

Collectivization and China's Agricultural Crisis in 1959–1961

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The agricultural crisis in China in 1959–61, after the initial success of the collectivization movement, resulted in 30 million extra deaths. In this paper, a game theory hypothesis proposes the main cause of this catastrophe. I argue that, because of the difficulty in supervising agricultural work, the success of an agricultural collective depends on a self-enforcing contract, in which each one promises to discipline oneself. A self-enforcing contract, however, can be sustained only in a repeated game. In the fall of 1958, the right to withdraw from a collective was deprived. The nature of the collectivization was thus changed from a repeated game to a one-time game. As a result, the self-enforcing contract could not be sustained and agricultural productivity collapsed. The empirical evidence is consistent with this hypothesis.

I. Introduction

China's agricultural collectivization movement in the 1950s is one of the topics most discussed among students of the Chinese economy. Collectivization started in 1952 with a very impressive success: agricultural output increased continuously from 1952 to 1958. The movement encountered no active resistance from the peasantry and

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was carried out relatively smoothly. Many economists at that time thought that the collectivization movement in China had avoided the devastating consequences associated with the Soviet Union's collectivization in 1929¹ and that China provided a model of agricultural development for underdeveloped, densely populated economies (Robinson 1964). As a result, strong sentiment in favor of learning from China's experiences developed in many countries (Eckstein 1966, pp. 35, 259). Nevertheless, this sentiment soon vanished. Suddenly in 1959, agricultural production plunged dramatically for three successive years. The grain output dropped 15 percent in 1959 and reached only about 70 percent of the 1958 level in 1960 and 1961. A careful study of the newly released demographic data leads to the conclusion that this crisis resulted in about 30 million excess deaths and about 33 million lost or postponed births in 1958–61 (Ashton et al. 1984). This disaster is, undoubtedly, the worst catastrophe in human history.

The reasons for the sudden collapse of agricultural production after the initial success of the collectivization campaign are not well understood because of the statistical blackout in China. The commonly accepted hypotheses are (1) three successive years of bad weather, (2) bad policies and bad management in the collectives, and (3) incentive problems due to the unwieldy size of collectives (Eckstein 1966, p. 379; Chinn 1980; Ashton et al. 1984; Perkins and Yusuf 1984, p. 79). In this paper I shall show that these hypotheses are inconsistent with the empirical evidence, and I propose that the collapse in 1959–61 was mainly caused by the deprivation of the right to withdraw from a collective in the fall of 1958. This switch in the form of organization, from a game theory point of view, changed the nature of a collective from a repeated game to a one-time game. The production collapsed because the success of an agricultural collective ultimately depends on a self-enforcing agreement, in which each member promises self-discipline. However, a self-enforcing agreement is not sustainable in a one-time game.

This paper is organized as follows. Section II briefly reviews the collectivization movement and the related agricultural development strategy in China. The competing hypotheses and the method of

¹ Soviet grain and meat production in 1928, on the eve of collectivization, had recovered from the destruction of World War I and had exceeded or reached its highest prewar levels. However, the production collapsed suddenly after the collectivization in 1929. It took another 23 years, minus the years of World War II, to reach the pre-World War I level (Jin, Lu, and Zhang 1985, chap. 6). Collectivization was estimated to have resulted in an excess mortality of 5 million during the intercensus period from December 17, 1926, to January 17, 1939 (Lorimer [1946, pp. 133–37]; cited in Eckstein [1975, p. 251]).

testing the relative validity of these hypotheses are discussed in Section III. Section IV contrasts these hypotheses with the empirical evidence. Some concluding remarks are provided in Section V.

II. Review of the Collectivization Movement and Agricultural Development

The Chinese economy inherited by the socialist government in 1949 was a war-torn economy in which 89.4 percent of the population lived in rural areas and industry accounted for only 12.6 percent of national income (Ministry of Agriculture 1989, pp. 50, 89). With the intention of quickly building up national power, the government adopted a Stalinist heavy-industry-oriented development strategy in 1952, once the economy had recovered from the destruction of the war. This development strategy resulted in a rapid growth in the demand for food and other agricultural products.² Since scarce foreign exchange was reserved mainly for importing capital goods, the increasing demand for agricultural products had to be satisfied by domestic production. Because agricultural stagnation and poor harvests would have an almost immediate and direct impact on industrial expansion, collectivization was promoted as a strategy for the simultaneous development of agriculture and industry. The dual core of this agricultural development strategy was the mass mobilization of rural labor to work on labor-intensive investment projects, such as irrigation, flood control, and land reclamation, and the increase of unit yields through such traditional methods and inputs as closer planting, more careful weeding, and the use of more organic fertilizers.³

The independent family farm was the traditional form of institution in rural China for thousands of years before the communist takeover in 1949. The farmland was not only small but also fragmented. In the wake of the revolution, nearly half of the land in rural China was owned by landlords and leased to peasants for cultivation. Rent was often as high as 50 percent of the output of the main crops.

² The demand came from several sources: First, the urban population increased dramatically from 57.65 million in 1949, to 71.63 million in 1952, and to 99.49 million in 1957. Second, since over 70 percent of China's exports had been agricultural and processed agricultural products up to the mid-1970s, the country's capacity to import capital goods for industrialization depended on the growth of agriculture. Third, agriculture was the main source of raw material for many industries, such as textiles and food processing.

³ Of course, the reasons for collectivization were numerous. The desire of the Communist party to consolidate its control over the countryside, to eliminate income disparity in rural areas, and to enable the government to increase the rate of extraction of agricultural surplus are the reasons most often mentioned.

Starting in the 1940s, a land reform program was implemented in areas under the Communist party's control, and under this program, land was confiscated from landlords without compensation and was distributed to tenants. The land reform program continued after the success of the revolution and was completed in 1952.

