Food Availability, Entitlements and the Chinese Famine of 1959-1961

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Abstract

The food availability decline and Sen's entitlement are two leading hypotheses for the causation of famine. Previous research based on case studies has given independent support to each of the accounts. This paper analyses the Chinese famine of 1959-61 by jointly considering entitlement arrangement and declines in food availability as complementary causes. We found that in the Chinese famine of 1959-61 both the food availability decline and entitlement arrangement contributed significantly to the increase of death rates in the famine. However, the differences in the entitlement arrangement were more important than the differences in food availability for explaining the observed differences in death rates across provinces.

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I. Introduction

The problem of famines and food shortages has received much attention from economists because they have continued to occur despite of persistent progress in agricultural production technology.[1] The traditional approach to famine analysis, which may be dated back to the writings of Adam Smith and Malthus, proposes that famines are primarily caused by a sudden food availability decline (FAD). Wars or natural calamities may effect an agricultural production collapse in a particular geographic region and result in widespread hunger and famine. This supply-based FAD account was an accepted explanation for famines before the influential work of Sen (1977, 1981a and b), who proposed a complementary entitlement approach. Sen emphasizes that famine is a result of some people failing to acquire enough food to eat. While a shortage in food output per head can be a cause of famine, it is only one of many possible causes. In his studies of several well known historical famines, Sen found that famine often occurred in absence of per capita food output decline. Famines were either resulted from a sudden collapse in the endowments of certain portion of the population or from dramatic changes in relative prices which cause certain portion of the population fail to acquire enough food.

While the entitlement approach has been accepted by many famine analysts, proponents of the FAD account have also offered criticism.[2] Instead of examining food availability at aggregate levels as Sen, the opponents emphasized local supply conditions. They argue that crop failures due to natural calamities often result in high food prices because of the supply shortage, speculative behavior, increased demand to deal with uncertainty and sales of possessions to exchange

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[1]Some famous historical famines include the Russian famine of 1932-33, which resulted in 5 to 6 million deaths, the 1943 great Bengal famine of 3 million deaths, the 1972-74 Ethiopian famine of 50 to 200 thousand deaths, the 1973 famine in the Sahel of 100 thousand deaths and the 1974 Bangladesh famine of 80 to 100 thousand deaths. More recent famines have taken place in Somalia, Ethiopia and other developing countries.

[2]See, for example, Seaman and Holt (1980), Cutler (1984) and Bowbrick (1986).

for food. Ultimately the poor and those who are negatively affected by bad weathers become famine victims because of reduced purchasing power. Since crop failures initiate the chain effects, the shortage in food supply is viewed as a necessary condition of famine.

Despite of the clarity of views at the theoretical level, the distinction between the two approaches has not yet been reflected clearly in empirical analysis. Although Sen has amply demonstrated that famine can occur without a reduction in per capita food supply, his measures of availability are either defined at national or highly aggregated regional levels, which may not directly refute the propositions of FAD opponents who emphasized local conditions.[3] A formal test of the entitlement hypothesis was further obstructed by other data limitations, such as the lack of records on personal properties and detailed market commodity prices. More importantly, previous research has not considered food supply and entitlement as complementary factors to cause famine. As a result, we still do not know the relative importance of the two hypotheses in explaining famine deaths.

In this paper we analyze the Chinese famine of 1959–61, where the drop in food availability and entitlement arrangements were both important factors. Under the centrally planned regime, urban residents were given the legally protected rights to food through an effective ration system. To the contrary compulsory grain quotas were imposed on the farm people. During the Great Leap Forward in 1959–61, the Chinese agricultural production collapsed because of a sudden institutional change, natural calamities and a series of policy mistakes. The grain output dropped by 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 data reveals that this crisis resulted in widespread famine and caused about 30 million excess deaths (Ashton et al. 1984). To analyze this worst catastrophe

[3]Due to data limitations, Sen (1981) used national per capita grain output as the indictor for food availability in the study of Ethiopian and Bangladesh famines. Presumably, per capita food supply in a famine region is a more relevant indicator. For the great Bagel famine Sen used food availability figures for the district, a more local indicator, as per capita availability measures. However, Bowbrick (1986) questioned the reliability of the production figures.

in human history, we introduce Sen's entitlement concept to the centrally planned system. We formulate a framework which is amenable to empirical test and jointly considers per capital food supply and the right to food as determinants of famine.

A panel data set for 28 Chinese provinces for the period 1954-1966 are used for the empirical analysis. We use the percentage of rural population and per capita grain output in a province as proxies for the entitlement arrangement and food availability in that province and assess respectively their contributions to the observed cross-province differences in death rate. We find that in normal years the cross-province differences in both variables did not result in cross-province differences in death rate. However, in the famine of 1959-61 both variables contributed significantly to the observed cross-province differences in death rates. This result gives supports to both the FAD hypothesis and the entitlement hypothesis as reasons for famine. However, the empirical evidence also shows that differences in the entitlement arrangement are more important than the differences in food availability for explaining the observed differences in death rates across provinces in the famine. To our knowledge, this paper is the first attempt to test the entitlement hypothesis rigorously and also the first attempt to test the entitlement hypothesis and FAD hypothesis simultaneously.

