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**Communal Dining System and the Puzzle of Great Leap Famine:
Re-examine the Causality between Communal Dining and Great Leap Famine**

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Abstract: The great leap famine started with a good harvest in the end of 1958 and ended when the rural grain consumption per capita touched the lowest level in 1961. All the hypotheses except for communal dining halls could not explain the puzzle. The communal dining system is the most important cause of great leap famine since it can explain the whole sequence from the start, aggravation and end of the famine. Basing on the panel data from 1958 to 1962 of 25 provinces, and employing the sharp change of the participation rate from elementary cooperative in 1954 to advance cooperative in 1956 caused by Mao's critique on Deng zihui in 1955 as the IV of the radicalism of communal dining system, we find that communal dining system do have greatest partial effect with high significance on the death rate than the other factors. The evidence of the beta coefficient and Gfields decomposition also show that communal dining system is the most important cause on the famine.

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I . INTRODUCTION

More than 55 years has elapsed since the end of the Great Leap Famine (GLF), a greatest disaster in human history. It has become clear through scholars' effort that it is a disaster made mainly not by weather as is still so claimed officially in China, but by human mistakes. However, the main causes of the famine are still subject to heated debate. As Johnson(1998) states, it is an impossible task to assess the joint and independent impacts of the various factors on the famine unless we can get enough data and construct and implement a complicated model. In this paper, in the light of new data and facts we revisit the existing hypothesis on the causes of famine. In particular, we aim to highlight the impact of the communal dining by assessing the relative importance of various factors on famine 2SLS estimation, beta coefficient and Gfields decomposition.

The existing hypotheses on the causes of famine, as illustrated in figure 1, focused on the production, distribution and consumption of rural grain. First, the hypothesis of food availability decline argues that the decline in grain output was caused by natural disaster ("*Resolution on Certain Historical Issues of The Party since the Founding of PRC*":1981), or by the deprivation of free exit rights from communes (Lin:1990),or by the excessive diversion of production resources from agriculture to industry(Li and Yang:2005). Second, the hypothesis on urban bias policy focuses on excessive grain procurement from rural areas to feed the urban population (Bernstein:1984; Walker:1984; Lin and Yang:2000;) or the drain caused by the support given to the development of local industry sector (Fan, forthcoming). Third, the hypothesis of collective accumulation finds that the collectives retained and wasted too much grain in promoting the Great Leap Forward in rural areas, resulting in insufficient grain left to feed the local peasants (Liu: 2010).

Finally, The hypothesis of communal dining focuses on the wastage of this institution and its negative effect on peasants' motivation to work hard (Yang Dali:1996; Chang and Wen:1997,1998). However, Kung and Lin (2003) argued that it was the political radicalism such as energy consuming projects in rural areas rather than communal dining system that caused the famine, because communal dining system did not function any more since food deficiency became popular after the spring 1959. As we will state in this paper, their understanding on communal dining system is biased, such consumption model means not only compelling grain collectivization, but also deprivation of household plots as well as forbidding of household sideline production. Furthermore, communal dining system experiences four stages from start in the spring and winter of 1958, retreat in the spring of 1959, recovery and consolidation after Lunshan conference and finally end after June of 1961, instead of simple pattern of rise and fall. A striking feature of GLF lies in its mysterious nature: it started with a good fall harvest in the winter of 1958 when the per capita rural grain consumption was among the highest since 1949, and ended when this index reached the lowest level in the second half year of 1961 and maintained at a level lower than that of 1959 when the famine was aggravated nationwide (see Fig. 1). All the other hypotheses except for communal dining could not explain the puzzle.

Sichuan, as the biggest grain exporter to the rest of the nation, can serve as a good example in this case. Its death rate in 1958 increased by 109% compared with 1957, while its grain possession per capita in rural areas

increased from 212.3 kg in 1957 to 235.5 kg in 1958.⁴ The whole country except for Sichuan terminated famine in 1961 while the grain consumption per capita⁵ touched the lowest level since 1952, and even lower than the standard of 1960 when the famine was worst.

As we can see, neither the hypothesis of grain output decline, nor the hypotheses of excessive grain procurement or high collective accumulation could explain the puzzle of great famine. We try to interpret the puzzle by focusing on communal dining system. Our central hypothesis will be illustrated in section II. A detailed empirical test on the various causes of famine will be presented in section III. Section IV summarizes the lessons from the famine.

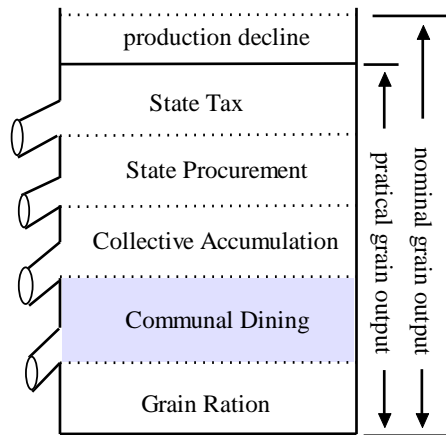


Figure 1: Grain Production, Distribution and Consumption during Great Leap Forward

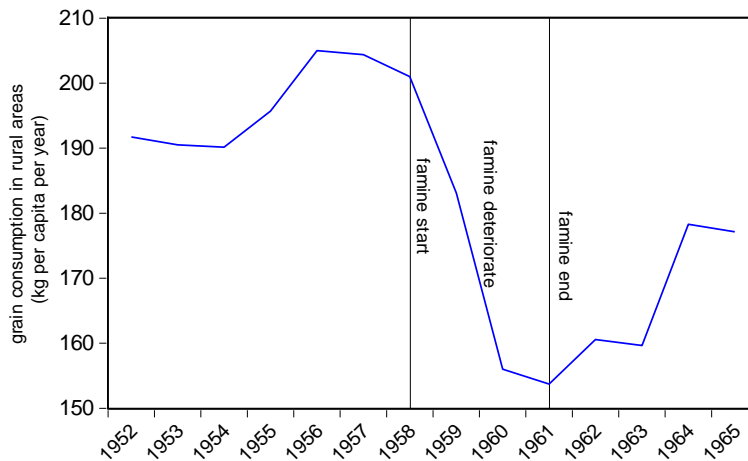


Figure 2: The Grain Consumption in Rural Areas from 1952 to 1965

Source: Price Department of State Statistics Bureau, 1984: p.27.

