stoppages apparently have occurred in some areas. The current movement to study the theory of the dictatorship of the proletariat is designed to educate the workers on the desirability and need for uniform wages, but it also is a convenient way to postpone significant movement toward that goal while still recognizing its importance politically.

Distribution patterns in rural areas are more heterogeneous and complex than in urban areas. Work points, not wages, are the primary mechanism for compensating agricultural (and some rural industrial) labor. Each laborer has the worth of a full day's work collectively evaluated once a year. The criteria of evaluation vary from team to team and from commune to commune. All units give heavy weight to physical effort exerted and to skill levels; units also make adjustments for political consciousness. The number of work points earned each day is recorded in the books of the accounting unit, usually the production team (which tends to be a small village) although some politically advanced areas now use the production brigade (a cluster of perhaps ten to twelve villages) as the accounting unit. Communes are an important link between the villages and the central government (at the county level), but they do not seem to serve as the accounting unit.

At the end of a production year the gross value of output for the production unit is calculated. After subtracting costs for purchased inputs, taxes owed to the State, and deductions for various welfare funds within the administrative province of the commune (to pay for the universal health insurance, accumulation funds, care for aged, schools, and the like), the net value of output for the accounting unit remains to be allocated to individuals. The allocation is made simply by determining the total number of work points earned within the production team or brigade during the year and then the average value of each work point. Each individual then draws an amount equal to his or her total work points times the average value per work point. Typically, food withdrawals are made in advance of the final reckoning to carry households until the harvest, and

deductions for these are made in the final reckoning at the State price for grain. In advanced agricultural areas households are free to buy as much grain as they need, within the limit set by their total accumulation of work points (and the likely value of those work points).

The level of accounting is the critical variable in distinguishing the Chinese system from traditional economic models. If the accounting unit were the individual, then the system would resemble a pure private agricultural wage economy. If the unit were the household, the system would resemble a traditional subsistence economy. As groups of households and entire villages are pulled into the accounting unit, the level of risk for an individual falls but so too does his perception of the link between his own effort and the resulting size of the harvest. Since work points do not depend on actual productivity but only on work effort, the larger accounting units tend to broaden the guarantee that everyone receives access to an adequate harvest. For example, two villages, one with extremely poor soil and one with rich soil, will have very different food consumption (or income) levels depending on whether they are two separate accounting units or whether both are included in a single accounting unit. In the separate case both sets of villagers can work equally hard, and yet one will prosper and the other will not. If both villages are in the same accounting unit, neither will face starvation, but the village with better resources will not prosper as much.

Not surprisingly, the type of income redistribution inherent in this second example has not proved popular with the more prosperous Chinese villagers. While there has been general willingness to incorporate families within a village or small area under the collective wing, this has been aided by familial ties and a strong traditional sense of community. These instincts have been reinforced by not pushing income redistribution very far. Accounting units tend to incorporate relatively homogeneous agricultural resources so that it is easier to share the resulting output on the basis of work effort expended.

The question of substantial differences in incomes and living standards among brigades and communes has already emerged as a major challenge to Chinese leaders. Disparities of at least two to one can be observed between wealthier and poorer brigades within some communes and of perhaps four or five to one between communes. These differences raise an inevitable pressure to broaden the accounting unit as a means of narrowing disparities in income, but so far the pressure has had little impact.

The Chinese leadership has repeatedly emphasized that the major reason for different productivity and income levels is the willingness of the people to put "politics in command." The national agricultural policy encapsulated in the motto, "In agriculture, learn from Da Zhai," makes precisely this point. Despite the most barren land and limited water resources imaginable, the Da Zhai production brigade succeeded in achieving high and stable yields for food grains, diversifying their agriculture through mechanization, and rebuilding their miserable village into a town that regularly receives international visitors among the thousands of Chinese who daily make a virtual pilgrimage to view the miracle.

The lesson of Da Zhai is startling and simple. Do not complain about lack of resources. Do not ask assistance from the State. Mobilize the workers and set them to transforming the fields, to finding water, to digging coal, and to making

cement.[3] Higher living standards are available to any production unit that has the political will to mobilize. And the rewards will accrue to those who earn them.

A strong material incentive exists to increase production. The incentive in the first instance is to the accounting unit collectively. But since the Chinese seem to have found a satisfactory balance between the individual and society, at the level of the production team, the incentives to individuals are not imperceptible. Strong political leadership at the team level can make the vision of the collective production gains quite real for the individual. The tension between distributional equity and private incentives is used creatively to set the task of local political cadre. If the cadre are good, prosperity grows. If they are not, backwardness continues until either the peasants force the issue or higher levels select new leaders.

