

Politics and Economics: Extending Entitlements Analysis

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Major Paper presented to the

Department of Economics of the University of Ottawa

in partial fulfilment of the requirements of the M.A. Degree

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ECO 7997

Ottawa, Ontario

September 1996

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1.0 Introduction

Michael Mortimore (1989) writes that, 'The purpose of studying famine is to contribute to its elimination'. It is in this spirit that I have chosen to contribute to this field. The facts are stark. Since the turn of the century there has been an unprecedented growth in real income the world over. In virtually every year this century the growth in the volume of food produced has outstripped the growth of the human race itself. Yet starvation and its attendant problems continue to haunt us. Television clips regularly beam these tragedies into our living rooms as a graphic reminder of misery amid affluence. This paper attempts to add a fresh perspective to the study of famine, it asks what processes ultimately precipitate famine. This paper first defines what a famine is in the subsection which follows. Section 2.0 discusses the evolution of famine analysis and highlights the current direction of debate. Section 3.0 deals with the role of public policy with regard to famines; subsection 3.3 takes a modelling approach to the positive role that government intervention can play in alleviating starvation. Section 4.0 is a comparative country study which illustrates how accountability has affected public strategy for dealing with food crisis in India and China. Section 5.0 summarizes and suggests avenues for further research.

1.1 What is a 'famine'?

To the lay person the term 'famine' conjures up images of an abnormal and dramatic event that leads to a mass starvation. Because of its unmistakable effects some scholars have questioned the need to provide any definition at all as a preliminary step to subsequent analysis. Sen (1981 pp.39-40) says: "While there is quite a literature on how to "define" famines, one can often diagnose it - like a flood or a fire - without being armed with a precise definition". Devereux (1993) nonetheless puts forward three reasons why it is essential to review definition as a starting point for any study. The first reason is that a definition is essential for establishing a rigorous framework of the

phenomena under study. Secondly, many widely accepted definitions are weak and misleading because the theoretical framework may be deficient. Thirdly, definitions often generate criteria upon which policy measures are based. The diagnostic purpose of a definition is therefore essential.

Dictionary definitions of famine highlight two features; that of severe shortages of food and that of starvation. A number of academics also define famine by emphasising the above features. Ferris and Toyne (1970, pp.60) define it in the following manner: "A temporary, but severe, local food shortage is called a famine. It is generally the result of an almost complete crop failure in an area of subsistence or near subsistence farming". Similarly, Watts (1983, pp.17-18) writes: "A famine is a food shortage leading to widespread death from starvation; a societal crisis induced by the dissolution of accustomed availability of, and access to, staple foods on a scale sufficient to cause starvation among a number of individuals". Cox (1991, pp. 5) extends the scope of earlier definitions by introducing the notion of distribution, in addition of food shortage: "Famine may be defined as the regional failure of food production or distribution systems, leading to increased mortality due to starvation and associated disease". The recurring themes in characterising famine are those of mass starvation leading to mortality.

While the above definitions accept mass starvation and mortality as features of famine, it is the implicit presupposition of these definitions, that food shortages are an essential prerequisite, which stands disputed. Indeed, given the definitions reviewed above it is impossible that famine should occur in the absence of food shortages. Historically, however, famine - such as the Bengal famine of 1943 - has occurred in the midst of plenty. This suggests that definitions of famine based solely on notions of food availability are flawed. Indeed, as is underscored by Sen's (1981, pp. 1) opening sentence in Poverty and Famines puts the above definitions into context: "Starvation is the

characteristic of some people not *having* enough food to eat. It is not the characteristic of their *being* not enough to eat. While the latter can be a cause of the former it is but one of many *possible* causes.”

Thus a satisfactory definition of famine must consequently address the fact that food shortage is neither a necessary nor a sufficient condition for famine to occur. A more appropriate definition of famine can be constructed by approaching the phenomena not simply in terms of food availability but, rather, in terms of food intake. Sen (1981) puts forward a definition of famine as a process which has inherent in it a ‘time contrast’:

“In analysing starvation in general, it is important to make a clear distinction between three different issues. (1) lowness of the *typical level* of food consumption; (2) *declining trend* of food consumption; and (3) *sudden collapse* of the level of food consumption. Famine is chiefly a *problem of the third* kind.”

Notice that Sen’s emphasis on the ‘sudden collapse’ of food intake enables one to distinguish famine from endemic hunger. This is important because it prevents one from confusing the two related but distinct phenomena of endemic hunger and famine. Sen’s definition of famine is therefore probably the most widely accepted in recent times. Note also that the definition has wide applicability because it does not specify the causal mechanism, but focuses rather on what many scholars agree is the key feature of famine, i.e, a rapid fall in food intake over a period of time¹. De Waal (1989, pp.192) has also pointed out that excess mortality is usually another feature common to famine; this may be caused by starvation alone or by disease afflicting a starving and weakened population. A more complete definition of famine may be: *A process where a collapse in the level of food consumption*

¹For further discussion and endorsement of Sen (1981) view point, refer to Woldemariam (1984), Devereux (1993), Sobhan (1990)

results in a rise in mortality. Having defined for our purposes what a famine is, we now review the evolution of famine theory.

2.0 Theories of Famine Analysis

The literature on famine predates the modern discipline of political economy. Chanakya (*circa. 300 BC*), Prime Minister of the Indian Emperor Chandragupta Maurya, devoted many chapters to the study of famines in his celebrated treatise on statecraft, the *Arthashastra*. The Chinese philosopher Confucius also wrote extensively on famines. The earliest scholars squarely blamed famine on 'acts of God'. Glantz (1987, quoted in Devereux 1993, pp. 36) summarises the 'act of God' position thus:

“ As, such climate was considered a major, if not dominant, constraint to economic and social development in many locations around the world. The view was that either a region received enough rain for agricultural production and yields and production would be high, or it did not and production would be low and erratic.”

Although scholars such as Cox (1981) have tried to resurrect the 'act of God' explanation by proposing that 'natural famine belts' exist on the earth due to climatic factors, evidence on the success of traditionally famine prone countries at combatting famine seems to have put an end to 'act of God' school.

Modern famine theory, however, starts with the contribution of the Classical Economists. Thomas Malthus' works Essay on the Principle of Population (1798) and An Investigation of the Causes of the Present High Prices of Provisions (1800) were the first comprehensive treatise on the issues of hunger, poverty and starvation. In striking contrast to these conventional beliefs, Malthus proposed that famine could be an outcome of human activity. Malthus argued that famines

were outcomes of an imbalance between the production of food and the size of the population. Increases in population outstripping increases in the level of food production was seen as the human activity which induced famine. Moreover, since population growth of the poor was considered uncheckable, and limits to the level of food production absolute, the Malthusian idea dominated discussion and policy about famine until the 1980s.

The dominance of the Malthusian view was not strongly challenged until the mid to late seventies when Ethiopia, Bangladesh and Sudan suffered serious famine without experiencing a fall in food output. Clearly the Malthusian/Supply failure theory could not explain these catastrophes. This led some scholars to look for other explanations. What eventually emerged was a theory of demand failure as a cause of famine, that is a collapse in the ability for some people to buy food.

Drawing from historical events, Sen (1977) provided evidence to show that the Bengal famine of 1943 resulted from a failure in demand. This analysis was subsequently extended to the Sahel and Bangladesh in 1981. The appearance of Sen's entitlement approach was to spark a fierce debate about the relative roles of supplies of food and demand for food as causes of famine, which carries on to this day. Sen coined the term *Food Availability Decline* (FAD) to refer to the supply-focused theories of famine analysis; it is also the term we will be using. Sections 3.0 and 4.0 critically examine the two schools, pointing out limitations and their relevance in effective policy making.

2.1 The FAD Approach

Until the 1980s, supply failures were widely seen as the cause of famines. The earliest modern exposition of this view was put forward in Malthus's (1789) Principles of Population. He writes:

“First, that food is necessary to the existence of man. Secondly, that the passion between the sexes is necessary, and will remain nearly in its present state.....Assuming, then, my postulata as granted I say the power of population is indefinitely greater than the power of the earth to produce subsistence for man. Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will show the immensity of the first of the first power as compared to the second. By that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers must be kept equal. This implies a strong and constantly operating check on population from the difficulty of subsistence.”

Malthus's original views have since received considerable scrutiny, particularly from an empirical stand point . Famines may not act as natural checks at all. Devereux (1993) points out that although the number of deaths in an famine are large in absolute terms, they usually represent a small proportion of national or even local populations. Evidence suggests that demographic crisis may trigger a post crisis demographic response, eg. a post crisis baby boom (Bongarts and Cain 1982, pp. 52). The populations of China and Bengal returned to their pre famine trend lines with two decades of the famine. Field (1989) draws on the Bangladesh famine to dramatically illustrate the same phenomena; in Bangladesh where famine deaths in 1974 represented 2% of the population, were outstripped by a population growth rate of 3%. Also the advent of contraception has meant that 'passion between' the sexes now is possible without adding to the population.

Despite its lack of predictive power in today's context, Malthus's ideas continue to find life with Neo-Malthusian scholars, who have considerably refined the original postulata. Devereux (1993) has laid out the modern FAD approach in five steps:

1. Population and demand for food increase at a parallel rate.
2. The rising demand for food can be satisfied either by more extensive cultivation or by intensive cultivation.
3. Land is both scarce and of variable quality. More fertile land is cultivated first, but as population pressures increase less fertile land is brought into cultivation, so that the marginal productivity of both land and labour declines as a result of extensive cultivation.
4. Attempts to increase output by intensive means will fail as the marginal productivity of labour falls because of diminishing returns.
5. Because of these inevitable diminishing returns to both land and labour, food production will always grow at a slower pace than population. Eventually, these limitations on potential food production will act as a binding constraint on population growth, with famine being the mechanism of control.

The Malthusian postulates have had a profound influence on policy making. Some authors such as Devereux (1993) attribute the popularity of the Malthusian position to its 'attractive simplicity', and in particular to the seductive characteristics of the elementary mathematical principles on which it rests. The main variables used to study or predict famine were the metric of food output and population, both relatively easy to measure. Most famine relief codes, such as the Indian Famine Codes of 1880, are based upon the changes in per capita availability of food, having a significant implications for famine policy.

Scholars of the FAD school periodically raise the alarm about impending food crises in the future: Lester Brown's (1995)'s recent work is such an example. Indeed, numerous studies sponsored by the Club of Rome have reached conflicting conclusions. The highly sensationalised

shortfalls in grain productions in the early 1970s fuelled speculation about the approaching crisis. Brown (1976) invoked classic Malthusian arguments to raise the spectre of widespread famine, thus in an influential monograph building a case for aggressive public policy measures to counter global population growth:

“Looking at the world of the early seventies, one is struck with the sobering realization that it appears to be losing the capacity to feed itself. The reasons for this, on the demand side, is the impact of rising affluence and population growth. The annual increase in demand for food is now immense.....we need to rely much more on curbing demand if we expect a reasonable balance with the supply of food at an acceptable price. Curbing population growth can make a difference.”

The prophets of doom do not seem to have been vindicated by history. They may find it difficult to explain how countries, historically prone to famine, have managed to avert the phenomena.

Woldenmariam (1984) rejects the notion the population pressures could explain famine:

“The problem of famine is not necessarily and solely related to population growth. Many countries in Western Europe, Tsarist Russia and China have histories of famine. Now in the same countries, in spite of larger populations, famine does not occur. This, certainly, is sufficient to exclude population growth as the cause of famine.”

Many countries which had run up against their “maximum” possible sustainable populations now sustain even larger populations. India in 1964, with a population of 550 million was condemned to starvation by many. In 1966, India became self sufficient in food grains production and continues to be in spite of an 80% increase in population. Improved agricultural methods certainly contributed to India’s breaking through the “ceiling”. And while it is possible that agricultural productivity may not increase indefinitely, there is also no evidence that population may increase indefinitely. Looking at Europe as a region, one notices how the populations of some countries have begun to decline after decades and even centuries of growth. While the same pattern may or may not emerge for the world, it is a distinct possibility. China’s population growth rate

declined from 3% p.a. in 1949, to just under 1% at present. India's decline has taken longer, but it is nonetheless happening. If at some future point the world were to hit the ceiling in terms of agricultural productivity the result would be an global decline in food intake, and not short sharp regional collapses in food intake. The FAD analysis would thus be a theory of endemic hunger, not famine.

The FAD analysis can also be faulted for seeking to address problems which are non-existent; to talk about future food crises while ignoring the existence and occurrence of wide spread hunger in the present appears somewhat misplaced. Even if one were to concede to the neo-Malthusians the possibility of future 'limits of growth', the FAD approach is inherently flawed as a theory of famine. For while it is not a matter of controversy that famine and starvation should occur when there is a general contraction in food output, Malthusian mathematics leaves one unable to explain why famines should occur in the midst of plenty.² Nonetheless, an important characteristic of many recent famines has been the absence of (or only modest) declines in food output per capita when compared to 'normal' years. Sen writes:

"Famines may not at all be anticipated in situations of good or moderate over-all levels of supply, but, notwithstanding that supply situation, acute starvation can hit suddenly and widely because of a failure of the entitlements system, operating through ownership and exchange. For example, in the Bangladesh famine of 1974, a very large number of people died in a year when food availability per head was at a peak -higher than at any other year between 1971 and 1975." (Sen 1983, pp.498)

The key flaw in the FAD approach is the blindness induced by '*Malthusian optimism*', i.e. not being worried about the food problem so long as food output grows at least as fast as population.