II. China's Food Procurement and Entitlement

In the entitlement approach, Sen (1981a, 1981b) proposes that the acquirement problem, rather than per capita food supply, is central to questions of hunger and starvation in the modern world. Consider a person's endowment vector x, which may include the possession of land, labor services, health conditions and the ownership of other properties. The person may produce his own food based on initial endowment, or he may exchange possessions in the market for a consumption bundle which includes food. This person will have to starve if he fails to obtain enough food. This may occur either through a fall in the endowment vector x (direct entitlement failure), or through an unfavorable shift in the terms of exchanging properties for food (trade entitlement failure). Consequently FAD is

not a necessary condition for famine. Towards testing his propositions, Sen recognizes that there can be ambiguities in the specification of entitlement and this problem can be compounded by data limitations.[4] Instead of conducting statistical analysis, Sen relied heavily on the indices of rice-exchange rate, the price ratios of other products or services to rice, as major indicators of changing entitlement relations. He found that sharp declines in the food-exchange rates for people in selected occupations explained much of the famines.

In contrast to the market environment where Sen laid out his entitlement hypothesis and applications, China had a planned economic structure where the acquisition and distribution of food were directly controlled by the central government. Rural people had to deliver compulsory quotas to procurement agencies at prices set by the government. Food rationing system existed in cities where urban residents had protected legal rights for certain amount of grain consumption. In this planned setting food availability and entitlement are still important factors. But how they result in starvation differ from a market economy.

After the founding of the People's Republic in 1949, an in-kind agricultural tax was the main vehicle that the state acquired grain from rural areas.[5] In 1953 the central government brought all grain procurement and distribution under its direct control with a system of Unified Procurement and Unified Sale for grain and oil-bearing crops as a way to suppress the procurement prices. Interprovincial grain trade by private traders was virtually eliminated. Accompanied the Unified Procurement and Unified Sale was a rigid household registration system, which deprived rural population's rights to move to urban areas and put the rural to urban migration under the government's tight control. The aim of these schemes was to extract as much as possible agricultural surplus

[4]In absence of a market-clearing equilibrium, for instance, entitlement may not be well defined. There is also a great deal of vagueness to characterize a person's possessions. See Sen (1981b) for additional explanations.

[5]Agricultural taxes were used by the Communists as early as 1938 in the Shansi-Gansu-Ningxia liberated regions (Perkins, 1966). The rate was set at 12 percent of the "normal" yield in the early 1950s. The rate fell to 6 percent in 1970 and then to 5 percent in 1978 (Perkins and Yusuf, 1984). The share of grain acquired through taxes declined over time in total grain procurement.

for facilitating the heavy-industry-oriented development strategy which had resulted in an increasing demand for grain and other agricultural products for urban food consumption and exports.[6] Under Unified Procurement and Unified Sale the central government set the target for purchase of grain nationwide before a production season began. The target depended on the planned urban consumption needs, urban reserves, industrial materials and international trade. The target filtered down through provinces and lower levels of government until they reached the basic production units and became mandatory quotas. The quotas specified the quantity of compulsory deliveries as well as their prices set by the state. When quotas were fulfilled, peasants were free to sell the remaining surplus to their fellow villagers, the state procurement departments, or a state-regulated grain market. In practice, however, because the state had procured to the maximum possible extent, the farmers were left with little surplus to sell (Walker, 1984).

After harvests, grain procurement agencies in each localities collected the quotas and delivered the grain to the state. The state then distributed the grain to the urban population in each province at subsidized prices. To control the urban food demand and to facilitate the distribution of food to the targeted group, food ration coupons were introduced in 1954 (Walker, 1984). In August 1955 the government established a more formal system and set up the ration standards according to age, employment and other demographic characteristics.[7] In subsequent years the ration norms were adjusted and the scope of rationing was extended to other agricultural products, including soy beans, coarse grains,

[6]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 (Lin 1990).

[7]For example, in 1956 the monthly ration of grain for unusually hard laborers ranged between 22.5 kg and 27.5 kg with national average of 25 kg, for hard laborers ranged between 17.5 kg and 22 kg with national average of 20 kg, for light laborers ranged between 13 kg and 17 kg with national average of 16 kg, for white collar employees ranged between 12 kg and 14.5 kg with national average of 14 kg, and for college and high school students ranged between 13 kg and 16.5 kg with national average of 16 kg (Chen 1982, p. 206).

cotton cloth, edible oil and pork.

The rationed urban consumptions were matched closely with the rural compulsory quotas. The former represented protected legal rights for city residents and the latter represented coercive burdens on the rural people. Under the procurement and rationing system, there was serious conflict between the government and the peasantry. Since the government gave priorities to industrial development, it pursued a heavy procurement policy to feed the expending city population, to provide raw materials, to accumulate city grain stocks and to export grain for foreign exchange. However, more grain acquisition implied a bigger extraction from agriculture which unavoidably created strong opposition.[8] Despite conflict, the government was always successful in acquiring grain for cities. It relied on effective administrative and political methods.[9]

A production unit's mandatory quota, specified before the production season began, in general, depended on the production unit's normal outputs in the previous years and its own consumption needs. In normal years, the farm household would have been left enough food for meeting subsistence needs. If the decline in grain output was a local phenomenon, the national or provincial government might also reduce the quota obligations or even deliver some grain relief to the farm households in the areas affected by the bad harvest. However, if there was a severe reduction in food supply nationwide, rural people would bear much of the consequences and a famine was likely to occur in rural areas because the

[8]Walker (1984) provided various accounts of rural opposition to the Unified Purchase and Unified Sale schedule. Crimes were committed against the coercive acquisition and people who were responsible for the crimes were sentenced, including imprisonment and even death penalty. The instability caused by grain procurement caught the attention of Mao Tse-tung who expressed concerns in his writings. Mao (1967) recorded: "Old women blocked the road and would not allow the grain to be taken away ..." and " ... At the time you (Minister of Food) said there was no grain problem but I said there was."