⁴ Rural grain per capita = (grain output - grain procurement + grain resold in rural areas)/ rural year-average population. This term is defined in this way unless otherwise specified. The trade grain procurement increased from 4.98 million ton in 1957 to 5.38 million ton in 1958, increasing by 8 percent. However, the net procurement rate decreased to 24.7% in 1958 from 25.3% in 1957 because the grain output and grain resold to rural areas rose. See Planning Office of Ministry of Agriculture(1983: p.172, p.390).

⁵ A standard deducted the grain procurement and collective accumulation from grain output.

II. HYPOTHESIS

Contrary to the definition on communal dining by Chang and Wen (1997, 1998), the communal dining system (CDHs) in this paper represent three logically coherent institutional changes: the compulsory collectivization of peasants' total grain rations, combined with the deprivation of private plots and the abolishment of household sideline production. For brevity, we refer this triune as CDHs wherever there is no need to discuss them separately.

Compared with Kung and Lin's understanding on the rise and fall of CDHs, it actually experienced four stages: the *establishment* in the autumn of 1958, de facto *suspension* in the spring of 1959 due to food shortage, the *restoration* and *consolidation* after the Lushan Conference in the summer of 1959, and the abrupt *dismantlement* around June of 1961 nationwide except for Sichuan. As China's senior economist named Zhang Shuguang pointed out, Lushan Conference thus became the turning point of GLF: before the conference many CDHs were being dismissed as the central committee of CPC softened some of the radical policies under food pressure since early 1959; after the conference most peasants were forced to return to CDHs because the participation in CDHs was viewed as an indicator of one's loyalty to socialism.⁶

We argue that the CDHs with the triune institutional components is the most significant cause of the GLF. Figure 3 simulates the sequencing of how the implementation, consolidation, and the dissolution of the CDHs triggered, intensified, and ended the famine. The horizontal axis measures time, and the vertical one measures three types of daily per capita grain intake: (a) the daily grain intake per capita in 1961, represented by a horizontally dotted line and labeled as the minimum subsistence standard, since the whole country came out of famine in 1961 when the grain intake reached lowest level; (b) the bona fide daily grain consumption by a typical peasant throughout the famine period, represented by a thick dark line; (c) the nominal daily grain intake based on the official data and represented by a dashed line. The blank area between the dotted line and thick line represents the occurrence of famine, and the dashed line lies most of the time above the dotted horizontal line from the winter of 1958 to the middle of 1961, indicating that the famine would not have happened without CDHs. The detailed mechanism of CDHs on famine is illustrated as following.

⁶Zhang Shuguang, *Yige Wutuobang de Xingshuai: Zhongguo Shekeyuan Jingji Yanjiusuo Liushinian Lishi (The Rise and Fall of A Communist Utopia: Communal Dining halls and The Report on it, Sixty-year History of Institute of Economics of Chinese Academy of Social Sciences)*, Vol.1, forthcoming.

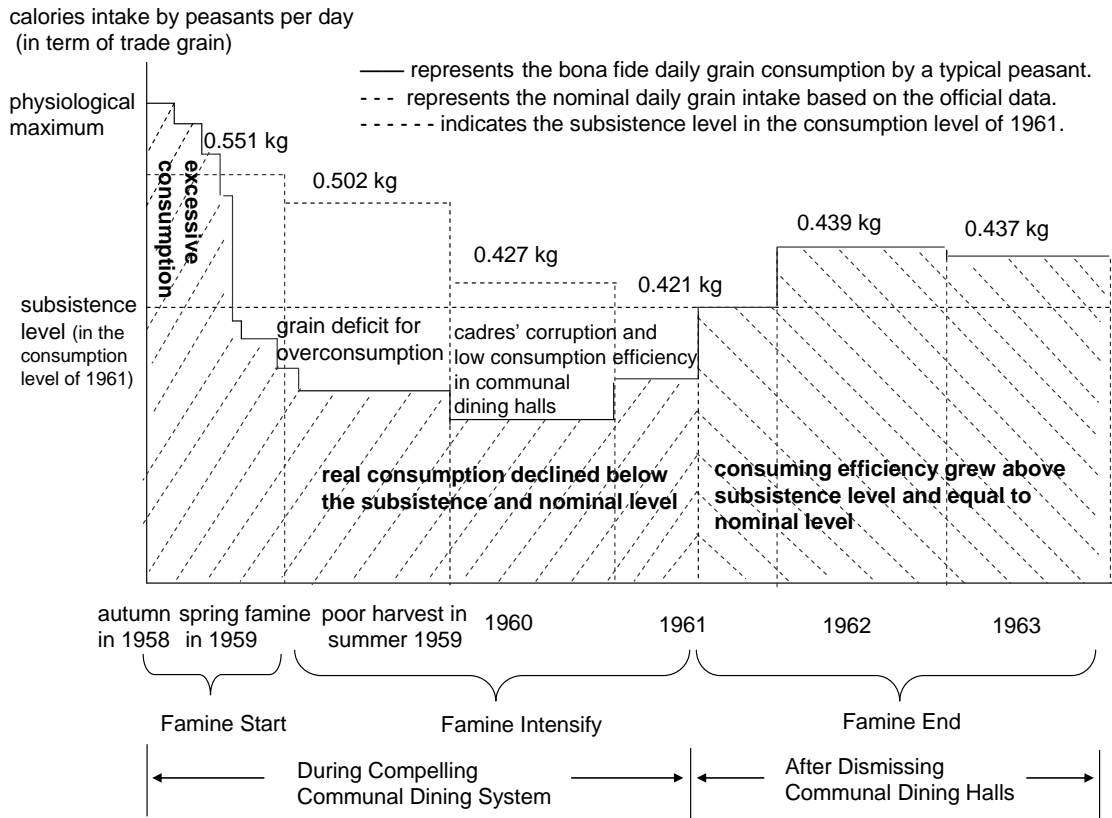


Figure 3: The Mechanism of Communal Dining on Famine

First, the tremendous wastage of communal dining halls triggered the famine in some provinces in the winter of 1958 and more regions in the spring of 1959. As Walter (1926) said, China was known as a land of famine for centuries. In normal years the grain was just enough for peasants in most regions to muddle through until the next harvest on a level slightly above the minimum subsistence standard. The free food system implemented in the autumn and winter of 1958 by CDHs blew away all the disciplines in food consumption, and the only limiting factor was the size of one's stomach. Peng Dehuai(1981), in his famous letter to Mao during Lushan Conference, pointed out a fact that in some rural areas the quantity of grain consumed by peasants in three months amounted to what usually sufficed for six months. Some dining halls even exhausted three-month grain ration within only half a month (Zhao,1988:p.109). According to the estimation of Xue Muqiao(1984:p.90;1996:p.265) who was in charge of the state statistics bureau and planning committee at that time, the overconsumption of grain in rural China in the first year of the commune movement (1958)amounted to about 17.5 million tons, equivalent to 11 per cent of the total grain supply for the rural population.⁷ It is clear that CDHs led to considerable food wastage, which would inevitably result in food shortage between two harvests and hereafter a famine in some provinces, especially in those acted more radically in communal