²Many authors such as Devereux (1993), Dando (1980) and Sen (1982) have dismissed Malthus's postulate as pseudo-precision without any empirical basis. Sen goes further and describes Malthus's 'particular fascination' with numbers as mischievous; 'an attempt to get profound insights from elementary mathematics - a tendency not altogether unknown in modern economics as well'.

The overemphasis on aggregate indicators of food availability has too often delayed response to famines. The problem arises because of the complacency which can result if rising food supply per capita is taken as evidence that individual food consumption per capita is rising concurrently. In summary the FAD approach indicates one way of looking at famines; it says nothing about the causal mechanism and cannot explain the occurrence of famine in the absence of food shortages. Thus the FAD approach is clearly limited. The entitlements approach first expounded by Amartya Sen (1977 & 1981) and refined by others has provided a better framework within which to analyse famines. The entitlements approach concentrates on peoples ability to command food through various means available to them including production possibilities and entitlements vis-à-vis the state. The entitlements approach, together with its various concepts and extensions, is examined in the following section.

2.2 The Entitlements Approach

The publication of Sen's *Poverty and Famines* (1981) introduced a completely new approach to the analysis of famine, based on the notion of entitlements analysis. The entitlements approach shifted the focus of famine analysis from that of supply to demand whilst creating considerable controversy. Since the 1980s the entitlements approach has gained wide acceptability as an alternative framework of famine analysis. In this section I lay out the entitlements approach, discuss its strengths and limitations, and suggest this framework may be extended to provide a more complete analysis of famine.

The entitlements approach expounded by Amartya Sen can be distinguished from the FAD school in that it focuses principally on the capacity of individuals to acquire food, either as a consequence of cultivation or through market transactions. Although very much a 'modern' theory

of famine, the entitlements approach has its roots very much within classical economics. Indeed, both David Ricardo and Adam Smith implicitly used this approach in their analysis of famine. Ricardo's application was in the context of the Irish famine of 1822. In a speech to Parliament Ricardo refuted the idea that famine was impossible in Ireland due to a superabundance of food (Sen 1990). He was acutely concerned about the problem of 'acquirement', or more precisely how the starving population could acquire the food in the absence of effective purchasing power. Adam Smith, in Book I of the Wealth of Nations has focused on market based entitlements of wage labour and has attempted to explain famine from that perspective:

“But it would be otherwise in a country where the funds destined for the maintenance of labour were sensibly decaying. Every year demand for servants and labourers would, in all classes of employment, be less than it had been the year before. Many who had been bred in superior classes, not being able to find employment in their own business, would gladly seek it in the lowest. The lowest class not only being overstocked by their own workmen, but with overflowing from all the other classes, the competition for employment would be great in it, as to reduce the wages of labour to the most miserable and scanty subsistence of the labourer. Many would not be able to find employment even on these hard terms, but would either starve or be driven to seek a subsistence either by begging, or by the perpetration of the greatest enormities. Want, famine, and mortality would prevail in that class, and from thence extend themselves to all superior classes.”

While the great classical economists recognized the problems of acquirements and entitlements, it was left to Sen (1981) to conceptualize the phenomena of poverty and famines in a monograph of the same name. Two fundamental arguments were advanced in this work. First, reacting against the emphasis put on the social relativity of poverty, Sen argued that there is indeed such a thing as absolute poverty, seen at its starkest during famines. Sen also emphasized that in order to fully understand the phenomena of famine and hunger it is important to take a socially disaggregated view of poverty. It was implied that a distinction needed to be made between various groups in terms of their access to basic necessities. It is this latter argument which is of relevance to us.

2.2.1 Some Concepts and Terminology

This subsection deals with the notion of entitlements as initially advanced by Sen, and introduces one to entitlements terminology, some of which will be used later on. His original thesis was presented in connection with the Great Bengal famine of 1943-1944, in which perhaps 3 million people perished. The peculiarities of the famine caused Sen to formulate two important and related criticisms from his study. He noted firstly that the FAD approach provided an inadequate explanation of the occurrence of the famine and, secondly, that policy based on FAD analysis had been ineffective. In fact, most of those who perished from starvation died not because per capita food production tumbled, but because they lacked socially sanctioned claims, or effective legitimate command over food. This command over food is called an individual's *entitlement*.

Sen (1981) developed a set of novel concepts for analysing the famines of Bengal, Bangladesh and Ethiopia. These concepts are summarized below. An individual's bundle (set) of resources (including his/her own labour power) is referred to as the individual's *endowment*. The set of commodity bundles that can be legally obtained by using one's endowment and opportunities is one's *exchange entitlement*. e.g. A carpenter receiving payment for building a desk is exchanging his skill (*endowment*) for the means with which to acquire a set of commodity bundles. Sen also set up a relation which specified the set of possible commodity bundles that are legally attainable from any given ownership bundle via trade or production.³

³This concept appeared briefly in the 1981 book and was called the Exchange Entitlements Mapping or E-mapping. The rigidity of the E-mapping framework has ensured its disappearance from subsequent entitlements literature, including Sen's own writings. It nonetheless merits this passing. See Sen (1981)

It is the relationship between food and entitlements which is pertinent to the analysis of famine:

“A person is reduced to starvation if some change either in his endowment (eg. alienation of land, or loss of labour power due to ill health), or his exchange entitlement mapping (eg. Fall in wages, rise in food prices, drop in the price of goods he buys and sells), makes it no longer possible to acquire a commodity bundle with enough food.”

Sen (1981) defines the onset of starvation as the collapse of an individual's entitlement in a 'starvation set', i.e. a commodity bundle not containing enough food. The collapse may occur in one of two ways: a) *Direct Entitlement Failure* - a shift in entitlements below subsistence level as a result of a decline of endowment. b) *Trade Entitlement Failure* - a fall in entitlements occurring from an unfavourable shift in the terms of exchange between commodities one sells and the food that one needs to buy. While the two types of failures may occur independently, one could certainly cause the other. As Devereux (1993) points out, in case of subsistence farmers, the latter type of failure occurs typically after the former.

2.2.2 The Strengths of the Entitlements Approach

The entitlements approach has been revolutionary in that it has directed attention away from the conventional supply-failure explanations of famine. The entitlements approach treats famine as the inevitable outcome of a collapse in the effective demand for food. What proponents of the entitlements approach have successfully pointed out, however, is that generalizations drawn from aggregate variables such as food availability per capita imply nothing about the distribution of food. The corollary of this observation is that the effects of famine are rarely shared equally among all elements of a population. Stein et al. (1975, pp.47-51) provide an illustration from the Dutch famine of 1944:

“The more fortunate got sporadic extra supplies from the black market and from forages into the country (hongertochten).....A successful hongertocht required knowledgeable contacts who could supply addresses of farmers who might have and sell food, a bicycle, and valuables to barter for the food. Knowledgeable contacts could come from occupational and family contacts.....estimates suggest that at the height of the famine, extra legal sources doubled the extremely meagre official ration. The estimates do not reflect the experience of a large segment of the population who could not afford black market food....The lower classes were at a disadvantage.....”

Thus an important feature of the entitlements approach is that it avoids misleading generalizations and aggregations, focusing instead on the access to food of individuals and groups within society.⁴

Another merit of an entitlements based analysis is its ability to explain famines in the absence of national or regional economic crisis. Intuitively famines should occur during times of economic crisis, but Sen’s (1977 & 1981) studies of the Bengal famine showed this was not necessarily the case. The Bengal famine of 1943 has been characterized as a ‘boom’ famine, because it occurred during a period of economic expansion. What is unique about such occurrences is that the *exchange* or *trade* entitlements of some people may fall because of a rise in the price of food or the marginalization of certain groups in society:

“Boom famines might seem particularly counter intuitive; but, as discussed, famines can take place with increased output in general and of food in particular if the command system (eg. Market pull) shifts against one particular group.....In the fight for market command over food one group can suffer precisely from another groups prosperity.” (Sen 1981, pp. 165)

⁴The basic unit of analysis chosen by Sen seems to be ‘occupational groups’ and ‘communities’, although a ‘class’ analysis could easily be carried out, Devereux (1993) asserts that the reason why ‘class’ as a unit of analysis was not included was because of its strong political connotation.

Quite simply, a boom for some could well mean increased vulnerability for others. As in the case of Bengal, although there was no FAD, precautionary and speculative hoarding, together with the pressures of a wartime economy exerted upward pressure on the demand and prices of food. This was not matched by a comparable increase in incomes, particularly of rural labour. Urban areas were insulated from this price rise by a state distribution system, the countryside was not. The result was 3 million deaths.

‘Slump famines’ are often the outcome of natural disasters. The most obvious example is that of crop failure following drought or floods. Slump famines typically result in direct entitlements failures. The failure of direct entitlements for one group may lead to a loss of income by other groups. Da Corta (1986) explains that ‘slump’ famines cause a decline in the incomes of the cultivating population, which in turn affects the income of those dependent for employment on the cultivating population. As Sen (1981) and Osmani (1990) point out, it is landless labourers who are most vulnerable in slump famines because of depressed incomes. Studies have shown that even if the price of food remains unchanged during a ‘slump’ many people become vulnerable to starvation because they may lose their sources of income (a loss in trade entitlements), thus leading to starvation. In poorer regions of the world this is typically the case for those groups who lack the ability to produce their own food, such as rural labourers and nomads. The relation between entitlements and famine is best summed up by Richards (1983): ‘famine is the result of the collapse of an established entitlements system’.

2.2.3 Implications for policy

The entitlements approach has different implications for policy from the supply side explanations of famine. The Malthusian emphasis on aggregate variables for monitoring the threat of famine

stands disputed. As mentioned earlier, Sen has used the entitlements approach to refute what he termed '*Malthusian optimism*' and '*Malthusian pessimism*'. '*Malthusian pessimism*' is reflective of the still widely held view that food production cannot match population growth and famine is an eventual outcome of this imbalance. The analytical shortcomings of this view has been discussed earlier. It is however significant that policy arising out of '*Malthusian pessimism*' has been directed towards reducing the fertility of the poor instead of addressing the underlying causes of famine, namely poverty and deprivation.

As far as famine relief is concerned, the entitlements school and FAD school hold conflicting views on the ability of the market to redress regional imbalances of food. While the traditional view has that the market mechanism alone can cure famines, entitlements analysis has shown that this may not be the case. FAD analysis states that famines occur through a failure of the market mechanism to provide food to deficit areas. Devereux (1993) expresses the entitlement approach's position on the matter by asserting that famines are but a predictable consequence of normal market processes. Given that markets respond to purchasing power, it is not unusual to see the movement of food out of famine afflicted areas. Sen (1982, p.456) has made the following observation:

“...private merchants and traders will not move food to famine victims when their needs are not translated into money demands. Indeed, frequently food does move out of famine areas when the loss of entitlement is more powerful than the decline-if any- of food supply, and such food 'counter-movement' has been observed in famines as diverse as the Irish famine of the 1840s, the Ethiopian famine in Wollo of 1973 and the Bangladesh famine of 1974.”

While Sen accepts the proposition that sudden disruptions in the existing market systems (ban on inter-regional grain transfer during 'normal' conditions) may induce famine, he has shown that once

a famine is in progress the market mechanism needs to be complemented by recreating lost entitlements.

While the FAD approach may be helpful in identifying regions afflicted by famine, distributional shifts are certainly not reflected by balance sheets showing food stocks and flows. An obvious policy implication of the entitlements approach is that famine relief measures can be better targeted and executed if an entitlements analysis were adopted. Most significantly, the entitlements approach prescribes very different remedies to famines once they have been identified. During famine, one way of generating entitlements is to distribute free food. A more appropriate method suggested by de Waal (1990) and Sen (1995) is to set up food for work programmes. These are seen as more advantageous because they are thought to be self targeting. Looking beyond immediate famine relief, Sen (1988) suggests longer term policies aimed at diversifying entitlements, by expanding the sources of personal income. Many studies, such as Dercon (1992), Heyer (1991) and Christensen (1989) from a variety of African contexts, have demonstrated the importance of diversified sources of income. Devereux (1993) emphasises that famines can be eliminated only by a sustained attack on conditions which give rise to food insecurity and famine.

2.2.4 Beyond Entitlements

During the eighties, the entitlements analysis approach emerged as an alternative and somewhat more compelling frame work to study famines. Despite its acceptance, the original proposition had many gaps in it. These limitations were accepted by Sen even when he first proposed the notion. Since the appearance of Sen's 1977 article, the entitlements approach to famine analysis has been widely critiqued, debated and extended. This section deals with the limitations and extensions of the entitlements approach.

Sen (1981) formulated the entitlements approach in the context of a private exchange economy, with a very strong concept of private property rights. It is therefore unsurprising that the entitlements approach runs into some problems when an individual's entitlements may be ambiguously specified, especially in societies where property rights are not defined. This may cause difficulty in applying the theory in societies where land is held in communal ownership. Sen himself accepts this as a limitation in entitlements analysis. While this is at odds with the letter of his formulation, this can be more easily accommodated within the philosophical framework of entitlements analysis. This is because during famines it is possible to study failures of entitlements for groups rather than individuals. As experience shows, it is normally the case that groups of individuals with shared characteristics - social, ethnic or economic - are hardest hit by famine. Secondly, extra-legal activity was not included within the framework of entitlements. Experience with recent famines in the Sudan and Somalia have caused a reevaluation of the scope of entitlements analysis. de Waal (1990) was quite vociferous in pointing out that all famines did not occur in Bengal-like situations where social harmony remained undisturbed. Violence and social upheavals can have detrimental effects on an individual's ability to command food. Osmani (1990) has pointed out that it is quite possible to include famines which have occurred due to social upheavals within the entitlements framework. Famines at some point involve a failure of entitlements to food. In this sense violent removal of food by RENAMO bandits in Mozambique does constitute a failure of a peasant's legal rights (whatever they may be) over food. Thus it is argued that disruption and violence can precipitate a famine through a removal of entitlements to food.