From table 1, we see that experiments with various forms of cooperatives began even before the completion of the land reform program. Of the three major forms of cooperatives up to 1955, the most common one was the "mutual-aid team," in which four or five neighboring households pooled their labor, farm tools, and draft animals for peak seasons on a temporary or permanent basis. In this way, resource ownership was not altered and crop decisions remained the responsibility of the individual household. The second form was the "elementary cooperative," in which 20–30 neighboring households combined their assets in a unified scheme. The net income of a cooperative was shared in two ways: dividend payments for land, draft animals, and farm tools and remuneration for work performed. The land, draft animals, and farm tools were still owned by individual member households. The third form was the collective farm, or the "advanced cooperative," in which all means of production were collectivized. Remuneration in a collective was based solely on labor contribution and took the form of work points. The income of a household depended on the number of work points earned by the family members and on the average value of a work point. The latter in turn depended on the net income of the collective farm. The size of an advanced cooperative initially consisted of about 30 households and later evolved to consist of all the households—from 150 to 200—in a village.

The official approach to collectivization was initially cautious and gradualist. Peasants were encouraged and even actively induced to join the various forms of cooperatives on a voluntary basis. However, the proponents of collectivization won the debate within the party in the summer of 1955. While there were only 500 advanced cooperatives at the end of 1955, 753,000 advanced cooperative farms with 119 million member households had been established by the winter of 1957 (see table 1).

This collectivization was surprisingly successful in its initial stages. It encountered no active resistance from the peasantry and was carried out relatively smoothly. Although the population increased 14.8 percent between 1952 and 1958, the gross value of agriculture measured at the prices of 1952 increased 27.8 percent and grain output increased 21.9 percent in the same period (see table 2). This experience greatly encouraged the leadership within the Communist party and led them to take a bolder approach. The main rationale for

TABLE 1
THE COLLECTIVIZATION MOVEMENT IN CHINA, 1950-58

	1950	1951	1952	1953	1954	1955	1956	1957	1958
Mutual-aid teams:									
Teams	2,724,000	4,675,000	8,026,000	7,450,000	9,931,000	7,147,000	850,000		
Households per team	4.2	4.5	5.7	6.1	6.9	8.4	12.2		
Elementary cooperatives:									
Co-ops	18	129	4,000	15,000	114,000	633,000	216,000	36,000	
Households per co-op	10.4	12.3	15.7	18.1	20.0	26.7	48.2	44.5	
Advanced cooperatives:									
Co-ops	1	1	10	150	200	500	540,000	753,000	
Households per co-op	32.0	30.0	184.0	137.3	58.6	75.8	198.9	158.6	
Communes:									
Communes									24,000
Households per commune									5,000

SOURCE.—Luo (1985), p. 59; Agricultural Cooperativization in China Editorial Office (1987b), pp. 6-7.

TABLE 2
POPULATION, AGRICULTURAL OUTPUT, AND GRAIN OUTPUT IN CHINA

Year	Population (Millions) (1)	Agricultural Output* (1952 = 100) (2)	Grain Output (Million Tons) (3)
1952	574.8	100.0	163.9
1953	588.0	103.1	166.9
1954	602.7	106.6	169.5
1955	614.7	114.7	184.0
1956	628.3	120.5	192.8
1957	646.5	124.8	195.1
1958	659.9	127.8	200.0
1959	672.1	110.4	170.0
1960	662.1	96.4	143.5
1961	658.6	94.1	147.5
1962	673.0	99.9	160.0
1963	691.7	111.5	170.0
1964	705.0	126.7	187.5
1965	725.4	137.1	194.6
1966	745.2	149.0	214.0
1967	763.7	151.3	217.8
1968	785.3	147.6	209.1
1969	806.7	149.2	211.0
1970	829.9	166.4	240.0
1971	852.3	171.4	250.2
1972	871.8	169.6	240.5
1973	892.1	183.8	265.0
1974	908.6	190.1	275.3
1975	924.2	196.0	284.5
1976	937.2	195.3	286.3
1977	949.7	194.3	282.8
1978	962.6	210.2	304.8
1979	975.4	226.0	332.1
1980	987.1	229.2	320.5
1981	1,000.7	244.0	325.0
1982	1,015.4	271.5	354.5
1983	1,025.0	292.6	387.3
1984	1,034.8	328.5	407.3
1985	1,045.3	339.7	379.1
1986	1,057.2	351.2	391.5

SOURCE.—Ministry of Agriculture (1989), pp. 6–8, 112–13, 147–49.

* The output value of village-run industry is not included.

collectivization was rooted in the notion that mobilizing rural surplus labor would increase rural capital formation and, hence, increase production. However, although a collective farm of 150 households provided a basis for mobilizing labor for work projects within the collective, the collective farm did not solve the problem of mobilizing labor for large projects, such as irrigation canals, dams, or the like. These kinds of projects would in general require the simultaneous participation of laborers from several dozens of collective farms. The obvious

solution for a large-scale labor mobilization was to pool 20 or 30 collective farms of 150 households into a larger unit.⁴ For this reason, a new policy was imposed in 1958 as part of the Great Leap Forward in industry. From the end of August to the beginning of November 1958, that is, within only 3 months, 753,000 collective farms were amalgamated into 24,000 communes consisting of 120 million households, or over 99 percent of total rural households in China in 1958. The average commune contained about 5,000 households, 10,000 workers, and 10,000 acres.⁵ Remuneration in a commune was based mainly on the subsistence needs and only partly on the work performed by a peasant. Working on private plots and trading at rural fairs, which existed in the other form of cooperatives, were prohibited. As planned, billions of person-days of labor were thus mobilized. The communal movement, nevertheless, resulted in the profound agricultural crisis that occurred between 1959 and 1961. The gross output of agriculture fell 14 percent in 1959, 12 percent in 1960, and another 2.5 percent in 1961. The most devastating result was that grain output plunged by 15 percent in 1959 and by another 16 percent in 1960, and then remained at the same low level for another year (see table 2). In contrast with many other serious famines that were caused by what Sen (1981) termed an "entitlement" to food, the estimated 30 million excess deaths in this crisis were the direct result of the crop failures (Ashton et al. 1984).

The commune system was not abolished after this crisis; however, its functions were reduced to administration and coordination. Starting in 1962, resource ownership, responsibility for production management, and accounting for purposes of income distribution were delegated to the small production team of 20–30 households. This new institution, in essence, was a hybrid of the elementary cooperative and the advanced cooperative of the 1950s. Remuneration, based on work points earned by each member, resembled the compensation scheme of the advanced cooperative, but the size and production

⁴ In addition to the construction of irrigation projects, mechanization was used as another rationale for increasing the size of a collective. In the document "Opinions concerning the Mechanization of Agriculture" approved and issued by the Politburo in April 1958, it was argued that for the purpose of mechanization, the size of the collectives should be increased. The document also set the goal of achieving total mechanization or semimechanization in agriculture within 5 years (Agricultural Cooperativization in China Editorial Office 1987b, p. 5).