PRICES

Implicit in the network of physical changes occurring in Chart 1 is an entire set of financial incentives and flows that reflect the accounting needed to make the system function. Wages and work points measure only the accounting prices for the labor flows. Similar accounting must be done for the machinery, fertilizer, electricity, and other commodities and inputs. The accounting is usually in physical units and labor work points for flows entirely within the accounting unit, but accounting for flows from one unit to another and more importantly from one level to another is nearly always done with prices. The level at which these prices are set and the extent to which they change are an extremely important part of the overall climate of inducement to increase food production.

The price of food grain relative to the prices of critical inputs needed to produce food grain, and especially to fertilizer price, is a critical variable in determining the climate of production incentives. In the decision making of market-oriented farmers in Asia, the evidence is strong that this grain/fertilizer price ratio plays a major role.[4] The evidence suggests that the variable is important in China also but that important differences exist. The details of the argument are provided in Appendix I, but the essence is straightforward.

Increasing fertilizer applications is a major source of higher food grain yields once the agronomic potential has been generated by means of water control, improved cultivation practices, and the availability of high-yielding varieties. Within a given price context fertilizer use can be increased, often dramatically, by policies that attenuate the risks of using fertilizer and that develop farmers' understanding of the yield increments to be expected from fertilizer applications. But in China as elsewhere in Asia the price context itself is used as a significant part of the overall package of inducements to raise yields.

Prices for both grain and fertilizer are set by the State, and no trading of either commodity is permitted in free markets. The control of food grain prices especially seems to have been effective for over a decade. At the same time that urban prices have remained stable, the farm prices have been raised somewhat on several occasions (requiring some State subsidy to pay the marketing costs). As rural fertilizer factories sprang up and imported fertilizers became more widely

[3] In short, start through the network of Chart 1.

[4] The evidence is reviewed in David (1), Timmer and Falcon (7), and Timmer (6).

available, the rural prices of chemical nutrients have been reduced. The very conscious effect has been to raise the grain to fertilizer price ratio as an inducement to production teams to intensify fertilizer applications as part of their effort to achieve higher yields. The intentional policy of using price incentives in this effort is seen even more clearly in the premium prices paid by the State for sales of grain above a commune's basic quota. This premium seems to range from 20 to 50 percent above the basic quota price.

Appendix I shows that average rice yields in China are somewhat higher, given the price for within-quota rice, than would be suggested by the experience of six tropical rice-growing countries. The price-yield relationship is even more impressive for the high and stable yield areas of China which are able to produce enough surplus grain to earn the premium, above-quota price. Indeed, these areas are as productive as the rice areas of Taiwan. They demonstrate how remarkably successful China has been relative to other Asian experience in integrating a package of yield-increasing technology into an atmosphere made financially attractive by very low risks and high awareness of input productivity. The high and stable rice-yielding areas of China are consistently impressive for the uniformity of the fields, a uniformity not to be seen elsewhere in Asia. It is attributable to meticulous cultivation organized collectively and spurred by a set of incentives that reward success.

ACCESS TO FOOD

Providing access to locally self-produced food is not a major problem once the production effort has succeeded. But two other difficult problems remain. First, in the rural areas what is to be done about villages, families, and individuals that are unable to share in a successful production effort? Second, how are food supplies to be guaranteed in urban areas?

The problem of excluded individuals and families is not widespread in China because of the strength of the extended family bonds. Three generation households are still the typical case and are encouraged by the government. The occasional individuals who do not fit into a family and who cannot work are cared for in special homes run with local welfare funds.

Families with too few able-bodied workers to earn sufficient work points to provide adequate food are supplied from local reserves accumulated as part of the welfare fund. Decisions on the size of this fund and distributions from it are made by all members of the production unit; the procedure resembles collective charitable action much more than a bureaucratic welfare scheme. Since the recipients are always well known by the collective decision-making group (indeed they are usually part of it), few opportunities for abuses exist.