Third, the approach implicitly assumes that people facing starvation will consume as much food as they can. In Poverty and Famines (1981) Sen declares that the entitlements approach does

not include 'starvation by choice' within its domain of analysis. The importance of 'starvation by choice' was, however, subsequently pointed out by Svedberg (1985), whose contribution Sen acknowledged (Sen 1986a). Studies of poor households' responses to famine has confirmed that rationing of consumption is the immediate response to food shortage. Jodha (1975) observed that Indian farmers reeling under drought chose to starve rather than sell their assets. Assets are perceived as protection to the future income of farmers, and thus the choice between starvation and disposing off assets is an inter-temporal trade off. Depressed incomes usually mean that farmers would receive low prices for their assets and thus they are hesitant about disposing off potentially productive assets. de Waal (1990) also noted a similar pattern in the Sudan, where the preservation of the existing way of life was deemed more important than satisfying the 'pangs of hunger'. Devereux (1993) has criticized the entitlements approach as being too narrowly concentrated on food consumption during famines:

"The evident disagreement between the theoretical entitlement approach and the empirical coping strategies literature may reflect different perceptions of the nature of the famine. Whereas Sen talks of people being 'plunged into starvation', studies of household responses support the view that famine is a process rather than an event, during which a number of sequential adjustments (such as rationing) are made to minimize the twin threats of destitution and starvation."

Another key criticism of the entitlements approach is the lack of a political dimension. Stewart (1982, pp.146) concluded her review of Poverty and Famines in the following manner:

"This book offers a framework, not a cure....we need to get behind the elegant framework of the political economy of reality: what is the politico/economic system that lies behind entitlement collapses? How can they be avoided? Who will benefit or lose?..... The framework provides a scaffolding with which to build an analysis of the political economy of poverty and famines. But more is needed as an effective attack on either."

Similarly, Mitra (1982) has accused Sen of deliberately not relating the problem of poverty and famines to the 'phenomena of asset and income inequalities'. Devereux (1993) asserts that the

theory comments only elliptically on the political and socio-economic processes which precede the collapse of entitlements. Swift (1989) describes entitlements as 'ahistorical', unable to cope with underlying causes which ultimately shift entitlements. While it is unquestionable that a change in circumstances can push people to starve, it is equally true that this is a phenomenon unevenly distributed regionally and globally. These changes in circumstances can often be the outcome of policy failures or plain callousness. The following section puts the question of entitlements in a political economy setting with the view of establishing the role of politics in the issue of famine analysis.

3.0 The missing link: State, policy and famine.

That famines arise from 'entitlements failures' is a widely accepted proposition today. Access to food depends at least as much on the ability of individuals and households to establish command over it as it does on the supply of food. In the case of a market economy, the ability to command food depends both on direct entitlements and trade entitlements. These entitlements are influenced not only by production and exchange capability, but also by political power of households (Sobhan 1990). The function of the state, as Golding (1984) writes, is "the preservation of conditions necessary for human flourishing". Indeed, food is the most important ingredient for human flourishing. Thus the state can act not only as protector of entitlements, but also as a source of entitlement creation, via subsidies, etc. Even the possibility of relying on the market mechanism as means of exchange must be viewed within a broader politico-legal setting. Markets function within a legal system of right and contracts enforceable by the state. Both the FAD approach and the entitlements approach either disregard the role of the state or attach only minor importance

to it. That 'entitlements failures' or decline in food output may stem from state policy is overlooked by both these approaches. While it is accepted that a FAD may lead to a declining trend in food consumption, the FAD approach fails to account for violent disruptions in trends of food availability. And whilst Sen (1981) may claim in his defence that the 'entitlements' approach does not seek to specify any particular cause of famine, any attempt to provide a complete analysis of the causal mechanism of famine must include the role of the state. As we will see in the following sections, it is almost always the case that famines are an outcome of a complex socio-political processes and state policy plays a significant role in affecting that outcome. While there is little doubt that Sen's theory has revolutionised famine analysis in the 1980s and 1990s, it is equally true that the framework is in some sense incomplete. Without a political context the theory will remain focused on proximate causes of famine. This paper attempts to extend the entitlement approach in a political direction. Sobhan (1990) has dwelt briefly on a political angle to entitlements, with reference to Bangladesh. Sobhan's analysis however is limited to a how a public distribution system's can play a role in securing the entitlements of vulnerable groups. Richards (1983) is of the view that:

"Entitlement systems are beliefs, created by political practice, about who ought to get what under what circumstances, and the embodiment of those beliefs in legal and economic process, eg. land tenure, notions of family obligations, wage rates, rules of market transactions, etc. Such standards are contingent and time bound (they are specific to particular historical circumstances). Consequently they do not (and cannot be expected to) work according to absolute standards of equity. Nor can they be predicted from an economic model."

In this paper I shall try to adopt a more complete approach towards analysing the phenomena of famines and Richards quotation from above makes an excellent starting points for my proposition.

3.1 The Significance of state policy

All socioeconomic activity occurs within some form of 'constitutional' framework. This framework may include national laws or international convention. As the international dimension has been extensively explored upon by Sobhan (1990), this paper focuses primarily on the role of national governments and their policies on famine. This analysis has two sides to it. I first discuss the role of state policy in protecting entitlements and famine prevention. I then go on to discuss how state policy may also undermine the entitlements of various groups.

3.1.1 The state as a protector of entitlements

The role of state policy is clearly highlighted when we look at those countries where famines do not occur despite recurring natural disasters. Indeed natural disasters push humans into margins of subsistence when their conditions are already weakened. A natural disaster is in itself neither a necessary nor sufficient condition to create famine. Annual flooding of the Mississippi, and the Ganges do cause hardships but do not cause people to starve to death. This can be best explained by the following observation of the entitlement approach.. Svedberg (1985) considers the positive role of state intervention as a characterisation of entitlements, as he points out:

“The essence of the approach is that people starve because they have insufficient income or wealth and because there is no other means of acquiring food. That is, inadequate food purchasing power is only a necessary, not sufficient, pre-condition for starvation. The ‘other’ means of acquiring entitlements to food essentially comprise transfers (redistribution) of food on the international, national, regional or family level. In the developed countries most people’s entitlements to food are not restricted by the effective demand they can exert in the market; the welfare state ensures at least a minimum bundle of food to its citizens.”

Speedy relief measures alleviate hardship and protect the entitlements of the populace in the afflicted regions, although without support from the state such natural occurrences have the

potential to create famine. This section deals with the constructive role that the state can play in securing entitlements both in times of crises and in the longer term.

The continued existence of the state system accords a measure of security to people. The plight of those residing in regions where the state has all but collapsed is well known to us. Thus protection from the state is possible only when all its institutions operate within a stable constitutional order. The first contribution to entitlements protection by the state is legalistic in nature. Sen (1981) and Osmani (1990) focus on the legalistic nature of entitlements, where the acquirement of food is based on established systems of inheritance and/or ownership. The system of ownership, whether individual or communal, is usually guaranteed and protected by the sovereign power of national laws. Thus the dissolution of the state would render the entitlements of its populace vulnerable. Issues of land tenure systems are also important in determining the entitlements of various groups in society, a point made by de Waal (1990) in his study of the famine in southern Sudan. Even those who oppose the idea of a 'leviathan' state would accept the importance of the role the state's policing functions.

Ever since they have existed, states have had to deal with crises such as famines. It is therefore unsurprising that all civilisations in history have developed some sort of mechanism to deal with such eventualities, mostly in the form of stocks of food held in state granaries. Famines also attracted the attention of ancient scholars. Book IV of the Arthashastra is devoted entirely to the discussion of appropriate policies of deal with famine. The remedies suggested by Chanakya are not very different from crisis management policies in many parts of the world today. The twin and complementary policies of holding buffer stocks and their distribution by the state in times of

emergency are the most common anti-famine policies in the world. In particular the redistributive role of the state is what will occupy our attention.

The state in many parts of the world plays a direct role in securing the entitlements of people afflicted by a food crisis. In anticipation of possible famine conditions, states today maintain stocks of grain as did their historical predecessors. These stocks can be quickly distributed to those experiencing a collapse in their ability to maintain normal levels of subsistence, either as a result of a shift in their endowments (eg. loss of standing crops) or their exchange entitlements (eg. Collapse in the market for certain skills or goods), while on a longer term basis states can supply subsidized grain as a support mechanism for vulnerable groups. This is also a method of protecting endowments, specifically the health of individuals. In times of crisis, policy measures can be used to expand the scale of support. During the Bangladesh famine of 1974, 5,680 gruel kitchens were used to feed millions of people in the afflicted areas on a bare subsistence diet (Sobhan 1990). Similar efforts have been seen in the Sahelian and Kampuchean famines during the late seventies and eighties. The redistributive power of the state is very important because it can be used as both a long term and as an emergency policy tool. In the longer term, ensuring an equitable distribution of resources and endowments allows the weaker sections of society to lead an improved existence, thereby decreasing their vulnerability to famine. On an emergency basis, i.e. during a famine, state intervention contributes by recreating lost entitlements of individuals who might otherwise perish.

The state may use a variety of policy options to protect entitlements. In addition to the subsidised distribution of food, the state can also create entitlements via various employment generation schemes. These may involve the direct disbursement of food in exchange for work, or could take the form of cash wages (Sobhan 1990). Both the above methods have been successfully used

in averting famine in India, albeit in a crisis response role (see Dreze and Sen 1989, and Dreze 1990). In an attempt to find a longer term solution to problems of entitlements creation in many developing countries the state plays the role of a major employer. Certainly, in both China and India it was hoped that by creating employment the state could reduce the vulnerability of the weaker sections of society, particularly by moving larger numbers of people off the land (see Riskin 1987). While many jobs in the public sector are clearly redundant these jobs have an implicit welfare function. Elimination of these jobs would most certainly increase the numbers of destitute in these countries.

Last but by no means least, the key to successful formulation of state policy and crisis response is access to information. Vulnerable groups can be targeted only and only if they and their needs can be identified. Thus the policy maker needs to have an information collecting system in place. Not only is such a system important for regularly monitoring the conditions of the destitute, but such a system becomes invaluable in ensuring proper crisis response. The state can move to protect the entitlements of individual or groups only when it has the requisite information on, 1) Which groups are suffering from an entitlements crisis., 2) What the scale of the crisis may be and 3) What the possible ways are to relieve the crisis. In most countries regular collection of statistical data helps the government to monitor such developments and extends support to cover the entitlements of various groups. The undermining of a dependable system of information gathering can lead to entitlements failure on a massive scale. It must however be emphasized that very often regimes destroy such agencies because they may be at odds with the manner in which a regime may want to portray itself.

3.1.2 State policy and famine creation

While on the one hand state policy can contribute directly to 'entitlement protection' in the ways discussed above, state policy can also contribute to famine directly, by inappropriate policies towards certain groups, or indirectly by failing to intervene to avert famines. This is not to suggest that 'famine creation' is an avowed goal of the governments in all countries which have been subject to famine, but rather that famines may be the byproduct of unintended government policy. Inappropriate policies normally stem from some sort of bias among policy makers, while malign intent in famine creation is used as a weapon by states to subjugate sections of the population within its boundaries. Failure to intervene in averting famine is an institutional failure arising out of information failure or callousness.

The most obvious role of the state in undermining entitlements is by actively removing them. This occurs all too commonly during internal strife in within a state. Famine and hunger turn into instruments of war. This has been the case in many parts of modern Africa. There are many instances where civil wars have disrupted normal agricultural processes. Appropriation of grain by combatants effectively remove the entitlements to grain for the producers: they are neither able to sell their produce nor consume it. The demands on manpower by warring parties saps the productive element of the population out of agriculture, thereby disrupting cropping patterns and grain output (Devereux 1993). History is also full of examples when populations have simply been cut off from their supplies of food: famines in the Netherlands, Ethiopia and Sudan are but a few examples. The Mengistu regime in Ethiopia periodically bombed markets and fields in the separatist provinces of Eritrea and Tigray.

It is not an uncommon observation that the hardships of famine are not equally shared by all. Lipton (1977) argues that in most famine prone countries, there is a bias towards urban development. This bias is responsible for the neglect of investment in agriculture. The consequences for agriculture are often disastrous. This can be attributed to the fact that most countries which have experienced famine in recent times have a greater proportion their population dwelling in the rural areas. Starving the agricultural sector of investment thus exposes the people in this sector to greater vulnerability. Social safety nets, when they exist in many poorer countries, are conspicuously absent in the rural areas. Thus every agricultural crisis as a result of flood or drought has the potential to turn into a famine as entitlements (eg. land or crops) are lost.

Governments often attempt to increase their control over food supplies by regulating inter-regional transfers of food grains. The imposition of such barriers can totally insulate a region within a country. This means that producers from surplus areas are unable to sell their produce in deficit areas, and consumers in deficit areas have to pay higher prices for grain. This results in a loss of trade entitlements, because the two sets of consumers are unable to expand and diversify their consumption bundles. Such regulation can also have devastating effects during times of food shortages. In normal circumstances food might flow from surplus to deficit areas (assuming of course unchanged purchasing power). While the market alone may not solve local food shortages, market mechanisms have been and should be used in conjunction with state intervention. This sort of market fragmentation might imply that local food shortages take on the proportions of a famine in the absence of state intervention, which is not always forthcoming.