⁷ The grain supply for rural population in 1958 amounted to 158.3 million tons. See Chang andWen(1997: p.33, note 76).

dining system.

However, the famine was not so severe in its early stages and many areas were abandoning CDHs by the spring of 1959. Unfortunately, CDHs was revived after Lushan Conference, which bring two consequences. On the one hand, the equalitarian distribution in communal dining halls, which constituted most of peasants' income, discouraged greatly peasants' initiative to work hard and the grain output decline further. The sharp decline of agricultural productivity in commune was evidenced by Hu Qiaomu's report to Mao after his investigation on Shaoshan commune of Hunan province on April 1961.⁸ On the other hand, corruption among rural cadres and their abuse of power became popular and fatal for common peasants as the food shortage developed. Consequently, peasants' real consumption became not only lower than nominal, but also less than the minimum subsistence standard. This made the famine greatly exacerbated through demoralizing peasants in their food production. The other two characteristics of the dining system, i.e., the prohibition of private plots and household sideline production completely cut off channels for self relief through self-production. Moreover, the traditional mechanism in rural China of running away from famine-stricken areas became difficult under the tight control of grain by CDHs. All these evil consequences of CDHs intensified the famine by further cutting down the real food consumption.

Some provinces such as Anhui had dismissed communal dining halls early in the spring of 1961, while the whole country was allowed to dismiss CDHs in the middle of 1961, so peasants regained their grain rations and were again permitted to prepare and consume their grain rations at home. Accordingly, efficiency in food consumption increased sharply with the recovery of family kitchen. Furthermore, the recovery of private plots and household sideline production timely provided peasants with supplementary food to collective grain distribution. The dissolution of CDHs raised the peasants' real consumption to a level that was at least not lower than the minimum subsistence standard. This explains how the famine could have ended in rural China just as rural grain consumption per capita hit its lowest level since 1958, when logically, one should have expected further deterioration of the famine. It is worthy to note that, Sichuan did not dismiss communal dining halls until 1962, and its death rate was still higher than that of 1957.

In summary, without taking CDHs into consideration, we can neither understand why the great famine broke out when rural grain consumption per capita was at its highest level, nor can we explain why the great famine ended abruptly when rural grain consumption per capita fell to its lowest level since the early 1950s. Our central hypothesis is that communal dining system is the most important cause of great famine.

III. A Test on the Causality between CDHs and Famine

As stated above, the rights lost and regained by Chinese peasants to exit from communal dining played an important role in triggering, intensifying and ending the Chinese great famine. In what follows, we present an

⁸ *JianguoYilaiZhongyaoWenxianXuanbian (Selection of Important Literatures Since the Foundation of New China)* (Volume 14), ZhongyangWenxianChubanshe, 1997, p.303.

empirical study using a panel data of 25 provinces from 1958 to 1962 to further testify the effects of various factors, especially the communal dining system on the famine.

A. Data and Model

As Figure 4 shows, the deaths during the famine mainly occurred among rural population, and the excessive death rate of the rural population mainly depended on the following factors: food availability per capita after procurement and rural resale, grain procurement, collective accumulation, political radicalism in forms of energy consuming projects, communal dining system. Focusing the role of communal dining on famine, we depict the relationship of the participation rate of communal dining halls (*prcd*) and the cumulative excessive death rate from 1958 to 1961(*cedr*)⁹ in figure 5, using the data of Chang and Wen(1997: 1997:pp.24-26). It indicates that those provinces with higher participation rate of communal dining halls suffered graver mortality rate.

In order test the causality of various factors on famine, we construct the following estimation model:

$$\ln dr_{it} = \beta_0 + \beta_1 \ln cdh_i + \sum \delta X_{it}^j + \alpha_i + \mu_{it} \quad (1)$$

where *i* indexes each province, *t* indexes each year, *dr* stands for the death rate, *cdh* means the participation rate of communal dining hall in the end of 1959. *X* include various controlled variables such as grain available to peasants after procurement and rural resale(*g*), net grain procurement(*netpr*), collective accumulation (*cip*), energy consumption projects (*hip*). The first three variables were used in previous empirical studies, but the *hip* need more interpretation since it did not appear in Kung and Lin(2003)'s estimation.

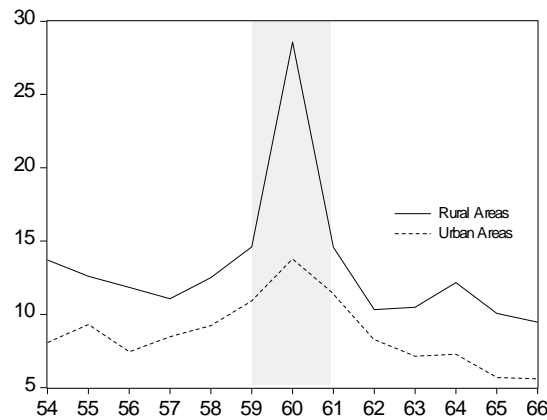


Figure 4: The Death Rates in Rural Areas and Urban Areas in China form 1954 to 1966 (in %)

Source: State Statistics Bureau, 1990: p.80.

⁹ According to Chang and Wen(1997), cumulative excessive death rate is calculated as to the following equation: $\sum (deathrate_t - deathrate_{55-57})$, in which t is represented by year of 1958, 1959,1960 and 1961.