[9]For instance, the formation of the large-scale agricultural organizations enhanced the power of rural cadres to mobilize large amounts of grain. And, the cadres had incentives to enforce procurement policies to achieve their own promotions. As noted by Perkins and Yusuf (1984, p. 4), the foremost feature of China's rural development has been the government's capacity to implement village-level programs on a nationwide basis through bureaucratic and Party channels.

government's predominant concern was urban food supply.[10] Given the above institutional arrangements in China, FAD and entitlement may be the fundamental causes of China's famine during a severe supply shock.

The above discussions gave useful hints for identifying proxies and units of observations for testing the entitlement hypothesis and FAD hypothesis as explanations for famine in the Chinese context. First, the entitlement was related to a household's legal status as urban household or rural household. The urban households had entitlement to a given amount of grain guaranteed by the state, whereas the rural households only had the right to the residual after fulfilling the quota obligation. Second, the relative price of grain to other commodities had limited power in explaining starvation in China because the distribution of grain in urban areas was carried out by in-kind rationing and the grain market in rural areas during a famine was too thin to be meaningful. Third, because the interprovincial grain trade by private traders was prohibited and the central government would not have the capacity to deliver relief to rural areas during the period of a sharp decline in grain output nationwide, the subsistence of farmers in a province during that period depended on the food production in that province.

The above specific institutional arrangements in China provide us a convenient way for testing the validity and relative importance of FAD and entitlement as explanations for famine in China. The per capita grain output in a province can be used as the proxy for the food availability in that province. Meanwhile, the proportion of rural population in a province can be used as a proxy for the entitlement arrangement in that province. This variable represents the proportion of population in that province which did not have the legally protected rights to food. We need not worry about how to measure a household's property entitlement or exchange entitlement as these two variables were not important determinants of the rights to food in the specific socialist setting

[10]Sen (1983) made an interesting contrast between India and China. He observed that China was more successful to eliminate malnutrition for the population while India had better records in avoiding major famines. Sen attributed these observations to differences in institutions.

in China.

The hypotheses we would like to test can be summarized as follows:

> In a famine in China, the death rate in a province is positively related to the proportion of rural population in that province (entitlement hypothesis) and negatively related to the grain output per capita in that province (FAD hypothesis).

In 1959-61 China experienced a serious famine. In the next section, we will document grain production declines, issues of procurement and the resulted famine. In section IV, we will conduct a statistical assessment on the relative effects of food availability and entitlement on the observed deaths in this human disaster.

III. Collectivization and Demographic Crisis: 1959-1961

China's agricultural collectivization started in 1952. The size of production organization increased from household farming to mutual aid teams, to elementary cooperatives and then to advanced cooperatives, which consisted of about 150 households and were widely adopted in 1957. The agricultural output increased continuously in this period with an average annual growth rate of 4.6 percent. Encouraged by the success the Communist party decided to adopt a bolder approach to mobilize surplus labors to increase capital formation.[11] In 1958 large scale communes were formed as part of a nation wide Great Leap Forward (GLF) movement.[12] Contrary to the expectation, however, the Chinese agriculture production plugged dramatically for three successive years and it resulted in widespread famine. As a consequence, the death rate per thousand people increased substantially in 1959-61 whereas the crude birth rate per thousand people

[11]Projects of capital formation include constructing irrigation systems, such as dams and reservoirs, building infrastructures, or the alike. Mechanization was also used as a rationale for increasing the size of a collective.

[12]The principle characteristics of the GLF may be summarized by policies related to technology, management and planning, and industries and ideology. See Riskin (1987) for additional descriptions.

declined substantially in the same period (see figure 1).[13]

Economists have attempted to explain the causes of the sudden reduction in agricultural output. Conventional hypotheses include three successive years of bad weather, bad policies and bad management in the communes, and incentive problems due to the unwieldy large size of the communes (Eckstein 1966, Chinn 1980, Ashton et al. 1984, and Perkins and Yusuf 1984). Lin (1990) formulated a game theory approach which proposed the main cause of the agricultural collapse as the deprivation of the peasants' right to withdraw from the collective. This switch in the form of organization changed the incentive structure of the peasants and consequently resulted in the agricultural productivity collapse. In this paper, we do not investigate the determinants of the sudden drop in output, but we focus on the consequences of the supply shock. More specifically, we analyze the relative importance of food availability and the legal entitlement to food in causing the subsequent famine.

Statistical figures in Table 1 reveal that there were sharp reductions in grain availability for the period 1959-61.[14] Prior to the collapse the total grain output continued to increase, reaching a record high in 1958 with 200 million tons. In 1959 total supply suddenly dropped by 15 percent and the following two years were even worse, reaching only about 70 percent of the 1958 level in 1960 and 1961. There was slow recovery from the slump in the subsequent years and the 1958 grain level was finally regained in 1966.

During the food crisis grain availability per head declined more severely because in the first two years the outflow of grain in China's trade reached historical heights. As shown in Table 1, net grain export increased from 2.7

[13]As shown in figure 2, the changes in population trends started in 1958. However, the increase in death rate and the decline in birth rate were likely to be the result of massive mobilization for producing steel by the traditional iron-casting furnaces, which were set up at the backyards overall China in 1958 as one of the most important component of the Great-Leap Forward Movement. Since the technique was extremely labor-intensive, people did not have time or were not given enough attention for health care and reproduction.

[14]Here and in the subsequent analysis, we use figures between 1954-66. This specific period is taken for consideration because important demographic statistics, such as death rate, are missing for some provinces prior to 1954. The period ends in 1966, the beginning of the Cultural Revolution when the nation entered into a distinct historical era.

million tons in 1958 to 4.2 million tons in 1959. This net export combined with the decline in output resulted in a 17 per cent and a further 13 percent reduction in per capita food supply in two consecutive years. Pressured by the food emergencies, China in 1961 imported 4.5 million tons of grain which helped to reduce food deficiency. Since then China became a grain importer in the 1960s.