⁵ The term "people's commune" first appeared in July 1958 in the article "A Totally New Society and a Totally New Man" carried in the party's theoretical journal, *Hongqi* (Red flag), by Chen Boda, a personal secretary of Mao Zedong. The first commune, Weixing People's Commune, was established in the same month in Henan province. By the end of September, 112 million households were organized into communes, and by the beginning of November, 120 million households were communized (Agricultural Cooperativization in China Editorial Office 1987b, pp. 6–7).

management were similar to those of the elementary cooperative. After 1962, some experiments in improving the evaluation of work points were made; nevertheless, the production team system was maintained as the basic farming institution until the household-based farming system reform was instituted in 1979. By the end of 1983, 94.4 percent of the farm households in China had adopted the new household-based farming system, which is now called the household responsibility system (China Agriculture Yearbook Editorial Board 1984, p. 69).

A more realistic approach toward agricultural development was also adopted after the crisis. Rural trade fairs were reopened in the fall of 1959, and private plots were restored in the summer of 1960 (Perkins 1966, p. 91). The state procurement prices paid to farmers were raised by an average of 28 percent in 1961 (Ministry of Agriculture 1989, p. 435). Meanwhile, the heavy-industry-oriented development strategy was temporarily replaced by an "agriculture-first" strategy. Industry stressed more the needs of serving the development of agriculture. The introduction of modern agricultural technology and input was thus accelerated. For example, the utilization of chemical fertilizers increased at an annual rate of 16.5 percent between 1962 and 1978. Accompanying the growth of chemical fertilizer consumption was the promotion of modern high-yield fertilizer-responsive crops: the new dwarf varieties of rice and wheat, introduced in the early 1960s, basically had replaced all the traditional varieties by the late 1970s. Similarly, modern varieties of corn, cotton, and other crops were introduced and promoted in the 1960s and 1970s.⁶ The irrigated acreage also increased gradually after 1962. Most additional irrigated acreage came from engine-powered irrigation instead of the traditional gravity system.⁷

The pace of mechanization showed a parallel acceleration after 1962, and especially during the 1970s. Mechanization had been used as one of the rationales for the collective campaign in the 1950s, and the idea survived the agricultural crisis. In the late 1970s, the complete mechanization of farm operation was once again promoted as the goal of agricultural modernization, which the planners hoped to achieve by 1985. Although tractors were often used as substitutes for trucks in rural areas (Perkins and Yusuf 1984, p. 60), mechanization

⁶ In 1979, the figures for area given over to improved varieties amounted to 80 percent for rice, 85 percent for wheat, 60 percent for soybeans, 65 percent for corn, 55 percent for sorghum, 75 percent for cotton, 70 percent for peanuts, and 45 percent for oil crops (Ministry of Agriculture 1989, pp. 348–50).

⁷ The irrigated acreage increased from 30.5 million hectares in 1962 to 44.2 million in 1986. The gravity system acreage declined from 24.4 million hectares to 19.2 million hectares, while engine-powered irrigation acreage expanded from 6.1 million hectares to 25.0 million hectares during the same period (Ministry of Agriculture 1989, p. 318).

made possible the expansion of multiple cropping, and that part of the labor force liberated from mechanization could always be used to increase the intensity of field management. Hence, this mechanization may be assumed to have also contributed positively to the growth of agriculture in the past two decades.

In short, the agricultural development strategy before the adoption of the household-based farming system reform in 1979 can be summarized as follows: Collectivization was initially a voluntary movement but became imposed in the fall of 1958. Before the agricultural crisis of 1959–61, collectivization was utilized primarily as a vehicle to mobilize a labor force for constructing labor-intensive projects and for increasing traditional input in agricultural production. After the crisis, more emphasis was placed on modern technology and input.

III. Hypotheses

The customarily proposed hypotheses for the sudden collapse of agriculture after the initial success of the collectivization movement are three successive years of bad weather, bad policies and bad management, and the incentive issue arising from the unwieldy size of a commune.

The bad-weather hypothesis was used, originally, as the official explanation for the calamity (Communist Party of China 1981). It was unlikely that three successive years of bad weather would hit every part of a large country such as China. In fact, weather seems to be used often by Chinese authorities as an excuse for crop failures caused by other reasons. Column 1 of table 3 lists the percentages of total sown acreage in 1949–86 reported to be hit by natural calamities that resulted in a 30 percent or more reduction in yield compared to normal yield. In the 9 years before the compulsory collectivization in 1958, the percentage never exceeded 10 percent. But after the imposed collectivization, the percentage was reported to exceed 10 percent in 15 out of the 26 years with available data. This contradicts the fact that more acreage was irrigated each year during this period and most of the increased irrigation came from the modern engine-powered irrigation, as indicated in columns 2 and 3 of table 3. This hypothesis, however, is not impossible because of the susceptibility of agriculture to climatic changes. If weather was in fact the main cause for the collapse of agricultural production, when the weather had returned to normal, agricultural productivity, nevertheless, should have soon recovered the level reached before the spell of bad weather.

The hypothesis of bad policies implemented by central and local authorities during the communal movement and bad management

TABLE 3
NATURAL CALAMITY AND IRRIGATION

Year	Sown Area Hit by Natural Calamity* (%) (1)	Irrigated Area (%) (2)	Power Irrigation in Irrigated Area (%) (3)
1949	8.5	...	...
1950	4.7	...	...
1951	3.7	...	...
1952	2.9	18.5	1.6
1953	4.9	...	...
1954	8.5	...	...
1955	5.2	...	...
1956	8.2	...	...
1957	9.5	24.4	4.4
1958	5.2	...	...
1959	9.7	...	...
1960	15.3	...	...
1961	18.6	...	...
1962	11.9	29.7	19.9
1963	14.3	...	...
1964	8.8	...	...
1965	7.8	31.5	24.5
1966	6.7	...	...
1967	...	...	...
1968	...	...	...
1969	...	...	...
1970	2.3	35.6	41.6
1971	5.1	36.2	45.6
1972	11.6	37.8	46.9
1973	5.1	39.1	50.4
1974	4.4	41.3	52.5
1975	6.7	43.4	52.9
1976	7.6	45.3	53.9
1977	10.2	45.3	54.1
1978	16.8	45.2	55.4
1979	10.2	45.2	56.3
1980	15.4	45.2	56.4
1981	12.9	45.0	56.6
1982	11.2	44.8	56.9
1983	11.3	45.4	56.6
1984	10.6	...	56.4
1985	15.8	...	55.9
1986	16.4	...	59.0

SOURCE.—Cols. 1 and 3: Ministry of Agriculture (1989), pp. 130–31, 318, 354–57; col. 2: Ministry of Agriculture (1984), p. 291.