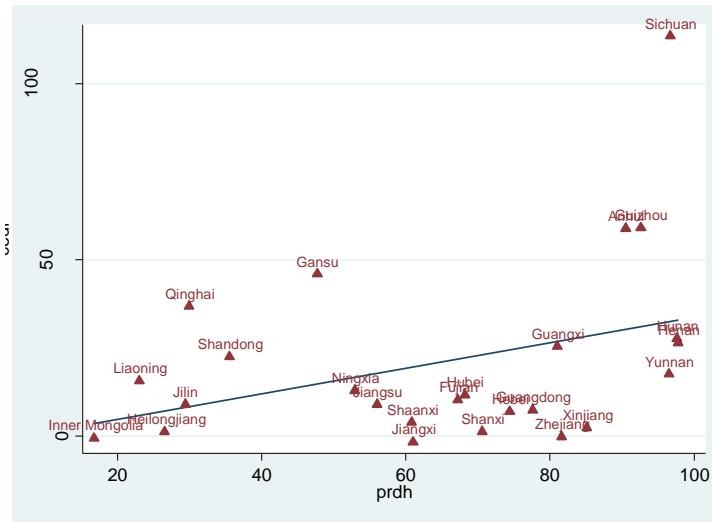


Figure 5: Relationship between participation rate of communal dining and cumulative excessive death rate.

Source: Chang and Wen, 1997: pp.24-26

High energy consuming projects during The Great Leap Forward included massive irrigation projects, and steel & iron production, but the data on provincial irrigation areas and steel output is incomplete. The Great Leap Forward was essentially a mass movement to carry out the so-called catching-up strategy by giving priority to the development of heavy industry, with steel production as its core.¹⁰ The increased emphasis on steel and iron production during The Great Leap Forward would certainly increase the percentage of the output of heavy industry to the gross output of industry and agriculture. Hence, we use this percentage, *hip*, as a proxy for political radicalism in form of high energy consuming projects. As Figure 5 reveals, steel production and the *hip* had the same trends at the national level. Especially during The Great Leap Forward, both variables increased rapidly throughout 1958, hit their maximum values in 1960 and began to decline in 1961. It can be inferred that the above defined percentage reveals the political radicalism in the form of high energy consuming projects.

¹⁰ For example, the slogan at that time was “taking steel production as the central task”. See Bo (1997, p.679).

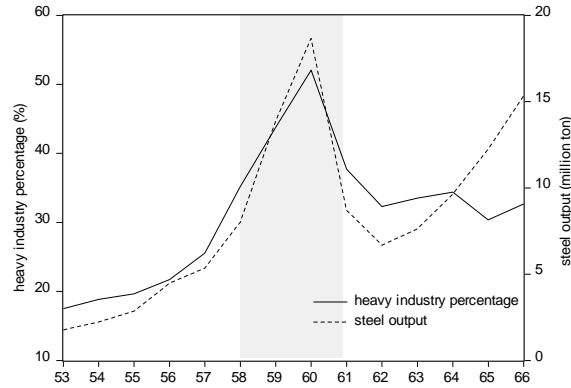


Figure 6: Heavy Industry and Steel Output

Source: General Office of State Statistics Bureau, 1990: p.10, p.18.

One potential problem in equation (1) is that the variable cdh is endogenous, that is $Cov(\ln cdh, u_{it}) \neq 0$, so the estimator of β_1 is biased. The endogeneity of cdh arise from three ways: measurement error, reverse causality and omitted variables biases. (a) The participation rate of communal dining halls in the end of 1959 can reflect the radicalism of various provinces in some degree, but such rate may have measure error since those regions acting more radically would overstate the participation rate. (b) As we quoted above, the participation rate of communal dining halls in the national level decreased from 90 percent in 1958 to 72.6 percent in 1959. Some provinces may retreat in the communal dining system in some degree to mitigate the hunger, especially in those provinces with extremely high death rate such as Anhui. In other words, dr may react to cdh in some provinces. (c) Since cdh represents political radicalism, some other factors that correlative with political radicalism are probably unobserved and omitted in the model.

The estimation by the Instrumented Variable (IV) can obtain the unbiased estimator of β_1 . Suppose the IV as Z , it must satisfied two conditions: $Cov(Z, \ln cdh) \neq 0$ and $Cov(Z, u_{it}) = 0$. We will examine the history of collectivization movement in rural China to find the proper IV for communal dining system.

As table 1 shown, the collectivization movement in China during 1950s experienced four stages including mutual-aid team, elementary cooperatives, advanced cooperatives and people's commune with increasing scales. As figure 7 illustrated, the collectivization movement in China is characterized by a recycle of "rash advance-opposition to rash advance-anti-opposition to rash advance"(冒进-反冒进-反反冒进). First rash advance appeared in some regions from the winter of 1952 to the spring of 1953, then the Rural Work Department of CPC issued the policy on mutual-aid production as "advance steadily" in the first National Conference on rural work in April of 1953, then the rash advance was rectified during 1953-1954. However, Chairman Mao did not agreed with the rectification work in the spring of 1953, and talked two times with the leaders of the Rural Work Department in October and November 1953. He criticized that the rectification blew down some agricultural production cooperatives that should not blow down. Then the elementary cooperatives were practiced from experiment to generalization and developed rapidly throughout the country before Mao

retreated to some extent on collectivization after he received some reports on the instability in rural areas due to rapid cooperation and excessive grain procurement in the spring of 1955.

However, Mao was inspired by new reports on grain procurement which revealed that the grain deficiency in rural areas was not true and his two inspects in southern areas in April and May of 1955, his attitude to the development speed of agriculture cooperation reversed totally in May 1955. Mao and Deng Zihui (the head of the Rural Work Department of CCCPC) disputed on the target on the development of agriculture cooperative in June 1955. Mao suggested that the cooperatives should be doubled from 650000 in the spring planting of 1955 to 1300000 before the autumn harvest of 1956. By contrast, Deng Zihui insisted that it should keep pace with the plan of the 3rd National Conference of rural Work, and it was very difficult to consolidate the planned 1000000 cooperatives.