Areas that have not managed to achieve high and stable yields for their basic food grains are much more vulnerable to natural calamity. Drought or floods would cause general starvation within localized areas if grain supplies from outside the afflicted area were not provided quickly and cheaply. The central and provincial governments have been very successful in building reserves from domestic surpluses and from imports to provide such grain, and no significant famines have been reported in China since the founding of the People's Repub-

lic.[5] This impressive achievement has been possible, of course, only because of the rapid improvement of substantial portions of Chinese agriculture. Those rural areas that have received emergency grain supplies have also been pushed hard toward local self-sufficiency. The model of Da Zhai is a constant embarrassment to any locality that must receive grain from the State. No local political leadership can expect to survive for long if it must resort regularly to State grain supplies.[6]

The net result in the rural areas has been firm guarantees that no one will starve but also equally firm pressures for that guarantee to be made good from local resources. The only way for a region to join in the promise of better living standards is to make the political commitment to local food self-sufficiency through the model depicted in Chart 1. Once such an effort is clearly underway, the State has mechanisms to provide assistance—access to special steels and compressors needed to build small-scale fertilizer factories, access to certain critical machine tools to begin a local agricultural machinery industry, and access to engines and sometimes tractors from State factories. But such access comes only after the local commitment; the rural communes, brigades, and teams must take the initiative.

Providing food supplies to the cities is an entirely different task. There can be no quid pro quo of food production effort in return for guarantees of emergency food supplies when deficits hit. Cities are by their very nature centers of continuing food deficit. This perpetual need and the social investment required to keep a person in a city are the major reasons the Chinese have stopped the growth of cities and have even sent many people back to their villages. There they can have the twin effect of producing some of their own food themselves and also of diminishing the food deficit in the city.

The State has four primary sources of grain supplies for urban areas. The agricultural tax provides about one-third of all grain deliveries to the State. The amount is relatively fixed because the rate is set per hectare and does not change when yields change. There is little opportunity for significant extension of cultivated acreage in China, and land reclaimed and improved by terracing, water conservancy, and other investments is temporarily exempted from taxation. The leadership is loath to raise the land tax rate because of the adverse effect on incentives to raise yields. Little flexibility exists with this grain source, and there is small prospect for growth.

Commune grain sales to the State, according to quotas set by historical productivity levels, provide the rest of urban grain supplies procured internally by the State. The price of sales within the quota has gradually increased since Liberation, but, relative to fertilizer prices at least, it is low by other Asian standards. In 1970, for instance, when world rice prices were at their lowest in many years, the relative price paid for within-quota rice in China was about the same as the floor price paid in Indonesia; only Burma and Thailand paid their farmers less. In Indonesia, however, this price was substantially higher than

[5] During the bad harvests from 1959 to 1961 famines were avoided by careful distribution to the neediest areas. Stores of grain were not available.

[6] Communes well suited to producing high yields of important industrial crops, especially cotton and silk, are permitted to buy grain regularly from the State. Even these communes, however, are not permitted to eliminate grain production entirely.

farmers had received historically, and farmers began to respond enthusiastically. In China, where such prices had been guaranteed for much longer, the production response was more nearly complete.

Grain quotas seem to be raised periodically but not as a regular response to higher yields. The attempt to keep the two separate is made for incentive reasons because sales to the State above the quota receive a substantial price premium. The existence and size of this premium cause some embarrassment for politically advanced model brigades and communes.[7]

Imports provide a fourth and important source of urban grain. Wheat imports in both 1973 and 1974 exceeded five million tons, most of which were allocated for urban consumption. Such imports, after the claim in 1971 that China was self-sufficient in food, need to be viewed in their proper context. During the same years China exported about two million tons of rice at significantly higher prices than it paid for wheat, a neat calorie arbitrage. Secondly, transportation facilities to bring rural grain to urban cities are limited and heavily overworked. Since Chairman Mao's call to "store grain everywhere" the decision has been made to build significant rural reserves of grain rather than burden the transportation network by moving the surplus to the cities. Imports then have served to build urban reserves for possible hard times ahead and at the same time to free railroads and trucks for higher priority shipments.

RATIONING

With adequate urban grain supplies assured, the mechanism of distribution remains to be discussed. The system of universal grain rationing for urban dwellers is without doubt one of the major factors which makes the Chinese system unique and uniquely successful.[8] Families receive food grain ration coupons in quantities determined by the age and composition of the family and by the occupation of the wage earners. The rations are presently large enough so that many families do not consume their entire allotment. To discourage waste and the sale of surplus coupons, "savings accounts" for grain have been set up where families may turn in their surplus food coupons each month and accumulate reserves that can be drawn on for special feasts at weddings, holidays, and so on. The grain is not physically stored in a warehouse any more than banks keep the cash from financial savings deposits physically locked in their vaults. But as long as confidence exists that the grain will be available when needed, small reserves are sufficient. The system itself seems to have engendered the feeling among urban families that food is plentiful. Their ration supplies, bought at low and guaranteed prices, are more than adequate. No household hoarding is needed. It is far better to let the State store the grain and to avoid the trouble and expense. Since hoarding greatly exacerbates what may be only marginal scarcity, this scheme has an enormous social payoff. Occasional slight shortages do not get turned into food panics.