* Area hit by natural calamity refers to those sown acreages reported to be hit by flood, drought, frost, and hail and to have 30 percent or more reduction in yield compared to normal yield.

within communes is, on the surface, plausible. In fact, local cadres were ill equipped to handle the complicated administrative task of so large a farm entity as a commune. Serious, but good-intentioned, mistakes in production plans, misallocation of resources, and mishandling of collective property could indeed lead to considerable disruption of production.⁸ Added to these difficulties was the communal kitchen program, which provided free meals to communal members and resulted in overconsumption at the initial stage of the movement. Furthermore, despite a 15 percent decline in grain output in 1959, the state compulsory grain procurement quota increased 14.7 percent in that year.⁹ Because of these mistakes, food availability in rural areas dropped dramatically during the crisis. However, most problems were soon recognized, and several emergency documents were issued by the central government to rectify these problems (*Agricultural Cooperativization in China Editorial Office 1987b*). By the end of 1961, most of these policies had been reversed: the mobilization of labor for irrigation projects was abandoned, production decisions were decentralized to those production teams with an average size of 20–30 households, income distribution basically reverted to the system prevailing in the advanced cooperative stage, communal kitchens were abolished, and, finally, the state compulsory grain procurement quota was lowered to its precrisis level. In short, bad policies and management did definitely contribute to the severity of this disaster. However, if these were the main causes of the crisis, then after the policy reversal in 1962, as I stated in the case of the bad-weather hypothesis, agricultural productivity should have soon recovered to the level reached before the communal movement.

Among the several traditional hypotheses, the incentive issue in the commune because of its unwieldy size appears to be the most convincing cause for the sudden collapse of agriculture. This argument is formulated by Perkins and Yusuf (1984, p. 79) as follows:

⁸ Many farmers were assigned to engage in the production of steel in backyard furnaces for the Great Leap Forward in 1958. Consequently, the harvest in some areas was neglected. Because of an overoptimism about grain production in 1958, the sown acreage of grain was reduced 9 percent in 1959, a drop from 127.6 million hectares in 1958 to 116 million hectares in 1959. The area grown to grain increased 5.5 percent in 1960; nonetheless, this was more than offset by a 20.4 percent drop in unit yield in the same year (*Ministry of Agriculture 1989*, p. 146).

⁹ In the years before and after the crisis, the state grain procurement quota was maintained at a level lower than 30 percent of the gross output. The quantity sold to the state, however, increased from 58.8 million tons (29.4 percent of total output) in 1958 to 67.4 million tons (39.7 percent of total output) in 1959. Although the procurement quota was reduced to 51.1 million tons in 1960, it still consisted of 35.6 percent of the gross output. The procurement quota was not reduced to 27.4 percent of gross output until 1961 (*Ministry of Agriculture 1989*, p. 410).

The incentive problem was . . . severe on at least two grounds. In a large unit there was little connection between an individual's effort and the value of each work point. The number of work points earned could still be related to effort expended, but the value of each point depended on the net output of the entire unit of 4,000 to 5,000 families. Even if an individual's effort were completely unproductive, the value of his work points would decline by only 0.01 percent. There was a premium on effective supervision, therefore, to prevent loafing on the job because internal motivation based on material gain was not a sufficient discipline. By the same token, however, there was no close supervision by fellow villagers because they too saw little connection between the work of other village members and the value of the work point. Reducing the basic accounting unit improved matters significantly on both counts. At a minimum, villagers had both the ability and incentive to make sure each did his or her share of the work.

Perkins and Yusuf's argument, however, is correct only if the supervision by communal management does not exist. If the supervision is perfect, the incentives to work actually will be higher in a commune than on a household farm.¹⁰ Certainly, since agricultural production cannot be concentrated under one roof, since it involves the continuous shift from one type of task to another, and since it crucially depends on the quick, discreet decisions by individual workers about the adjustments necessary to the operation in response to slight changes in the humidity, temperature, and other climatic conditions, close supervision is too costly to be feasible. Therefore, the supervision in an agricultural collective tends to be very crude and approaches a situation of no supervision. If the disaster was caused by the incentive issue that arose mainly from the unwieldy size of the communes, as argued by Perkins and Yusuf, then agricultural pro-

¹⁰ The reason is that, if supervision were perfect in a commune, the returns to a peasant's additional unit of effort contribution would have two components: he or she would get (1) a share of the marginal output arising from the additional effort or (2) a larger share of the total output since now the share of effort in the total effort had increased and thus resulted in a larger share of the total work points. The first component is insufficient by itself to cause the peasant to offer as much effort in the commune as on the household farm, but the second outweighs this as long as the average product per unit of effort is greater than the marginal product of effort in the commune. Since the relevant region of production is, in general, located where the average product is greater than the marginal product, a peasant had the incentive to contribute more effort in a commune than on a household farm if the supervision in the commune were perfect. For formal models, see Sen (1966) and Lin (1988).

ductivity, as in the two previous cases, should have soon recovered to the level reached prior to the communal movement when the production team was made the basic unit of production management and accounting. After all, the size of a production team was only about the size of an elementary cooperative. Moreover, the remuneration scheme in the production team was similar to that of the advanced cooperative.

The arguments above are plausible explanations for the catastrophe. As I shall show, however, the main cause for the initial success and the sudden collapse of this movement is more likely to be found in the change of the nature of the collectivization from a repeated to a one-time game in the fall of 1958.