While the massive food shortage was a plausible cause of the subsequent famine, another important factor was the food entitlement to the farm population. As shown in Table 1, despite of the sharp decline in total grain supply, the total procurement reached the highest level of 64.12 million tons which drastically raised the quota-output ratio from 25.9 percent in 1958 to 37.7 percent in 1959. The quota-output ratio remained at 32.4 percent in 1960 despite of the further reduction in grain output. As a result, the excessive procurement severely reduced the food supply entitled to rural people.

The large quantity of grain acquisition in 1959-60 were primarily due to several reasons. First, the newly launched industrial GLF increased the demand for grain not only as raw materials and sources of export but also for consumption in cities. Riskin (1987) documented that the employment in state industries was tripled from 7.8 million in 1957 to 23.16 million in 1958, with a net inflow of 15.68 million agricultural laborers.[15] Consequently the state had to raise compulsory quota. In the winter of 1958-59, however, urban grain supplies began to fall short of demand. To guarantee the success of GLF, Chairman Mao made an important speech in the spring of 1959 and described the nation as "one chessboard", a policy which reaffirmed the central planning of grain and gave a high priority of city grain supplies over rural localities. This policy was rigorously implemented in 1959 (Walker 1984). A second possible reason for heavy procurement was the deception from a bumper harvest of 1958 which made the

[15]Other studies indicated similar magnitude for the urban immigration. Ashton et al. (1984) recorded that net inflow of urban population was about 31 million between 1958-60. Walker (1984) described that, between the end of 1957 and the end of 1958, urban population increased by at least 13 million, or approximately 13 percent. Bernstein (1984) provided similar migration numbers as Ashton et al. and pointed out that most of the inflow took place in the second half of 1958.

central government believe that China had solved its "grain problem." The government simply increased procurement to claim its own share of the harvest.

Nevertheless, a careful examination of evidence favors the first explanation that the central government harshly squeezed the peasantry on behalf of urban residents. The evidence does not fit in with the explanation that the excessive deprivation of grain was caused by misjudgment of the state. Fierce procurement campaigns were conducted by the government in 1959 and in the same time government realized that peasants employed all methods of actions to prevent the state from taking away their grain.[16] The strong local resistance would quickly correct any government deception of a production miracle, but the state continued to take coercive actions. The state utilized effective political strategies to induce the enthusiasm of rural cadres to submit grain and punished those who resisted orders. The formation of large-scale people's communes provided opportunities to the cadres to mobilize large amounts of grain (Bernstein 1984). The result of the procurement campaign was astonishing: in 1959 the state managed to increase the grain collection by about 24 percent when the grain output plugged by 15 percent.

Accompanied the sharp reduction in food supply and excessive procurement was massive famine in China for three consecutive years 1959-61. However, this famine was not known to academic circle outside China until the release of important demographic data by the Chinese government in the early 1980s.[17] In a careful study of the population statistics by interpolating between pre- and post famine mortality levels, Ashton et al. (1984) concluded that "the number of excess deaths during the crisis amounts to about 17.3 million deaths over the age of 10 and 12.2 million deaths under age 10, giving a total of almost 30 million

[16]Actions taken by the peasantry was found in Mao's writings (1967). They hid things in "secret cellars, ... posted sentries. ... ate turnips during the day and concealed rice at night." See Walker (1984) and Bernstein (1984) for additional description.

[17]In a recent talk in Bangkok given by one of the authors, a senior FAO official would not believe that the famine actually occurred in China. In 1960 he travelled for a couple of weeks from the Northeast to the South of China and did not observe the usual signs of famine that he observed in the incidence of famine in other countries. However, his trips were restricted to cities and not in the rural areas.

excess deaths." Measured in number of deaths this disaster is, undoubtedly, the worst famine in the history of the world.

Summary statistics for the period 1954-66 on the Chinese population, death rate and birth rate, including separate accounts for rural and urban areas, are presented in Table 2. Largely an agrarian economy, the share of rural population was above 81 percent in the entire period despite of a declining trend. The death and birth rates figures clearly demonstrate a major demographic catastrophe in 1959-61. The national death rate increased from 1.198 percent in 1958 to 1.459 percent in 1959. Then it jumped to 2.543 percent in 1961. From the city and country figures we see that much of the high national death rate could be traced to rural areas where there was an astonishing 2.858 percent death rate in 1960. In the famine period city death rates were above normal standard but were much lower than rural rates. The opposite patterns are found in the birth statistics where the national rate dropped considerably in the years of crisis. Again rural population was more severely affected with the lowest birth rate of 1.699 percent occurred in 1961, which was about one half of the birth rate in 1957. Reduced birth also seriously affected the wellbeing of the population. But since they do not directly represent loss of lives, our analysis shall concentrate on death rates.

Table 3 provides more detailed death rates between 1954-66 at the provincial level. Among the existing 30 provinces and municipalities, Hainan province and Tibet autonomous region are not included in the table because the former is a newly established province and the latter did not have official death rate records for the period under consideration. The figures reveal variations of death rates during the crisis. In the worst famine year 1960, the lowest death rates are found in the three municipalities, (1)Beijing, (2)Tianjing and (9)Shanghai, which were the most important political and industrial centers in China.[18] There are also noticeable regional variations in death rates: the north

[18]The exception is (5)Neimonggu which had death rate below (2)Tianjing. (5)Neimonggu is a special province because a high percentage of its population were herdsmen who primarily engaged in stock-raising activities. This province was relatively isolated from the rest of the economy.

and north-east provinces generally suffered less in death tolls in the famine.