[7] During the delegation's visit the leaders of one brigade went to considerable pains to explain that they had refused the higher price paid by the State for their above-quota sales, but the State had "forced" them to accept.

[8] Cooking oil and cotton cloth are also rationed.

The system of rationing the minimum necessities of life so they can be sold at very low prices also solves the problem of access to food supplies for the poorest of the population. Apprentice and low grade worker wages are very low in China, and even with cheap housing, medical care, and transportation, such workers would be unable to compete on a price basis for food. The rationing system guarantees that everyone has access to food and clothing. The poorest people will have little access to anything else because meat is expensive and so are the light industrial products widely available throughout China. But, as the Chinese are quick to point out, China is still a very poor country. The wonder is not that many families cannot afford bicycles, transistor radios, or daily servings of meat, but that all can have three adequate, if starchy, meals each day. It would be no miracle for rich countries to solve their food problems, although the evidence is otherwise. China has done it while poor.

The wonder and magnitude of this accomplishment—of transforming one of the world's poorest and malnourished nations to one of the most adequately fed—in today's hungry world must not be lost in polemics or adulation. Hard work, sensible and sensitive policies, and an amazing pragmatism and flexibility in the face of failures are the ingredients of China's success.

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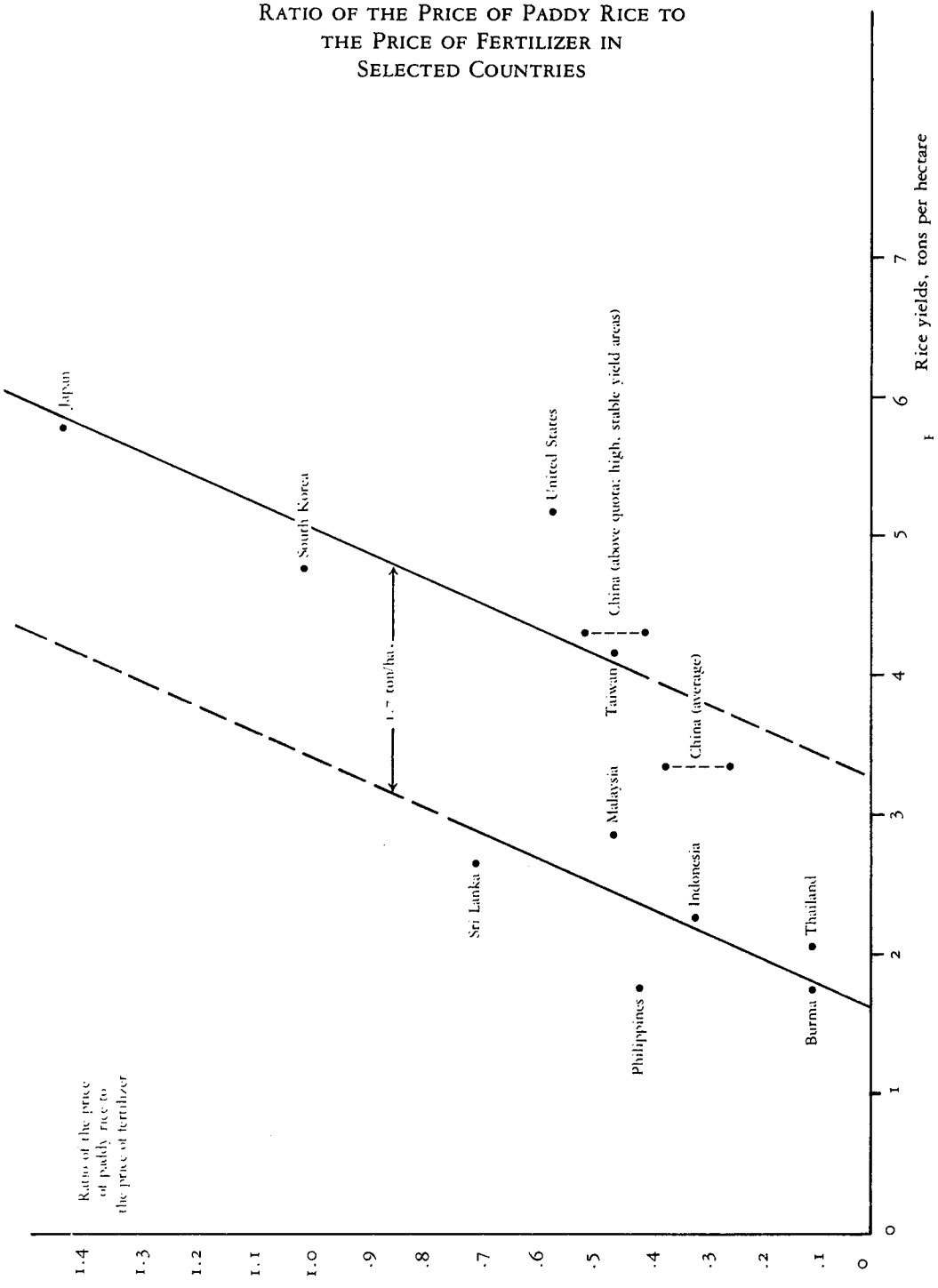
APPENDIX