Devereux (1993) writes, 'Famines occur because they are not prevented'. Failure to respond to crises is probably the most important reason why they develop into full fledged famines.

State intervention may not be forthcoming for the following reasons. The authorities may not intervene because they lack information that a problem may be on their hands, or the state (represented by its incumbent regime) may feel no sense of responsibility towards the victims of the famine.

The lack of a famine early warning system may be a major reason why states do not intervene to alleviate food crisis. As section 4.2 illustrates, the severity of the famine in China may be attributed to the lack of accurate information on the part of the authorities. But the existence of a sound information gathering apparatus is no guarantee that a regime may act to alleviate crises. The extent to which a regime perceives itself as responsible for its citizens welfare depends on its political legitimacy (more fully discussed in the following section). Typically, in many famine prone countries the incumbent regime derives legitimacy from a small section of the population, and acts in their interests. Thus, in times of crisis, the entitlements of the more vulnerable sections of the population are usually callously neglected. Devereux (1993 pp. 139) quotes an aid worker who sums up the dilemma of many African regimes: ‘Starve the city dwellers and they riot; starve the peasants and they die. If you were a politician which would you choose?’. Entitlements of groups thus fail because they are allowed to fail because of state inaction. The next section deals with the issue of inducing governments to act in protecting the entitlements of those facing famine conditions.

3.2 Protecting entitlements: Political Entitlements

“In the good of his people lies the good of a king. In their joy his and in their pain his. No king must ever forget that his position rests on his subjects, that their demise is his.”

-Introduction to Chankya’s Arthashastra (circa. 300 BC)

In the preceding sections we focussed on the significance of state policy in supporting the entitlements of various sections of the population. We also looked at ways in which state policy could actively or passively undermine entitlements. This section asks why famines are allowed to happen. What causes states to intervene in famine prevention? It also examines the importance of political entitlements on famine prevention policies. Section 3.3 adopts a modelling approach to the same issue.

We have already established the importance of state policy to famine prevention and creation. Policy is always formulated and exercised by governments or regimes acting on behalf of the state. Quite simply then, to *ensure* that policies are formulated to protect entitlements, regimes must have an *incentive* to do so. Sobhan (1990) states that *regime preservation* is the most important goal of any government. One might argue it is their only goal. Thus regime preservation may be the incentive which eventually influences policy formulations. The nature of the regime can have important implications for the manner in which policy is formulated and who might benefit from such policies. The ability of individuals in society to influence policy decisions to increase their welfare is their *political entitlement*. Different types of regimes depend on the goodwill of different sections of the population for survival. Broadly, regimes can be divided into two kinds, representative regimes and unrepresentative regimes. We shall deal with the latter first.

The less representative a regime, the fewer the number of groups or individuals capable of influencing it. In the majority of the states with an authoritarian power structure, the military is the most important in the pecking order, normally followed by the civil service. Similarly, regimes may draw their support from specific ethnic groups. No matter what the exact structure of an authoritarian state may be, it is clear that not all citizens of the state can exert anything like equal

influence on the regime. In these situations interest groups clearly exert a disproportionate amount of influence on the regime. Thus few people in this sort of setup have political *entitlements*. The narrower the legitimacy of a regime, the smaller the number of people who the regime perceives any responsibility towards. As always the incentive for the regime is to maintain itself in power. But since an unrepresentative regime reflects the aspirations of few, its first responsibility is towards those few.

In states where unrepresentative regimes hold power, those groups without any *political entitlements* against the regime form the most vulnerable groups and are the weakest claimants on the state's protection. Often the state may actively undermine the entitlements of certain groups if it perceives that the regime's position is threatened. In the context of a food crisis an unrepresentative regime will be motivated only to alleviate the sufferings of only those groups whose interests are represented by the regime and on whose well being the survival of the regime depends. The lack of the rest of the population's ability to influence policy in their favour would lead a failure of entitlements for them. A good illustration of this situation is the 1974 famine in Ethiopia, famine which was ravaging the country but not even acknowledged by the Emperor Haile Salassie. Even after the BBC had revealed to the world that much of the country was in the grip of a major famine, the Emperor responded thus (quoted from a BBC interview in Sen 1981):

“there is of course hunger, but we have always said that there are those who work hard and those who don't. It is natural that those who merely complain, and do not put in adequate hard work should starve.”

This should leave one in little doubt that the monarchy's legitimacy did not depend on popular support. Indeed in the fall of that year when famine reached Addis Ababa, Salassie was deposed in a coup d'etat. When the new regime started receiving food aid from abroad, the first rations went

to provisioning the army who had engineered the coup. Thus regime preservation was again dependent on pleasing interest groups. A similar pattern can be found in virtually every famine this century (and possibly even further in the past), where the entitlements of pressure groups were maintained at the expense of less influential groups.

Pluralistic societies with representative governments act in a different manner. This is primarily because greater numbers of people have *political entitlements* vis-a-vis the regime. In any state structure where the polity is based on universal franchise, regimes have to be active or even pro-active in order to retain their incumbency. Failure on the part of the government to act suitably during crises would lead to retribution at the hands of an electorate. In the presence of adversarial politics there is competition between at least two groups each attempting to succeed in governing the country. The threat of being voted out of office for policy failures should keep regimes treading carefully. Indeed if a such a state should lapse into famine, the survivors themselves would form sizable voting block who could potentially alter the position of an incumbent regime. Thus any regime in a pluralistic regime would hasten to rectify policy or market failures that may cause a famine. The examination of the political structures within which major famines have occurred since the turn of the century will illustrate how major famines this century seem to have occurred in countries where the regimes have been narrowly based.

Table 3.1 MAJOR FAMINES IN THE 20th CENTURY

Country (Region)	Year	Nature of Regime
Soviet Union (Ukraine)	1932	One party state
India (Bengal)	1943	Colonial Administration
Holland	1944	Foreign Military Occupation
China	1959-61	One party state
Nigeria (Biafra)	1967-69	Military Government engaged in civil war
Ethiopia (Wollo)	1972-1973	Absolute Monarchy
Ethiopia(Southern Provinces)	1973-1974	Absolute Monarchy
Bangladesh	1974	One party state
Ethiopia (Tigray and Eritrea)	1980-84	One party state
Mozambique	1981-1985	One party state engaged in civil war
Niger	1984-1985	Military Government
Sudan (Darfur)	1984-1986	Military Government
Somalia	1992- present	Dissolution of one party state leading to civil war

Sources: Devereux, Stephen. *Theories of Famine*. New York Simon and Schuster International, Harvester Wheatsheaf, 1993. And Dreze, Jean; Sen, Amartya Kumar. *Hunger and public action*. WIDER Studies in Development Economics, Oxford: Oxford University Press, 1989.

Policy failures are the result of badly formulated and poorly executed policies, specially if they in any way decrease public welfare and entitlements. Famines are typically outcomes of such policy, quickly turning local food shortages into massive famine. The role of a free press becomes extremely important in this context, because an independent and dedicated press (or any media) can facilitate debate on such policy. Investigative reporting can spark constructive debates about proposed government legislation (Dreze and Sen 1989). A free press can bring greater pressure to bear on incumbent regimes to formulate policies which are both morally and socially acceptable. In an atmosphere of accountability, regimes have an incentive to protect entitlements because that is

what allows them to remain in power. The greatest good of the greatest number is the philosophy which allows regimes to continue in power under a pluralistic system. Empirical evidence has shown that states with a pluralistic polity have been better at preventing famines than those with unrepresentative regimes, this has to do with their respective compulsions in dealing with the question of regime preservation. Thus the greater the scope of *political entitlements* within a politico-economic system, the smaller the chance of famine.

3.3 Political Entitlements and Famine Relief

In this section I shall illustrate with the help of a simple inter-temporal general equilibrium model, the manner in which the entitlements can be protected. Indeed, it is possible for a state to adopt policy measures that alleviate the sufferings of those most vulnerable to starvation during a crisis. Political entitlements are represented by the role of government policy. The model that I analyse is one that generates famine during ‘booms’, akin to the situation that prevailed in Bengal in the early 1940s, and indeed the event upon which Sen ‘s (1977) initial analysis of entitlements was based. While to identically model the situation prevailing in Bengal of the 1940s would require a more complicated model, this model nonetheless highlights the fact that famines can indeed happen in the midst of plenty and increasing output.

3.3.1 The Economy

In our case we assume a closed economy, in which one consumption good, food (X), is produced from labour (L) and land (S). The economy has two kinds of citizen players: the rural landowner, the classical Bengali Zamindars, indexed by Z and the agricultural labourer indexed by A . The supply of land is assumed to be fixed at S . The land tenure system ensures that the land remains within this Zamindar class. Land holdings at time t are $s_t = S/N_t^z$, where N_t^z is the number of Zamindars.

The labour of Zamindars and agricultural labourers is perfectly substitutable and L is the total labour used per farm. On the production side assume, an identical constant returns to scale Cobb-Douglas production function for each farm which takes land and labour as its arguments, and output is determined by a random shock θ_t that determines the state of the world and can take any value within a specified range. Higher values of θ_t indicate better states of the world. Consequently, production is described by,

$$(1) X_t = \theta_t \cdot L_t^\alpha s_t^{1-\alpha}$$

where $100 < \theta_t < 1000$.

On the production side the Zamindars choose the use of labour to maximize profits. This profit maximization exercise thus determines the *demand for labour*. On the supply side it is assumed that both Zamindars and agricultural labourers are endowed with l units of labour, which is supplied inelastically to the labour market. Labour is also supplied inelastically. The model is an *equilibrium* model, and so relative prices adjust so that full employment is always achieved. The assumption of full employment is made for the sake of simplicity.

The Consumer Market

In the consumer market, the issue is that of utility maximization by the agents. This is achieved by consuming food x^i . An important feature of the model is the survival constraint, to survive an

individual must at least x^s or else will die with an exogenously determined probability. Thus the maximization problem may be written as;

$$(2) U^i = U(\max\{x^i - x^s, 0\}) \quad i \in \{Z, A\}$$

This is a fairly general utility function which has only food as an argument. Note that I have taken a parsimonious approach to modelling the consumer market. This of course has its limitations because in a more realistic model the consumer would have had the choice of a multitude of consumption goods.

Utility is maximized subject to a budget constraint

$$(3) Y^i = p_t \cdot x^i \quad i \in \{Z, A\}$$

Where Y^i denotes income and p_t is the price of food in period t . Income for the Zamindars is net farm profits plus own labour income, that is

$$(3.1) Y^Z = p_t X_t - L_t + l \\ = p_t \theta_t L_t^\alpha s_t^{1-\alpha} - L_t + l$$

Observe that labour is used as the numeraire good. Agricultural labourers, in contrast derive income from the sale of their labour power, thus

$$(3.2) Y^a = l$$

Population Dynamics

The population of the country in any period t is given by the total number of Zamindars and Agricultural labourers. Thus

$$(4) P_t = N_t^z + N_t^a$$

Observe that since all Zamindars and all agricultural labourers are identical, the experience of both prosperity and hardship by individuals is shared with all members of their class. This allows us to view population dynamics as pertaining to the classes of zamindars and agricultural labourers, rather than following the experience of particular dynasties. In case any community starves, i.e. receives less than the minimum subsistence diet x^s then we observe a decline in the population of that type.

Population growth rate is determined in the following manners;

$$(5) N_t^z = \beta_t \cdot N_{t-1}^z$$

Where, $\beta_t > 1$ if $x_{t-1}^z > x^s$, otherwise $\beta_t < 1$

$$(6) N_t^a = \gamma_t \cdot N_{t-1}^a$$

Where, $\gamma_t > 1$ if $x_{t-1}^a > x^s$, otherwise $\gamma_t < 1$

In the absence of famine, the population of each type of citizen increases at an exogenously determined rates Π and Ξ . Note that the specification of the model is such that it is possible that Π and Ξ may differ even if both experience famine or prosperity. This reflects the fact the fertility and mortality rates in practice show strong dependence on socio economic variables.

3.3.2 Solving the Model

Given the assumptions made above we now examine the equilibrium behaviour in this model.

Production

Each producer chooses their use of labour and takes as given the share of land to maximize profits

(β_t). Recalling that we have assumed that labour is the numeraire, solve the programs,

$$(7) \text{Max } \beta_t(L_t) = p \cdot \theta_t L_t^\alpha s_t^{1-\alpha} - L_t$$

Differentiating (7) with respect to L_t will yields per farm labour demand as a function of prices, land shares and state of the world ;

$$(8) L_t^* = (1/\alpha \cdot p \cdot \theta_t s_t^{1-\alpha})^{1/(1-\alpha)}$$

Aggregating across zamindars, aggregate demand for labour is

$$(9) \Lambda_t = N_t^z \cdot L_t^*$$

Where Λ_t is the market demand for labour at time t. Recall that labour is supplied inelastically, and that both zamindars and agricultural labourers are endowed with 1 units of labour. Labour supply is thus equal to the per citizen endowment times the population at time t, that is;

$$(10) \lambda_t = (N_t^z + N_t^a) \cdot l$$

Where λ_t denotes market supply for labour.