Mao regarded the rightist represented by Deng zihui as a great hinder to accelerate the progress of agriculture cooperation. Mao made an important speech entitled with *On the Problem of Agriculture Cooperation* on the conference of the Secretary of a provincial-level Party Committee in July 1955, and severely criticized Deng Zihui as *a woman with bound feet* for his rightist mistake in agriculture cooperation. On this important conference, Mao declared that the tide of agriculture cooperation is coming in the whole country, and requested all the cadres should push rather than hinder the cooperative movement. Mao revised his speech and sent it as “A Notice from Central Committee” to all level Party organizations and all Party members from provincial committees to rural branches in August 26th 1955, the revised edition was published in *People’s Daily* in October 17th 1955. The cadres in all level made self-examination and criticized the rightist mistake in the previous work on agriculture movement. *The Resolution on the Problem of Agriculture Cooperation* was passed in the seventh session of the sixth plenary session of the CPC in October 1955, and it became the turning point of agriculture cooperation movement in rural China, the whole country was inspired by Mao to accelerate the progress of cooperation sharply, with the percentage of advance cooperation rose from 0.033% in 1955 to 62.6% in 1956. The target of socialist transformation that planned to be done within eighteen years had been accomplished eleven years ahead of schedule in the end of 1956.

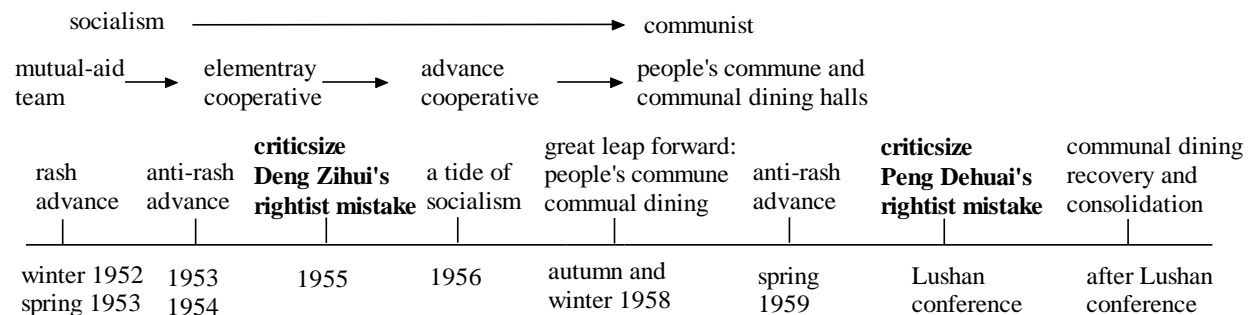


Figure 7: Collectivization Movement in Rural China during 1950s

Table 1: Collectivization Movement in Rural China from 1950 to 1958

Year	Mutual-aid group			Elementary agriculture cooperative			Advance agriculture cooperative			People's commune		
	Number	Scale	Percentage	Number	Scale	Percentage	Number	Scale	Percentage	Number	Scale	Percentage
1950	2724000	4.2	10.91	18	10.4	0.0002	1	32	0.00003			
1951	4675000	4.5	17.54	129	12.3	0.0015	1	30	0.00003			
1952	8026000	5.7	39.86	4000	15.7	0.05	10	184	0.002			
1953	7450000	6.1	39.23	15000	18.1	0.235	150	137	0.002			
1954	9931000	6.9	58.37	114000	20	1.948	200	58.6	0.01			
1955	7147000	8.4	50.66	633000	26.7	14.162	500	75.8	0.033			
1956	850000	12.2	8.75	216000	48.2	29.1	540000	199	62.60			
1957				36000	44.5	4.47	753000	159	69.60			
1958										24000	5000	99

Source: Shi(1959, pp.992-999); Lin(1990,p.1232).

As a matter of fact, the recycle of rash advance and anti-rash advance not only appeared in the early stage of cooperation, but also happened during Great Leap Forward. As stated above, almost all the peasants were pushed to commune and 90.6 percent peasants took part in communal dining halls in the autumn of 1958, the famine in some regions in the winter of 1958 and the spring of 1959 forced the Central Committee to take measures to anti rash advance, the communal dining halls were dismissed in some regions, and the policy of great leap forward was retreated in some degree. However, the situation reversed totally as Mao criticized Peng Dehuai's rightist mistake on attacking the Great Leap Forward in the "Ten Thousand Words Letter" in Lushan Conference. Communal dining system was regarded as the battle between socialism and capitalism again. Consequently, the dismissed communal dining halls were recovered and even consolidated in some regions.

We argue that the anti-rightist movement in 1955 and 1959 both launched by Mao were quite similar and highly correlative. The cadres in all levels acted more radically in agriculture cooperation after Deng Zihui was criticized by Mao. According to political institution with Mao as the most authoritative leader in China, the same logic will run when a new anti-rightist movement was launched again in all regions after Mao criticized Peng Dehuai in Lushan Conference. Especially, the history experience from 1954 to 1956 in agriculture cooperation was imbed in the memory of the cadres in all levels, those regions acted more radically in agriculture cooperation would do the same things after Lushan Conference.

That is to say, the radicalism in agriculture cooperation in 1956 is high correlative with the radicalism in communal dining in Great Leap Forward due to history memory, while it would not have direct impact on famine. We employ the ratio of the participation rate of elementary cooperative in 1954 to participation rate of advance cooperative in 1956 (*adcelc*) to measure the radicalism of agriculture cooperation. More radically the regions acted, higher the *adcelc* is: taking the participation rate of elementary cooperative as constant, those regions with higher participation rate of advance cooperative acted more radically. The *adcelc* may be a proper instrumented variable of communal dining system as it satisfied the above two conditions: (1) *adcelc* is correlative with *cdh*; (2) *adcelc* has no partial effect on the death rate in famine. We will demonstrate these two conditions in the following.

Another proper IV for communal dining system is the population density in rural areas. The willingness of peasants to join communal dining halls is affected by the population density in rural areas. In those regions with rich land and few people, peasants lived dispersedly in rural areas. Therefore, it is difficult for peasants to dine together in communal dining halls. By contrary, it is relatively easier to build the communal dining halls in those regions where peasants live closely. For instance, in the sparsely populated northeast provinces, there were only 23 percent, 29.4 percent and 26.5 percent peasants took part in communal dining halls for Liaoning, Jilin and Heilongjiang province respectively in 1959, even quite lower than the counterpart (61 percent) of densely populated Jiangxi province. Therefore, population density in rural areas is closely correlative with the participation rate of communal dining halls. Here we employ the cultivated land per capita in rural areas (*landpc*) to measure the land entitlement. One thing that must be pointed out is that *landpc* may affect the death rate through such mechanisms as grain output and procurement other than communal dining halls. Fortunately, we can control the above factors in the model easily.