To begin with, the collectivization movement was guided by the state from its very beginning. In the early stage, nonetheless, the principle of voluntarism was stressed and well respected. The authorities actively persuaded farmers to participate in the various forms of cooperatives. However, peasants had the right to decide whether or not to join a cooperative. After they had joined a cooperative, they could still withdraw their membership and their own assets from the cooperative if they decided to do so. Up to the end of 1957, there was a continuous flow of directives issued from the state to remind local authorities not to violate the basic principle of voluntarism in the movement.¹¹ The best proof that the collectivization movement before the establishment of communes adhered to the principle of voluntarism is the numerous reports that peasants in many areas withdrew from cooperatives, and quite a number of cooperatives disintegrated as a result.¹² The initial success of the collectivization movement, however, greatly encouraged Mao and his followers. A bolder approach was adopted, and cadres who insisted on gradualism were criticized. Significantly, in the summer of 1958, Mao personally

¹¹ There are too many documents to quote. For a succinct summary of these documents, see Agricultural Cooperativization in China Editorial Office (1987a). *Zhongguo nongye hezuoshi ziliao* is a bimonthly journal, established in 1986, for the purpose of collecting material about the cooperative movement in China as a preparation for a book to be entitled *The Agricultural Cooperativization in Modern China*. This journal is a rich source of data and reports concerning the real situations, rather than the myths, that existed before and after collectivization in the 1950s.

¹² To mention just a few examples, a document issued in December 1956 by the Rural Department of the Central Committee of the Communist party acknowledged that, after the fall of 1956, about 1 percent of the households nationwide withdrew from the cooperatives, and in some areas, the rate was as high as 5 percent. In Guangdong province alone, 70,000 households withdrew and 120 advanced cooperatives collapsed. This phenomenon continued until 1957. A report from Zhejiang province showed that, in Xianju county, of the total number of 302 advanced cooperatives, 116 collapsed totally and 55 collapsed partially in May 1957. The proportion of households participating in the cooperatives dropped from 91 percent to 19 percent afterward. Similar figures were also reported in other provinces (Ye 1987).

promoted the people's commune as the institutional innovation for quickly realizing communism in rural China. Thus zealous cadres created communes all over China in a matter of 3 months. Membership in the commune became mandatory, and the right to withdraw from a collective was deprived. The compulsory nature of this collectivization remained after the crisis. In the 16 years between 1962 and 1978, no evidence indicates that any farmer was ever allowed to withdraw freely from a production team nor that any production team had ever collapsed because of losses of members. The right to withdraw was a crucial component of voluntarism, and this right was not restored until the beginning of the individual household-based farming system reform in 1979.

From the game theory point of view, the deprivation of the right to withdraw has a significant impact on the incentive structure of the collective. When the freedom to quit exists, at the end of each production round, the members of a collective can decide whether they want to participate in the collective in the next round. Those who find that they are better off being members of the collective will retain their membership. Otherwise, they will withdraw from the collective. Because in China a household's landholding is highly fragmented and the size is often too small for that household to raise a draft animal alone, certain gains can be obtained by pooling the land and farm tools of several households (Chinn 1980). The gain from the economies of scale, nevertheless, is overshadowed by the incentive issue arising from the difficulties of supervision in agricultural production. To make a collective an efficient institution, some effective substitute for supervision is required. A self-enforcing agreement among collective members in which each one promises to provide as much effort as on the household farm is an effective alternative when supervision is too costly.¹³ Certainly, because of the heterogeneity in personal preferences, abilities, and endowments, a member may determine that he or she will be better off by reneging on the agreement. That is, the member breaks the promise and does not contribute as much to production as initially proposed. When this is the case, the other members in the collective have to decide whether to stay in the collective and allow this member to be continuously derelict toward the agreement or to withdraw from the collective and resume household farming. If they find that the losses due to this member's default are larger

¹³ A self-enforcing agreement does not require a third party to enforce the agreement, to determine whether there have been violations, or to impose penalties. When the costs of third-party intervention are too high, a self-enforcing agreement is an effective substitute for third-party intervention and guarantees the continuation of the transaction. However, a self-enforcing agreement is sustainable only if the game is repeated. For further discussion of self-enforcing agreements, see Telser (1980).

than the gains from the economies of scale, the collective will disintegrate. However, the possibility of the collective's collapse obliges the would-be shirker to rethink the position: Should the member break the promise and let the collective collapse or honor the commitment and prevent the disintegration of the collective? Shirking in the current round definitely leaves the member better off at the end of this round. But if the collective collapses, the gains from the economies of scale are lost from the second round on. If the discounted present value of future losses is larger than the one-time gains in this round, the member will honor the agreement. Therefore, it is the threat of a collective's collapse that greatly reduces the incidence of shirking. This implicit threat also guarantees that the production in a voluntarily formed collective will be at least as good as the sum of production of a group of households working separately.¹⁴ At the worst, even if the collective collapses, household production will remain at the same level reached before the formation of the collective.

However, when a collective is imposed, from the viewpoint of the possibility of withdrawal, the nature of the collective is changed to that of a one-time game. It becomes impossible to use withdrawal either as a way to protect oneself or as a means to check the possibility of shirking by the other members. Consequently, the self-enforcing agreement cannot be sustained in a one-time-game collective (Telser 1980). Supervision becomes crucial in establishing work incentives and productivity levels in the collective. If supervision is effective and rewards are closely related to each individual's effort contribution in production, work incentives will be high. Conversely, if supervision is ineffective and rewards are not closely related to each individual's effort contribution in production, the incentives will be low. Since supervision in agricultural production is extremely difficult and too costly, the incentives to work in a compulsorily formed agricultural collective must be low. A peasant will not work as hard as on the household farm (Lin 1988). Therefore, the productivity level of a collective will be lower than the level reached on the individual household farm. The collective is besieged by the "prisoner's dilemma."¹⁵

¹⁴ This statement assumes that one's income is the only objective for joining a collective and that reorganization is cost-free. If a collective also provides services such as risk sharing and if reorganization is costly, the productivity of a collective is allowed to be somewhat lower than the sum of the household farms. Moreover, if moral suasion is used in forming a collective, a member will also accept a somewhat lower income in the collective for fear of social opprobrium.