At this point we note a few idiosyncratic factors which may cause variations in provincial death rates but will not be scrutinized in the later statistical analysis. First, the political strength of provincial government to resist the central administration directly determined the volume of local grain extraction and consequently affected the severity of famines. For instance, (19)Guangdong and (7)Jilin only had mild increases in excess deaths because these two provinces had been successful in reducing their grain export burdens. To the contrary provinces, which were cooperative or obedient to the state, such as (25)Gansu, (16)Henan, (21)Sichuan and (28)Hunan, all had high death rates. Personalities and political strategies of provincial leaders in weighing local welfare and central orders played a direct role in affecting the death rates.[19] Second, inter-provincial grain transfers to disasters regions or to regions with a concentration on industrial materials, such as cotton and forestry, were also important to understand the variations in mortality rates. However, these transfers were often done on a very short-run basis and are not reflected in recorded data. This limitation prevents further investigation along this direction. Third, the nationwide lavish consumption of grain occurred in the end of 1958 and the early 1959 may partly explain interprovincial differences. Deluded by the good harvest in 1958, commune kitchens supplied grain to villagers without cost and caused enormous waste (Johnson 1990). Since over consumption occurred at differential levels across provinces, their effects on death rates

[19]See Walker (1984) for an exhaustive analysis of China's grain supplies and procurement in the 1950s and 1960s and detailed descriptions about the political struggle between the provincial and central government. The general secretary of the Guangdong province, who effectively resisted the central procurement in the years of disasters, was purged during the Cultural Revolution. In other provinces, administrations managed to export .361 million tons of grain from Kansu, .935 million tons from Henan, 2.24 million tons from Sichuan and .440 million tons from Hunan province despite of severe food shortages in 1959-60. These provinces were severely hit by famine. As early as the 1958-59 agricultural year, a procurement slogan was propagated in Sichuan: "First the center, than the locality; first external (commitments), then internal (commitments)." The province organized 5 million people to transport grain for export and the procurement reached the highest historical level of 2.595 million tons. Because of this, massive famine hit the province earlier than elsewhere, resulting in a 4.7 percent death rate in 1959. The obedience of the provincial government was also responsible for the highest provincial death rate of 2.94 percent in 1961.

in 1959 and 1960 were also different.

IV. Empirical Analysis

A panel data of 28 Chinese provinces for the period 1954-66 are used for empirical analysis. These data were collected by the Chinese Statistical Bureau and were published in Quanguo Gesheng Zizhiqu Zhixiashi Lishi Tongji Ziliao Huibian, 1949-1989 (A Compilation of Historical Statistical Data of Provinces, Autonomous Regions, and Municipalities) and various volumes of the Chinese Statistical Yearbook. Recent demographic studies on China have utilized these data and stressed the consistency of the information with other data sources (Banister 1984, Coale 1984, and Ashton et al. 1984).

The rationale for analyzing provincial death rates is discussed in section II. We choose this observation unit also because data at the provincial level in China is the most complete and readily available. The State Statistical Bureau has released voluminous province-level data to the public since the early 1980s. We choose 1954 as the starting year and 1966 as the ending year for empirical analysis because, as shown in figure 1, there was a significant decline in death rate prior to 1954, probably due to the transition to social stability from the previous civil wars and other social destructions, and 1966 marked the start of cultural revolution, another period of social chaos in China.

Empirical Hypotheses and Specification

We consider entitlement and grain availability as complementary causes of famine and assess their relative importance. The dependent variable for analysis is the provincial death rate in 1954-1966. The principle explanatory variables are the proportion of rural population in a province, a proxy for entitlement arrangement, and the per capita grain output in a province, a proxy for food availability. As explained in section II, we do not include property possessions and relative prices between food and other commodities as explanatory variables. This approach differs from Sen's analysis in a market setting where properties and relative prices were the basic ingredients of analyzing famine.

The basic estimating equation is:

[20]Changes in grain supply can affect the availability of net energy, protein and fat in a standard diet. See Piazza (1986) for conversion of food to nutrition levels which took into account the factors such as animal feed, agricultural seed and grain lost in processing and distribution. This paper does not systematically deal with the efficiency of food consumption and uses.

years are expected to be a negative function of A (that is,

international trade and the national death rates within the famine period exhibited noticeable changes. Additional time interactions facilitate an examination of within period variations. This allows for a richer understanding of the actual situations.

It should be noted that this study does not systematically analyze the effect of epidemics on mortality rates. Famine related disease, such as cholera, malaria, fever, dysentery and diarrhea, may cause additional deaths. Sen (1981a) documented that disease related mortality usually persists into the years subsequent to the famine. In China, famine related epidemics may not be an important cause of excess deaths. Table 3 provides the evidence that mortality rates returned to the normal level in 1962, the year immediately after the crisis. In addition, we did not find any documentation on famine epidemics in China in the existing literature. Based on these information, we do not consider epidemics as a major determinant of famine deaths.

Estimation Results

Per capita grain output and its two-year moving averages are used as alternative availability measures. Applying one measure at a time, we fit a set of three regressions which include the basic specification, a formulation with quadratic terms of grain output and one with entitlement and availability measures interacting with each individual famine year. Provincial and time dummies are also included in each regression. In all specifications the statistics from Hausman test do not reject the null hypothesis that the fixed effect model is consistent and efficient, confirming our prior judgement. The F-values in all regressions reject the possibility that the specified variables do not significantly explain variations in provincial death rates. Another result is that the estimated parameters are almost identical for using either per capita grain output or its two-year moving average as the availability measure. However, the adjusted R^2 is consistently higher by about 1 percentage point if using the moving averages. Based on these information, we first report the baseline regressions of the two availability variables. Then, to avoid repetition, we only report the two variant regressions with moving average food

supplies.