Table 2: the participation rate in cooperative in different stage

province	<i>Communal dining halls</i>	<i>Advance cooperative</i>	<i>Elementary cooperative</i>
	in 1959	in 1956	in 1954
Hebei	74.4	99.4	7.35
Shanxi	70.6	97.9	9.54
Inner Mongolia	16.7	77.5	20.20
Liaoning	23	91.8	3.89
Jilin	29.4	95.7	5.21
Heilongjiang	26.5	98.7	7.14
Jiangsu	56	78.9	1.47
Zhejiang	81.6	60	1.84
Anhui	90.5	80.7	1.57
Fujian	67.2	62.2	1.59
Jiangxi	61	62.2	0.32
Shandong	35.5	67.2	3.45
Henan	97.8	97.2	1.50
Hubei	68.2	69	0.30
Hunan	97.6	13.8	0.08
Guangdong	77.6	44.1	0.36
Guangxi	81	62.2	0.27
Sichuan	96.7	7.4	0.18
Guizhou	92.6	27.9	0.20
Yunnan	96.5	51.6	0.42
Shanxi	60.8	65.2	0.50
Gansu	47.7	34.5	1.02
Qinghai	29.9	9.2	0.29
Ningxia	52.9	N.A	N.A
Xinjiang	85.1	42.1	0.14
Nation Mean	72.6	62.6	2.87

Table 3: the meaning of variables

variable	description	unit of measurement
<i>dr</i>	death rate	one in a thousand
<i>cdh</i>	participation rate of communal dining hall	percentage
<i>g</i>	grain available to peasants after procurement and rural resale	kg per capita per year
<i>netpr</i>	ratio of grain procurement minus rural resale to grain output	percentage
<i>ruralp</i>	ration of rural population to total population	percentage
<i>cip</i>	output of collective industries in the constant price of 1957	million yuan
<i>hip</i>	percentage of the output of heavy industry to total output of industry and agriculture	percentage
<i>landpc</i>	cultivated land per agriculture population (1957)	mu per capita
<i>adcelc</i>	ratio of the participation rate of elementary cooperatives in	percentage

Table 4: Statistics Description of Variables

variable	obs	mean	std. dev.	min	max
<i>dr</i>	125	15.239	9.762	5.350	68.580
<i>cdh</i>	125	64.672	25.624	16.700	97.800
<i>g</i>	125	203.589	52.017	123.950	419.791
<i>netpr</i>	125	23.125	10.334	5.383	59.599
<i>ruralp</i>	125	80.797	9.413	35.875	92.530
<i>cip</i>	125	472.787	380.049	5.520	1771.000
<i>hip</i>	125	33.095	14.615	10.635	73.885
<i>landpc</i>	125	3.890	2.965	1.324	12.479
<i>adcelc</i>	120	87.487	84.152	3.836	307.299

B. Benchmark Regression

We first use OLS to test the effect of communal dining halls on the famine. If only considering the single variable of *lnchd* in the model (1), we find that communal dining system did significantly raise the death rate. The participation rate grows by 10%, the death rate will increase by 2.43%. When more factors such as *lng*, one year-lagged *lnnetpr*, *lnruralp*, *lncip*, and *lnhip* are controlled from model (2) to model (5) respectively, the parameter of communal dining system ranges from 0.198 to 0.354, and is still statistically significant. It indicated that given other conditions are constant, 10% growth in the participation rate in communal dining halls will lead to 1.98% to 3.54% increase in death rate.

The other variables have the predicted parameters as the existed hypotheses. The parameter of *lng* is significantly negative, which means that the increase of grain available for peasants after procurement and rural resale would be helpful to alleviate the famine: 10% increase in grain availability would lead to a reduction in death rate by at least 5.04%. Meanwhile, the rise of one year-lagged net grain procurement ratio will greatly worsen the famine: the ratio of net grain procurement was raised by 10%, then the death rate will rise by 3.62% to 3.96%. Since the ratio of net grain procurement has covered the effect of urbanization of rural population during great leap forward, it is rational that the effect of *lnruralp* is not significant. As Liu(2010) argued, the collective accumulation was raised sharply during great leap forward, such change will inevitably lower the grain consumption for ordinary peasants and made the famine worsen. The parameter of *lncip*, a proxy for collective accumulation, is positive but insignificant in statistics. It is because that the increase in collective accumulation appeared in 1958 and 1959, not in the whole period of great leap forward. Finally, the energy consuming activities, indicated by *lnhip*, also has positive effect on death rate: the percentage of the output of heavy industry to the gross output of agriculture and industry increase by 10%, the death rate will rise by 1.93%.

To test the dynamic effect of communal dining system on famine, taking year 1962 as the benchmark period model (6) incorporates four interaction terms of *lnchd* and year dummies. We find that the coefficient of *lnchd* is still positive though its magnitude decreases in some degree. Contrast to the situation in 1962, communal dining system caused extra death by 7.6%, 10%, 16.6% 4.9% from 1958 to 1961 respectively. It reveals that the effect of communal dining halls

on famine is most serious in 1960, and less in 1961, moderate in 1958 and 1959, such change is consistent with the theoretical perception described in figure 3 and empirical dynamics depicted in figure 4.

Table 5: The Estimation of OLS

Variables	Indr					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>lncdh</i>	0.243*** (0.082)	0.198*** (0.069)	0.354*** (0.103)	0.346*** (0.096)	0.353*** (0.103)	0.175 (0.103)
<i>lng</i>		-0.528** (0.207)	-0.683*** (0.228)	-0.663*** (0.232)	-0.573** (0.240)	-0.504* (0.280)
<i>lnnetpr₋₁</i>			0.388*** (0.122)	0.396*** (0.119)	0.362*** (0.119)	0.167 (0.128)
<i>lnruralp</i>			-0.298 (0.250)	-0.240 (0.261)	0.077 (0.295)	-0.027 (0.237)
<i>lnCIP</i>				0.033 (0.028)	0.042 (0.033)	0.007 (0.030)
<i>lnhip</i>					0.193* (0.107)	-0.016 (0.091)
<i>lncdh*58</i>						0.076*** (0.017)
<i>lncdh*59</i>						0.100*** (0.012)
<i>lncdh*60</i>						0.166*** (0.034)
<i>lncdh*61</i>						0.049*** (0.015)
<i>Constant</i>	1.615*** (0.309)	4.591*** (1.131)	4.886** (1.819)	4.344** (1.973)	1.849 (2.318)	3.851* (2.107)
Observations	125	125	125	125	125	125
R-squared	0.077	0.156	0.287	0.296	0.321	0.496

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C. IV Estimation

As stated above, the key variable of *cdh* may be endogenous for reverse causality, omitted variables and measure error. In this subsection, we will reexamine the causality of communal dining system and famine by instrumented variables.