¹⁵ Chinn (1980) also noticed that overall productivity would decline if the membership in a collective was mandatory. Nevertheless, he attributes the failure of the collectivization movement to the elimination of dividend payments in the advanced cooperatives. He is right in saying that because household endowments are different, some

From the game theory point of view, the initial success of the collectivization movement in 1952–58 can be attributed to the existence of freedom of exit during that period, and the sudden collapse of agricultural production in 1959–61 was mainly a result of the deprivation of the right to withdraw in the fall of 1958. Bad weather, bad policy and management, and the size of communes definitely all contributed to the severity of the catastrophe; however, they were only secondary reasons for this crisis. If the game theory hypothesis is valid, then agricultural productivity in the production team period after 1962 will be found to be lower than the level reached during the individual household farm period before 1952 and the voluntary cooperative movement period of 1952–58. The reason is that the production team was a compulsory collective. It follows then that both the incentive to work and productivity will be lower in the production team system than in the individual household farms and in the voluntarily formed collective.¹⁶

From the discussion above we find that there exists an easy way to evaluate the hypotheses to establish the main cause for the precipitous slump in agricultural production. If the conventional hypotheses are valid, regardless of whether the collapse is explained by this argument or that, or even by a combination of any or all of the three arguments, it would nonetheless remain true that after the production team system was instituted and the loss of labor force and draft animals was rectified, agricultural productivity should have recovered to the level reached before the disaster of 1958. On the other hand, if the game theory hypothesis is valid, the productivity level reached during the production team system period should be lower than the productivity level reached during both the individual household farm period and the voluntary cooperative period.¹⁷

well-endowed household might be hurt by the elimination of dividend payments. However, if the income distribution scheme were the main cause of the crisis, the crisis should have happened in 1956 or 1957, since advanced cooperatives had become the dominant form of cooperative at the end of 1956. In fact, in 1957 the elimination of dividend payments resulted only in an increasing incidence of withdrawal from the cooperative, but not the collapse of agricultural production. Moreover, even if the dividend payment were resumed while membership in the collective remained mandatory, the crisis could still not have been prevented. Inasmuch as time preferences for each member are different, some members would have shirked. Thus the prisoner's dilemma was unavoidable. Hence, the main cause for the crisis is still found in the change in the nature of organization instead of in the change in the income distribution scheme.

¹⁶ It is worthwhile to note that what I want to refute is not using the incentive issue as the main cause of the disaster, but using the size of communes as the main source of incentive problems.

¹⁷ Because of the introduction of many modern technologies and inputs after 1962, this test is actually biased against the game theory hypothesis.

IV. The Agricultural Productivity

To examine the validity of the competing hypotheses discussed above, a study is required of the changes in total factor productivity that occurred during the crisis and for a long period before and after the crisis. This presents certain problems. Up to 1958, the Chinese government periodically published agricultural statistics. However, after the crisis, official data on agriculture exist only as widely scattered fragments. A partial resumption of data release began in 1979. Because enormous efforts are required to piece the scattered fragments together for the period 1958–79, few attempts have ever been undertaken to study systematically the year-to-year changes in agricultural productivity before 1979 except for the pioneer work of Tang (1984).

Tang's study covers the period 1952–80. Most of his work was completed before the partial release of historical data in 1980. Column 1 of table 4 reports the total factor productivity index as estimated by Tang. The reported index series have already incorporated the new released series on total value of agricultural output and on selective inputs available to him in 1980. The methodology adopted by Tang is the Solow (1957) and Denison (1967) type of growth accounting, which uses factor shares as weights to compile individual input series into a total input series and then divides the aggregate output series by the total input series to obtain the total factor productivity index. The gross value of agricultural output is calculated from grains, cash crops, and livestock. Inputs included labor, land, capital, and current inputs. The weights used are .50 for labor, .25 for land, .10 for capital, and .15 for current inputs. Tang adopted these weights after consulting a number of national agricultural growth accounting studies.

Tang's work was extended by Wen (1989) to cover the years up to 1988. In addition to this extension, Wen also replaced many of the time series Tang derived from the scattered fragments with official data made available to the public in the years after the publication of Tang's book. The series on the gross value of agricultural output and on inputs compiled by Wen are found in Appendix table A1. The total factor productivity index estimated by Wen is reported in column 2 of table 4. By comparison, Tang's estimates show the same pattern of changes in total factor productivity that occurred before and after the compulsory collectivization in 1958 that Wen's estimates show, although there is a gap of 15 percentage points between these two estimates for most of the years in the 1970s. These gaps arise from Tang's overestimation of the value of outputs and his underestimation of current inputs. Most students of the Chinese economy agree that the best available data are the official statistics and that the

TABLE 4
INDICES OF TOTAL FACTOR PRODUCTIVITY

Period and Year	Tang (1)	Wen (2)	Wiens (3)	Hayami-Ruttan (4)	Chow (5)
Voluntary collectivization:					
1952	100	100.0	100.0	100.0	100.0
1953	100	99.6	99.5	98.7	100.0
1954	100	99.0	98.4	97.3	99.0
1955	104	103.8	103.0	103.2	104.0
1956	102	104.1	101.7	104.3	105.0
1957	103	102.4	100.3	98.5	102.9
1958	102	104.7	97.0	100.7	109.0
Compulsory collectivization:					
1959	85	94.3	89.1	91.0	94.9
1960	74	78.4	73.4	78.6	79.7
1961	76	78.0	76.3	78.9	74.9
1962	78	80.0	79.6	79.3	76.4
1963	83	83.0	82.0	80.2	80.2
1964	89	85.9	83.7	82.2	85.0
1965	92	86.8	83.7	82.2	87.6
1966	95	85.4	81.2	80.2	89.4
1967	94	87.8	84.6	82.2	90.2
1968	90	87.2	85.2	81.7	88.4
1969	87	83.0	80.4	78.2	85.8
1970	93	82.0	77.7	76.5	89.2
1971	91	76.5	72.0	70.2	84.8
1972	88	72.2	67.3	65.8	82.2
1973	91	76.6	71.4	69.4	87.1
1974	92	78.0	72.9	70.2	88.9
1975	92	75.8	70.1	67.4	88.9
1976	91	75.8	70.4	66.9	88.0
1977	89	74.2	68.7	64.8	87.1
1978	92	77.6	71.1	67.2	94.1
Decollectivization:					
1979	96	80.5	73.6	68.8	99.7
1980	91	83.4	76.2	71.1	103.7
1981	...	87.4	80.1	74.4	108.9
1982	...	93.7	85.9	79.6	108.9
1983	...	104.5	96.9	87.7	117.6
Post-household responsibility system reform:					
1984	...	122.7	115.2	100.6	127.0
1985	...	129.3	122.7	104.3	144.8
1986	...	129.7	122.8	103.1	150.6
1987	...	132.6	125.0	105.1	153.6
1988	...	132.6	124.7	104.6	159.8