As this is an equilibrium model, in every period markets must clear, that is, relative prices adjust so that aggregate supply equals aggregate demand, or

Setting $\Lambda_t = \lambda_t$, this gives us;

$$(13) (1/\alpha \cdot p \cdot \theta_t s_t^{1-\alpha})^{1/(1-\alpha)} = ((N_t^z + N_t^a) \cdot l) / N_t^z$$

This allows us to solve for p^* , the equilibrium price of food in terms of units of labour,

$$(14) p_t^* = (N_t^z / (N_t^z + N_t^a)) \cdot l \cdot \alpha \cdot \theta_t s_t^{1-\alpha}$$

We can also now solve for output per farm (or Zamindar); Recall from (1) that output per farm is;

$$X_t = \theta_t L_t^\alpha s_t^{1-\alpha}$$

Substituting (10) into (1), and denoting equilibrium output by X_t^* , we have that

$$(15) X_t^* = \theta_t \cdot [((N_t^z + N_t^a) \cdot l) / N_t^z]^\alpha \cdot s_t^{1-\alpha}$$

Turning to the consumption side we can now calculate the incomes Y^z and Y^a , recall that

$$Y^z = p_t X_t - L_t + l \quad \text{and} \quad Y^a = l$$

In equilibrium therefore;

$$(16) Y_t^z = \{ (N_t^z / (N_t^z + N_t^a)) \cdot l \cdot \alpha \cdot \theta_t s_t^{1-\alpha} \} \cdot \{ \chi_t [((N_t^z + N_t^a) \cdot l) / N_t^z]^\alpha \cdot s_t^{1-\alpha} \} - L_t^* + l$$

$$(17) Y_t^a = l$$

Recalling that both zamindars and agricultural labourers devote all their income to the purchase of food, their relative 'shares' of total food production can be shown to be;

$$(18) x_t^{Z*} = X_t^* - (L_t^* - l) / [(N_t^Z / (N_t^Z + N_t^A))]. l. \propto \theta_t s_t^{1-\alpha}$$

$$(19) x_t^{A*} = l / [(N_t^Z / (N_t^Z + N_t^A))]. l. \propto \theta_t s_t^{1-\alpha}$$

3.3.3 Introducing Politics

We now wish to extend our modelling framework to examine the impact of the political system on the prevalence of famine in otherwise identical economies. To this end, we simulate the behaviour of this economy over time under two distinct political regimes. The first regime considered is one in which the government seeks to promote the interests of landowners, assumed to constitute the minority of the population. This government adopts laissez faire policies, and lets markets work. The second regime protects the landless, although it does not go so far as to collectivize land ownership. Each scenario is discussed in greater detail below.

Non Representative Government: Laissez Faire policies

In the first instant we can think of a country where power is held by the zamindars. In this case, as we see below, the government can be expected to champion 'market forces', as this will enrich those whom the regime seeks to serve. The situation is thus one of laissez faire. For suppose there is a normal state of the world where $\theta = 100$, for given values of l , N^Z and N^A . If we run our model in this period we find that the equilibrium value of p_t allows both groups, and particularly the agricultural labourers, to meet their nutrition requirements, i.e. $x_t^I > x_t^S$. The outcome of this is that population grows in both groups by β_t and γ respectively. Assuming $\beta = 1.1$ and $\gamma = 1.2$

respectively we can move on to the next period where the economy now has a population of $N^z_1 = 1.1 N^z_0$ and $N^a_1 = 1.2 N^a_0$. Supposing now that the economy went into a “boom”, with $\theta_t = 1000$, we find that the benefits from the “Boom” are unequally distributed. The zamindars experience a disproportionate increase in their income as output and prices rise. The agricultural labourer on the other hand is reduced to starvation as his effective demand $x^{a*} = l/p_t$ falls and $x^a_1 < x^s$. In this case the population of the agricultural labourers falls by some 30% over the preceding period as specified by (4)

Representative Government: Income Support Policy

In the preceding case the lack of any means to redistribute huge surpluses from the zamindars cause the labourer to starve. If, however, the regime in the economy were sympathetic to the plight of agricultural labourers, it could induce a redistribution of the large food surpluses from the zamindars to the agricultural labourers in times of crisis. This would reflect the existence of political entitlements among greater numbers of people in the population. Assume that the redistribution is achieved by a non-distortionary tax on each farm (Zamindar)’s output⁵. The fact that surpluses are acquired through taxation and not expropriation reflects that all individuals within society have political entitlements, so that in order to protect one class of citizens another is not reduced to destitution. Thus consider the following scheme. Suppose that the zamindars pay a tax at a rate $= T$ on their net income to ensure more equitable redistribution during crises where $0 < T < 1$. Therefore from (3.1), net income for zamindars is now,

⁵Securing political entitlements in the real world could also be achieved by land reform and the model as specified may come under criticism for ignoring this. The model that we are analysing is far from a comprehensive model of a rural economy; however our focus here is on the impact of political regime rather than on the optimality of policy responses. Thus for this reason we may assume that for some reason, perhaps “religious”, land reforms is not an option.

$$Y^Z = (1-T) \cdot p_r X_t - L_t + l$$

Thus output is now

$$(18) X_t' = \theta_t (1-T) L_t^\alpha S^{1-\alpha}$$

The government could thus build up a grain stocks G that could be disbursed during a crisis.

$$(19) G_t = T X_t' \cdot N_t^Z$$

Given the nature of this model the government could operate its taxation systems, either by using carry over stocks from period to period or by raising fresh stocks every year. As the crisis situation in our model is an outcome of a 'boom' it is simpler for the G to be raised by fresh taxation each year. The buildup of G must ensure that there is enough in the granary so as to meet the minimum subsistence requirements of the Agricultural population, thus:

$$(19a) G_t > x^s \cdot N_t^a$$

Support can be disbursed in the following manner during a crisis C to each labourer.

$$(20) \text{state support} = \max \{0, x^s - x_t^a\}$$

Observe that support is received only in periods of crisis. The consequence of this policy is that in each period the agricultural population is properly fed and continues to grow. As population grows the output of the economy grows. An interesting feature of the model is that if support from the state is maintained long enough, ultimately the spectre of famine disappears.

3.3.4 Simulation Exercise: Observations and Analysis

In order to check the inter-temporal behaviour of the economy based on the above model, a simulation exercise was run using MAPLE V vr.2, a mathematical software package⁶. The purpose of the exercise was to compare the behaviour, over time, of the economies which differ with respect to the political regime, but were otherwise identical at the outset and had identical experiences of weather!

Population in the first period was set at

$$N^z_t = 10$$

$$N^a_t = 100,000$$

The ratio of Zamindars to labourers are set with real world in mind. It is not uncommon to find societies where a microscopic minority exercise a disproportionate amount of political and economic influence. In periods $t + 1$ onwards, the population dynamics are determined endogenously based on ;

$$(5) N^z_t = \beta_t \cdot N^z_{t-1} \quad \text{where, } \beta_t = 1.1 \text{ if } x^z_{t-1} > x^s, \text{ otherwise } \beta_t = .9$$

$$(6) N^a_t = \gamma_t \cdot N^a_{t-1} \quad \text{where, } \gamma_t = 1.2 \text{ if } x^a_{t-1} > x^s, \text{ otherwise } \gamma_t = .7$$

As previously mentioned it is generally the case that the growth rates of population for the two classes differ, with the weaker section exhibiting greater rates of growth (both positive and negative).

$x^s = 15$ units of food.

We suppose that the survival constraint is arbitrarily set. The endowment of labour is also fixed exogenously at;

⁶Program code included in Appendix 3.

$t=16$

The productivity parameter α is assumed to be;

$\alpha = 0.6$

The random productivity shock variable θ_t , is assumed to be uniformly distributed between 100 and 1000.

The taxation rate T is the variable which ultimately determines the political entitlements of the two classes. Under the first policy regime i.e. *laissez faire* the entitlements of the Zamindars are protected and thus the government does not tax them. Under the *government intervention* policy regime the government political entitlements exists among the peasants also, thus a tax is levied on the producers, i.e. the Zamindars. The taxation rate reflects the fact that all individuals within society have political entitlements, that in order to protect one class of citizens another is not reduced to destitution, i.e. the Zamindars are not taxed into oblivion. We suppose that

$T = .2$

In a more complex model T could have been allowed to change from period to period, for the sake of simplicity T remains fixed in all periods, so as to meet the requirement that there is enough in the granary so as to meet the minimum subsistence requirements of the Agricultural population.

By running the simulation we are able to compute the following items:

p_t^* = equilibrium price of food

X_t^* = output per farm

x_t^z = demand of the Zamindars

x_t^a = demand of the Agricultural labourers

Income is equal to l for the Agricultural labourer and remains fixed throughout. In the following subsections the results of the simulations are presented for 20 periods under two distinct regimes.

3.3.4.2 Simulation Analysis under Laissez Faire

Under laissez faire the political entitlements clearly favour the Zamindars, this is because they pay no taxes. We run the model for 20 periods and see how the economy behaves. The results are summarized in table 3.2. In the first period the world is not in a crisis state and the agricultural labourers are able to meet all their intake requirements, and more. In the subsequent periods the economy sees 'booms', or increases in technological productivity. Because of the manner in which the incomes of the two classes are determined, we see a disproportionate increase in the demand of the Zamindars (x^z). The demand by the agricultural labourers collapse as their incomes do not change as the price of food goes up. In practice this is certainly similar to the Bengal famine of 1943. The result is that over the 20 periods that we run the simulation, the agricultural worker remains vulnerable and N^a goes into a downward spiral. The population of the Zamindars on the other hand explodes. So at the end of 20 periods we see that N^z has actually increased five fold, while N^a falls to 1/500 of its initial level. What is interesting to note is that as N^a declines productivity is severely affected.

Table 3.2 SIMULATION RESULTS UNDER LAISSEZ FAIRE

Period	θ_t	N_t^z	N_t^A	p_t^*	X_t^*	x_t^a	x_t^z	Result
1	100	10	100000	.64	760515	25	533702	N
2	655	11	120000	3.49	5557164	4.57	5507300	F
3	266	12.1	84000	2.1	1656431	7.44	1604773	F
4	286	13.31	58800	3.49	1307209	4.57	1286996	F
5	654	14.46	41160	12	2221407	1.33	2217613	F
6	579	15.9	28812	16.06	1444155	.99	1442351	F
7	101	17.49	20168	4.2	184938	3.7	180585	F
8	982	19.23	14117	62.31	1320000	.25	1319008	F
9	765	21.16	9881.9	73.38	754914	.21	754812	F
10	186	23.28	6917	68.69	134808	.59	134632	F
11	531	24.61	4841	113.4	294264	.141	134632	F
12	304	27	3388.7	97.83	124185	.163	124164	F
13	839	29.7	2237.2	430	243633	.037	243630	F
14	444	32.67	1566	342	95051	.046	95049	F
15	799	36	1096	898	1106003	.017	123030	F
16	355	39.2	767	605	42002	.026	42001	F
17	223	43	537	583.8	20626	.027	20625	F
18	759	47.3	375	2765	50492	.005	50492	F
19	868	52	262.5	4495	44010.95	.003	44010.93	F
20	293	57.2	183.75	2097	11510.62	.007	11510.64	F

The important role that labour plays as a factor of production becomes apparent as we move into the later periods of the simulation. Along with the decline of N^a , the Zamindars also begin to get poorer as x^z also begins a dramatic decline after period 10. In this model once the Agricultural workers

experience starvation due to a consecutive high values of χ_t (unequal economic expansion), the ability for the workers to feed themselves does not return due to recurring high prices of food. In the next subsection we carry out an identical exercise, only now the government is an active participant.

3.3.4.2 Simulation Analysis under Government Intervention

The only manner in which this exercise differs from the preceding one is the manner in which entitlements are specified. The government is no longer a bystander who maintains a laissez faire stance just because the Zamindars are doing well. The fact that taxes are raised is an indication of redistributive activity in the economy. The government uses taxation to maintain the entitlements of the peasants.

The results from the simulation exercise reveal that with government support, i.e., maintenance of subsistence entitlements the agricultural labourers are able to ride out the times of crisis. When the Agricultural labourers experience a shift in entitlements to below subsistence, due to price rises, the state makes up the shortfall by drawing on its own reserves. Even though in certain periods the state has enough reserves to do more than merely fill the subsistence gap, for the sake of simplicity this model has been specified so that state support is determined by the difference between x^a and x^s . Due to support from the government the Agricultural workers prosper and grow in each period.

Table 3.3 SIMULATION RESULTS WITH STATE INTERVENTION

Period	θ_t	N_t^z	N_t^A	p_t^*	X_t^*	x_t^a	x_t^z	State Support	Result
1	100	10	100000	.60	669249	26.41	405074	0	N
2	655	11	120000	3.5	4445731	4.57	4395868	10.43	N
3	266	12.1	144000	1.25	1831039	12.75	1679239	2.25	N
4	286	13.31	172800	1.19	1996623	13.44	1822074	1.56	N
5	654	14.46	207360	2.38	4688399	6.71	4592131	8.29	N
6	579	15.9	248832	1.86	4211179	8.59	4076663	6.41	N
7	101	17.49	298598	1.55	4697961	10.3	4504260	4.7	N
8	982	19.23	358317.6	2.45	7349690	6.51	7228371	8.49	N
9	765	21.16	429981.2	2.16	7451441	7.37	7301530	7.63	N
10	186	23.28	515977.44	1.91	7555803	8.35	7370516	6.65	N
11	531	24.61	619172	.89	4313388	17.94	3861638	0	N
12	304	27	743006	.44	2510016	35.57	1532992	0	N
13	839	29.7	891607	1.09	7025548	14.60	6586979	.4	N
14	444	32.67	1069928.4	.51	4713316	31.2	3688727	0	N
15	799	36	1283914	.79	8832413	20.01	8098107	0	N
16	355	39.2	1540689	.31	3908858	50.5	1923660	0	N
17	223	43	1848826	.17	1997754	91.27	192688	0	N
18	759	47.3	2218591	.52	6895956	30.39	5470372	0	N
19	868	52	2662309	.53	8002736	30.12	6460151	0	N
20	293	57.2	3194770	.19	3455790	97.5	1345767	0	N

The growth in population of Agricultural labourers adds to the size of the labour force thereby causing a massive expansion of output. Eventually (period 14 onwards) rising purchasing power among the agricultural labour appears to have rid the economy of famine. Increased demand is the outcome of both

large increases of production and low prices under this regime when compared to the laissez faire because price, in this model, is an argument of population and as population of Agricultural labourers grow price falls. In the longer run government support appears to have helped the Agricultural labourer attain a level of security that is not disturbed by any random shock.