Column (1) and (2) in Table 4 report the two basic regression results which give support to the main hypothesis that both entitlement and food availability are important causes of famine in the disaster years. The estimated coefficient (

entitlement effect in the famine period can be calculated using the conventional formula $r = t/(t + d.f.)$, where t is the t-value of

in 1961 gradually recovered from 1960 due to several factors: grain output increased by 4 million tons, the net export was reduced by about 7.2 million tons, and the national population decreased by about 3.48 millions. At the national level, these changes effected a 8.5 percent increase in per capita grain availability in 1961. These considerations help to understand the results that availability and entitlement have their most significant effects in 1960.

A second set of factors that may explain the observed yearly variations are the efficiency of food consumption and government adjustment policies. After the experience of massive starvation in 1960, people may adapt to the severe situations by forming more efficient consumption habit, by improving storage facilities, and by discovering efficient substitutes for grain. These activities may help to reduce hunger and famine deaths. Government adjustment policies may also help to achieve the same end. Total procurement was dramatically reduced in 1961 (Table 2). Also in that year, 10 million urbanites were sent to the countryside to release the pressure of urban food demand and to increase labor inputs for agricultural production (Bernstein 1984). The implications of all these adaptive activities are consistent with the statistical findings that entitlement and availability effects are stronger in 1960. The various adjustments made in 1961 resulted in less starvation and reduced the importance of the two factors as determinants of excess deaths.

V. Concluding Remarks

The food availability decline and Sen's entitlement are two leading hypotheses for the causation of famine. Previous research based on case studies has given independent support to each of the accounts. In this paper we have analyzed the Chinese famine of 1959-61 by considering availability and entitlement as complementary causes. In the Chinese centrally planned system, the problems of food entitlement originated from the biased policies in favor of urban residents, who were given the legal right to food through a ration system. The peasantry as food producers were burdened by coercive quota and only entitled to the residual food supply. We choose province as the basic analytical unit not only because of the constraint of data availability but because each province had a portion

of the population guaranteed with food and it had obligations to meet a procurement target set by the central government. Statistical analysis shows that during the severe supply shocks in 1959–1961, both per capita grain output (an availability proxy) and percentage of rural population in a province (an entitlement proxy) are important determinants of the observed death rates in that province. A larger reductions in per capita grain supply caused more death tolls and a larger urban population resulted in less famine victims in a province. Moreover, provincial death rates explained by entitlement variations is about 4 times as large as the death rates explained by availability variations. This result indicates that institutional based factors were the principle cause of the Chinese famine.

In this paper we have attempted to introduce Sen's entitlement concept into a centrally planned system. This endeavor is rewarding because some results may be generalized to other economic systems. Sen (1981a, 1981b) documented that virtually all famine victims came from rural backgrounds in the famous historical famines. In addition, there were evidence of "food countermovement" away from the famine-affected regions and government policies which protected city food supply. These observations and our analysis all emphasize the importance of rural-urban and institutional based policies in famine analysis. This paper has made some progress in this direction. Much is still not known and much needs to be known.

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Table 1. Grain Output, Procurement and International Trade: 1959-61

Year	Output (million tons)	Quota (million tons)	Quota/ Output (%)	Export- Import (m tons)	Per Capita Grain (kg/year)
1954	169.52	50.89	30.02	1.7	278.5
1955	183.74	47.54	25.87	2.1	295.5
1956	192.75	40.22	20.87	2.5	302.8
1957	195.05	45.97	23.57	1.9	298.7
1958	200.00	51.83	25.92	2.7	299.0
1959	170.00	64.12	37.71	4.2	246.7
1960	143.50	46.54	32.43	2.7	212.7
1961	147.50	36.55	24.78	-4.5	230.8
1962	160.00	32.42	20.26	-3.9	243.6
1963	170.00	36.99	21.76	-4.5	252.3
1964	187.50	40.14	21.41	-4.7	272.6
1965	194.53	39.22	20.16	-4.0	273.7
1966	214.00	41.42	19.35	-3.6	291.9

Source: State Statistical Bureau, Quanguo Gesheng Zizhiqu Zhixiashi Lishi Tongji Ziliao Huibian, 1949-1989 (A Compilation of Historical Statistical Data of Provinces, Autonomous Regions, and Municipalities), Beijing: China Statistical Press, 1990; p. 12, p. 26. Ministry of Agriculture, Planing Bureau, Nongye Jingji Ziliao, 1949-1983 (Economic Data of Agriculture, 1949-1983), Beijing: Ministry of Agriculture, 1984, p. 434.

Table 2. Summary Statistics of Population, Death Rate and Birth Rate, 1954-66

	Population			Death Rate			Birth Rate		
Year	Nation (million)	City (%)	Country (%)	Nation (.1%)	City (.1%)	Country (.1%)	Nation (.1%)	City (.1%)	Country (.1%)
1954	602.66	13.7	86.3	13.18	8.07	13.71	37.97	42.45	37.51
1955	614.65	13.5	86.5	12.28	9.30	12.60	32.60	40.67	31.74
1956	628.28	14.6	85.4	11.40	7.43	11.84	31.90	37.87	31.24
1957	646.53	15.4	84.6	10.80	8.47	11.07	34.03	44.48	32.81
1958	659.94	16.2	83.8	11.98	9.22	12.50	29.22	33.55	28.41
1959	672.07	18.4	81.6	14.59	10.92	14.61	24.78	29.43	23.78
1960	662.07	19.7	80.3	25.43	13.77	28.58	20.86	28.03	19.35
1961	658.59	19.3	80.7	14.24	11.39	14.58	18.02	21.63	16.99
1962	672.95	17.3	82.7	10.02	8.28	10.32	37.07	35.46	37.27
1963	691.72	16.8	83.2	10.04	7.13	10.49	43.37	44.50	43.19
1964	704.99	18.4	81.6	11.50	7.27	12.17	39.14	32.17	40.27
1965	725.38	18.0	82.0	9.50	5.69	10.06	37.88	26.59	39.53
1966	745.42	17.9	81.1	8.83	5.59	9.47	35.05	20.85	36.71

Source: State Statistical Bureau, Statistical Yearbook of China 1991, Beijing: State Statistical Press, 1991, pp. 79-80.