SOURCE.—Col. 1: Tang (1984), pp. 95–97; col. 2: Wen (1989), p. 123; col. 3: calculated with the factor shares (labor = .35, land = .36, capital = .09, current input = .20) proposed by Wiens (1982); col. 4: calculated with the factor shares (labor = .45, land = .1, capital = .3, current inputs = .15) in Hayami and Ruttan (1985), p. 151; col. 5: used the method of weighted geometric mean proposed by Chow (1985). Cols. 3–5 use the output and input series in Appendix table A1 for the calculations.

quality of the official statistics is very respectable compared with the quality of data in other countries with the same level of income (Eckstein 1980; Perkins and Yusuf 1984, p. 31). Hence, the following discussion will focus on Wen's estimates because his study uses mainly official data.

Before further analysis, however, it should be mentioned that there are two critiques of Tang's, and therefore also of Wen's, estimates. The first critique questions the factor shares that Tang uses to integrate the individual input index into the total input index. The second critique attacks the method of integration of various inputs into the total input. Tang uses a weighted arithmetic mean of the four input indices to compile his total input index. An alternative method, proposed by Chow (1985, p. 86), is to use a weighted geometric mean. It is thus necessary to examine how robust Wen's estimates are with respect to the changes in factor shares and method of aggregation before any conclusion can be drawn from his estimates.

To see how changes in factor shares affect Wen's results, two alternative sets of share parameters are utilized. One set is proposed by Wiens (1982) (.35 for labor, .36 for land, .09 for capital, and .20 for current input); the other is the estimates of Hayami and Ruttan (1985, p. 151) (.45 for labor, .10 for land, .30 for capital, and .15 for fertilizer). The total factor productivity indexes estimated with these two alternative sets of factor shares are reported in columns 3 and 4 of table 4. The total factor productivity index calculated by the method of the weighted geometric mean is reported in column 5. These various estimates of total factor productivity in table 4 show that in terms of absolute magnitude, different factor shares and methods give rise to somewhat different estimations; nevertheless, in terms of the pattern of changes, the results are identical. Since our interest lies in the pattern of productivity changes, the conclusions drawn from Wen's estimates will not be altered by the critique's proposed changes in either the factor share or the aggregation method.

For ease of interpretation, Wen's estimates are plotted in figure 1. From the figure, we see that the total factor productivity indexes in 1952–88 can be divided into four subperiods, namely, 1952–58, 1959–78, 1979–83, and 1984–88. In the subperiod 1952–58, that is to say, during the period of voluntary collectivization, the total factor productivity shows a rising trend, although the increments are very small. It declined dramatically in 1959 and 1960, when the compulsory collectivization was first imposed, and throughout the second subperiod, stayed at a level about 20 percent below the total factor productivity reached in the first subperiod. The records improved dramatically in the third subperiod, the period of decollectivization. By 1983, the total factor productivity had recovered its 1952 level. In

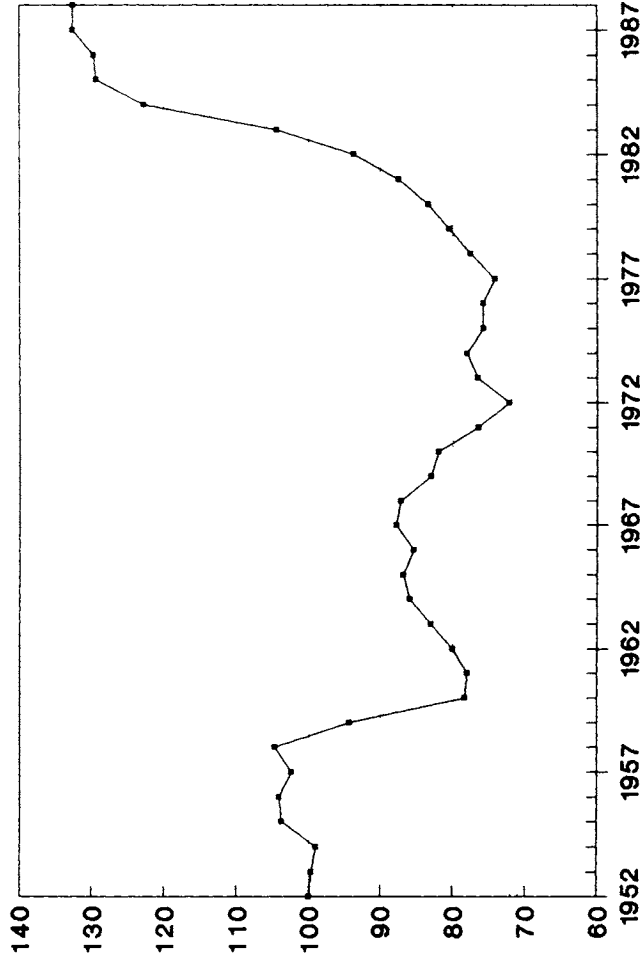


FIG. 1.—Total factor productivity index, 1952-88 (index: 1952 = 100)

the last subperiod, the post-household responsibility system reform period, the indices of total factor productivity were about 30 percent higher than the 1952 level. Despite the introduction of many forms of modern technology and input after the agricultural crisis, the productivity lingered at a level far below the level reached in the precrisis period and did not recover the precrisis level until the compulsory collective system was replaced by the individual household responsibility system in 1983. This pattern of productivity change is consistent with the prediction of the game theory hypothesis.¹⁸ Therefore, we can conclude from the evidence that the change in the incentive structure due to the deprivation of the right to withdraw from a collective, that is, the transition from a voluntary to a compulsory collectivization in the fall of 1958, was the main cause of the catastrophe in 1959–61, and the conventional hypotheses are only secondary explanations.¹⁹