The most important conclusion that one can draw from the simulation exercises is that redistribution of resources by the state is crucial in maintaining the entitlements of all classes of citizens. The nature of political institutions ultimately determines which class will have its interests protected. In 3.3.1.1 government inaction could be attributed to the influence of the Zamindars, and the Zamindars were not required to part with their wealth even when people were dying of starvation. In 3.3.3.2 taxation of the Zamindars to help the Agricultural labourers in crisis reflects that the government finds it important to maintain the destitute possibly because of their influence. At the same time the government does not meet the needs of one class by impoverishing the others. The requirement that Zamindars' tax assessment is a fraction of his output and not expropriation of it all indicates that the state is balanced in its policy implementation. It is possible that the magnitude of the results would have changed with different values but the general direction of the results would remain the same. A very high rate of taxation, for example, would drive the zamindars into starvation.

It is only fair that the limitations of the preceding modelling exercise be emphasized. The model examined is intended to be purely illustrative and not one of generalized application. The "Robinson Crusoe" type economy was chosen for its simplicity. In order to better simulate "realistic" situations, one needs to build into the model greater numbers of variables. A more complex model would include a variety of consumption goods from which agents would derive utility. Also the market for food and other produce would need to be set up in such a way that prices are explicit. The differentiation of

agents based on simply their endowments of land and labour are also rather simplistic. Also the equilibrium nature of the model leads to the clearing of all markets (especially the labour market); needless to say this is not the case in reality. Despite all its shortcomings, the model serves its major purpose; that is to show how the political entitlements of different groups can have a bearing on their welfare. The model also highlights the major role that the state can play in securing and maintaining the entitlements of various groups in a socio-economic setup.

4.0 Policy and Famine: The Cases of India and China

This comparative study illustrates how state policy can influence different outcomes with respect to famine prevention. The two countries that are compared have similar attributes in terms of population sizes and a history of famine in the pre-World War II era. In recent years, both countries have made progress in dealing with the spectre of famine. While the Indian state has presided over the eradication of famine after 1947 through effective policy measures, the elimination of endemic hunger remains a distant goal. The study of endemic hunger, however, is beyond the scope of this paper. China has been more successful in the eradication of endemic hunger, probably because of the 'equitable' nature of the socialist state, but the state has on one occasion collapsed into severe famine as a result of misguided policy. We first look at India's experience since 1947 (the year of its independence) and then discuss the Chinese contrast in 4.2.

4.1 The Indian Experience since independence

India's achievement in eradicating famine is widely cited as evidence that state policy can secure entitlements even without a dramatic rise in per capita food output. While it is true that India's output of food has increased tremendously since the 1960s, per capita consumption has remained fairly constant.

Quite surprisingly the period in which the frequency of famines began to decline (late 19th century onwards) coincided with a declining level of food production per capita (Dreze 1990). Dreze also provides evidence to show that per capita consumption in the post independence period is actually lower than in the late 19th century. Furthermore, many countries in the world have experienced famine with per capita food output at levels much higher than India's; the Sahelian countries are the most recent example.

India still remains vulnerable, mainly because the extreme weather conditions have the potential to induce severe food crisis. Both the failure of the monsoons and heavy rains can adversely affect rural livelihoods. The destruction of crops whether by drought or by flood can undermine the entitlements of not only the small or marginal farmer, but also of the rural labourer. A loss in the direct entitlements of the small farmer can translate into a decline in demand for the services of rural labour, thus constituting a trade entitlements failure for the latter group. The fact that despite of numerous floods and droughts (the latest in 1987) India has not lapsed into famine can be attributed to the state's active famine prevention policies. Active state policy in India has a long history. The *Arthashastra* speaks of redistribution of food to the poor and initiation of public works as effective ways to deal with famine. Such entitlements protection policies have been used by Turkic Sultans in medieval India and even by the Mughals (see Rashid 1980, and Dreze and Sen 1989).

The modern system of famine relief in India can be traced back to the British administration. For much of the early period of the colonial administration the government was unwilling to intervene in any manner to alleviate famine. This misplaced faith in the power of the market alone to heal local food crisis caused the state to passively stand aside while millions died in the famines of 1812, 1820, 1848 and 1880 (Rashid 1980). A Crown commission appointed in 1880 tabled a series of recommendations which became known as the Famine Codes. The codes recommended that criteria be established for recognising

famine situations, and that alleviation take the form of public works projects that provided cash remuneration to the affected area. The colonial administration was loathe to using redistributive methods to channel food to affected areas, hoping that cash remunerations alone to the affected would help prevent market failures (Dreze 1990). The famine policy in present day India owes its origins to the Codes of 1880. They have, however, been significantly modified. The redistributive power of the Public Distribution System (PDS) is extensively used to smooth out impending market failures. While the government of India has by and large refrained from interfering directly in the private grain markets, the PDS has been widely used to deter hoarding and speculation in times of crisis.

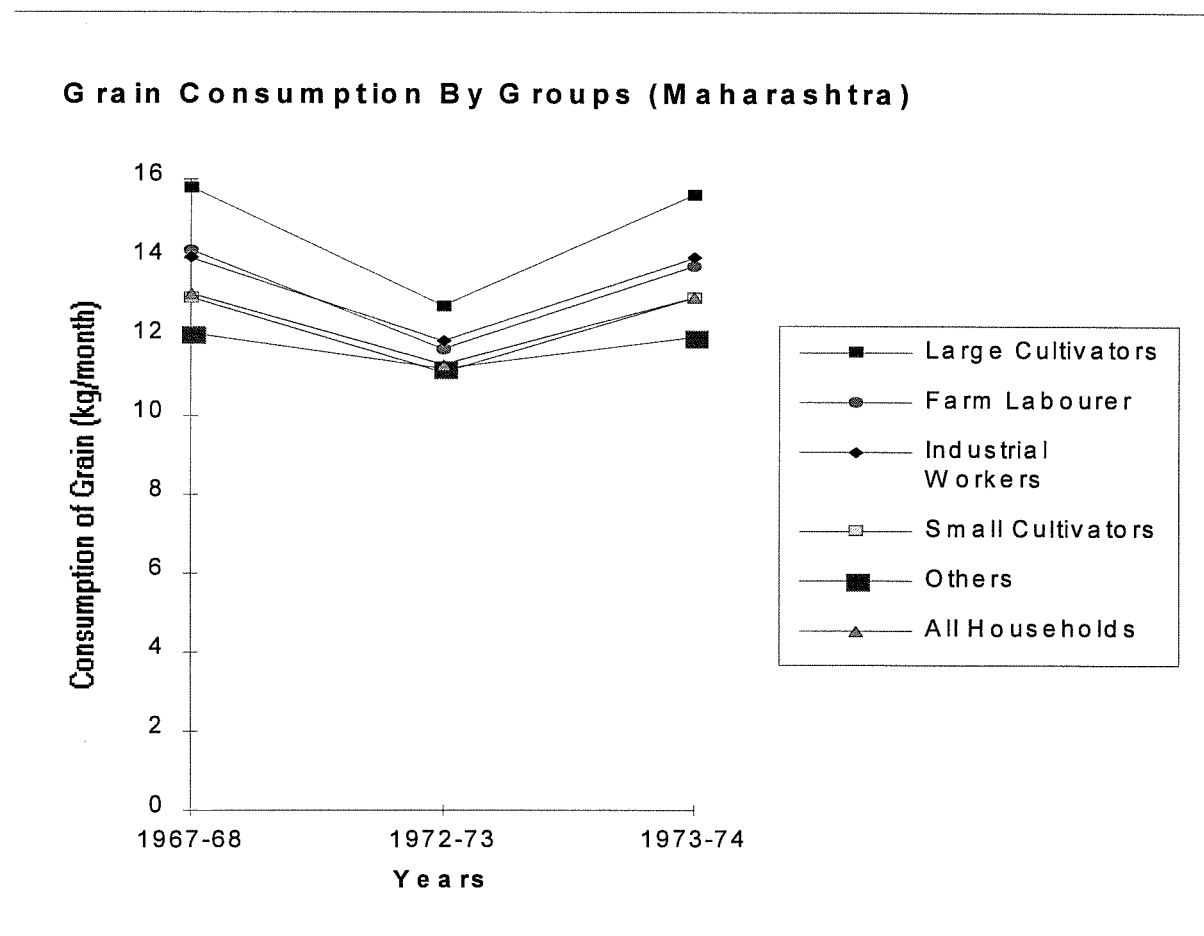
In assessing the role of the PDS in famine prevention Dréze and Sen (1989) and Kumar (1988) have sought to distinguish between its function of improving price stability from that of income generation. In its price stabilization role, the PDS secures entitlements by preventing rapid increases in the price of food stuffs. This is achieved by large scale distribution of food via the PDS. During the drought of 1987, when there was a considerable decline in food production, price rose by less than 10% because of effective and timely state intervention via the PDS (Kumar 1988)⁷. The primary vehicle for income generation is that of public works, mostly remunerated in cash. Dreze (1990) has emphasised the importance of this type of state policy in sustaining rural purchasing power through the Maharashtra drought of 1970-73. During the drought the level of food production per capita was about a third of the national average. An extensive public works programme was initiated to maintain the entitlements of those affected by the drought while grain shipments were channelled into the affected districts by the PDS. The Maharashtra drought has been extensively studied by Dreze and is further examined in the remainder of this section.

⁷During the drought period 13.6 million tons of grain were drawn down from the PDS, whose stocks in January 1987 stood at 23.6 million tons (Kumar 1988, pp.13)

By Indian standards the state of Maharashtra is a fairly progressive one. It is ahead of most states in conventional indicators of human development, i.e., literacy, urbanisation, income per head, etc. However, in the early 1970s there were enormous disparities between rural and urban lifestyles and even within the rural areas there existed a massive inequalities. The state of Maharashtra was already suffering from an agricultural decline when it was hit by drought for three successive years from 1970-73. The declining trend in food production went through the floor in these years. During the height of the drought in 1972, per capita output of cereals was 51 kg, less than a third of the average level of per capita consumption for India as a whole (Dreze and Sen 1989)⁸. The agricultural crisis resulted in collapse of private employment and thus a collapse in incomes for large sections of the population, threatening large scale entitlement failures. But fortunately timely intervention by the state ensured that the drought did not turn into a famine. There were no increases in mortality due to the agricultural crisis. In a bid to restore and maintain entitlements the Maharashtra Government helped generate one billion person days of employment by way of public works projects during the twelve month period ending July 1973 (Dreze 1990). At the height of the crisis, the government of Maharashtra had on its payroll nearly 5 million labourers employed on rural infrastructural projects (Dreze and Sen 1989). The emphasis of the state's relief policy was the generation of employment for cash wages, supplemented by handouts to those unable to work. The most important affect of this income generation programme was that the drought-hit areas attracted significant amounts of food imports from the rest of India, in addition to food distribution by the PDS. Nonetheless,

⁸For a district-wise production index of Maharashtra 1967-1973, see Dreze and Sen (1989), Table 8.1 pp.127.

Maharashtra suffered a significant decline in food consumption during 1972-1973. Dreze and Sen (1989) draw our attention to the fact that due to the role of state intervention, the reduction in food consumption was evenly distributed across different socioeconomic groups.⁹ The sustained purchasing power of the most vulnerable groups allowed them to lay claim a suitable amount of food.



Source: Dreze and Sen (1989), Figure 8.2 pp.131.

⁹See Dreze and Sen (1989), Table 8.3 pp.130.

That political factors were involved in initiating the government's response in 1970-73 is unquestionable. The drought was the subject of 696 questions in both houses of Maharashtra's legislature in 1973 alone, and the subject of critical newspaper reports (Dreze and Sen 1989). Activity on the part of the affected populations (rallies, marches, pickets, etc.) no doubt impressed upon the government the need to set its relief machinery into motion. As one labourer confessed candidly, "They would let us die if they thought we would not make a noise about it."¹⁰ The Maharashtra government was thus motivated by things other than just humanitarian concern, namely by concerns of regime preservation.