Table 3. Death Rates of the Chinese Provinces: 1954-1966, unit .1%

Province	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
(1)Beijing*	8.6	9.5	7.7	8.2	8.1	9.7	9.1	10.8	8.8	8.1	8.3	6.8	7.2
(2)Tainjing*	9.3	9.9	8.8	9.4	8.7	9.9	10.3	9.9	7.4	7.3	7.8	6.2	6.9
(3)Hebei	12.1	11.6	11.3	11.3	10.9	12.3	15.8	13.6	9.1	11.2	10.9	8.7	8.7
(4)Shansi	14.7	12.9	11.6	12.7	11.7	12.8	14.2	12.2	11.3	11.4	14.0	10.4	10.3
(5)Neimonggu	20.9	11.4	7.9	10.5	7.9	11.0	9.4	8.8	9.0	8.5	11.8	9.3	8.1
(6)Liaoning	8.6	9.4	6.6	9.4	6.6	11.8	11.5	17.5	8.5	7.9	9.3	7.1	6.2
(7)Jilin	10.4	9.9	7.5	9.1	9.1	13.4	10.1	12.0	10.0	9.4	12.6	9.7	8.6
(8)Helongjiang	11.1	11.3	10.1	10.5	9.2	12.8	10.6	11.1	8.6	8.6	11.5	8.0	7.4
(9)Shanghai*	7.1	8.1	6.8	6.0	5.9	6.9	6.8	7.7	7.3	7.0	6.1	5.7	5.3
(10)Jiangsu	12.2	11.8	13.0	10.3	9.4	14.6	18.4	13.4	10.4	9.0	10.1	9.5	8.1
(11)Zhejiang	13.4	12.6	9.5	9.3	9.2	10.8	11.9	9.8	8.6	7.9	9.2	8.1	7.1
(12)Anhui	16.6	11.8	14.3	9.1	12.3	16.7	68.6	8.1	8.2	7.9	8.6	7.2	7.1
(13)Fujian	10.9	8.9	8.4	7.9	7.5	7.9	15.3	11.9	8.3	7.4	8.6	7.3	7.1
(14)Jiangxi	14.2	16.2	12.5	11.5	11.3	13.0	16.1	11.5	11.0	9.8	10.9	9.4	8.5
(15)Shangdon	11.7	13.7	12.1	12.1	12.8	18.2	23.6	18.4	12.4	11.8	12.0	10.2	9.9
(16)Heinan	13.3	11.8	14.0	11.8	12.7	14.1	39.6	10.2	8.0	9.4	10.6	8.5	8.2
(17)Hubei	15.9	11.6	10.8	9.6	9.6	14.5	21.2	9.1	8.8	9.8	10.9	10.0	9.7
(18)Hunan	17.5	16.4	11.5	10.4	11.7	13.0	29.4	17.5	10.2	10.3	12.9	11.2	10.2
(19)Guangdong	11.2	10.6	11.1	8.4	9.2	11.1	15.2	10.8	9.4	7.6	8.3	6.8	6.4
(20)Guangxi	15.2	14.6	12.5	12.4	11.7	17.5	29.5	19.5	10.3	10.1	10.6	9.0	7.5
(21)Sichuan	8.4	9.2	10.4	12.1	25.2	47.0	54.0	29.4	14.6	12.8	13.9	11.5	10.8
(22)Guizhou	8.8	8.1	7.5	8.8	13.7	16.2	45.4	17.7	10.4	9.4	10.5	8.4	9.2
(23)Yunnan	16.7	13.7	15.2	16.3	21.6	18.0	26.3	11.8	10.9	14.1	15.2	13.0	10.8
(24)Shansi	11.0	10.5	9.9	10.3	11.0	12.7	12.3	8.8	9.4	10.6	15.6	13.0	12.9
(25)Gansu	11.6	11.9	10.8	11.3	21.1	17.4	41.3	11.5	8.3	10.4	15.6	12.3	11.5
(26)Qinhai	13.3	14.1	9.4	10.4	13.0	16.6	40.7	11.7	5.4	8.4	15.5	9.1	9.8
(27)Ningxia	13.1	10.2	10.6	11.1	15.0	15.8	13.9	10.7	8.5	10.2	13.4	9.3	9.4
(28)Xinjiang	16.8	14.4	14.2	14.0	13.0	18.8	15.7	11.7	9.7	9.4	16.3	11.1	9.4
Nation	13.2	12.3	11.4	10.8	12.0	14.6	25.4	14.2	10.0	10.0	11.5	9.5	8.8

Note: Regional classification: North=(1)-(5), North East=(6)-(7), East=(9)-(15), Center South=(16)-(21), South West=(21)-(23) and North West=(24)-(28).

Source: State Statistical Bureau, Quanguo Gesheng Zizhiqu Zhixiashi Lishi Tongji Ziliao Huibian, 1949-1989 (A Compilation of Historical Statistical Data of Provinces, Autonomous Regions, and Municipalities), Beijing: China Statistical Press, 1990.