V. Concluding Remarks

In the developing countries, collectivization has been promoted as a strategy for the development of agriculture. However, the pattern of collectivization not only in China but also in the Soviet Union and other countries shows that the initial success of this movement was

¹⁸ One alternative hypothesis proposed by Lardy (1983) is also consistent with the pattern of productivity change. He argues that the increases in total factor productivity in the first and third subperiods can be attributed to the gains in regional comparative advantage and that the stagnation of productivity in the second subperiod can be attributed to the losses of regional comparative advantage arising from the local food self-sufficiency policy. This hypothesis is plausible, but it is unlikely that it is the major cause of the pattern of productivity change in 1952–88. Lardy rightly points out that the policy of local self-sufficiency forced an area to deviate from the crop pattern dictated by regional comparative advantage. There are definitely some losses in productivity due to this deviation. However, the question of magnitude remains. In the literature of international trade, it has been found that the loss arising from trade restrictions in general is lower than 1 percent of gross national product (World Bank 1987, p. 90). As in the case of international trade, the loss associated with local self-sufficiency is not outrageous. In a separate paper (Lin 1989), I estimate that the 9 percent increase in nongrain crops in 1978–84—due to the removal of the self-sufficiency policy during this period—resulted in only about a 1 percent increase in total factor productivity. Therefore, it is safe to conclude that gains and losses of regional comparative advantage can explain only a small portion of the changes in total factor productivity in 1952–88, and much of the decline in total productivity in the third subperiod needs to be explained by reasons other than the loss of regional comparative advantage. It is estimated by McMillan, Whalley, and Zhu (1989) that the change from the production team system to the household responsibility system between 1978 and 1984 increased total factor productivity by 32 percent. This estimate indirectly confirms that the collapse in 1959–61 and the stagnation in the third subperiod were caused by the reasons described in the game theory hypothesis.

¹⁹ The game theory hypothesis also solves the puzzle posed by Putterman (1985) about the bewildering trends of increased productivity in the transition both from the household system to the collective system during the mid-1950s and from the collective system to the household system during the early 1980s.

followed by severe difficulties and a long period of stagnation in agriculture.²⁰ This paper attempts to explain this phenomenon by the following arguments. Since effective supervision in agricultural production is too costly, the success of an agricultural collective depends inescapably on a tacit agreement of self-discipline established by the collective members. However, a self-enforcing agreement can be sustained only if the members of the collective have the right to quit the collective when the other members do not honor their agreement. At the initial stage of a collectivization movement, the right to withdraw, in general, is well respected. Consequently, the self-enforcing agreements in most collectives can be sustained and the overall agricultural performance is improved. However, there is a built-in danger in the initial success of a collectivization movement. Because of the differences in their time preferences, abilities, and other endowments, some members of a collective may take advantage of the low supervision in the collective and attempt to evade the responsibilities stipulated in their self-enforcing agreement. Consequently, the disintegration of some collectives is inevitable, even though the overall performance of the movement is successful. The collapse of some collectives is like a safety valve for the collectivization movement. It makes potential violators of the self-enforcing agreement realize that honoring the agreement is to their advantage. Encouraged by the initial success, however, zealous political leaders of a collectivization movement may interpret differently the withdrawal of some individual members from the collectives. These individuals are viewed as the enemies of the movement. To prevent the further collapse of other collectives, the right to withdraw is deprived. The collectivization is thus changed from a voluntary to a compulsory movement, and the safety valve is removed. If this change in the nature of the collectivization movement happens gradually, agricultural performance declines gradually. If this change happens swiftly, a devastating agricultural crisis—like the one in the Soviet Union between 1929 and 1932 and the one in China between 1959 and 1961—follows immediately.

²⁰ The same pattern was observed in the Soviet Union, China, Tanzania, and Peru. Among these countries, the devastating impact was most dramatic in the Soviet Union and China.

Appendix

TABLE A1
INDICES OF GROSS VALUE OF AGRICULTURAL OUTPUT AND MAIN INPUTS

Year	Gross Value of Agriculture	Labor	Land	Capital	Current Input
1952	100.0	100.0	100.0	100.0	100.0
1953	103.1	102.5	101.6	106.8	107.7
1954	106.6	104.8	103.8	113.4	120.3
1955	114.7	107.4	105.7	109.5	129.6
1956	120.5	107.1	109.9	108.6	158.6
1957	124.8	111.5	109.5	133.6	169.6
1958	127.8	89.4	106.1	126.1	254.7
1959	110.4	94.0	102.2	121.3	216.3
1960	96.4	98.3	105.6	101.6	249.0
1961	94.1	114.0	102.7	98.2	188.1
1962	99.9	122.9	101.6	112.5	178.6
1963	111.5	126.8	101.8	131.1	216.0
1964	126.7	131.7	103.3	144.3	275.2
1965	137.1	135.1	103.4	155.3	326.7
1966	149.0	140.3	105.1	170.8	405.6
1967	151.3	145.3	104.5	173.4	374.2
1968	147.6	150.5	102.5	171.8	340.8
1969	149.2	156.6	103.2	171.6	390.8
1970	166.4	160.6	104.4	190.9	516.6
1971	165.3	164.0	105.6	217.4	573.0
1972	163.7	163.3	106.7	231.6	634.8
1973	177.2	166.6	107.2	241.4	647.9
1974	183.4	168.7	107.4	254.2	655.5
1975	189.2	170.1	108.0	277.6	733.4
1976	188.4	170.0	108.4	289.5	715.6
1977	187.5	169.4	108.4	306.5	735.6
1978	202.7	163.8	109.0	325.7	796.5
1979	218.1	165.7	106.0	350.9	843.0
1980	230.0	168.5	105.0	358.5	863.2
1981	243.7	172.3	104.3	364.2	868.3
1982	271.1	178.5	103.9	378.3	909.1
1983	292.3	180.2	103.6	391.4	829.7
1984	327.9	178.6	103.7	416.1	736.5
1985	339.3	180.1	102.7	437.2	686.4
1986	351.0	180.8	102.8	471.6	715.9
1987	371.4	183.2	103.1	489.1	759.1
1988	383.3	185.8	103.0	509.8	796.7

SOURCE.—Wen (1989), p. 123.

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