Model (7)-(9) presents the estimation of two-stage OLS. In the first stage estimation, we find that those regions acted more radically during agriculture cooperation from 1954 to 1956 do play more radically in communal dining system. 10 percentage points rise in *adcelc* will lead to 3% increased in the participation rate of communal dining halls. Meanwhile, those provinces with low population density did play less radically in communal dining halls: 10% increase of the cultivated land per capita in rural areas will lead to 4.68% decrease of the participation rate of communal dining hall. When both *adcelc* and *Inlandpc* are taken as the instrumented variables for *lncdh* in model (9), both

instrumented variables have the same significant effect on *lncdh* as model (7) and (8) with coefficients fall slightly. All the estimations by 2SLS show that the variable of *lncdh* is endogenous¹¹ and the instrumented variables are highly correlative with *lncdh*. The Sargan test in model (9) shows that both the IVs are valid: both *adcelc* and *lnlandpc* are correlative with *lncdh* but have **no partial effect** on death rate.

In order to test the validity of IV while single IV was used in model of (7) and (8), we make use of the approach initiated by Acemoglu etc.(2001). The basic idea is that, the IV may significantly influence the dependent variable while excluding the endogenous variable in regression, but the role of IV becomes insignificant once the endogenous variable is included in regression. It indicates that the IV does affect dependent only through the channel represented by endogenous variable. The results can be found in table 7. We can see that both *adcelc* and *lnlandpc* have the expected significant effect on *lnldr* while *lncdh* is excluded in the regression in model (10) and (11) respectively, but the effect of both IVs become insignificant when *lncdh* is simultaneously included in the model (12) and (13) respectively. The evidences show that either *adcelc* or *lnlandpc* is valid since each of them does not have partial effect on death rate when *lncdh* is controlled.

As we state above, the problem of reverse causality and omitted variables will result in an overestimation of the parameter, and the measurement error will tend to underestimate the coefficient. The estimation by instrumented variables resolves the endogenous problem of *lncdh* caused by the above three ways, so the estimated coefficients by two stages OLS is consistent and unbiased. It can be seen that the coefficients of *lncdh* by two stages OLS is highly statistically significant with 1% level, and range from 0.599 to 0.618. It means that the participation rate of communal dining halls raised by 10 percent, the death rate will increase about 6 percent, which is much larger than the estimation by OLS. This suggests that measurement error in the communal dining variables that creates attenuation bias is likely to be more important than reverse causality and omitted variables biases.

Table 6: The estimation of IV

	(7)	(8)	(9)
<i>lnldr</i>	2SLS	2SLS	2SLS
First stage	<i>lncdh</i>	<i>lncdh</i>	<i>lncdh</i>
<i>adcelc</i>	0.003*** (0.000)		0.002*** (0.000)
<i>lnlandpc</i>		-0.468*** (0.061)	-0.413*** (0.057)
Second stage	<i>lnldr</i>	<i>lnldr</i>	<i>lnldr</i>
<i>lncdh</i>	0.618*** (0.159)	0.599*** (0.139)	0.616*** (0.116)
<i>lng</i>	-0.615*** (0.172)	-0.603*** (0.168)	-0.615*** (0.171)
<i>lnnetpr_1</i>	0.403*** (0.105)	0.421*** (0.099)	0.403*** (0.102)
<i>lnruralp</i>	-0.341 (0.435)	-0.302 (0.413)	-0.338 (0.402)

¹¹ The p value of endogeneity tests in model (7)-(9) is 13.6%, 12.4% and 0.3% respectively, it indicates that the endogeneity of *lncdh* becomes more significant when two IVs is simultaneously included in the regression.

lnCIP	0.043 (0.030)	0.036 (0.027)	0.043 (0.030)
lnhip	0.237** (0.102)	0.205** (0.095)	0.236** (0.102)
cons	2.543 (2.477)	2.479 (2.416)	2.539 (2.460)
<i>N</i>	120	125	120
<i>R</i> ²	0.262	0.265	0.262
<i>Endogeneity Tests</i>	2.384 [0.136]	2.532 [0.124]	10.633 [0.003]
<i>Weak IV Test</i>	40.768 [0.000]	58.567 [0.000]	55.651 [0.000]
<i>Sargan Test</i>			0.000 (0.987)

Table 7: Validity Test of the IV

Variables	ln _{dr}			
	(10)	(11)	(12)	(13)
ln _{cdh}			0.261* (0.137)	0.231** (0.103)
ad _{celc}	0.002*** (0.001)		0.001 (0.001)	
ln _{landpc}		-0.280** (0.106)		-0.172 (0.108)
ln _g	-0.769*** (0.230)	-0.538** (0.197)	-0.704** (0.252)	-0.563** (0.219)
ln _{netpr}	0.305** (0.130)	0.448*** (0.129)	0.346*** (0.120)	0.437*** (0.122)
ln _{ruralp}	0.481 (0.406)	0.214 (0.256)	0.134 (0.327)	0.015 (0.265)
lnCIP	0.081** (0.039)	0.019 (0.039)	0.065 (0.041)	0.026 (0.040)
ln _{hip}	0.276*** (0.080)	0.161 (0.125)	0.259** (0.096)	0.178 (0.121)
Constant	2.051 (2.464)	2.787 (1.713)	2.258 (2.517)	2.668 (2.084)
Observations	120	125	120	125
R-squared	0.302	0.315	0.348	0.348

The relative importance of the various causes of the famine

According to the estimation, the causes of Great Leap Famine include the communal dining system, grain availability decline, excessive grain procurement and high energy consuming projects. The estimated coefficients by OLS and two stages OLS only reveal the marginal effect of various factors

on famine, it is necessary to calculate the sum effect to compare the role of different factors on famine.