Table 4. OLS Fixed Effect Estimation of Provincial Death Rates, 1954-66: Per Capita Grain Output and Two-Year Moving Averages as Availability Measures

Independent Variables	Dependent Variable = Provincial Death Rate (.1%)			
	A=Per Capita Grain Output	A=Two-Year Moving Averages		
	(1)	(2)	(3)	(4)
% Rural Population (E)	.011 (.067)	-.013 (.067)	-.031 (.078)	.023 (.071)
ExFamine Years (D)	.195** (.039)	.196** (.040)	.245** (.056)	__
Ex1959	__	__	__	.083* (.059)
Ex1960	__	__	__	.491**
Ex1961	__	__	(.060) __	.042
Food Availability (A)	-.006 (.008)	-.005 (.011)	(.062) -.037 (.037)	-.011 (.010)
AxFamine Years (D)	-.022** (.009)	-.021** (.009)	-.065* (.042)	__
A^2	__	__	.000039 (.000048)	__
A^2*Famine Years (D)	__	__	.000086 (.000076)	__
A*1959	__	__	__	-.001
A*1960	__	__	(.011) __	-.060**
A*1961	__	__	(.014) __	-.020 (.017)
Provincial Dummy	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes
F-Statistics	8.061	8.017	7.732	9.261
Adjusted R^2	.461	.474	.474	.528
Hausman-Statistics	3.616	2.796	.000	10.001
Probability Value	.460	.592	1.000	.265

Note: Numbers in parentheses are standard errors. * and ** devote statistical significance at the 10 and 5 percent level.

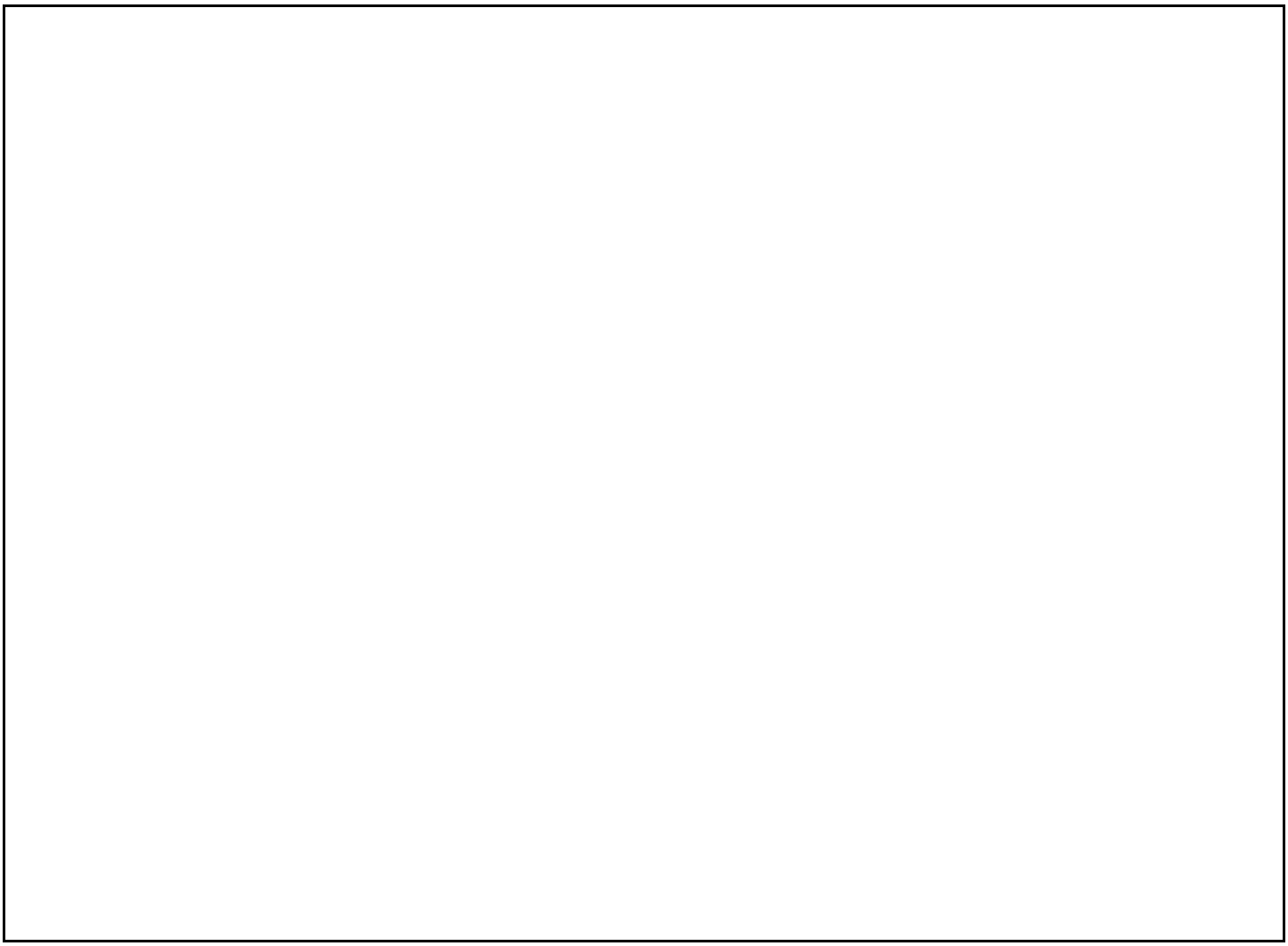

Figure 1: Birth Rate and Death Rate in China, 1949–1989

Source: State Statistical Bureau, 1990, p. 2.