Chart 1-A plots the relationship that existed in 1970 between rough rice yields on the horizontal axis and the ratio of paddy rice price to fertilizer price on the vertical axis. A number of important provisos about the reliability of the statistical data have as a net result that the data points should be more or less fuzzy gray areas. But the magnitudes of the likely errors do not come close to wiping out the overwhelming variation in both rice yields and price ratios across this sample of Asian countries, nor could the errors change the basic results depicted

CHART 1-A.—RELATIONSHIP BETWEEN RICE YIELDS AND THE RATIO OF THE PRICE OF PADDY RICE TO THE PRICE OF FERTILIZER IN SELECTED COUNTRIES



in Chart 1-A. High rice prices relative to fertilizer prices tend to be associated with high yields, and low rice prices relative to fertilizer prices are associated with low yields. The intermediate processes in this argument, the relationship between prices and fertilizer applications and between such applications and ultimate rice yields, have also been documented by the Stanford Rice Project.

Beyond this simple lesson about the link between profitability of using fertilizer and its actual use are more subtle lessons. The three relatively well off and temperate zone observations—Taiwan, South Korea, and Japan—achieve higher rice yields, about 1.7 tons per hectare, for any given relative price ratio than do the six tropical and poorer countries. This is also true of their fertilizer use and of the efficiency with which the fertilizer is converted into rice. More hours of daylight during the growing season probably account for part of this effect.

A further reason for the larger fertilizer applications and higher yields at each price level is that all three societies in East Asia used mechanisms to lower the risks farmers bore when using fertilizer. Japan used a well enforced, guaranteed price mechanism (guaranteeing the highest farm price for rice in the world in 1970); Taiwan and South Korea both successfully implemented a barter arrangement which permitted farmers to pay back fertilizer loans with a fixed amount of rough rice. The barter ratio was more favorable in South Korea than in Taiwan (but, marginally, so were yields, in a country not well suited to rice). With risks substantially lowered, farmers will apply more fertilizer for a given relative price. Longer experience with fertilizer also raises the amount applied at a given price. The two aspects together—guaranteed price and long experience with fertilizer—might explain why the United States observation is well to the right of the Asian observations.

Asian farmers react to different relative price levels in an economically appropriate fashion, but their observed level of fertilizer use is discounted by lack of knowledge and high risk. Within a given price context fertilizer use can be increased by policies that attenuate risk and develop farmers' understanding of the yield increments to be expected from fertilizer applications. Use can also be increased by improving those yield increments with better varieties, water control, and cultivation practices. The Chinese have used all of these techniques, and the results show that, relative to other Asian experience, they have been remarkably successful. For rice, Chart 1-A shows that in 1971 China's average yields were quite high given the relative prices faced by her farmers. The relative prices were calculated from data received by the delegation in the summer of 1975, but they have changed little since 1971. The average figures reflect the sale price of rough rice within the State quota; the range occurs because the price of nitrogen from ammonium nitrate was lower than from ammonium bicarbonate. Sale prices to the State for amounts above the basic quota are 20 to 50 percent higher than the basic sale price. Areas of high and stable yields tend to produce sufficient surplus grain to benefit from the higher price; such areas are also shown in Chart 1-A.