We first estimate the beta coefficient of various variables according to model (4), (6)-(8), and the results are reported in table 7. It can be read in the second column of table 7 that one standard deviation change in *lncdh*, *lng*, *Llnnetpr* and *lnhip* will cause 0.401, 0.310, 0.343 and 0.191 standard deviation rise in *lnldr* respectively, which shows that communal dining system does cause more death loss than the other radical policies. The estimation by two stages of OLS also indicates that the beta coefficients of *lncdh* rise from 0.401 in model (4) to 0.491, 0.495 and 0.567 in model (6)-(8) respectively. It shows that the effects of communal dining system on famine as well as the other factors increase with IV estimation. What is interesting is that when both instrumented variables are incorporated in the regression, the beta coefficient of *lncdh* reaches the maximum. That is to say, two instrumented variables can best overcome the endogenous issue especially the measurement error of *lncdh*.

Table 7: The Beta Coefficient of Variables

Variables	(4)	(6)	(7)	(8)
<i>lncdh</i>	0.401 ^{***}	0.491 ^{***}	0.495 ^{***}	0.567 ^{***}
<i>lng</i>	-0.310 ^{***}	-0.333 ^{***}	-0.327 ^{***}	-0.333 ^{***}
<i>Llnnetpr</i>	0.343 ^{***}	0.380 ^{***}	0.398 ^{***}	0.379 ^{***}
<i>lnruralp</i>	0.023	-0.105	-0.092	-0.104
<i>lnCIP</i>	0.124	0.118	0.107	0.118
<i>lnhip</i>	0.191 ^{**}	0.229 ^{**}	0.203 ^{***}	0.229 ^{***}

Second, in order to further compare the relative importance of various factors on famine, we decompose the effect of various variables according to Gary Fields(2003)'s approach as equation (2) listed. Let $s_j(\ln Y)$ denote the share of the log-variance of explained variable that is attributable to the j 'th explanatory factor and let $R^2(\ln Y)$ be the fraction of the log-variance that is explained by all of the explanatory factors Z taken together. Then, the log-variance of Y can be decomposed as the following equation, of which α_j is the coefficients effect, $\sigma(Z_j)$ is a standard deviation effect, and $cor[Z_j, \ln Y]$ is a correlation effect. In other words, the attribution of j 'th factor to the log-variance of Y depends on three factors: the estimated coefficient, the change of the explanatory variable, and correlation coefficient between Z and $\ln Y$.

$$s_j(\ln Y) = \text{cov}[\alpha_j Z_j, \ln Y] / \sigma^2(\ln Y) = \alpha_j * \sigma(Z_j) * cor[Z_j, \ln Y] / \sigma(\ln Y) \quad (2)$$

As we can see in table 8, the Gfields' decomposition shows similar results as beta coefficients. In the estimation by OLS as model (4), *lncdh* contribute 11.13% to the log-variance of death rate, and the shares of *lng*, *Llnnetpr*, *lnhip* are 10.16%, 5.97% and 2.99% respectively. It indicates that communal dining system does be the most important cause of famine. According to the estimation of model (6)-(8), the share of *lncdh* first decreases to 8.71% and 10.42% then go up to 16.84%, while the shares of other variables increase slightly. We compute the correlation coefficient between *lnldr* and *lncdh*, the predicted *lnchd* in the first stage of IV estimation, and find that the correlation effect of *lncdh* does first decrease in model (6)-(7) and then rise in model (8). The similar change appears in the standard deviation effect of *lncdh* on famine.

According to the Gfields' decomposition of famine, we find the total effect of communal dining system on death rate exceeds the effect of grain availability decline or excessive grain procurement. In model (8), the effect of communal dining system almost covers the aggregate effect of grain availability decline and excessive grain procurement. That is to say, the famine may not happen if there is no communal dining system though rural China encounters crop failure and over-procurement during great leap forward.

Table 8: the Gfields Decomposition of Indr

Variables	(4)	(6)	(7)	(8)
<i>lncdh</i>	11.13***	8.71***	10.42***	16.84***
<i>lng</i>	10.16***	10.92***	10.69***	10.92***
<i>LlnLnetpr</i>	5.97***	6.64***	6.93***	6.64***
<i>lnruralp</i>	0.26	-1.16	-1.02	-1.15
<i>lnCIP</i>	1.54	1.58	1.33	1.58
<i>lnhip</i>	2.99**	3.65**	3.16**	3.65**
residual	67.95	75.31	66.65	66.48

Table 9: the statistics of Indr and lncdh

Model	Variable	Indr(correlation coefficients)	Std. Dev.
(4)	<i>lncdh</i>	0.277	0.504
(6)	<i>lncdh</i> [^]	0.177	0.357
(7)	<i>lncdh</i> [^]	0.208	0.366
(8)	<i>lncdh</i> [^]	0.296	0.413

IV. Conclusion: The Importance of Exit Rights from the CDHs

We aim to emphasize in this paper that after the communes had been established in 1958, Chinese peasants lost not only the right to exit from the commune, but also the right to exit from CDHs. While the deprivation of the right to exit from the commune led to the nationwide food shortage for over twenty years, it is mainly the deprivation of and the restoration of the right to exit CDHs led to the sudden break-out and the abrupt end of the most unprecedented famine in human history. People's communes promoted militarization of organizations, regimentation of actions, and collectivization of livelihoods, while CDHs made compulsive collectivization of grain rations under the pressure from the State, and finally destroyed the family, the last stronghold of individual freedom. Chinese peasants were driven onto the road to serfdom and forced to bear the fatal consequences of the state's catching-up strategy and its goal of rushing to communism.

We revisit the causes of the great famine for two compelling reasons. First, we believe that finding the truth of this tragic famine on the occasion of its fifty-five anniversary is the best way to memorize the tens of millions of the victims. They were tricked to join the dining halls by the promise of unlimited food supply to only find out that the initial feasts offered by the CDHs actually set the stage for turning them into ghosts of hunger on an unprecedented scale. Second, we believe that the lesson on the importance of exit right drawn from this tragedy is directly

relevant for resolving the soaring “Three Agrarian Issues” in China.¹² If China can respect farmers’ free will by allowing them to exit from the current system of compulsive collective land ownership, many of the conflicts between rural and urban areas today will disappear, just as the GLF ended abruptly when the peasants regained the right to exit from the compulsory dining halls.

¹² “Three Agrarian Issues or San Nong problems” refer to the problem of peasants’ income, rural reconstruction, and agricultural production in China.

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