The mere existence of a famine code does not imply its automatic enforcement during times of crisis. Indeed during the Bengal famine of 1943, famine was not even 'declared', let alone relief measures instituted (Sen 1977 and 1981). Since the ultimate aim of any regime is self preservation, so long as crises do not threaten the continuance of the regime in power; it is no crisis at all. Indeed, the imperial government of 1943, embroiled in a major conflict had little incentive to aid the millions of rural labourers who constituted little threat to its preservation. The wartime censorship also curbed activities by the press, thereby suppressing any information about a major crisis. In contrast, the modern Indian state, which is led by an elected government, cannot remain impervious to any such crisis (Sen 1982). The existence of a free press and pluralistic polity means that a government which chose to ignore famine would soon lose power. Survivors of the famine would ultimately constitute a significant block of voters who could certainly threaten the continuance of an incumbent regime. The press could simultaneously disseminate information on response failure by the state around the country thereby making even more precarious the position of an incumbent. Whether or not Indian policy makers act out of concern for humanitarian concern during food crisis is a matter for discussion, what is clear is that they will in fact act, if only out

¹⁰Cited in Dreze and Sen (1989, pp.133) from Mody(1974), *Economic and Political Weekly*, pp.2483.

of fear of retribution at the ballot box. Thus, the importance of the political entitlements in preventing famines becomes obvious as we contrast the Chinese experience in the next section.

4.2 The Chinese contrast

Despite China's relative success in combatting endemic hunger since the communist took power in 1949, between 1958 and 1961 China suffered one of the worst famines this century. The famine was the outcome of a massive economic programme known as the Great Leap Forward (GLF). The programme sought to expand China's industrial base while subsequently consolidating gains made in agriculture. While the failure of the GLF has widely recognised, information about the famine that accompanied it has been slower to emerge. Estimates of excess mortality during this famine vary from 16 million to 29 million (Ashton et al. 1984, and Riskin 1987, 1990). One reason why information continues to be scarce is that the Chinese authorities continue to guard information from the GLF period with obsessive secrecy. This section analyses the role of state policy both in triggering the famine and subsequently aggravating the crisis.

Provincial self sufficiency in grain production and collectivization of agriculture were the cornerstones of China's immediate post revolution agricultural policies. The former objective was seen as a necessity to achieving national self sufficiency in grain output. The collectivization policy was based on the hope that the larger scale of agricultural operation would raise marginal rates of production, and rid the country of the 'Kulak' class of farmers, whose existence was seen to be at odds with socialist ideology. While the former reason for collectivization was probably sound, the extermination of the 'Kulak' was certainly a policy based on malicious intent. The manner in which collectivization was carried out and incentive systems destroyed negated the benefits from collectivization. In 1955 Mao,

in a series of speeches, urged *all* provinces to attain self sufficiency in grain. In order to achieve this end the state banned all inter-provincial transfers of grain via the existing market mechanism, redirecting these transfers through a centralised state run system. The full impact of these policies became apparent in the early part of 1956, when after a failure of rains the western and central provinces edged toward famine. The breakdown of market mechanisms kept these provinces from importing grain until the central government intervened by drawing on its own reserves. Although a full scale famine was averted, this triggered an exodus of people to the cities, an estimated 1 million in 1957 alone (Bernstein 1983). Due to the new role of the state-run distribution organisation all resale of grain to rural areas was necessarily routed via the government. So long as the government had accurate information on the requirements of the deficit areas, allocations were effectively made; as we shall see, once there was a failure of information, famine occurred.

The policy of collectivisation was vigorously pursued from 1956 onwards. A plan to raise agricultural productivity based on the notion of mobilising “the masses”, was put forward.¹¹ It stressed raising farm labour inputs and said nothing about introducing new technologies. Peasants were to be organised into large collectives because this bias towards gigantism was seen as essential to achieving communism. Already from 1955 onwards the growth in grain output was beginning to stall because of sudden changes in policy. In 1956 grain output grew by 2% and in 1957 by 1.6% (Lardy 1983). Although the harvest of 1958 was of a record size, initial estimates of the harvest were put at 375 million tons, almost twice as high as the true figure (Ashton et al. 1984). The new process of development based on ‘mass mobilization’ took the place of organised planning, as the bureaucratization

¹¹The underlying thrust was provided by Mao’s April 1956 speech on the ‘Ten Major Relationships’. See Lardy (1983) pp.88-89.

caused by Central Planning was seen as dampening the enthusiasm of the people. Those who had reservations about the direction of state policy were ridiculed as being “reactionary”. Statisticians, particularly, were ridiculed for their “dogmatism”. The apparent successes in agriculture motivated Chairman Mao to launch the Great Leap Forward (GLF) in 1958. The stated objective of this program was to make China an industrialised economy within a short period of time. Buoyed by the belief that feeding the country was no longer a problem, an economic experiment was launched. “The people” were seen as the key to economic progress. The undermining of rational assessments meant that production targets were set arbitrarily, without any reference to the country’s real capabilities.¹²

The GLF speeded up the collectivisation programme and by December 1958 the peasantry were merged into communes encompassing 120 million peasant households. The average commune was made up of 5,000 peasant households.¹³ The commune thus became the smallest unit of accounting. All control over rural development was transferred to the communes. The cadres in the commune organised these peasant communities into more than farming entities. Communes were entrusted with the management of agriculture and also of running industries related to agriculture. Communes were wholly autonomous and, so long as they met production targets set by higher levels of administration, they were not interfered with. Thus there was a tremendous incentive for cadres to state over-fulfilment of targets. Destruction of the statistical system was so complete that neither the central nor provincial governments had any way of evaluating the claims made by the communes.

¹²A centrepiece of the GLF was the call for China to equal Great Britain’s output in steel within fifteen years. It did not matter that Britain produced almost 8 times as much steel as China. So complete was the deception of the authorities that all plans were based on the exaggerations of 1958. Investment in industry went up by 43%, which already accounted for 70% of all state expenditure, with the rest divided up between health/education and agriculture, and biased against the latter. See Riskin (1987) pp.123 , and also Riskin(1990a)

After the 1958 harvest, many communes diversified into non agricultural activities, in aid of the state's industrial programme. In the winter of 1958 communes were engaged in the production of steel in "backyard furnaces", to meet production targets prescribed by the state. The steel produced was of such poor quality that it added nothing to national output. But the state's policy of providing food grain to those engaged in industrial production created tremendous pressures on agriculture. The winter crop of 1958 was not fully harvested due to an acute shortage of farm labour. It is estimated that between 1958-59 labour engaged in agricultural activity had dropped by some 40 million (Riskin 1987, pp.126). Thus food shortages started to be felt in the spring of 1959, initially affecting only urban areas, the main centres of industrial activity. In order to address this the government increased procurement of grain in the countryside, little knowing that the output of food grains had fallen. Both 1959 and 1960 saw considerable damage to crops as a result of severe floods; this worsened the already precarious position of food supplies. Still deceived by the 1958 figures, the Communist Party's Central Committee decided to reduce the hectreage under food grain and replace it with cash crops. Thus despite falling output, the area sown in grain declined by 12% between 1957 and 1959. By the end of 1961, when production began to climb from an all time low in 1959-1960, about 20 million people had perished (Ashton et al. 1984).

What started out as a shortfall in food grains output in 1959 took on the dimensions of a major famine within the course of under a year. There is ample evidence to support the view that state policies in 1958-1959 and even prior to that were responsible for pushing the country into famine. Mao's bias towards heavy industry in economic development allowed resources to be pulled out of the agricultural sector (Riskin 1987, pp.74). A major consequence of these industrialisation efforts were that they encouraged migration to the urban areas. The urban population in China rose from 58 million (out of 540 million) to 99 million (out of 657 million) in the decade to 1958 (Ashton et al. pp.628). Urbanization meant that greater pressure was exerted to keep the urban areas fed. The state extended entitlements to

food by distributing ration permits to people in urban areas at their places of work. These permits guaranteed minimum supplies of food to those urban labourers. Also the precedence that the urban areas had over the rural areas put tremendous pressure on the grain supplies from the countryside. Complaints by peasantry about excessive procurement were brushed aside as being "selfish". In 1958 the state procured 29.9% of the total grain output. In 1959 it procured 39.7% of a smaller harvest and in 1960 it procured 35.6% of a still smaller harvest (Ashton et al. pp.628).

Excessive procurement by the state in 1959 caused annual per capita rural grain supply to fall below that of the urban areas for the first time: the respective figures were 183 kg and 201 kg respectively (Riskin 1990a pp. 35 and 1990b pp.258). This was a clear indication of a failure in entitlements of the peasantry. A disproportionate amount of grain produced by the peasant was removed by government regulation, immediately depriving them of their ability to adequately nourish themselves. Grain thus procured was used to insulate the urban areas from the ravages of famine (Sen1982). Although, there was eventually a decrease in per capita supply in the urban areas, this was a reflection of declining harvests through 1960 & 1961. But government policy ensured that the supply of grains in the urban areas remained significantly higher than in the countryside.

Table 4.1 China 1957-64: Annual per capita supply of grain (kg/year)

Year	Urban	Rural
1957	196	204
1958	186	201
1959	210	183
1960	193	156
1961	179	154
1962	184	161
1963	190	160
1964	200	178

Source: Statistics on China's Commerce and prices 1986, quoted in Riskin (1990b) pp.258.

In 1960 the per capita supply of grains in the cities fell to 193 kg per person/year. This should have alerted the authorities to the existence of a crisis and they should have acted to stem supplies falling to even lower levels. Contemporary writings of Chen Yen (Minister for Agriculture) illustrate that there was a sense of crisis in urban areas. The fact that grain imports did not begin until late 1961 must be interpreted as a response failure to meet the entitlements of the people. Minister Chen pointed out that state stocks had been depleted from 18.2 million tons of processed grain in 1957 to 7.4 million tons in June 1961. Right through 1959-1960 the government exported a total of 7 million tons of grain, representing enough food energy to feed 16 million people on a diet of 2000 calories per day for two

years.¹⁴ It is open to speculation how many lives might have been saved if this grain had been diverted to local consumption.¹⁵

The reduced food intake in the countryside led to what may be classified as a failure of direct entitlements. Diseases associated with undernourishment were detrimental to agricultural productivity. Healthy people were certainly not in plentiful supply in rural China of the early 1960s. Ivan London then travelling through China reported severe cases of malnutrition and oedema. Low levels of nutrition caused a rise in mortality rates and massive migration to the cities. Chen Yen was quoted in 1961 as saying, "Everyone wants to go to the cities; they can at least make a living by sweeping streets". As people migrated through 1959, agricultural recovery became an even more distant prospect because land under cultivation fell and the 1960 & 1961 harvests were even more depressed. The attendant problems of disease in a period of famine also took their toll. In 1960 for the first time since the establishment of the Peoples Republic the population declined. Mortality rates in the rural areas increased from 11.07 per 1000 in 1957 to a high of 28.58 in 1960; an increase of 158%. Urban mortality rates in the same period went up from 8.47 per 1000 to 13.77, an increase of 63% (Riskin 1990b pp.257-258).

In addition to per capita grain availability differentials between the rural and urban areas, the mortality figures confirm that the entitlements of the peasants had indeed not been protected. Some critics of the entitlements approach have argued that since there were more deaths in the urban areas than rural areas in 1961, no groups entitlements were protected. These conclusions are probably arrived at

¹⁴Ashton et al.op.cit.p.629

¹⁵This pattern of food moving out of famine hit areas is not unique to China; the same phenomena has been observed in Bengal, Ethiopia and Ireland.

by including deaths of the millions of migrants who sought to refuge in the cities once the famine had ravaged the countryside. But their findings are not backed up by any statistical data. Kane (1988) and Jowett(1987) suggest that large number of deaths in the urban areas may have occurred among migrants who were unable to secure food, due lack of ration permits. Some authors, such as Kula (1987) have suggested that a FAD-only explanation is sufficient to explain the occurrence of the famine. But, while it is true that the China's output fell massively during the famine, this is attributable to errors in state policy. The unequal distribution of hardship is another indication of that there were indeed failures of entitlements among large sections of the population. If the authorities had not undermined all objective sources of information China could have turned to international grain markets to make up deficits, as she later did. But China did not purchase any grains overseas until 1961 when the hardship increased in the urban areas; tragically, until then the authorities did not even acknowledge the existence of a famine (Rummel 1991).

It has also been suggested that earlier errors in water management policies may have accentuated the crisis. The construction of dams and reservoirs without prior assessment of their impact on the water table led to salinisation and alkalinisation of the soil. Such damage to the soil is not easily reversed and might explain why grain output in the Northern provinces of Henan, Hebei and Shandong did not regain pre-1958 levels until the late sixties. This can be seen as a failure of endowment entitlements for the peasant, because the quality of soil which was to be sown had been altered by salinisation, which in turn affected its productive capacity. Close planting techniques forced upon peasants by the cadres also took their toll in terms of increasing the marginal cost of grain output (Riskin 1987, pp.137).

Lardy (1983) has claimed that it is significant is that in the political atmosphere created by the GLF local officials were unwilling to report food shortages. Consequently, the central government was

frequently not aware, until it was too late, of the need to distribute food interregionally. This hypothesis is confirmed by investigation carried out at the time by Chen Yen and Peng Tuhuai (Defence Minister). After the 1958 party conference in Waching where the grain output figure of 375 million tons was announced (and the subsequent increased procurement by the government), Peng visited his home town of Hunan and found production not soaring as officials had led him to believe. His urgent telegram to Mao about the danger that the “masses might starve” were ignored until it was too late. Chen travelled to the province of Honan, where First Secretary Wu had been credited by Mao with creating China’s first commune. In line with the prevailing mood Wu claimed that Honan had doubled its output of grain in a single year and was in thus a position to export grain to other provinces. Chen doubted these claims and asked precise questions such as: “What was the level of consumption of food grains of the peasant with the lowest living standard?” “What were Honan’s requirements for fodder?” “How many people were receiving rationed grain?”. But all these questions were rebuffed by local officials. Since the likes of Mr. Wu held office at the pleasure of Chairman Mao (or his lieutenants) they had to worry about little more than keeping their mentors happy. Thus there was a tremendous incentive for local officials to distort and even suppress news of the famine. Nothing could change the mood of the times. Those who begged to differ, such as Marshal Peng, were subsequently purged for not towing the party line.¹⁶

It is indeed unfortunate that famine should have occurred in China. China possessed the infrastructure to overcome food shortfalls, and the government could either have undertaken imports of grain or have rationed grain in a more equitable manner. Instead by undermining objective avenues of assessing economic performance, the state plunged itself into ignorance about the shortcomings in

¹⁶Quoted from the writings of Chen Yen, Minister of Agriculture in Lardy(1983).

policies. At a more fundamental level, the autocratic nature of the state meant that all policies were formulated without serious debate (Riskin 1990). Mao's all pervasive influence ensured that his policies were adopted irrespective of their true worth. The initial food crisis in 1959 was a direct outcome of the state's (or Mao's) naive attempts to bring about an industrial revolution in China. In the aftermath of the abolition of the statistical service, all decisions that the leadership took were-at best-based on inaccurate information. The exaggeration of the 1958 harvest is one such example. At worst, they were based on nothing more than the self-interested but fertile imaginations of local officials (Lardy 1983).

Although China the capacity to deal with famine, there was no triggering mechanism to set this system in motion. Nor were there any incentive mechanisms in place to induce the government to formulate sound policy. It is here that the comparison with India becomes striking. The manner in which China lapsed into famine is not possible in India for three reasons. The collapse of entitlements is reflected in the comparative trends in life expectancies for the two countries over a 30 year period. The rapidity with which the life expectancy in China during the famine years collapsed, this indicates what a shock the famine was to the Chinese socio-economic environment. In contrast the Indian state is pluralistic, and its policy is open to debate and criticism, in which the press takes an active part. The regimes in India have to ensure at each level that the population is accorded a minimum living standard (which is truly very low), is because of the threat of loss of power which the population can exert upon the regime due universal adult suffrage. Secondly, the presence of a free press ensures that crises do not go unreported, even if somewhat sensationalised. Finally the state statistical service collects information which is useful to all parties in identifying the onset of a crisis and in formulating appropriate policy response defeat. In contrast, in China the only way in which the populace could express its frustration with the scarcity of food would have been via an armed insurrection. Realising that the group most likely to embark upon such a course was the Military, it was kept well provisioned even at the expense of

others. The lack of political entitlements for vast numbers of people in China meant that the regime had little incentive to attend to their needs. It is possible that the presence of a pluralistic polity in China may have prevented the formulation of ill informed policies, led to a pressures for a quicker recognition of the existence of the famine, and to its effective alleviation. The famine was indeed a blot on the otherwise remarkable achievements of the Communist Party.

5.0 Conclusions

The principal concern of this paper has been to draw attention to the importance of political entitlements in influencing both the onset of famine, and public sector response to such crisis. In section 1.0 famine was defined. It was stressed that, as pointed out by Sen, famine is the result of persons not *having* enough to eat. This may or may not be accompanied by a significant drop in food production per capita, that is, the circumstances of there not *being* enough to eat.

Section 2.0 reviews the various schools of thought which have influenced the field of famine analysis. Most of the theoretical literature in famine analysis has traditionally been premised on the occurrence of a "Food Availability Decline", more recently researchers have drawn attention to the importance of entitlements. While the former emphasise famine to be the outcome of supply failures, the latter treat the phenomena as the outcome of demand failure. Indeed, the entitlements approach has gained much acceptance because many recent famines have occurred without declines in food production. Nonetheless, the entitlements analysis remains incomplete. While scholars of the entitlements school argue correctly that individuals may starve because of an inability to acquire food due to a shift in endowment or trade entitlement, what unaddressed is the mechanism by which these entitlements can be protected. Specifically, traditional entitlements theory fails to recognise the crucial role of the political system in securing economic entitlements.

Section 3.0 , focuses on political entitlements. It is important to recognise the effect of state policy in affecting economic and demographic outcomes, especially how the political entitlements of various social classes can affect their well being by securing direct and trade entitlements. This analyses a model which is consistent with observations that famines can, and indeed have occurred during periods of economic boom. We model how the political entitlements of two classes in a hypothetical economy helps them surmount hardship. The result obtained from the model is that intervention by the state during crises positively impact the entitlements of the economically more vulnerable. It would be interesting to extend the model developed in section 3.0 to include the parameters which would represent the manner in which various groups assert influence over policy. However, to better capture real world situations one needs to engage in building a more sophisticated model, and this is certainly one avenue of research that would be fruitful to embark upon.

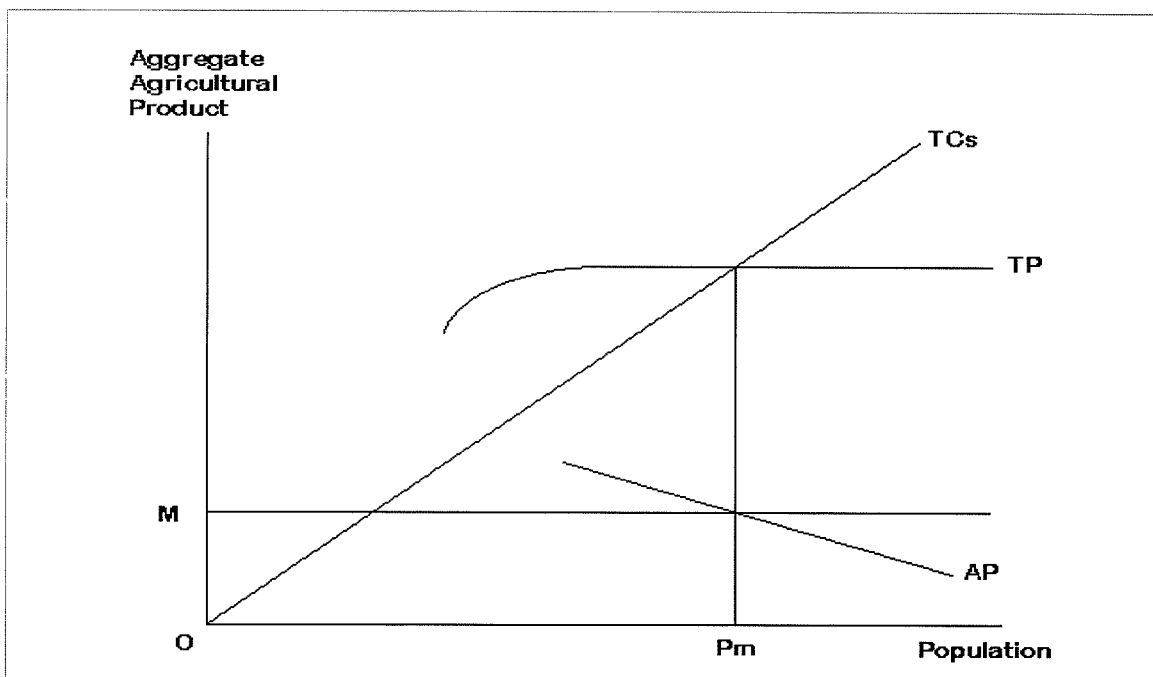
Section 4.0 , presents two case studies, which compare the recent experiences with famine of China and India. These countries are interesting to compare because of similar attributes such as population, income per capita, etc. While China has had greater success in dealing with the problem of endemic hunger than has India, unlike the latter she ironically suffered the greatest famine in the post World War II era. The conclusion that is drawn is that the differences in the political structures of the two countries has tempered their respective responses to crisis such as famine, with the Indian state being more responsive.

While there is probably a strong relation between a country's political structure and its susceptibility to famine, it would be interesting to see more studies in this field. The direction of research in the field of famine analysis should in my opinion pay greater attention to the role institutions play in the prevention of famine. That 'famines, it appears ,happen because they are not prevented' is most likely true.

There is little to prevent any regime from alleviating the instituting longer term measures that protect entitlements. And this process can be guaranteed only when the political entitlements of any class in society is not undermined. The issue of political entitlements should be examined more closely in future research because issues hunger and famine seem to have become an endemic part of human society.

Appendix 1: A Graphical representation of Malthus's Model.

The Malthusian view of famine has been graphically formalized by Ghatak and Ingersent (1984, pp.254), in their diagram, population proxies agricultural labour inputs and wages are determined by average agricultural labour productivity. They also assume a Cobb-Douglas production function. The TC_s line represents total consumption needs as population rises at a per capita subsistence requirement OM . Agricultural surpluses occur so long as total production (TP) < TC . Average product (AP) per worker declines when TP levels off because agricultural output is constrained by diminishing returns at the margins of cultivation. When population reaches OP_m , the agricultural surplus is zero. This is what Ghatak considers the 'Malthusian equilibrium' point. If population exceeds OP_m , such that AP falls below the minimum subsistence point OM , people starve. In the long run, provided that fertility rates or



production system remain unaltered, the 'natural check' of starvation on unconstrained population growth will restrict population to the maximum level OP_m .

Of course this representation has come under criticism from many. Watkins and Van de Walle (1983) feel that this sort of graphical representation is 'too schematic' to convey Malthus's postulates properly. Devereux (1993) critiques this representation on the basis of the production function chosen. The idea of decreasing return at the margins of production is seen as unrealistic. He feels that the graph would have been more realistic if one could add a series of discrete production functions above the TP curve, each representing the TC_s line at a higher point, showing steadily increasing quantities of food for a steadily increasing populations.

A person who is initially in the food secure position x can be 'plunge into starvation if his endowment collapses into the 'starvation set', i.e. a move from x to x^* . Alternatively a change in the relative exchange prices of the two commodities may induce starvation. A shift in relative price from p to p^* would lead to starvation. This could also be interpreted as an expansion of the starvation set from OAB to OAC. Sen stresses the importance of this possibility where in a famine starvation may develop simply because of an adverse movement in prices.

Appendix 3: The Maple Simulation Codes for Section 3.3.1

The programming code which was used to generate results for the model in section 3.3 is included in this appendix. The programming was done in two stages. In the first stage the model was set up to obtain results in terms of the equilibrium (p^*) and equilibrium output (X^*). In the second stage the expressions for p^* and X^* were substituted into expressions that solved for incomes Y^i and demands x^i . The simulation exercise was run in the second stage using predetermined endogenous variables and the program code for a worked example is included.

Stage I: Setting up the Model

The solution of the model in various markets was the first part of our program. The notation in the program corresponds to the notation in the text and is also illustrated here.

$$x^i = xi, \quad x^s = xs, \quad x^{Z*} = xz, \quad x^{A*} = xa, \quad X^* = Xstar, \quad Lt^* = Lstar, \quad l=1, \quad N_t^Z = Nz_t, \quad N_t^a = Nat_t, \\ \equiv a, \quad \chi_t = Tt, \quad s_t = st, \quad p^* = pstar, \quad p = p, \quad T = tx, \quad Y^i = Yi$$

Consumer Market

```
>Ui:=xi-xs;
>Yi:=p*xi;
>xi:=Yi/p;
>Yz:=p*X-Lt+l;
>Ya:=l;
```

Labour Market

```
>w:=1;
>reproduction:=Nzt=Bt1*Nzt1
>Mktclearing:=Nzt*Lt=(Nzt+Nat)*l;
>Lt:=solve(Mktclearing, Lt);
```

Producers market

```

>st:=S/Nzt;
>Promaxt:=p*X-Lt;
>Promaxt2:=p*Tt*(1-tx)*Ltp^a*s^(1-a)-Lt;
>dpromaxt2:=diff(Promaxt2, Ltp);
>Lstar:=(1/(p*Tt*(1-tx)*a*s^(1-tx)))^(1/(a-1));

```

Equilibrium conditions

```

>LabourmarketEqui:=Lstar=Lt;
>pstar:=(Nkt/(Nkt+Nat))^l*a*Tt*(1-tx)*s^(1-a);
>Xstar:=Tt*Lstar*s^(1-a);

```

Stage II: Solving an Example

Having obtained equilibrium expressions from Stage I, we program in the results in a separate file with the aim of solving for incomes and demand. The notations remained the same, only now we allow the exogenous variables to take on values. The state of the world variable Tt is randomly determined by the computer program.

Determining States of the world

```

>with(stats):
>Tt:=rand(100..1000);
>T:=Tt();

```

Setting parameters

```

>l:=16;
>Nz:=10;
>Na:=100000;
>a:=.6;
>S:=1000;

```

>tx:=0.2;
 >s:=S/Nzt;
 >xs:=15;

Solutions

>L:=((Nzt+Nat)/Nzt)*I;
 >Xstar:=T*(1-tx)*L^a*s^(1-a);
 >pstar:=(Nzt/(Nzt+Nat))*I*a*T*s^(1-a);
 >Yz:=pstar*X-L+I;
 >Ya:=I;
 >xa:=I/p;
 >xk:=Yk/p;

Government

>AfterTaxinStateGranary:=tx*Xstar*Nzt;
 >ConA:=xa;
 >MiniconA:=xs;
 >if evalb(ConA<xs) then NetGovSupportA:=MiniconA-ConA else NetGovSupportA:=0 fi;

Population dynamics

>if evalb(xbar>xa) then Populationa:=.7*Nat else Populationa:=1.2*Nat fi;
 >if evalb(xbar>xz) then Populationz:=.9*Nzt else Populationz:=1.1*Nzt fi;

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